Labs for InRoads V8i SELECTseries 2

Colorado Department of Transportation

CADD and Engineering Innovation Updated March, 2011



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Software Versions

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MicroStation® version 0811.07.443 InRoads® version 08.11.07.428 CDOT Configuration Version 05.00.00

Document Conventions

There are several conventions that are used throughout this document to indicate actions to be taken or to highlight important information. The conventions are as follows:

<u>ltem</u>	Meaning
View Perimeter	a command name or a file that you are to select
Tools > Options	a command path that you are to select – usually from the pull-down menus
Document Name	the name of a document that is not hyperlinked
Emphasis	style used when referring to important word or phrases
<u>Hyperlink</u>	style used when you have a direct link to another document on the web
Key in	entering data with the keyboard
Quote	style used to indicate an external source quotation
<i>Note:</i> text	information about a command or process that you should pay particular attention to
1. Numbered Steps	actions that you are to perform as part of the lab activities
<d> or Data</d>	press the data button on the mouse
< R> or Reset	press the reset button on the mouse
<t> or Tentative</t>	press the tentative button on the mouse

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Chapter 3 - Interchange Project

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Labs

LAB 1 - Getting Started in InRoads

This lab demonstrates how to start and set up InRoads to work on a project. It demonstrates the Project Creation Utility, starting InRoads, loading data, and changing some InRoads settings.

Chapter Objectives:

- Create a new project folder structure.
- Start InRoads and set up the InRoads project defaults.
- Load the initial project data.
- Demonstrate how the Locks work.
- Demonstrate Precisions and Factors.

The following files are used in this lab:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Projects\12345\Design\InRoads\12345DES_Geometry.alg
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\DES12345_Templates.itl

Lab 1.1 - Creating a Project Directory

The first step when beginning a project is to create a project directory structure. Use the Project Creation Utility to generate a uniform directory structure which will allow other users easy access to the project data when they need it.

Section Objectives:

- Create a project directory.
- Explore the folder structure created.
- Demonstrate how the PCF file works
- 1. From the Windows Explorer, navigate to:

$\label{eq:c:Workspace-CDOT_V8i} C: Workspace-CDOT_V8i \ Standards-Global \ MicroStation \ \ exes$

2. **<D>** the **Project Creation Utility** icon to open the *CDOT Project Creation Utility* dialog box.



3. In the *CDOT Project Creation Utility* dialog box, **<D>** in the *Job Project Code (JPC)* field and key in *54321*.

4. Verify that *Create Project Configuration File* is toggled on. This file automatically sets the directory path in MicroStation so that navigating to the correct project folder is easier.

🖻 CDOT Project Creati	on Utility		- • 🔀	
Project Template:	Workspace\Workspace-CDOT_XM\\Project Template	•••••	Apply	
Destination:	C:\Projects	••••	Close	
Job Project Code (JPC):	54321			
Create Project Configuration File				

- 5. **<D> Apply** then **<D> Close** to dismiss the dialog box.
- Open Windows Explorer and navigate to C:\Projects\54321\Design\Drawings\. Notice that the directory structure has been built for all disciplines and it has been populated with the standard drawings.
- 7. Close the Windows Explorer.
- 8. Start MicroStation.
- 9. In the *MicroStation Manager* dialog box, set the *Project:* to **54321**. Notice that the *Look In:* folder automatically changes to the 54321 directory.

Look in:	34321		- 😳 🤣 🔛	"L) 🍯 🖹		
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Computer	Project_Cor	figuration	6/30/2010 1:48 PM	File fol		
	🛯 📗 Project_Mai	nager	7/7/2010 4:32 PM	File fol		
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Network	•			ŗ		
	File name:	Test.dgn		Open	User:	CDOT User
	Files of type:	CAD Files (*.dgn;*.dwg;*.d	txf) 🔻	Cancel	Project:	54321
		Open as read-only		Options	Interface:	CDOT

10. In the *MicroStation Manager* dialog box, navigate to the **Design > Drawings > Reference Files** folder. 11. **<D>** on **54321DES_Model.dgn** then **<D> Open**. This is the location and file that most Roadway Design work is done in.

📕 File Open - C:\	\Projects\54321\De	esign\Drawings\Reference_Files\					x
Look in:	🔒 Reference_File	es 🔹	G 🤌 📂 🛄 -	i) 🛐 🖲			
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	54321DES_M	2	9/30/2010 9:38 AM 9/30/2010 9:39 AM	MicroStat MicroStat			
Desktop	54321DES_Pr		9/30/2010 9:39 AM 9/30/2010 9:39 AM	MicroStat			
Libraries							
Computer					1		
Network	•	m		Þ			
	File name:	Test.dgn	E	Open	User:	CDOT User 🔻]
	Files of type: CAD Files (*.dgn;*.dwg;*.dwf)		•	Cancel	Project:	54321 -	
		Open as read-only		Options	Interface:	CDOT -]

12. Close MicroStation.

Section Summary:

- Using the Project Creation Utility builds a standard directory structure for the project.
- Standard drawing files with project specific names are included in the project directories.
- Using the PCF file in MicroStation make navigation within the project directory easy.

Lab 1.2 - Initial InRoads Set-up

MicroStation uses the pcf file to set directory paths. InRoads use a different method called Project Defaults. The process of setting project defaults is normally a tedious job. However, using the *CDOT_V8i Disciplines.reg* file supplied with the CDOT workspace makes this job very simple. The .reg file uses variables stored in the pcf to set the directory paths when opening or saving InRoads related data files.

In addition to setting up the project defaults, students will learn how to create a project file which allows several data files to be loaded into InRoads simultaneously.

Note: This lab uses the 12345 project directory which already has the initial InRoads data for the remaining labs.

Section Objectives:

- Open MicroStation and InRoads using the 12345.pcf file.
- Import the CDOT_V8i Disciplines.reg file into the project defaults.
- Load the project alignment, surface, and template data.
- Create a project (rwk) file.

- Start MicroStation and InRoads by selecting Start > All Programs > Bentley > InRoads Group V8i (SELECTsceries 2) > InRoads or select the InRoads desktop icon.
- 2. In the *MicroStation Manager* dialog box, set the *Project:* to **12345**. This setting accesses the 12345.pcf file.
- 3. In the *MicroStation Manager* dialog box, navigate to the **Design > Drawings > Reference Files** folder.
- 4. **<D>** on **12345DES_Model.dgn** then **<D> Open**. This opens MicroStation and InRoads.

Look in:	Reference_F	iles 🗸 🗸	G 🤌 📂 🛄 -			
(Here)	Name		Date modified	Туре 🔺		
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	🕌 12345DES_Ir	nterchange.dgn	6/14/2010 10:42 AM	MicroS		
	12345DES_Ir	ntersec100SH86.dgn	6/14/2010 10:42 AM	Micro5		
Desktop	🕌 12345DES_N	1odel.dgn	6/14/2010 2:56 PM	MicroS		
A	12345DES_N	lodel_Median-Ditch.dgn	6/14/2010 10:43 AM	Micros		
	🖊 12345DES_N	lodel_Overlay.dgn	6/14/2010 10:43 AM	Micro		
Libraries	🖊 12345DES_N	Nodel-Create End Cond Search S	6/14/2010 8:54 AM	MicroS		
	🖊 12345DES_N	Iodel-Create Raised Median.dgn	6/14/2010 8:50 AM	MicroS	1	
	🖊 12345DES_N	1odel-Create Ramp Model.dgn	6/14/2010 8:53 AM	MicroS		
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~	🖊 12345DES_N	lodel-End Cond Mult Sol.dgn	6/14/2010 8:56 AM	MicroS		
	12345DES P		6/14/2010 10:43 AM	Micros *		
Network	•	111		•		
	File name:	Test.dgn	-	Open	User:	CDOT User
	Files of type:	CAD Files (*.dgn;*.dwg;*.dxf)		Cancel	Project:	12345
		Open as read-only		Options	Interface:	CDOT

From the InRoads menu bar, select File > Project Defaults. This displays the Project Defaults dialog box.

👬 Be	ntley InRo	oads V8i (SE	LECTseries	; 2)						23
File	<u>S</u> urface	Geometry	<u>D</u> rainage	Evaluation	Modeler	Site Modeler	Dr <u>a</u> fting	<u>Q</u> uantities	<u>T</u> ools	<u>H</u> elp
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	<u>S</u> ave Save <u>A</u> s						'	By Whom		Last
	<u>Close</u>						•			
	<u>P</u> roject Del									
	Project Opt	tions								•
'闺 '	Text Import	t <u>W</u> izard								

6. On the *Project Defaults* dialog box, **<D>** the **Import** button. This displays the *Open* dialog box.

- In the Open dialog box, navigate to C:\Workspace\Workspace-CDOT_V8i\ Standards-Global\InRoads\Preferences\ and highlight the CDOT_V8i Disciplines.reg file.
- 8. **<D> Open**.

Ket Project Defaults						ß				
Configuration Name:	<none></none>				•	Apply				
Default Preferences						Close				
						New				
Preferences (*.xin):						Copy				
Turnouts (*.txt):						Rename				
Drainage Structures (*.dat):						Delete				
Rainfall Data (*.idf):						Browse				
Bridge Sections (*.txt):						Import				
Drafting Notes (*.dft):										
Pay Items (*.mdb):						Export				
Site Modeler Options (*.spf):						Help				
Default Directory Paths		ĺ	🚔 Open							×
ProjectWise Directory:			Look in:	Preferences	3		Ţ	🎯 🏚 📂 🖽	+	
Project Default Directory:				Name		*	_	Date modified		ype
Report Directory:				CDOT_V8i	Discipline	s.rea		11/29/2010 12:4		egistrati
Projects (*.rwk):			Recent Places							
Surfaces (*.dtm):										
Geometry Projects (*.alg):			Desktop							
Template Libraries (*.itl):										
Roadway Design (*.ird):										
Survey Data (*.fwd):			Libraries							
Drainage (*.sdb):										
Style Sheet (*.xsl):			Computer							
Quantity Manager (*.mdb):			Computer (•						P.
Site Modeler Projects (*.gsf)				File name:				-	C	Dpen
Default Grid Factor Grid Factor: 1.0000		Export	Network	Files of type:	Registra	ation Files (*.reg)		•		ancel Help

This loads the data into the Project Defaults dialog box. This file only has to be loaded one time. Once loaded, it will work with any project so long as the pcf file is used when starting MicroStation and InRoads.

Back on the Set Project Defaults dialog box, set the Configuration Name to CDOT Design Discipline.

Note: Although the Design Discipline is used for this lab, there are project defaults for each of the other disciplines as well.

10. **<D> Apply** then **<D> Close.**

Setting the project defaults using this method defines the default locations for both general InRoads resource files and project specific data files. This will make it easier to conform to graphics standards and assist in navigating to the correct project directories when loading or saving data files.

11. Select the **Preferences** tab on the Workspace bar and verify that the correct InRoads Project resource file (CDOT_Civil.xin) is loaded.

Bentley InRoads V8i (SELECTseries 2)		- • ×
File Surface Geometry Drainage Evaluation M	odeler Site Modeler Dr <u>a</u> fting <u>Q</u> uantities	<u>T</u> ools <u>H</u> elp
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	File Name Type	Access Mode
□- ¹ Preferences □- ¹ C:\Workspace\Workspace-CDOT_Vi	☆ C:\Workspace\Wo XIN	Read-Write
✓ Image Image Image Image Image	•	•
Toggles the Feature Highlight Lock		

Next, the initial InRoads data files are loaded.

- 12. From the InRoads menu bar, select **File > Open**. This displays the **Open** dialog box.
- 13. The *Open* dialog box defaults to the *C:\Projects\12345\Design* folder. **<D> <D>** on the **InRoads** folder.
- 14. Highlight **12345DES_Geometry.alg** and **<D> Open**.
- 15. Highlight 12345DES_Templates.itl and <D> Open.

🙀 Open				×
Look in:	퉬 InRoads	•	G 🌶 📂 🛄 -	
æ	Name	Date modified	Туре	Size
2	퉬 Lab - Interchange Data	8/24/2009 4:13 PM	File Folder	
Recent Places	Lab - Intersections Data	8/24/2009 4:13 PM	File Folder	
	DES12345_Templates.itl	9/8/2009 8:21 AM	ITL File	89
	Combined Surfaces.ird	8/3/2009 7:17 AM	IRD File	13
Desktop	12345DES_Geometry.alg	9/9/2009 8:56 AM	ALG File	71
Chris Ferree				
Computer				
	•			•
	File name:		-	Open
Network	Files of type: In Roads File	s (*.rwk;*.dtm;*.alg;*.itl;*	.ird;*.sdb;*> ▼	Cancel
				Help

Typically, the template library is copied from C:\Workspace\Workspace-

 $CDOT_V8i\stam\dards-Global\InRoads\Templates\, however, for future labs the template library (with additional data) was provided in the Design\InRoads\ folder.$

In the *Open* dialog box, use the *Look In* drop down menu and navigate to the *C:\Projects\12345\ROW_Survey\InRoads\DTM* folder.

🚔 Open									X
Look in:	🐌 DTM			-	0	ø	Þ		
Recent Places	 Recent Items Desktop Network Chris Ferree Public 		\square	e					
Desktop	Computer	(C:)		1					
Chris Ferree	📗 Ini	V_Survey Roads DTM							
	Desi								
Computer	DVD RW I								
.		\$ (\\a-abq-nas1) (Z:) nical Communication		J			•	Оре	n
Network	Files of type:	Surfaces (*.dtm)					•	Cano	

- 17. Highlight **12345 existing ground.dtm** and **<D> Open**.
- 18. **<D> Cancel** to close the *Open* dialog box.

The project (rwk) file is used to load or save all of the project data files at one time. This file can be updated as new data files are added to the project.

- Select File > Save > Project from the InRoads menu bar. This displays the Save As dialog box.
- 20. In the File name field, key in 12345DES, do not press the Enter key.
- 21. **<D>** the **Options** button. This displays the *Project Options* dialog box.

🙀 Save As				×
Save in:	🕕 InRoads	•	G 🤌 📂 🛄 🗸	
An	Name	Date modified	Туре	Size
Recent Places	Lab - Interchange Data Lab - Intersections Data	8/24/2009 4:13 PM 8/24/2009 4:13 PM	File Folder File Folder	
Desktop				
Chris Ferree				
Computer				
	•	III		•
Network	File name: 12345DES		<u> </u>	Save
	Save as type: Projects (*.rv	/k)	-	Cancel
				Help
			0	ptions

22. In the *Project Options* dialog box, toggle on the *Update* check box for the data files loaded above.

Project Options		×		
Template Library	Roadway Design	Site Modeler		
Surfaces	Geometry Project	XIN Preferences		
	Project Options		×	
	Template Library	Roadway Design	Site Modeler	
	Surfaces	Geometry Project	XIN Preferences	
Add Update Surface Na	me	Project Options		
2345 exist	ting	Surfaces	Geometry Project	XIN Preferences
		Template Libr	ary Roadway Design	Site Modeler
File Name:	2 2 12	ometry Nat 345DES_C fault		More Options
		Add Update	Template Library File Name	
	File Name:		12345DES_Templar C:\Projects\1234	5\Design\InRoads\12345DES
		File Name:		
			OK Cancel	

23. **<D> OK** to dismiss the *Project Options* dialog box.

24. In the *Save As* dialog box, **<D> Save** then **<D> Cancel** to dismiss the dialog box.

Section Summary:

- The CDOT_V8i Disciplines.reg file only needs to be imported one time, then it can be used for any project.
- Initial project data is loaded after the project defaults are set up. This data must include an existing ground dtm and may include geometry as well.
- Creating a project (rwk) file speeds up the process of loading and saving project data.

Lab 1.3 - Toolbars

This lab demonstrates how the InRoads Interface can be populated with toolbars for easy access to commands. The drop-down menus can be used to select the correct tool, but it may be more convenient to use toolbar icons. All InRoads toolbars can be customized to fit your workflow or personal preferences.

Section Objectives:

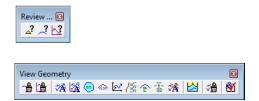
- Learn how to access addition toolbars used for viewing and reviewing geometry.
- Learn how to access and use the Global Scale Factor Add-in

Opening Additional Toolbars

1. From the drop-down menu select **Tools > Customize**. The *Customize* dialog box appears.

Kustomize	
Toolbars Commands Keyboard Macros Export Import	
Toolbars: Image: Constraint of the second secon	Reset All New Rename Delete Help

- 2. Under the **Toolbars** tab, toggle on the boxes for **Review Geometry** and **View Geometry** are selected. When checked on, the toolbars are displayed on the InRoads interface or as floating toolbars.
- 3. **<D>** the **Close** button in the *Customize* dialog box.



4. **Dock**, **Undock** and **Resize** the toolbars until you are comfortable repositioning them. Notice how toolbars can be docked in the InRoads interface but not in MicroStation's.

Hentley InRoads V8i (SELECTseries 2)	
<u>File</u> <u>Surface</u> <u>Geometry</u> <u>Drainage</u> <u>Evaluation</u> <u>Modeler</u> Site Modeler	Dr <u>a</u> fting <u>Q</u> uantities <u>T</u> ools <u>H</u> elp
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▲	🏝 🕙
File Name	Type Access Mode
Preferences	o XIN Read-Write
C:\Workspace\Workspace-CDOT_V	
Preferences Drainage 🕂 Te + > +	4
Toggles the Station Lock	

5. From the drop-down menu, select **Geometry > View Geometry** and look at each command and its associated icon. Notice the correlation of the icons between the drop-down menu and the toolbar.

- Active Horizontal	
🏦 Active Vertical	
🏂 Horizontal Annotation	
Vertical Annotation	
😑 Closed Areas	
Stationing	
🕰 <u>3</u> -D Alignment	
Station Offset Annotation	
膏 Curve Set Annotation	
The Vertical Change In Plan	
濟 Annotate <u>G</u> raphics	
출 <mark></mark> All Horizo <u>n</u> tals	
🛃 Options	
View Geometry	
🔒 🛗 🦛 🎉 😑 🗠 🗠 🌾	e 🕆 🎕 🔀 🖓 🕷

- 6. Place the cursor over an icon in any toolbar. A *Tool Tip* will appear at the lower right of the cursor, additionally a description of the command shows in the status field.
 - The tool tip feature is controlled in the *Customize* dialog (*Tools > Customize*) box via the *Show Tool Tips* check box and is turned on by default.

Global Scale Factors

Global scale factors are used to determine the size of displayed text, cells, and linestyles. The global scale factor function can be found under the *File* > *Project Options [Factors]* tab. However, enabling the command directly from the menu bar is more efficient.

7. Select **Tools > Application Add-ins** to display a list of available InRoads commands and functions that can be added to the InRoads interface.

Application Add-ins										
vailable:										ок
Export Plasser and Theurer Add-In									_	
Export to MATISA Add-In									C	ancel
Find Near Points Add-In										Help
Generate Grade Contour Add-In								=		нер
GENIO Translator Add-In										
Global Scale Factors Add-In										
Graphics Translator Add-In										
🔀 Horizontal and Vertical Elements Ad	d-In									
Hydrology and Hydraulics Add-In										
Description The Active Project Settings Add-In pro- and vertical alignments and supereleva		oating	dialog	that di	splays	the ac	tive su	uface,	, horiza	intal
The Active Project Settings Add-In pro-		oating (dialog	that dis	splays	the ac	tive su	urface,	, horiza	ntal
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The Active Project Settings Add-In pro- and vertical alignments and supereleva	ation.							.		*
The Active Project Settings Add-In pro- and vertical alignments and supereleva	ation.							.		*
The Active Project Settings Add-In pro- and vertical alignments and supereleva	ation.									*
The Active Project Settings Add-In pro- and vertical alignments and supereleva	ation.									*

Selecting an item displays a description of the tool(s). The command category shows both the menu location and the InRoads product(s) it can be activated with.

- 8. Toggle on Global Scale Factor, <D> OK, and Close the dialog box.
- 9. Select Tools > Global Scale Factors...

🐂 Scale Fa	actors		- • 💌
Text:	100.0000		Apply
Cell:	100.0000	<u> </u>	Close
Line Style:	100.0000		

- 10. Set the *Text* and *Cell* factors to *100*. Set the *Line Style* factor to *1*.
- 11. **<D> Apply** then **Close**.

These settings are multipliers for displayed graphics. Generally the values should be set to correspond to the plotting scale factor. As with most MicroStation or InRoads commands, you have the option of either enabling or disabling the lock symbol to input values universally or individually.

Note: Global Scale Factors apply to all InRoads data displayed. This includes the display of features from a DTM. While it is possible to 'regenerate' plan view topography by displaying the features from a survey-supplied DTM, this is NOT an accepted workflow. The reason for this is because any attributes collected in the field are processed by InRoads Survey. These attributes (rotation, Q & Z reports, etc) are not stored in the DTM and the resulting graphics will be incomplete and/or incorrect without being evident.

Section Summary:

- Students learned how to access the Review Geometry and View Geometry toolbars and how they compare with the pull-down menus.
- Students learned how to access the Global Scale Factors Add-in and how the global scale factors impacts graphics generated from InRoads commands.

Lab 1.4 - Locks

This lab illustrates the use of the Feature Filter lock, Pen/Pencil Mode, and Station Lock.

Section Objectives:

- Demonstrate how the Feature Filter lock reduces items in list boxes.
- Demonstrate the difference between Pen and Pencil mode.
- Demonstrate the effects of Station lock.
- 1. On the InRoads main dialog box, verify that the *Feature Filter* lock is *on* and the filter name is set to **<Unnamed>**. Unnamed is in effect no filter.

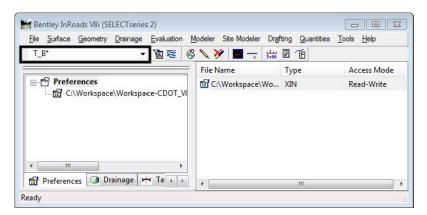


- Bentley InRoads V8i (SELECTseries 2) File Surface Geometry Drainage Evaluation Modeler Site Modeler Drafting Quantities Tools Help View Surface • 📏 🎉 📕 🛶 🛛 🗤 🗉 👚 <Ur Honore Display... Fit Surface File Name Access Mode Туре C:\Workspace\Wo... XIN Read-Write Triangulate Surface... Design Surface Edit Surface <u>F</u>eature Feature Properties. Feature Selection Filter. Surface Properties ... Component Properties. ✓ Active Surface... Copy Surface... 6 <u>D</u>elete Surface... Edits ti Utilities .
- 2. From the InRoads menu bar, select **Surface > Feature > Feature Properties**.

The illustration below shows the Feature Properties dialog box as displayed with no active feature filter.

Feature Properties			- • •
Surface: 12345 existing ground Feature:	•	Style Available:	Apply Close
Name Centerline Profile T_Billboard Over 10ft T_Billboard Over 10ft280 T_Billboard Under 10ft T_Billboard Under 10ft Light5 T_Bin Walls T_Bin Walls T_Bin Walls855 T_Bindge T_Bindge Abutment T_Bindge Abutment 745	Style	B_RAIL_Ty-10M B_RAIL_Ty-10R B_RAIL_Ty-3 B_RAIL_Ty-7 B_RAIL_TY-7 <t< td=""><td>Close Filter List Points New Style Help</td></t<>	Close Filter List Points New Style Help
T_Bridge Abutment 746	T_Bridge Abutme	Name Description From Style	
T_Bridge Abutment 757 T_Bridge Abutment 758 T_Bridge Abutment 759 T_Bridge Curb	T_Bridge Abutme T_Bridge Abutme T_Bridge Abutme T_Bridge Curb	DATABASE NOT OPEN Yes	
Name: Centerline Profile Description: Parent: Refresh/Display in 3-D/Plan View		Triangulation Feature Type: Breakline Point Density Interval: 0.00 Exclude from Triangulation	

3. On the InRoads main dialog box, set the Feature Filter to **T_B***.



Notice that in the *Feature Properties* dialog box only features that start with T_B are displayed. The illustration below shows the dialog box with the filter active.

Feature Properties					- • 💌
T_Billboard Over 10ft T_Billboard Over E T_Billboard Over 10ft 280 T_Billboard Over E T_Billboard Under 10ft T_Billboard Under E T_Billboard Under 10ft Light T_Billboard Under E T_Bin Walls T_Bin Walls T_Bin Walls 854 T_Bin Walls	BillE BillE BillE	Style Available: B_RAIL_Ty-10M B_RAIL_Ty-10R B_RAIL_Ty-3 B_RAIL_Ty-3 B_RAIL_Ty-7 Centerline Primary: Breakline Secondary:			Apply Close Filter List Points New Style
		Pay Items	Desertation	En Out	%
		Name	Description	From Style	
<	٢		DATABASE NOT OPEN	Yes	*
Name: Centerline Profile		Triangulation			
Description:		Feature Type:	Breakline	•	
Parent:		Point Density I	nterval: 0.00	+	
Refresh/Display in 3-D/Plan View		Exclude from	Triangulation		

- 4. **<D>** the **Filter** button. This displays the *Feature Selection Filter* dialog box.
- 5. Notice, in the *Rules* area of the dialog box, the rule **Exclude Style = T_Bridge***. This rule prevents the bridge features from being displayed.
- 6. **<D> Cancel** to dismiss the *Feature Selection Filter* dialog box.
- 7. Close the *Feature Properties* dialog box.
- 8. Set the Feature Filter back to **<Unnamed>**.

Next, the Pen/Pencil mode and the Station lock are demonstrated.

9. On the InRoads main dialog box, set the *Pen/Pencil* mode to **Pencil**.

10. Turn the *Station* lock off.

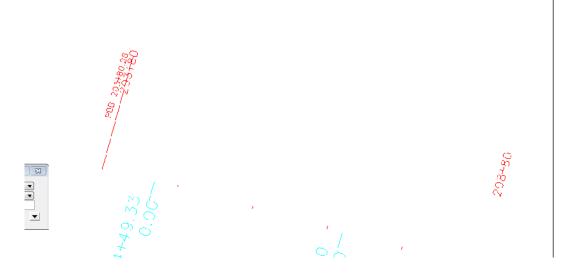
Rentley InRoads V8i (SELECTseries 2)	- • •
<u>File Surface Geometry Drainage Evaluation Modeler Site Modeler Drafting Quantities T</u>	ools <u>H</u> elp
T_B* 🗸 Ta 📚 🚳 🔪 🎽 🚍 🚽 🛗 🗉	
File Name Station Lock Off	Access Mode
Preferences 🔐 C:\Workspace\Wo XIN	Read-Write
C:\Workspace\Workspace-CDOT_V	
🗃 Preferences 💿 Drainage 🚧 Te ()	•
Toggles the Station Lock	.4

11. **<D>** the **Geometry** tab in the InRoads Explorer and verify that the *SH 86* alignment is active.

✓ Tar Reference Constraints metry Projects Default 2345DES_Geometry Cogo Buffer ✓ Off Ramp	S	Description	File Name C:\Projects\12	By \ cfer cfer
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Default .2345DES_Geometry ;; Cogo Buffer		SH 86 Design g	C:\Projects\12	
2345DES_Geometry Cogo Buffer	崖 Default			cfe
SH 86 SH86_Offset_Left SideRoad	₽			
-	✓ SH 86 ✓ SH86_Offset_Left ✓ SideRoad etry	J SH86_Offset_Left J SideRoad	J SH86_Offset_Left / SideRoad	J SH86_Offset_Left ↓S J SideRoad

- 12. From the InRoads menu bar, select **Geometry > View Geometry > Stationing**.
- 13. On the *View Stationing* dialog box, **<D> Apply**.

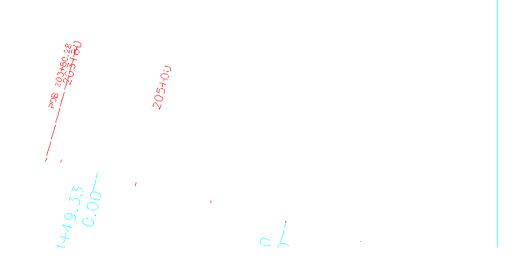
14. Examine the stationing displayed. The regular stations end in "+80". This is not CDOT standard.



15. On the InRoads main dialog box, turn the *Station* lock on.

Bentley InRoads V8i (SELECTseries	2)						• •
File Surface Geometry Drainage	Evaluation M	<u>I</u> odeler	Site Modeler	Drafting	<u>Q</u> uantities	<u>T</u> ools <u>H</u> e	lp 🛛
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		Geon	netry Proj	Delacime	n Lock On	ile Name	By V
□品 Geometry Projects		12	345DES_G				12 cfer
Default		Ë De	fault				cfer

- 16. Redisplay the Stationing.
- 17. Examine the stationing displayed. There are two things to note. First, the original stationing was deleted and the new stationing was displayed. This is a result of the Pencil mode. Second, the stations end in "+00" in even 500 foot intervals.



- 18. On the InRoads main dialog box, set the *Pen/Pencil* mode to **Pen**.
- 19. Turn **Delete Ink** off. *Delete Ink* makes *Pen* mode behave like *Pencil* mode. It is turned off here to illustrate *Pen* mode.

🚟 Ber	ntley InRo	ads V8i (SE	LECTseries	; 2)							×
File	<u>S</u> urface	Geometry	<u>D</u> rainage	Evaluation	M	odeler	Site Modeler	Dr <u>a</u> fting	<u>Q</u> uantiti	es <u>T</u> ools <u>H</u> elp	
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Next, Pen mode is demonstrated.

- 20. Redisplay the Stationing. The stationing will appear the same as it did in the previous step. This is done so that the stations are redisplayed with Pen mode. The original stationing was displayed in Pencil mode so it will always behave in Pencil mode.
- 21. Turn off the **Station lock** and redisplay the stationing. This time the original stationing is left in place and the new stationing is also displayed.



22. Turn the Station Lock back on and set the Pen/Pencil Mode back to Pencil.

23. Delete the stationing that was displayed.

Section Summary:

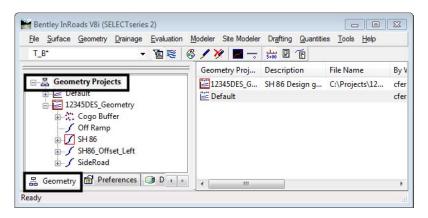
- The Feature Filter lock has two items to set; The Filter Name and the Filter lock On/ Off switch.
- Items placed retain the Pen/Pencil mode they were placed with, regardless of the mode setting at the time the items are placed again.
- Station lock On is the standard operating mode for CDOT.

Lab 1.5 - Precision and Factors

Precision affects the number of decimal places used in InRoads dialog boxes. Factors determine the size of graphic elements displayed by InRoads. This lab illustrates these affects.

First, precision is examined. The Review Horizontal Alignment command is used to illustrate the affects.

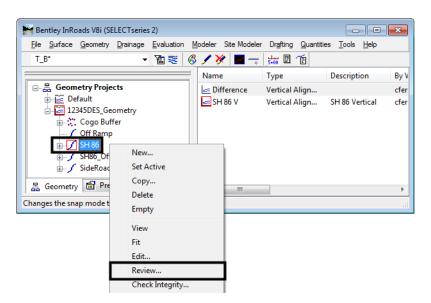
- 1. In the InRoads Explorer, select the **Geometry** tab.
- 2. Expand the **12345DES_Geometry** geometry project to show the SH 86 alignment.



- 3. From the InRoads menu bar, select **File > Project Options**.
- 4. Verify that the *Precision* tab is active.

Notice that the precision for *Station* is set to **0.12**.

5. In the InRoads Explorer, **<R>** on the **SH 86** alignment and select **Review** from the right click menu.



Beometry Project: 12345DES_Geometr ▼ Horizontal Alignment: SH 86 ▼ _	Mode Curve Sets	Alignment 🔘 Eleme	nt	Close Save As
Project Name: 1234 Description: SH 8 Horizontal Alignment Name: SH 8 Description: SH 8 Style: ALG	6 Design geometry 6 6 Centerline		* 11	Append Display Print
	STATION	NORTHING		Help
Element: Circular PC () PI () CC () PT () Radius: Delta: Degree of Curvature(Arc): Length: Tangent: Chord: Middle Ordinate:	203+80.28 203+83.79 203+87.30 30000.00 0^00'48" R 0^11'28" 7.02 3.51 7.02 0.00	1556706.07 1556705.14 1527759.88 1556704.22 ight		Select First < Previous Next >

In the *Review Horizontal Alignment* dialog box, notice that the stations have 2 decimal places.

- 6. Close the *Review Horizontal Alignment* dialog box.
- 7. In the *Project Options* dialog box, change the *Station* precision to **0.1234**.
- 8. **<D> Apply**.

🗑 Project Opti	ons 🗖 🗖 💌
Tolerances	Factors Abbreviations Rail Sight Distance
Precision	General Units and Format Geometry
Northing/East	ing: 0.12
Elevation:	0.12 💌
Angular:	0 -
Aspect:	0.12 -
Slope:	0.12 -
Linear:	0.12 -
Station:	0.1234 👻
Acres/Hectare	es: 0.1234 -
Area Units:	0.12 -
Cubic Units:	0.12 -
Scale:	0.1234 👻
A	pply Preferences Close

Geometry Project: 12345DES_Geometr	Mode	Alignment 🔘 Eleme	nt		Close Save As
Project Name: 12 Description: SH Horizontal Alignment Name: SH Description: SH Style: AL	86 Design geometry 86 86 Centerline	NORTHING	EASTING	E	Append Display Print
Element: Linear POB () PC () Tangent Direction: Tangent Length:	203+80.2820 231+75.2986 S 74 45 13 E 2795.02	1556706.07 1555971.14	3277567.49 3280264.16		Help Select
Element: Circular PC () PI () CC () PT () Radius:	231+75.2986 233+25.0487 234+72.9689 1100.00	1555971.14 1555931.76 1557032.43 1555932.44	3280264.16 3280408.64 3280553.39 3280558.39	-	<pre>Previous</pre>

9. Redisplay the *Review Horizontal Alignment* dialog box for SH 86.

Notice that the stations now show 4 decimal places. Next the affects of factors is demonstrated.

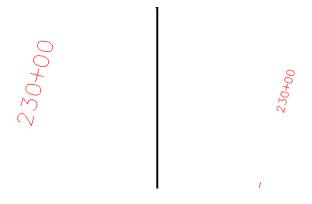
- 10. Reset the *Station* precision back to **0.12**.
- On the *Project Options* dialog box, <D> the Factors tab. Notice that the *Text Scale Factor* is set to 100.
- 12. From the InRoads main menu, select **Geometry > View Geometry > Stationing**.

<u>File</u> <u>S</u> urface	<u>G</u> eometry <u>D</u> rainage <u>E</u> valuation	Modeler Site Modeler Drafting Quantities	<u>T</u> ools <u>H</u> elp	
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	Simplified Vertical Element	Curve Set Annotation		
±	Superelevation	Vertical Change In Plan		
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icplays a three	Review Vertical	⊉ All Horizo <u>n</u> tals		
isplays a three	Review Geometry Points	options		

- 13. On the *View Stationing* dialog box, **<D> Apply**.
- 14. Zoom in on a station and note the size of the text.

- Project Options
- 15. On the *Project Options* dialog box, key in *50* for the *Text Scale Factor* and *<D> Apply*.

16. Redisplay the stationing and notice the change in the text size. The illustration below shows the difference.



17. Reset the *Text Scale Factor* to *100*.

18. Delete all of the graphics displayed in the drawing, then close InRoads and MicroStation.

Section Summary:

- Precision controls the decimal places displayed in InRoads dialog boxes only.
- Factors control the size of text, cells, and linestyles displayed by InRoads.
- The Linestyle Scale should be set to 1, Text and Cell scales should be set to the plot scale.

Chapter Summary:

- Start a project by creating the directory for the project.
- Project defaults make it easier to Open and Save project data files.
- Locks affect the way InRoads works and displays information. These should be set as desired prior to work on the project.
- Precision and Factors affect displays in InRoads dialog boxes and items placed by InRoads. These should be set as desired prior to work on the project

LAB 2 - Review Geometry

The purpose of this lab is to go into a detailed review of the contents of the *12345DES_Design* geometry project (*12345DES_Design.alg*) file.

In subsequent labs geometry data will also be loaded from the ROW_Survey directory structure for reference purposes only. To maintain the integrity of the ROW_Survey geometry data, subsequent exercises will show you how to copy geometry projects in their entirety and also how to selectively copy information (alignments and cogo points) to a separate geometry project.

Important! Data from the ROW/Survey directory should only be modified by the ROW/ Survey group. Staff from other disciplines should not modify ROW/Survey geometry projects in any way and take any precautions to ensure that it is not changed.

Chapter Objectives:

- Illustrate the process of setting active geometry.
- Review an existing geometry project.
- Review alignment attributes.
- Review alignment stationing.

The following files are used in this lab:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Projects\12345\Design\InRoads\12345DES_Design.alg

Lab 2.1 - Review Geometry Project

Section Objectives:

- Learn how to identify and change the "active" geometry.
- Learn how to review and view geometry including cogo points.
- Learn how to save the results of an InRoads report.
- Learn how to clean up MicroStation graphics and keep them in sync with InRoads data.
- Practice gathering alignment information.
- Open the file in the 12345DES_Model.dgn file from the C:\Projects\12345\Design\Drawings\Reference Files folder.
- Open the geometry project named 12345DES_Design.alg located in the folder C:\Projects\12345\Design\InRoads.

3. **Expand** the geometry project tree by selecting the + (plus) symbol located to the left of the geometry project name. You should see something similar to the image below

Hentley InRoads V8i (SELECTseries 2)		
<u>File Surface Geometry Drainage Eval</u>	uation <u>M</u> odeler Site Modeler Dr <u>a</u> fting	<u>Q</u> uantities <u>T</u> ools <u>H</u> elp
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□ 品 Geometry Projects	12345_Design SH 86 Design	C:\Projects\12 cferree
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i		
ia∫ Side Road		 Scroll Bar
品 Geometry 🛗 Preference 🕢 🕨	<	Þ
Toggles the Feature Highlight Lock		H.

- 4. Look at the information pane on the right side of the InRoads main menu. Use the **Scroll bar** at the bottom of the window to view the columns of information to the right. The following is a list of columns you will see (they may be in a different order):
 - *Name* The horizontal alignment name and the Cogo Buffer are shown here.
 - *Style* The Style name attached the horizontal alignment is listed here.
 - **Description** The horizontal alignment's description, if any, is shown here.
 - **By Whom** The Windows user ID of the person who created the alignment is shown here.
 - Last Revised This column lists the most recent revision date for the file.
 - Access Mode This column indicates whether the file has write access or is read only.
 - *Integrity* This column indicates whether the alignment elements are connected properly or not.
 - *Curve Definition* This column indicates whether curves are defined by arc or chord.
 - *Start Station* This column lists the beginning station value for the alignment.
 - *End Station* This column lists the ending station value for the alignment.
 - Number of VAs This column lists the number of associated vertical alignments.
 - *Number of Superelevations* This column lists the number of associated superelevation definitions.
- 5. **<D>** on any of column headings to sort ascending or descending.
- 6. To reposition the columns either to the left or right, **<D>** and hold down the column heading and slide the mouse on to any of the column headings.

 <D> on the Cogo Buffer. Notice the detail screen to the right showing the contents of the Cogo buffer. Also notice the columns showing Northing, Easting, and Elevation by adjusting the view pane.

<u>File Surface Geometry Drainage</u>	Evaluation Modeler	Site Modeler Drafting	<u>Q</u> uantities <u>T</u> ools	<u>H</u> elp
<unnamed></unnamed>	Ta 📚 🤞 🖊 🎽	2 🗾 🛶 📴	Ē	
	Name	Description	Style	N
□ Ⅰ Geometry Projects	1		ALG_EXIST	155
Default	2		MON_Sect-corn	155
12345 Design	÷::3		MON_Sect-corn	155
Egen Buffer	4		RW_Sec-Line_ex	155
	::: 100		Default	155
⊞ 📝 SH 86	::: 101		Default	155
🗄 🖍 Side Road	::: 1000		ALG_EXIST	155
	::: 1001		ALG_EXIST	155
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8. **<D>** on the first horizontal alignment listed. Notice the associated vertical alignment.

Rentley InRoads V8i (SELECTseries 2)				
<u>File Surface G</u> eometry <u>D</u> rainage <u>E</u> va <unnamed></unnamed>			Quantities Tools	<u>H</u> elp
	Name	Туре	Description	By Whom
Default 12345_Design	🔙 SH 86 🛃 SH 86 V	Vertical Align Vertical Align	Proposed SH 86 Proposed SH 8	cmfriesen cmfriesen
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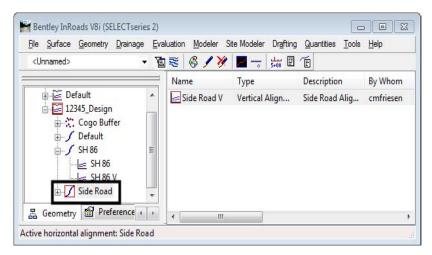
Only one horizontal alignment can be active at a time. Being *active* specifies the alignment to be modified, displayed, or defined by default in dialog boxes. To set a horizontal alignment active:

9. Select Geometry > Active Geometry. To display the Active Geometry dialog box.

Kactive Geometry	1		
Туре:	Horizontal Alignment	→	Apply
Description	Side Road Alignment		Close
Style:	ALG_PRO	~	Help
Current	10045 D		nop
Geometry Project:	12345_Design		
Horizontal Alignment:	Side Road		
Vertical Alignment:	Side Road V		
Name	Description	Style	
Default	Deserved CUL 0C	Default	DO
SH 86 Side Road	Proposed SH 86 Side Road Alignment	ALG_P ALG_P	

- 10. Set *Type* to Horizontal Alignment.
- 11. **<D>** on alignment **Side Road**.
- 12. **<D> Apply** then **Close**.

Notice that the alignment called *Side Road* in the InRoads explorer pane shows a red indicator box around it signifying that it is the *active* alignment.

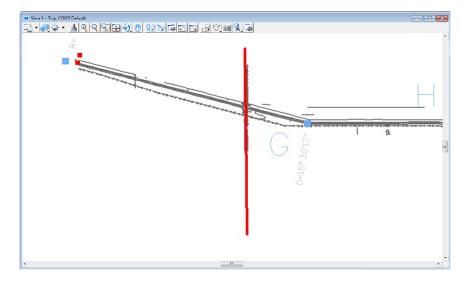


13. Select **Geometry > Review Horizontal** for a textual display of the active alignment. When reviewing an alignment, a temporary dynamic display is shown in MicroStation representing the location of the alignment being reviewed.

- Review Horizontal Alignment Geometry Project: Mode 12345_Design Close O Curve Sets Alignment O Element Horizontal Aligr Side Road Save As. Project Name 12345_Design Append. SH 86 Design Alignments Description: ignment Name: Side Road Side Road Alignment Horizontal Δ1 Display Description: Stul Print NORTHING EASTING STATION Help Element near POB 9+00.00 22+50.68 36'36" W 3279686.08 1554533.43 PI 1555884.03 3279671.70 Tangent Direction Tangent Length N 01 1350.68 First Element: Linear PI 22+50.68 1555884.03 1556883.30 3279671.70 3279660.92 POE 32+50.00 `37'05" W 999.32 Tangent Direction: Tangent Length: N 01 Next 3 Last < >
- 14. Explore the four main areas of the dialog box.

- Geometry Project and Horizontal Alignment (in the dialog box frame)
 - Change the Horizontal Alignment
- Mode (in the dialog box frame)
 - Change the Mode and watch how the information in the dialog box changes
- Geometry header (in the view port)(not displayed in Element Mode)
 - Note the change to the Project Name, Description, Alignment name, Description, Geometry Style
- Element Details (in the view port)
 - The element details change according to what mode is selected.
- 15. Review this display for alignment information such as Cogo point ID assignments, bearings, distances, northing, easting, etc.
- 16. **<D>** the **Close** button.
- 17. Verify that the *Side Road* alignment is active.
- 18. Select **Geometry > View Geometry > Active Horizontal** to display the alignment in the MicroStation file.
 - **Note:** It may appear that nothing happened. This is because the view window is not positioned correctly to see the data. The next step will resolve this.
- Select Geometry > Fit Alignment and <R> (press the right mouse button) in a MicroStation view to reposition the MicroStation view to the limits of the active alignment.

Note: If the graphics for the existing features disappear, use the key in *dp* = -10000, 30000 and left click in *View 1* to expand the MicroStation clipping planes.



20. In the InRoads Explorer pane **<R>** (right-click) on the active alignment name. Note the *Active, View, Fit*, and *Review* commands are available from the right click menu.

	New Set Active Copy Delete Empty View					
Bentley InRoads <u>File S</u> urface <u>G</u> eo <unnamed></unnamed>	Fit Edit Review		Site Modeler	Drafting		 Help
 	Check Integrity Hilite Read-Only	d V	Type Vertical A		Description Side Road	By Whom cmfriesen
	Read-Write Details					
	Arc Definition Chord Definition					
몸 Geometry M Pro	eference					ا

21. Experiment using this right click menu with any alignment.

22. In the InRoads Explorer pane **<R>** on the **Cogo Buffer** and select **Review...** to display the *Review Geometry Points* dialog box.

Bentley InRoads V8i (SELE	CTseries 2)							×
<u>File S</u> urface <u>G</u> eometry <u>D</u>)rainage <u>E</u> va	luation <u>M</u> odele	r Site Modeler	Dr <u>a</u> fting	<u>Q</u> uantities	<u>T</u> ools	<u>H</u> elp	
<unnamed></unnamed>	• 1	💐 🚳 🖊	🎉 📕 🚽	1 🗉 🕹	Ē			
		Name	Descripti	ion	Style			Nc 🔺
🕀 🗮 Default		②1			ALG_EXIST			1556
🖃 🔛 12345_Design		2			MON_Sect	-corn		1556 🗉
E Cogo Buffer		- <u>***</u> 3	1		MON_Sect	-corn		1558
Default	Delete	·	1		RW_Sec-Li	ne_ex		1558
i⊒∫ SH 86	Empty	/			Default			1555
	View				Default			1556
					ALG_EXIST			1558
	Fit				ALG_EXIST			1558 🛫
몶 Geometry 😭 Prefer								•
Toggles the Style Lock	Review	N						н
	Read-	Only						
	√ Read-	Write						
	Details	s						

- 23. **<D>** the **Next** button to review the information about subsequent points. Notice the available navigation buttons *First, Previous, Next,* and *Last*.
- 24. **<D> Report** to list all Cogo points stored in the active geometry project.

🚔 Review Geon	netry Points	
Mode: 🔘 Alignn	nent: Side Road	 Apply
All Poi	ints	Close
Point		+1 Report
Name:	1	* <u>* </u>
Description:		Help
Style:	ALG_EXIST -	
Northing:	1556963.86	
Easting:	3276609.90	
Elevation:	0.00	
Synchronize S	Shared Point Elevations	Center in View
Shared Points		
Point Type	Alignment	
COGO		
First	< Previous Next	> Last

25. Examine the Results dialog box.

Report Result	s		<u>^</u>	Close
₹6		DIOMT ICO	-	Save As
POINT NAME	NORTHING	EASTING	E.	
2	1556963.86 1556883.30	3276609.90 3279660.92	=	Append
}	1558531.40	3279637.21		
	1558509.37	3279625.93		Display
00	1555633.69	3279672.47		
101	1556633.64	3279663.14		Print
L000	1558417.74	3267409.40		
L001	1558457.06	3268756.14		Help
L002	1558469.66	3270669.73		
[003	1558050.59	3272645.47	_	

The buttons on the right side of the *Results* dialog box allow you to save or display this report. Below is a description of each button's function:

- *Close* closes the *Results* dialog box
- Save As saves the contents of the dialog box to an ASCII (text) file
- *Append* appends to an existing ASCII file
- **Display** allows the user to select a location in the MicroStation drawing to place the dialog contents as text and using the active text and element settings when writing the text to the CADD file
- *Print* sends the contents to the default system printer
- Help displays the InRoads help file for this command
- 26. **<D>** the **Close** button in the *Results* dialog box
- 27. In the *Mode* section of the *Review Geometry Points* dialog, toggle on **Alignment**. Notice that the Alignment drop-down list is activated.

🐂 Review Ge	ometry Points
Mode: 💿 Alig	nment: SH 86 Apply
© Al I	'oints Close
Point Name:	1000 + Report
Description:	Help
Style:	ALG_PRO
Northing:	1558417.74
Easting:	3267409.40
Elevation:	0.00
Synchronize	Shared Point Elevations 🔲 Center in View
Shared Point	3
Point Type	Alignment
POB COGO	SH 86
First	<pre> < Previous Next > Last</pre>

28. Select SH86 in the *Alignment* drop-down list.

- 29. **<D>** the **Report** button again to review the vertices of the selected alignment.
 - **Note:** The *Point Name* column is not showing point numbers or names (except for point 1000) indicating this alignment was created as unnamed geometry points.

Report Result	s		^	Close
POINT NAME 1000	NORTHING 1558417.74 1558450.09 1537339.09 1558458.63 1558467.52 1555467.58 1558402.30 1558117.51 1547356.90 1557965.30 1557001.57	EASTING 3267409.40 3268517.55 3269133.91 3270345.09 3270345.09 3270364.85 3270987.32 3272329.96 3270047.57 3272956.51 3276471.06	E.	Save As Append Display Print Help

30. **<D>** the **Close** button in both the *Results* and *Review Geometry Points* dialog boxes.

- Bentley InRoads V8i (SELECTseries 2) - - X File Surface Geometry Drainage Evaluation Modeler Site Modeler Drafting Quantities Tools Help <Unnamed> View Geometry **※** | 📕 ------ 🔛 🗄 🔳 🛃 Fit Alignment Nc 🕋 Description Style Horizontal Curve Set ALG_EXIST 1556 Vertical Curve Set 1556 🗏 MON_Sect-corn . . 1558 MON_Sect-corn Horizontal Element Ē. 1558 Vertical Element RW_Sec-Line_ex Ė Default 1555 Simplified Horizontal Element Default 1556 Simplified Vertical Element ALG_EXIST 1558 <u>ف</u>... Superelevation ALG_EXIST 1558 _ 品 Geometr Review Horizontal. Ш Þ Review Vertical.. Searches for a ord Review Geometry Points... Cogo Points Locate Traverse... Active Geometry.. Copy Geometry .. Delete Geometry.. Rename Geometry. Utilities
- **Note:** The previous steps used the right click menus, all actions can also be found under the *Geometry* pull-down menus.

Multiple Geometry Projects can be loaded into memory simultaneously. However, only one geometry project, horizontal, and vertical alignment can be active at any given time.

<u>File Surface Geome</u>	try <u>D</u> rainage <u>E</u> v	aluation <u>M</u> odeler	Site Modeler Dr <u>a</u> fting	<u>Q</u> uantities <u>T</u> ools	<u>H</u> elp
<unnamed></unnamed>	- Y	i 🗟 🖉 🎉	· 🗾 🔛 🗉	Ē	
		Name	Description	Style	Nc
🗄 🧮 Default	^	\$ 1		ALG_EXIST	1556
📄 🔛 12345_Des	-	2.2		MON_Sect-corn	1556
⊡		213		MON_Sect-corn	1558
Default		27.4		RW_Sec-Line_ex	1558
🚊 📝 SH 86		100		Default	1555
	86 V	101		Default	1556
		1000		ALG_EXIST	1558
i ⊡… 🖌 Side Ro	vau ≠	1001		ALG_EXIST	1558
品Geometry 📓 F	Preference 🕢 🔸	***			Þ

- 31. Use the previously covered commands to display the horizontal alignments *SH 86* and *Side Road*.
- 32. Use the review command to investigate the various data for the same two alignments.
 - What is the beginning station value for:

SH 86 _____

Side Road _____

• What is the overall length of:

SH 86 _____

- Side Road _____
- What is the shortest radius used in:

SH 86 _____

Side Road _____

Section Summary:

- Many of the view and review commands can be accessed from the right click menu as well as the main toolbar
- Reports displayed by review commands can be saved to a text file
- Use the Mode options, where available, to display data in different formats

Lab 2.2 - Review Alignment Attributes

The geometry *Name*, *Description*, and *Style* are assigned to an alignment or Cogo point when it is created. These attributes can be queried by utilizing the review geometry command.

Section Objectives:

- Review Alignment Attributes
- Review Cogo Point Attributes
- 1. Select Geometry > Review Horizontal...

eometry Project: 12345_Design v orizontal Alignment: SH 86 v	Mode O Curve Sets ③	Alignment O Eleme	nt		Close Save As
Project Name: 1234 Description: SH 8 Horizontal Alignment Name: SH 8 Description: Prop. Style: ALG	6 Design Alignmen 6 osed SH 86 PRO	ts			Append Display Print
	STATION	NORTHING	EASTING	6	TIME
Element: Linear					Help
POB (1000) PC ()	100+00.00 111+08.62	1558417.74 1558450.09	3267409.40 3268517.55		
Tangent Direction:	N 88^19'40" E	1000400.07	5200317.00		Select
Tangent Length:	1108.62				First
Element: Circular					11101
PC ()	111+08.62	1558450.09	3268517.55		< Previous
PI () CC () PT ()	113+47.31	1558457.06	3268756.14		
	115+85.98	1537339.09 1558458.63	3269133.91 3268994.82		Next >
FI () Radius:	21120.00	1000400.00	3200774.82	~	
<]	21120.00		>	1000	Last

 Using the selection box labeled *Horizontal Alignment*, Compare the settings for alignment SH 86 with the attributes for *alignment* Side Road. Note the changes in Description and Style.

- 3. Close the *Review Horizontal Alignment* dialog box.
- 4. Select **Geometry > Review Geometry Points...** to review Cogo point names, descriptions, and style assignments.
 - *Note:* This dialog box is used to review both alignments and Cogo points based on the *Mode* setting.

🚔 Review Geom	netry Points		- • 💌
Mode: 🔘 Alignm i All Poir		4	Apply
Point Name: Description: Style:	1000 ALG EXIST	+	Report
Northing: Easting: Elevation:	1558417.74 3267409.40 0.00		•
Synchronize S Shared Points Point Type	hared Point Elevations Alignment	Cer	nter in View
POB	SH 86		
First	< Previous Next	>	Last

5. This information can also be accessed through the InRoads explorer pane. **<D>** on the *Cogo Buffer* and notice the description(s) and Style(s) as displayed in the information pane.

<u>File Surface Geometry Drainage</u>	Evaluation	n <u>M</u> o	deler Site Mode	eler Dr <u>a</u> fting <u>G</u>	uantities <u>T</u> ools	<u>H</u> elp	
<unnamed> -</unnamed>	D S	8.	/ 🤾 🗖		9		
	Na	me	Style	Northing	Easting	Elevation	
	A	1	ALG_EXIST	1556963.86	3276609.90	0.00	
Default		1011	ALG_EXIST	1553315.19	3291416.57	0.00	
🔄 🔛 12345_Design		1010	ALG_EXIST	1553821.34	3290431.45	0.00	
		1009	ALG_EXIST	1554474.27	3288508.48	0.00	
Default		1008	ALG_EXIST	1555699.32	3283343.64	0.00	
🚊 🖊 SH 86		1007	ALG_EXIST	1555939.60	3282135.29	0.00	
<u>-</u> == SH 86 ∨		1000	ALG_EXIST	1558417.74	3267409.40	0.00	
51100 V		1001	ALG_EXIST	1558457.06	3268756.14	0.00	
品 Geometry 🗃 Preference 4	F	1002	ALG_EXIST	1558469.66	3270669.73	0.00	

Section Summary:

• Geometry data can be reviewed through a variety of commands, accessed through the Geometry menu on the main bar or from right click menus

Lab 2.3 - Review Alignment Stationing

The default station at the beginning of a newly created horizontal alignment is 0+00. If the alignment previously existed, the beginning station may not be 0+00. The beginning station value can be changed to accommodate the needs of the project as shown in a later lab.

The first thing to do is to determine the current beginning station by using the review alignment commands.

1. Make **SH 86_West** alignment active by **right-clicking** on the alignment name and selecting **Set Active** from the right click menu.

	New			
	Set Active			
	Сору			
	Delete			
	Empty			
	View			
🚔 Bentley InRoads V8i (SEI	Fit Edit		[- • •
<u>File</u> <u>S</u> urface <u>G</u> eometry	Review	te Modeler Dr <u>a</u> fting	<u>Q</u> uantities <u>T</u> ools	<u>H</u> elp
<unnamed></unnamed>	Check Integrity	<u></u>	Ē	
	Hilite	Туре	Description	By Whom
	Hinte	Vertical Align	Proposed SH 86	cferree
Default	Read-Only	Vertical Align	Proposed SH 8	cferree
	✓ Read-Write			
⊕ Cogo Buff ⊕ ∫ Default	Details			
	Arc Definition			
Side Road	Chord Definition			
	Chora Dennition	1		
몶 Geometry 🛍 Prefere	nce + > + III			۱.
Toggles the Style Lock				

2. **Right-click** on the alignment **SH 86_West** and select *Review* from the right click menu. The *Review Horizontal Alignment* dialog box is displayed.

	New Set Active Copy Delete Empty View			
Bentley InRoads V8i (SELE <u>File Surface G</u> eometry <unnamed></unnamed>	Fit Edit Review	Modeler Drafting	Quantities Tools	Elp
Geometry Project Geometry Pr	Pred Only	vertical Align	Description Proposed SH 86 Proposed SH 8	By Whom cferree cferree
品 Geometry 聞 Preference Active horizontal alignment: SH 86				م ان.

- **Note:** Right click menus can be accessed from either the InRoads explorer or information panes. Also note that selecting an alignment for review switches it to being the *active* alignment.
- 3. Write down the initial station value assigned to horizontal alignment SH 86_West:

eometry Project: 122	45 Design	Mode				<u> </u>
123	45_Design ▼		Alignment 🔘 Eleme	nt		Close
prizontal Alignment:	86_West ▼ _+					Save As
	ject Name: 12345_ scription: SH 86		+-			Append
	ment Name: SH 86					Display
	scription: Propos	ed SH 86 West				Dispidy
	Style: ALG_PR		NODTITNO	ELOPTIO		Print
		STATION	NORTHING	EASTING		
lement: Linear						Help
POB	(1000)	➡100+00.00	1558417.74			
PC	() Direction:	111+08.62 N 88^19'40" E	1558450.09	3268517.55		Select
	ent Length:	1108 62				Seleci
-	-					First
lement: Circular	r _j	444.00.00				
PC PI		111+08.62 113+47.31	1558450.09 1558457.06	3268517.55 3268756.14		< Previous
CC	2	113447.31	1537339.09	3269133.91		Next >
PT	()	115+85.98	1558458.63	3268994.82		Ivext >
	Radius:	21120.00			-	Last

4. Close the *Review Horizontal Alignment* dialog box.

Bentley InRoads V8i (SELECTsee File Surface Geometry Drainag <unnamed></unnamed>	Delete	Drafting Quantities Iools Help
Default	Review	
Cogo Buffer Default Default Default SH 86 Side Road SH 86_West SH 86_West SH 36_West SH 36_West SH 36_West SH 36_West SH 36_West	•	
Toggles the Feature Filter Lock		łł.

5. Review the *Vertical* alignment **SH 86_West-V** associated with the horizontal alignment SH 86 West.

6. Write down the initial station value assigned to vertical alignment SH 86-West-V:

eometry Project:	lignment 12345 Design ╺	Mode			Close
lorizontal Alignment:	SH 86_West +				Save As
ertical Alignment:	SH 86_West-V 🔹	C Element			Append
Horizontal Al	ignment Name: SH 8 Description: Prop Style: ALG_ ignment Name: SH 8	6 Design Alignments 6_West osed SH 86 West PRO 6_West-V osed SH 86 West Pro			Display Print Help
		STATION	ELEVATION		Select
Element: Line T	POB PVC Tangent Grade: 'angent Length:	→ 100+00.00 107+50.00 -3.76 750.00	6630.07 6601.88		First < Previous Next >
Element: Para	bola PVC	107+50 00	6601 88	-	Last

- 7. Close the *Review Vertical Alignment* dialog box.
- 8. Delete all of the graphics in this file, then close InRoads and MicroStation.

Section Summary:

• The beginning and ending stations can be found in the information pane or the review alignment dialog boxes

Chapter Summary:

- Use the right click menus to find many of the view and review geometry commands without searching the InRoads main menu
- Use the navigation buttons provided in the review dialog boxes to move through long reports

• The attributes for geometry elements can be found in the information pane or in review reports

LAB 3 - Geometry Annotation

This lab demonstrates how annotate horizontal geometry, set and display alignment stationing, and use horizontal alignment tracking tools.

Chapter Objectives:

- Display horizontal alignments.
- Annotate horizontal alignments and cogo points.
- Reset stationing on an alignment.
- Display stationing.
- Add a station equation.
- Use Tracking and Horizontal Alignments Tracking.

The following files are used in this lab:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Geometry-Annotation.dgn
- C:\Projects\12345\Design\InRoads\12345DES_Design.alg
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm

Lab 3.1 - Geometry Display

Section Objectives:

- Set the proper scale factors.
- Open a saved view in MicroStation.
- Display alignments using the View and Annotation commands.
- Select Tools > Global Scale Factors and set the scales to 100 for Text and Cell and 1 for Line Style.

Scale F	actors	
Text:	100.0000	Apply
Cell:	100.0000	
Line Style:	1.0000	

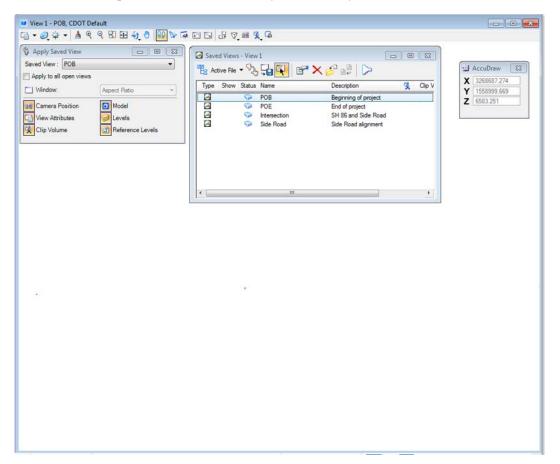
- 2. **<D> Apply** then **Close** to accept the changes and dismiss the dialog box.
- Using the *MicroStation* menus, select Utilities > Saved Views to open the saved views dialog box.

4. **<D>** on the name **POB**, **<D>** the **Apply Saved View** button, then **<D>** in **View 1**.

🔄 Save	d Views - View	1	
Eg Act	tive File 🔻 🖓	, 🔂 📉	🚰 🗙 🤌 📭 🖒
Туре	Show Status	Name 3	Description 👰 Clip V
		POB	pply Saved View Beginning of project
		POE	End of project
		Intersection	SH 86 and Side Road
		Side Road	Side Road alignment
•		1	II

5. Close the *Saved Views* dialog box.

Below is an example of the saved view. Only two small symbols are visible.



6. Display alignment **SH 86_West** from the Geometry Project *12345_Design* by rightclicking **<R>** on the alignment name and selecting **View** from the right click menu.

Bentley InRoads V8i (SELI File Surface Geometry [<unnamed> Cogo Buffe Cogo Buffe Cogo Buffe Cogo Buffe SH 86, West Surfaces B Geome</unnamed>	□ Hilite Read-Only ✓ Read-Write Details ✓ Arc Definition Chord Definition	Modeler Drgfting Quartities Iools Help Vertical Align Proposed SH 8 cferr
View 1 - POB, CDOT Default ✓	3 8 4 9 10 6 6 6 8 1	⊽.iii \$.G

View 1 - POB, CDOT Default	
CI • 3 4 • 9 4 4 21 EF 4 9 100 10 10 11 10 11 16 11 16 10	
	Lif AccuDraw E2 X 3268968.861 Y 1559009.850 Z 6583.251

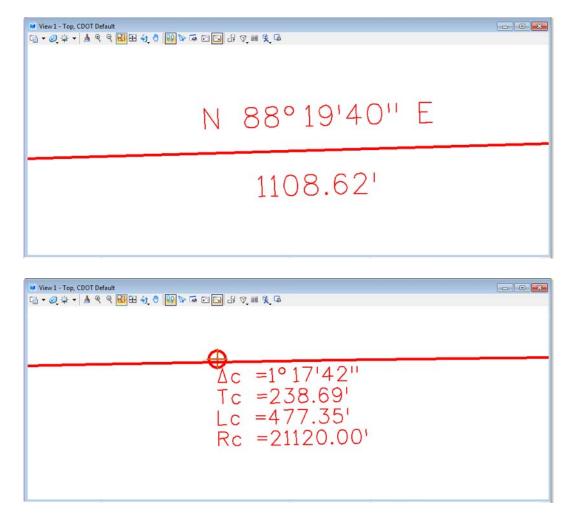
The alignment display is based on the geometry style assigned to the alignment. This display method does not allow the user to annotate of the geometry. The next steps illustrate how to display various types of horizontal alignment data.

View Horizontal Annotation Main Tabling Styles	_ = =
Apply Style Assigned Active Over Horizontal Alignment: ALG_EXISTING Cogo Points: Default	vrite
	Cogo Points
Name Descri Style SH 86_West Proposed ALG_P	Name Descri Style
<►	Annotate
Points	Points
🕼 On-Alignment 📃 Event Points	Elements
Off-Alignment Station Equation	ns Duplicates
Elements	Dual Dimensions
Radials Tangents	Try Alternate Styles
Chords Subtangents	Extend Beyond Element
Display As Complex Linestring	Planarize
Apply Interactive Graphics	s Preferences Close

7. Select Geometry > View Geometry > Horizontal Annotation.

- 8. Key in *SH 86_West* in the *Annotate* field and *Tab* from the field.
- 9. Set options for the *Display* and *Annotate* sections of the dialog box as shown in the above illustration.
- 10. **<D>** the **Apply** button. The *SH86_West* alignment and its annotation are displayed.

11. Note how *Bearing* and *Distance* annotation is displayed along the tangents. If the alignment contains horizontal curves, curve data will be displayed.



12. Return to the View Horizontal Annotation dialog box.

	Styles					
Apply Style Assigned	A	ctive	Overwrite			Filter
Horizontal Align	ment: 🔽	ALG EXISTIN	~			Help
Cogo Points:	<u> </u>	Default	a			
ogo r onno.	Ľ	Jerault				
Horizontal Align	ments			Point	s	
nclude:		+	Inclu			-+
Selected:			Sele	ected:		
Name	Descri	Style	Nar	ne	Descri	Style
SH 86_West	Propose	ed ALG_P				
<		_			notate	
<		_	ts	V	notate Points Elements	
 ✓ Display ✓ Points 	ment	ł		v	Points	
 ✓ Display ✓ Points ✓ On-Align 	ment	Event Poin		V	Points Elements	sions
< ✓ Display ✓ Points ✓ On-Alignr ─ Off-Alignr	ment	Event Poin			Points Elements Duplicates	
	ment	Event Poin	uations		Points Elements Duplicates Dual Dimen Try Alternati	

13. In the *Annotate* area of the *Main* tab, Toggle on *Points* and **<D> Apply**

In addition to annotation for tangents and curves, notice that alignment vertices are also annotated.



14. On the **Main** tab, click the **Help** button and review the descriptions for the various components that can be displayed.

Main Tabling Styles		X
Apply Style	Filter	
Horizontal Alignment: ALG_EXISTING Cogo Points: Default	✓ Help	
Horizontal Alignments	Cogo Points Include:	
Name Desc Style	Name Descri Style	1
4 III >		
Display Points	Annotate	
V Points	Annotate Points Elements	
V Points	Points Elements	
Points On-Alignment Event Points	Points	
Points On-Alignment Event Points Off-Alignment Station Equation	Points Elements Duplicates	
Points On-Alignment Event Points Off-Alignment Station Equation Off-Alignments	Points Elements Duplicates Dual Dimensions	
Points On-Alignment Event Points Off-Alignment Station Equation Eements Radials Tangents	Points Eements Duplicates Dual Dimensions Try Alternate Styles	

- 15. Experiment displaying an alignment with *Points* and *Elements* turned on or off in both the *Display* area and the *Annotate* area.
- 16. Close the View Horizontal Annotation dialog box.

Section Summary:

- InRoads displayed graphics are governed by the Global Scale Factor in InRoads. The MicroStation Annotation Scale has no affect on these elements.
- The view alignment commands (from the right click menu or from Geometry > View Geometry > Active Horizontal) only display the lines and arcs that make of the alignments path.
- Horizontal Annotation also displays the alignment's path and it can display other geometry data as well.

Lab 3.2 - Selecting Multiple Alignments for display and/or Annotation

Section Objectives:

- Illustrate how to display and annotate multiple horizontal alignments at one time.
- 1. Select Geometry > View Geometry > Horizontal Annotation.

- 2. **<D>** the *Main* tab.
- 3. Set the *Apply Style* to Assigned.
- 4. **<D>** in the *Include* field in the *Horizontal Alignments* area. The *Filter* button becomes active.

View Horizontal Annotation Main Tabling Styles Apply Style 	Vverwrite
Horizontal Alignments Include: Selected: Name Desc Style	Cogo Points Include: Selected: Name Descri Style
< ► Display ♥ Points	Annotate Points
On-Alignment 📃 Event Points	s 📝 Elements
Off-Alignment Station Equa	ations Duplicates
Elements	Dual Dimensions
Radials Tangents	V Try Alternate Styles
Chords Subtangents	s Extend Beyond Element
Display As Complex Linestring	Planarize
Apply Interactive Grap	ohics Preferences Close

5. **<D>** the **Filter** button to display the *Geometry Selection Filter* dialog box.

🚔 Geometry	Selection Filter						—
Name:	Included	•	•				ОК
Description:	Included	•	•				Cancel
Style:	Included	•	•				Preferences
Fence Mode:	Ignore	-					Help
Available:				_	Selected:		Пор
Name	Description	Style		Add ->	Name	Description	Style
SH 86_We	Proposed SH 86 Proposed SH 86 Side Road Alignm	_	'RO 'RO	<- Remove <- Swap -> All None			

Note: Available alignments are shown on the left, **Selected** (for display or annotation) alignments are shown on the right. This makes it possible to select multiple alignments for display or annotation.

- Move the alignments SH 86_West and Side Road from the *Available* list to the *Selected* list by highlighting their names in the *Available* list and then <D> the ADD button (or <D><D> on the names).
 - **Note:** To sort the data in this dialog box, **<D>** on the column headers. To select multiple alignments use of the **<CTRL>** or **<Shift>** keys.

Name:	Included	- ·				ОК
Description:	Included	•				Cancel
ityle:	Included	•				Preferences.
Fence Mode:	Ignore	-				
Available:			_	Selected:		Help
Name	Description	Style	Add ->	Name	Description	Style
Default SH 86	Proposed SH 86	Default ALG_PRO	<- Remove <- Swap -> All None	SH 86_West Side Road	Proposed SH 86 Side Road Alignm	-
•		•				

7. **<D> OK** to dismiss the *Geometry Selection Filter* dialog box and populate the *Horizontal Alignments Selected* field of the *View Horizontal Annotation* dialog box.

View Horizontal Annotation Main Tabling Styles Apply Style Apply Style @ Assigned Active Overwrite	Filter
Horizontal Alignment: ALG_EXISTING Cogo Points: Default	
Include: Inclu	<u>+</u>
Selected: Sel Name Desc Style Na	ected: me Descri Style
Cisplay	Annotate
V Points	Points
On-Alignment Event Points	Elements
Off-Alignment Station Equations	Duplicates
Elements	Dual Dimensions
Radials Tangents	✓ Try Alternate Styles
Chords Subtangents	Extend Beyond Element
☑ Display As Complex Linestring	Planarize
Apply Interactive Graphics	Preferences Close

8. **<D> Apply** and the selected alignments are displayed in MicroStation.

9. Review the results in MicroStation.

View 1 - Top, CDOT Defau	dt	X
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999, <u>1</u> 29	N 0° 5705" W	
	Становически ст	Ос =3,00059 h =150593

Section Summary:

- Alignments can be selected for annotation by key in, graphic selection using the \pm button, or by using the Filter options.
- The Display area is used to turn on or off the display of the geometry elements.
- The Annotate area is used to turn on and off the text data associated with the geometry elements.

Lab 3.3 - Display or Annotation of Cogo Points

Section Objectives:

• Illustrate a method for defining cogo points for display and/or annotation.

Note: Whether you are annotating Points or Alignments, keep in mind that the element

selection button the can be used to graphically identify the geometry of interest. This is universally true in InRoads whenever the selection button is displayed.

10. **<D>** the *Include* field in the *Cogo Points* area to activate the *Filter* button

ain Tabling Style				Filter
	Active Over	rwrite		Filter
Horizontal Alignment	ALG EXISTING		*	Help
Cogo Points:	Default			
Horizontal Alignment		Cogo Poi	nts	
Include:	+	Include:		+
Selected:		Selecte	d:	
N. D	• •	Name	Descri	Style
Name De	sc Style	Name	2000	Злую
< ™ Display		A	nnotate	Злую
< ™ Display		A		Jujie
< Ⅲ Display ♥ Points	Þ	A Rest	nnotate 7 Points	Julyic
 ✓ III Display ✓ Points ✓ On-Alignment ◯ Off-Alignment 	Event Points	A Rest	nnotate 7 Points 7 Elements	
 III Display ✓ Points ✓ On-Alignment 	Event Points	A Ins II	nnotate 7 Points 7 Elements 9 Duplicates	nsions
 ✓ III Display ✓ Points ✓ On-Alignment ✓ Off-Alignment ✓ Elements 	Event Points Station Equation	A R	nnotate] Points] Elements] Duplicates] Dual Dimer] Try Altema	nsions

11. **<D>** the **Filter** button. The *Geometry Selection Filter* dialog box is displayed.

12. Select points **1001-1005 & 1010** from the *Available* field and add them to the *Selected* field.

Name:	Included	-					ОК
Description:	Included	•					Cancel
Style:	Included	•					Preferences
Fence Mode:	Ignore						
Available:					Selected:		Help
Name	Description	Style	*	Add ->	Name	Description	Style
1009		ALG_EXIST		<- Remove	1001		ALG_EXIST
1011		ALG_EXIST			1002		ALG_EXIST
1012		ALG_EXIST		<- Swap ->	1003		ALG_EXIST
1		ALG_EXIST	=	All	1004		ALG_EXIST
100		Default			1005		ALG_EXIST
101		Default		None	1010		ALG_EXIST
2		MON_Sect-c	or				
3		MON_Sect-c	or 👻				

- 13. **<D>** the **OK** button. The points populate the *Selected* field.
- 14. **<D> OK** to dismiss the *Geometry Selection Filter* dialog box and populate the *Cogo Points Selected* field of the *View Horizontal Annotation* dialog box.

Apply Style Assigned Active	Overwrite	Filter			
Horizontal Alignment: ALG EX		Help			
Cogo Points: Default					
Derault	*				
Horizontal Alignments	Cogo Points				
Include:	-+- Include:	+			
Selected:	Selected:				
Name Descri Style	Name Descri				
	1001	ALG_E ≡ ALG_E			
	1002	ALG_E			
	1003	ALG_E			
	٠ III				
V Display As Complex Linestrin	g				
Display	Annotate				
V Points	Points				
🔽 On-Alignment 📃 Ever	nt Points 🛛 🖾 Elements				
🔲 Off-Alignment 📃 Stati	on Equations 📃 Duplicates	5			
Elements	Dual Dime	insions			
Radials Tan					
		-			
Charde Subt	angente Extend Be	wond Element			
Chords Subt	angents Extend Be	yond Element			
	angents Extend Be	yond Element			
Planarize					
Chords Subt		ryond Element			
Planarize					
Planarize					
Planarize Apply Interact	ctive Preferences	Close	11 8 9		
Planarize Apply Interact	ctive Preferences	Close	10 % 6	_	
Planarize Apply Interact	ctive Preferences	Close	10 X .G		
Planarize Apply Interact	ctive Preferences	Close	10 X G		
Planarize Apply Interact	ctive Preferences	Close	10 L G		
Planarize Apply Interact	ctive Preferences	Close	10 Q .G		
Planarize Apply Interact	ctive Preferences	Close	10 Q G		
Planarize Apply Interact	ctive Preferences	Close	10 2 4		
Planarize Apply Interact	ctive Preferences				
Planarize Apply Interact	ctive Preferences				
Planarize Apply Interact	ctive Preferences				
Planarize Apply Interact	ctive Preferences	Close			
Planarize	ctive Preferences			_	
Planarize Apply Interact	ctive Preferences				
Planarize Apply Interact	ctive Preferences				
Planarize Apply Interact	ctive Preferences				

15. **<D>** the **Apply** button in the *View Horizontal Annotation* dialog box.

- 16. Experiment displaying various *Alignments* and *Points* with the assorted settings.
- 17. Close the *View Horizontal Annotation* dialog box.

Section Summary:

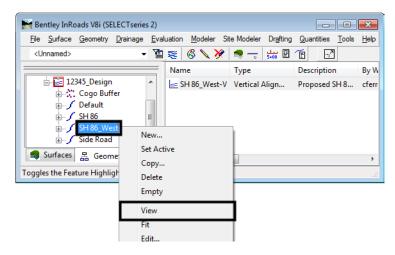
- Cogo Points can be selected for annotation by key in, graphic selection using the button, or by using the Filter options.
- In the Display area, the Points toggle is used to turn on or off the display of the geometry points.
- The Annotate area is used to turn on and off the text data associated with the geometry elements.

Lab 3.4 - Displaying Stationing

Section Objectives:

- Display stationing and alignment keypoints.
- Use the Symbology toggles to turn on and off various items.
- 1. Prior to displaying the stationing, display the linework for the horizontal alignment **SH 86_West.**

Right-click on the alignment name in the InRoads explorer pane and select *View* from the right click menu.



2. Select Geometry > View Geometry > Stationing. The *View Stationing* dialog box is displayed.

Miew Stationing		
Vew Stationing General Regular Stations Cardinal Stations Pls Station Equations Event Points Radius + A Transition Radii Vertical Stations	Horizontal Alignment: SH 86_West	
	Apply Preferences Close	Help

- 3. **<D>** the *Preferences* button.
 - **Note:** The Preferences dialog box is used to load predefined settings for a particular tool. In the View Stationing dialog box the preference sets the interval and symbology of the display graphics.

The following steps load the Preference Proposed–100 Ft Interval as the active symbology.

Name:	Close
Existing-100 Ft Interval Right	
Existing-500 Ft Interval	Load
Existing-500 Ft Interval Left	
Existing-500 Pt Interval Right	Save
OTHER-100 Ft Interval OTHER-500 Ft Interval ≣	
Proposed-100 Ft Interval	Save As
Proposed-100 Ft Interval Left	
Proposed-100 Ft Interval Right	Delete
Pronoced-500 Pt Interval	Help
4	Licib

- 4. **<D> Proposed-100 Ft Interval**.
- 5. **<D> Load** then **Close** button.

- - -🖌 View Stationing Data: 🔄 View Stationing Object Suffix Precision Format Name General Prefix Major Station ALG_PRO_Sta \Rightarrow Regular St 0 SS+SS.SS Cardinal Stations 🛛 Major Ticks ALG_PRO_Sta Pls Submajor Station 0 SS+SS.SS Station Equations Submajor Ticks Event Points sss+[ss.ss] ALG_PRO_Sta-Minor Station 0 Radius + A 🛛 Minor Ticks ALG_PRO_Sta 🕍 View Stationing - • • Data: Ciew Stationing General Obje Placement Prefix Suffix Precision Format Name Regular Stations Station 0.12 SS+SS.SS ALG_PRO_Can \Rightarrow Northing 0.12 Pls 0.12 🞽 View Stationing 🔄 View Stationing Data Format General Object Placement Prefix Suffix Precision Name Station Regular Stations Out 0.12 SS+SS.SS ALG_PRO_PI Cardinal Stations 🔶 Pls Station Equations Event Points Radius + A Display Curveset PI Transition Radii Vertical Stations Display Individual Element PI Display On: O Multiple Lines O Single Line Leaders: Object Relative To Name Length Angle Leader Line ALG_PRO_PI Segment 1 1.50 90^00'00'' Alignment Segment 2 100.00 0^00'00" Alignment Apply Preferences... Close Help
- 6. Using the dialog box explorer, select or de-select alignment stationing components for display.

7. **<D> Apply** to display the stationing.

102+00	103+00	104+00	105+00	106+00
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	+			
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The *View Stationing* dialog box is populated with the predefined settings from the preference. The display toggles define what will display; the name column identifies the named symbology used for that station type.

There are several standard CDOT preferences to choose from. These are based on the type of alignment and station interval. Choose the appropriate **Preference** and **<D> Apply** to see the stationing.

Keep in mind that text size is dependent on the active *Global Scale Factor* at time of display. If necessary, select **File > Project Options [Factors**] to change the value of the Global Scale factors.

- 8. Change the Global Scale Factor and redisplay stationing.
- 9. **Experiment** displaying stationing using various CDOT preferences.
- 10. **Experiment** with the various settings in the *View Stationing* dialog box and investigate what changes are made when stationing is redisplayed.

Section Summary:

- The stationing Preferences are set to CDOT standards and should be used in most cases.
- Using the Pencil mode automatically deletes old stationing when new stationing is displayed.

Lab 3.5 - Defining Stationing

Section Objectives:

• Change the beginning station of an alignment.

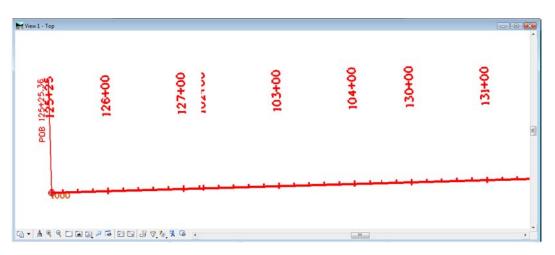
Upon creation, alignments are defined with a beginning stationing of 0+00. Stationing can be redefined from any location along the alignment.

1. Select **Geometry > Horizontal Curve Set > Stationing**. By default, this dialog box displays the beginning station value of the active alignment.

🐂 Stationing				- • 💌		
Horizontal Alignment:	SH 86	•	+	Apply		
Starting Station:	100+00.00			Import		
Name:	1000			Report		
Northing:	1558417.7	4	÷	Close		
Easting:	3267409.4	0		Close		
Vertical and Superelevation Alignments Help						
 Synchronize Star Maintain Station 	-					
Station Equations						
Back Station		Ahead Static	n			
	New	Edit		Delete		

- 2. Verify that SH86_West is set as the *Horizontal Alignment*.
- 3. Select Synchronize Starting Stations in the *Vertical and Superelevation Alignments* section.

- *Important!* Do not use this option if any of the vertical alignments associated with the horizontal do not start at the beginning of the horizontal alignment. Using this option will move those vertical alignments that start after the beginning of the horizontal alignment to the beginning station of the horizontal alignment.
- 4. In the *Starting Station* field, key in 125+25.36 then <D> the Apply button.
- 5. **Verify** the change has been applied by redisplaying the stationing. Also, check the beginning station value of the associated vertical alignments by using the review command.



- **Note:** The options for **Vertical Alignments** should be considered carefully. **Do Not Update** will leave the stationing of vertical application stations as is, **Synchronize Starting Stations** will update their stationing to match that of the horizontal and **Maintain Station Difference** will keep any difference (delta) in the current starting stations.
 - InRoads does not require a '+' when keying in a station. The plus sign will be added automatically.
 - Stationing can be set from any alignment point. If the point selected is not the POB, the stationing is computed for the POB from the selected point.

Section Summary:

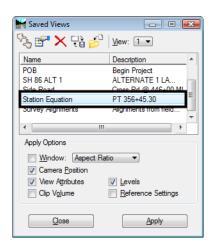
- When stationing is set for a particular point, the stationing for the remainder of the alignment (forwards and backwards).
- The reference to Superelevation in the Vertical and Superelevation Alignments area refers to geometry created in the 2004 edition of InRoads. It does not affect the superelevation contained in the Roadway Designer.

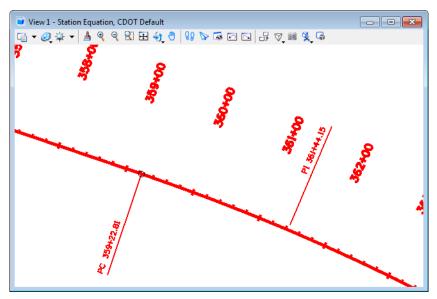
Lab 3.6 - Station Equations

If there are inequalities in the alignment, station equations may be required. These equations can be either gap or overlap equations.

Section Objectives:

- Add a station equation to an existing alignment.
- Redisplay stationing to show the station equation.
- 1. From MicroStation, select **Utilities > Saved Views**.
- 2. Highlight the **Station Equation** saved view and **<D> Apply** then **Close** the *Saved View* dialog box.





At the PT of the curve a station equation is necessary to tie to previous work. The values are:

```
Back = 359+22.81
Ahead = 359+27.81
```

- 3. Select Geometry > Horizontal Curve Sets > Stationing to display the *Stationing* dialog box.
- 4. Verify **SH 86_West** is the horizontal alignment.
- 5. At the bottom of the dialog box, choose **New**. The *Add Station Equation* dialog box is displayed.

🐂 Stationing				- • •			
Horizontal Alignment:	SH 86_West 👻 🕈			Apply			
Starting Station:	125+25.36			Import			
Name:	1000			Report			
Northing:	1558417.74 +			Close			
Easting:	3267409.4	0					
Vertical and Superelevation Alignments Help Do Not Update Synchronize Starting Stations Maintain Station Difference Station Equations							
Back Station	New	Ahead Static	n	Delete			

- 6. In the *Add Station Equation* dialog box, set the *Mode* to **By Station**.
- 7. Enter the *Back Station* and the *Ahead Station* as shown below.

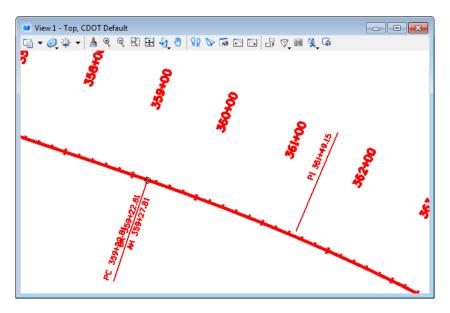
Add Station Equations						
Mode:	By Station		Apply			
	By Northing/Easting	_	Close			
Back Station:	359+22.81	-	Help			
Northing:	1553892.50		Пор			
Easting:	3290221.86	-#-				
Ahead Station:	A 359+27.81					
Add Horizontal Event Point						
Add Vertica	l Event Point					

- 8. **<D> Apply**.
 - **Note:** The ahead station must be prefixed with an equation name. The name must consist of at least one alpha character.
 - An alignment can contain multiple station equations.

- Annotation of stationing lying within the range of a station equation will be prefixed with the equation name. The toggle *Drop Station Equation Name* in the *General* leaf of the *View Stationing* dialog box is on so that the equation name is not displayed.
- 9. **<D> Close** to dismiss the *Add Station Equation* dialog box. The station equation is shown in the parent dialog box.

🖬 Stationing 📃 🗉 💌						
Horizontal Alignment:	SH 86_West 👻 🕂			Apply		
Starting Station:	125+25.36			Import		
Name:	1000			Report		
Northing:	1558417.7	4	+	Close		
Easting:	3267409.4	0				
Vertical and Superelevation Alignments Help						
Synchronize Starting Stations Maintain Station Difference Station Equations						
Back Station Ahead Station			n			
359+22.81 A 359+27.81						
	New	Edit		Delete		

- 10. **<D> Close** in the *Stationing* dialog box.
- 11. Redisplay the stationing for alignment SH 86_West.

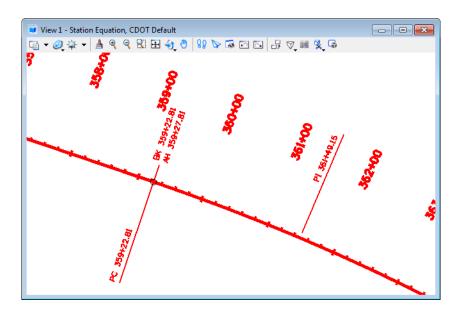


Notice that the station equation text is on top of the PC station text. To fix this problem:

- 12. Select Geometry > View Geometry > Stationing.
- 13. Select the Station Equation leaf.

- 14. Toggle the *Placement* to **Out**.
- 15. **<D> Apply** to redisplay the stationing.

🕌 View Stationing							- • •
Image: Station of the state of the sta	Data: Object Station	Place Right Left Right D Out	ment Prefix	Suffix Pr 0.		Format ss+ss.ss	Name ALG_PRO_Equ
	Leader Line	Length -0.25 100.00	Angle 90^00'00'' 0^00'00''	Alignmen Alignmen		PRO_Can	
			Apply	Prefere	nces	Close	Help



The equation is now displayed on the opposite side of the alignment from the PC stationing text.

Section Summary:

- Station equations are used to change the stationing from a given spot forward, along the alignment. Stationing prior to the equation retains its original stationing.
- The ahead station must have a prefix, containing at least 1 letter, followed by the new station number.

Lab 3.7 - Horizontal Alignment Tracking

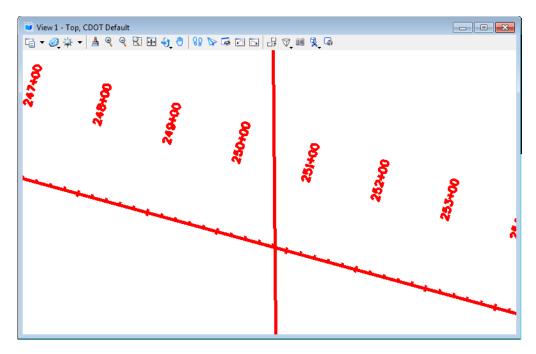
Two methods exist for receiving interactive information relative to a horizontal alignment. These are Tracking and Horizontal Alignment Tracking. Both methods report on stationing, offset, elevation, etc. Tracking reports the elevation of the active surface, Horizontal Alignment Tracking reports the elevation of the active vertical alignment.

Section Objectives:

- Demonstrate the Tracking command.
- Demonstrate the Tracking Horizontal Alignments command

Tracking (horizontal alignment and surface data)

- 1. Recall Saved View Side Road.
- 2. If the *Side Road* alignment is not visible, display it.



Tracking reports on station and offset information relative to the active alignment along with information relative to the active surface.

3. Select File > Open and load the surface 12345SURV_Existing_Ground.dtm from the C:\Projects\12345\ROW_Survey\InRoads\DTM folder.

To display the surface features from the existing ground dtm:

4. Select Surface > View Surface > Features.

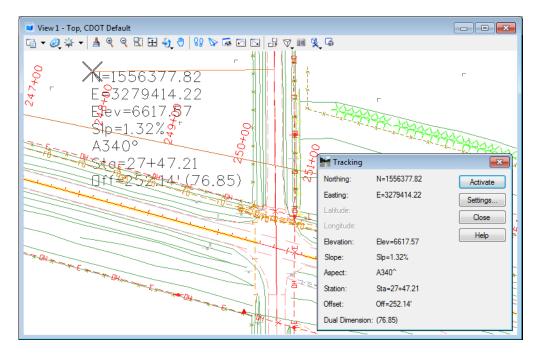
- Miew Features X Surface: 12345 existing groun 💌 Apply Fence Mode: Ignore ÷ Close Filter. Edit Style .. Help Features: † Name Style Description . Select All Ctrl+A Select None Ctrl+N Invert Selection Bin Wall -Bin Walls855 Bridge Abutment Bridge Abutment7
- 5. **<R>** in the *Features* list and **<D> Select All**.

6. **<D> Apply** then **Close**.

Displaying surface features is a good way to orient yourself to the location you are at in the model.

- 7. Select **Tools > Tracking > Tracking** to track both the active horizontal alignment and information relative to the active surface.
 - **Note:** This command will display information about any data that is present. Neither geometry or a dtm are required to get some feedback from this command.

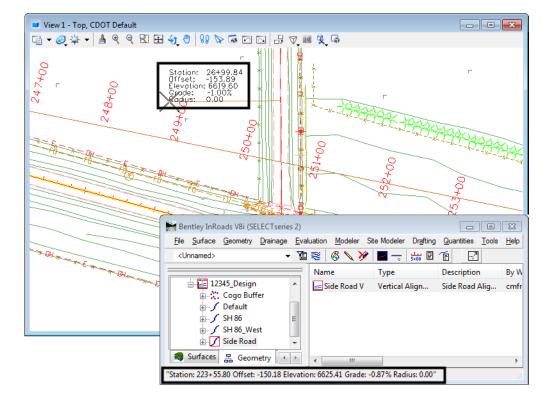
8. Select **Activate** to initialize the command. Slide the cursor along the alignment to interactively update the display in the *Tracking* dialog box. If a **<D>** (data point) is entered in the design file the information toggled on is displayed graphically.



Note: Select the **Settings** button in the *Tracking* dialog box to examine the attributes assigned to annotation placed in the MicroStation design file.

Horizontal Alignment Tracking (with vertical alignment data)

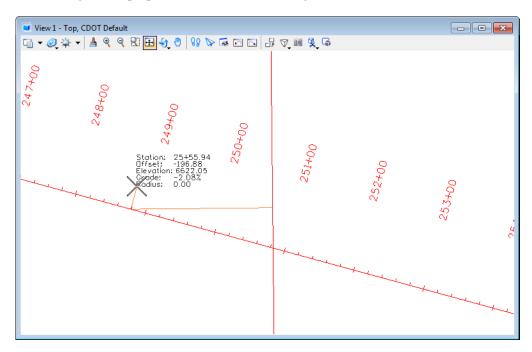
This tracks the station and offset relative to the active horizontal alignment along with the elevation of the active vertical alignment. Station, Offset, and Elevation information is displayed in the message field of the InRoads interface. Note: A horizontal alignment must be present for this command to work.



1. Select **Tools > Tracking > Horizontal Alignment** to track the active horizontal alignment.

The results display at the cursor and in the status bar of the InRoads interface.

Note: The readout interactively reflects the location of the cursor relative to the active alignment. If a second horizontal alignment is selected with a data point, the offset displayed will be the distance to intersect the selected alignment from the active alignment, perpendicular to the active alignment.



Section Summary:

- Use the Tracking command to get surface information in relation the horizontal alignment.
- The Tracking command can be used to display the information in its dialog box as MicroStation graphics.
- The tracking Settings options are used to enable and disable the graphic display of items in the Tracking dialog box.
- Use the Horizontal Alignments tracking to get vertical alignment information in relation the horizontal alignment.
- Horizontal Alignments tracking can not be displayed graphically.

Chapter Summary:

- Horizontal alignments can be displayed using the View and View All Horizontals from the right click menu or from the main tool bar, or by using the horizontal alignment annotation command.
- Use the preferences to set up the Stationing dialog box. Items in the Stationing dialog box should only be changed for special circumstances.
- Use the Stationing options under the Horizontal Curve Set commands to change the stationing for the entire alignment.
- Use station Equations to change the stationing from a point on the alignment to the end.
- Tracking is used to gain station and offset information at the cursors location.

• Tracking also collects surface data, while Horizontal Alignment tracking gets vertical alignment data.

LAB 4 - Geometry Management

This lab illustrates some of the common commands used to manage geometry for a project.

Chapter Objectives:

- Copy a geometry project
- Rename alignments

The following files are used in this lab:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Geometry-Management.dgn
- C:\Projects\12345\ROW_Survey\InRoads\Geometry\12345SURV_Fieldbook.alg

Lab 4.1 - Copy a Geometry Project

Section Objectives:

- Access a Geometry Project created by the Survey/ROW discipline
- Save the renamed Geometry Project in the Design project folder (vs. the Survey folder)
- Rename horizontal alignment names, add/modify descriptions, and review the geometry styles assigned to the alignments
- 1. From the **Geometry** tab in the InRoads *Explorer* window, right-click on **Geometry Projects** and select **Open** from the right click menu.

🕌 Bentley InRoads V8i (SELECTse	rries 2)	×
<u>File S</u> urface <u>G</u> eometry <u>D</u> raina	ge <u>E</u> valuation <u>M</u> odeler Site Modeler Dr <u>a</u> fting <u>Q</u> uantities <u>T</u> ools	<u>H</u> elp
<unnamed></unnamed>	💌 🖥 📚 🚳 🏷 🏏 🔳 🛶 📠 🗉 🖆 🔛	
	Geometry Proj Description File Name	By W
Geometry Projects	""" Defeule	cferr
🕂 📴 Default	New	
	Open	
	Active	
	Close All	
	Encode All	
몶 Geometry 🛍 Preferen	Empty All	P.
Toggles the Feature Filter Lock		

2. Navigate to the directory C:\Projects\12345\ROW_Survey\InRoads\Geometry.

🙀 Open							X
Look in:	🔒 Geometry			•	G 🤌	بي 🥙	
Recent Places Desktop		Date modif Fieldbook.alg Geom.alg		Size			
Computer							
Network	File name: Files of type:	12345SURV Geometry Pro	_Fieldbook.alg ojects (*.alg)			•	Open Cancel Help

3. **<D>** the Geometry Project **12345SURV_Fieldbook.alg**.

4. **<D> Open** then **Cancel** button. The *Open* dialog box is dismissed

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	_		<u>Q</u> uantities <u>T</u> ools	<u>H</u> el
<unnamed> 👻 🚡</unnamed>	🚳 🔪 🎘	🖬 🛶 🛃	Ē 🖸	
	Name	Description	By Whom	Li
□ Ⅰ Geometry Projects	13103	Edge of Oil	Ron Brys	6,
⊕ default	13107	Edge of Oil	Ron Brys	6,
12345SURV_Fieldbook01	13205	Traffic Control	Ron Brys	6,
	13214	Traffic Control	Ron Brys	6,
	13216	Traffic Control	Ron Brys	6,
	16101	Fence-Barbed	Ron Brys	6,
🖁 Geometry 🔯 Preference 🕢 🕟	< III			F.

At this point, a 'copy' of the survey geometry project is loaded into memory. The following steps will rename the geometry project and save this copy in the Design discipline folder.

Note: Loading a file into InRoads makes it the active entity by default.

From	Verticals Cogo Points	
Geometry Project:	12345SURV_Fieldbook01	Apply
		Help
Name Default	Description	
12345SURV_Fieldbo	ook01	
To-		
To Geometry Project:	FB-Working Copy	
	FB-Working Copy	
	FB-Working Copy	
Geometry Project:	FB-Working Copy Copy of Survey Data	

5. Select Geometry > Copy Geometry.

- 6. On the *Projects* tab, in the *From* section select **12345SURV_Fieldbook01**.
- 7. In the *To:* field key in *FB-Working Copy*.
- 8. In the *Description:* field key in *Copy of Survey data*.
- 9. **<D>** the **Apply** then **Close** buttons.
- 10. Verify the copy is created by checking the InRoads Explorer pane.

File Surface Geometry Drainage Ev	val	uation <u>M</u> odeler S	ite Modeler Dr <u>a</u> fting	<u>Q</u> uantities <u>T</u> ools	H
<unnamed></unnamed>	Ē	🛪 🗸 🗞 😸	<u></u>	Ē 2	
		Name	Description	By Whom	L
Geometry Projects		13103	Edge of Oil	Ron Brys	6
Default 12345SURV_Fieldbook01		13107	Edge of Oil	Ron Brys	6
		13205	Traffic Control	Ron Brys	6
FB-Working Copy		13214	Traffic Control	Ron Brys	6
		13216	Traffic Control	Ron Brys	6
		16101	Fence-Barbed	Ron Brys	6
品 Geometry 📓 Preference 🕢 🔸		4 m			ь

11. In the InRoads explorer pane, **<R>** on the **FB-Working Copy** geometry project and select Save As... from the right click menu. The *Save As* dialog box is displayed.

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<u>File</u> <u>S</u> urface	<u>G</u> eometry <u>D</u> rair	nage <u>E</u> valuation <u>M</u> odeler Site Modeler Dr <u>a</u> fting <u>Q</u> uantiti	ies <u>T</u> ools <u>H</u> elp
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		Name Description By Who 13103 Edge of Oil cferree 13107 Edge of Oil cferree 13205 Traffic Control cferree New Save	1!
Save As		Copy Close Empty	
Save in:	In Roads		
Recent Places Desktop	Name 12345_Des	Date modif Type Size	
Computer		FB-Working Copy ald	Save

- 12. Navigate to the C:\Projects\12345\Design\InRoads folder. If necessary, use the drop-down arrow in the Active field and reselect FB-Working Copy to ensure the saved file name will match the active surface name.
- 13. **<D>** the **Save** then the **Cancel** buttons. The *Save As* dialog will close.

FB-Working Copy.alg

FB-Working Copy

Geometry Projects (*.alg)

File name:

Active:

Save as type:

Network

Note: To minimize confusion, be sure to save the geometry project with the same name seen in the InRoads Explorer pane.

Save

Cancel Help

Options...

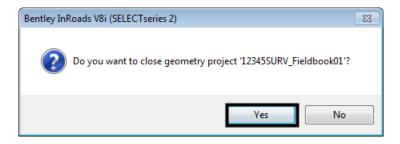
Ŧ

Ŧ

 The original geometry project generated by the survey staff is no longer required. In the InRoads explorer pane, <R> on the geometry project name 12345SURV_Fieldbook and select Close from the right click menu.

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<u>File Surface Geometry Drainage Eva</u>	aluation <u>M</u> odeler Si	ite Modeler Dr <u>a</u> fting	<u>Q</u> uantities <u>T</u> ools	<u>H</u> elp
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	Name	Description	By Whom	Li 🔺
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12345SURV_Fieldbook01	New			6,
E FB-Working Copy	Course		6,	
	Save		6,	
	Save As			6, 🛫
品 Geometry 👔 Preference 🕢	Set Active			•
Toggles the Style Lock	Сору			ad
	Close			
	Empty			

- **Note:** This will 'unload' the geometry project from memory. It does not delete any files from the hard drive.
- 15. **<D> Yes** and verify the geometry project is removed from memory.



Section Summary:

 Specialty groups using ROW/Survey geometry files should always make their own copy of the original data.

Lab 4.2 - Renaming Alignments

In the case of the geometry project copied in the previous exercise, the horizontal alignment names (and geometry styles) were assigned when the survey fieldbook was exported based on the InRoads Survey feature table (FWF file). These attributes are assigned based on the feature coding assigned in the field. These names accurately reflect the coding used in the field, but could benefit from more intuitive naming.

Section Objectives:

• Modify the alignment names, add descriptions, and assign appropriate Geometry Styles.

Graphics clean-up

Before continuing with this lab, delete all visible graphics in your MicroStation file using the element selection tool or a fence. Note that you are deleting the graphical display of data, not the data itself. The graphics could be redisplayed using the InRoads display commands shown in previous sections.

Note: The screened topography and the training guides are either locked graphics or in an attached reference file, you will not be able to delete these graphics and will use them for orientation.

Renaming Horizontal Alignments

1. **<D>** on the InRoads icon in the top left corner of the view window and **<D> View Save**/ **Recall** from the menu.

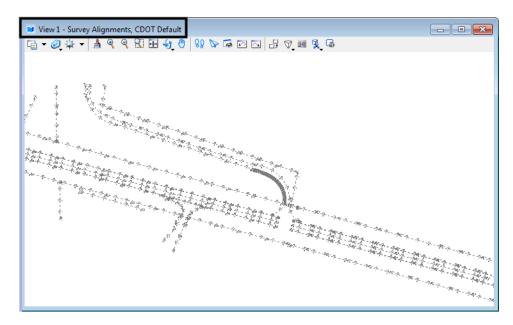
		iew 1 - Top, CDOT D	efault
Ι	ø	Restore	
		Move	
		Size	
	-	Minimize	
		Maximize	
	x	Close	Alt+F4
		View Attributes	
		Level Display	
		View Save/Recall	

- 2. From the *Saved View* dialog box highlight **Survey Alignments**.
- 3. **<D>** the **Apply Saved View** and then **<D>** in **View 1**.

 d Views - View ive File ▼ Show Status		Saved View End of project End of project	Clip V
	Intersection Station Equation Untitled Side Road Untitled-2	SH 86 and Side Road Sta 359+22.81	
(A	Survey Alignments	Alignments from fieldbook	Þ

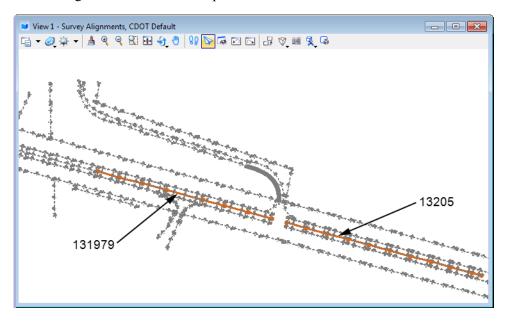
4. Close the *Saved Views* dialog box.

5. Verify that the view name includes Survey Alignments. The view window should look similar to the following image.



6. Display alignments **13205** and **131979**. **<R>** on the alignment and select **View** from the right click menu.

ile <u>S</u> urface <u>G</u> eometry <u>D</u> rainage <u>I</u>	Evaluation <u>M</u> odeler	Site Modeler Drafting	<u>Q</u> uantities	<u>T</u> ools <u>H</u> elp
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	13205 13214	Traffic Control Traffic Control		View
1310120 1310126 1310128	\$ 13216 \$ 16101	Traffic Control Fence-Barbed	cferree cferree	Fit Edit
1310128 13103 13107	∫ 16108 ∫ 20429	Fence-Barbed Culvert Corr St		Review Check Integrity
13107 131077 131081	\$ 43132 \$ 131077	Electrical Over Edge of Oil	cferree cferree	Hilite
	/ 131081	Edge of Oil	cferree	Read-Only
	131682 131884	Traffic Control Traffic Control	cferree	Read-Write Details
13205	1 31979 1 32083	Traffic Control Traffic Control	cferree 🗸	Arc Definition
📇 Geometry 🛅 Preference 4 🕨	4 III			Chord Definition



The the alignments should show up in the view window as shown below.

- 7. Select **Geometry > Rename Geometry** from the InRoads main menu. The *Rename Geometry* dialog box is displayed.
- 8. From the *Type:* drop-down menu select Horizontal Alignment.

🖌 Rename Geomet	ry	_ 🗆 🛛
Туре:	Horizontal Alignment	Apply
C From		Close
Geometry Project:	FB-Working Copy	
Horizontal Alignment:	131979 +	Help
Vertical Alignment:	-+-	
Name	Description Style]
20429	Culvert Corr Steel Pip T_Cul Corr Stl 18"	
43132 131077	Electrical Overhead LT_Elect Overhea Edge of Oil T_Edge of Oil	
131077	Edge of Oil T_Edge of Oil	
131682	Traffic Control Doubl T_Traffic Double	
131884	Traffic Control Single T Traffic Single S	
131979	Traffic Control No Pa T_Traffic No Pass., 🗡	
- То		
Name:	Ex CL Seg A	
Description:	Ex centerline segment A	
Style:		

- 9. In the *From* section, verify the *Geometry Project* is **FB-Working Copy**.
- 10. In the *From* section list locate and **<D>** on alignment **131979**.

Note: This alignment represents the centerline of existing pavement.

- 11. In the To section key in the Name: Existing CL Seg A.
- 12. Key in the *Description: Ex centerline segment A*.
- 13. Set the *Style: ALG_EXISTING*.
- 14. **<D>** the **Apply** button. A confirmation dialog box is displayed.

Hert	×
Do you want to rename horizontal alignment '131979' to 'Existing CL Seg A' and update the file on the disk?	
Yes No	

- 15. **<D>** the **Yes** button to confirm the change and dismiss the confirmation box.
- 16. **Rename** the centerline alignment *13205* using the following information:
 - Name: *Existing CL Seg B*
 - Description: *Ex centerline segment B*
 - Style: *ALG_EXISTING*
 - **Note:** You can use the dialog selection icon \bullet to graphically identify the alignments for renaming.
 - *Important!* Profile or Cross Section sets that were created based on the original alignment names will lose their linkage to the alignment names after renaming of the alignments. Geometry renaming should be done prior to the generation of Profile or Cross Section sets.
- 17. **Close** the *Rename* dialog box and check the InRoads explorer window to verify the results.

Bentley InRoads V8i (SELECTseries 2)			
<u>File Surface G</u> eometry <u>D</u> rainage <u>E</u> v	valuation <u>M</u> odeler Site M	lodeler Dr <u>a</u> fting <u>Q</u> uantities <u>T</u> o	ools <u>H</u> elp
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	Existing CL Seg A	Ex centerline segment A	cferree
FB-Working Copy	👯 Cogo Buffer		cferree
	\$ 3033132	Coniferous Tree Grove (CCW	/) cferree
	\$ 3015105	Coniferous Hedge	cferree
	1 3013111	Coniferous Trees Grove (CW)) cferree 🔻
😂 Surfaces 🖁 Geometry 💽	 ■ 		•
Toggles Pencil/Pen mode			.d

Renaming Vertical Alignments

Two horizontal alignments have been renamed, a description has been added and the alignments are assigned the appropriate geometry style. Horizontal alignments are 'parent' alignments which can contain 'child' vertical alignments.

- 18. In the InRoads explorer, **<D>** the **Geometry** tab.
- 19. Check the horizontal alignments for associated vertical alignments by expanding the + icon.

Bentley InRoads V8i (SELECTseries 2)			, • ×
<u>File Surface G</u> eometry <u>D</u> rainage <u>E</u> va	luation <u>M</u> odeler Site Me	odeler Dr <u>a</u> fting <u>Q</u> uantities <u>T</u> ools <u>I</u>	<u>H</u> elp
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·-?			
	Name	Description	By Whom 🔺
÷ 131884 ^	13103	Edge of Oil	cferree
Existing CL Seg A	13107	Edge of Oil	cferree
131979	13214	Traffic Control Single Solid White	cferree
Existing CL Seg B	13216	Traffic Control Single Solid White	cferree
13205	16101	Fence-Barbed Wire	cferree
···· ↓ 132083 ···· ↓ 132128 ▼	16108	Fence-Barbed Wire	cferree
	\$ 20429	Culvert Corr Steel Pipe 18"	cferree 👻
Surfaces 몸 Geometry ◀ →	< III		P.
Toggles the Cogo Audit Trail			

- 20. Select Geometry > Rename Geometry. The *Rename Geometry* dialog box is displayed.
- 21. From the *Type:* drop-down menu select Vertical Alignment.
- 22. In the *From* section verify the *Geometry Project* is set to **FB-Working Copy**.
- 23. Verify the active *Horizontal Alignment* is set to Existing CL Seg A.
- 24. **<D>** on alignment **131979** from the *Vertical Alignment* list.

Note: This alignment represents the vertical elevations of existing pavement.

- 25. In the To section key in the Name: Existing Pavement.
- 26. In the *Description:* field, key in *Surveyed elevations*.
- 27. Set the *Style*: to ALG_EXISTING_Vert.
- 28. **<D> Apply** then **<D> Yes** button.

Next, change the name of the vertical alignment attached to Existing CL Seg B.

- 29. Now set the active *Horizontal Alignment* to **Existing CL Seg B** in the *From* area of the *Rename Geometry* dialog box.
 - **Note:** You can use the graphic selection icon <u>+</u> to graphically identify the alignments for renaming.

- 30. In the To section, key in the Name: Existing Pavement.
- 31. key in *Surveyed elevations* for the *Description*:.
- 32. Set the *Style:* ALG_EXISTING_Vert.

🐂 Rename Geometry	/		
Type: From Geometry Project: Horizontal Alignment: Vertical Alignment:	Vertical Alignment FB-Working Copy Existing CL Seg A 131979	▼ ▼ ◆ ◆	Apply Close Help
Name 131979	Description	Style	
To Name: Description: Style:	Existing Pavement Surveyed Elevations [ALG_EXISTING_Vert		

33. **<D> Apply** then **<D>** the **Yes** button in the confirmation box.

34. **<D> Close** the *Rename Geometry* dialog box.

A copy of the ROW/Survey's geometry project was made. Key alignments were renamed and assigned appropriate styles. The alignments now have intuitive name and conform to CDOT design standards.

This is a good time to save the Geometry Project to disk.

35. **<R>** on the geometry project **FB-Working copy** and select **Save As** from the right click menu.

🕌 Bentley InRoads V8i (SELECT	series 2)	
<u>File S</u> urface <u>G</u> eometry <u>D</u> rain	nage <u>E</u> valuation <u>M</u> odeler Site Modeler Dr <u>a</u> fting <u>Q</u> uant	ities <u>T</u> ools <u>H</u> elp
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	View All Horizontals View All Turnouts View All Rails, Joints and Distance Keepers Fit Details	

36. This will overwrite the geometry project FB-Working Copy stored in the folder *C:\Projects\12345\Design\InRoads*.

Section Summary:

• Rename Geometry is used to rename geometry, add or revise a description, and/or update the associated style

Chapter Summary:

- Take care not to inadvertently edit or delete another group's work. Communication is the key to reducing data loss.
- Survey geometry has names meaningful to them, but possibly not to other groups. Rename your copy of survey's geometry data.

LAB 5 - Horizontal Alignments

Although there are multiple methods for creating horizontal geometry in InRoads, this lab will concentrate on the using the horizontal curve set commands and importing geometry from graphics. Additional methods covered in the Geometry for ROW course include cogo and traverse commands.

This lab also demonstrates how to modify an existing alignment and create a parallel alignment to an existing alignment. An example of this would be to create parallel/offset alignment from a road centerline to represent the edge of road or other feature that parallels the centerline.

Chapter Objectives:

- Create a new geometry
- Create alignment tangents
- Understand the difference between Named and Unnamed cogo points and how to apply cogo point names
- Define alignment curves
- Define and modify alignment stationing
- Annotate an alignment
- Create a horizontal alignment from graphics
- Modify an existing alignment
- Create parallel horizontal alignments

The following files are used in this lab:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345_Horizontal Alignments.dgn
- C:\Projects\12345\ROW_Survey\InRoads\Geometry\12345SURV_Fieldbook.alg
- C:\Projects\12345\Design\InRoads\12345DES_Design.alg

A typical workflow is:

- 1. Create or open a geometry project
- 2. Create horizontal alignments
- 3. Assign stationing for alignments
- 4. Define station equations, if any
- 5. Define alignment key-points (unique points of interest)
- 6. Review alignments
- 7. View created alignments
- 8. Display stationing for alignments
- 9. Annotate created alignments
- *Note:* The screened topography and the training guides are either locked graphics or in an attached reference file, you will not be able to delete these graphics and will use them for orientation.

Lab 5.1 - Name Alignment Points

Section Objectives:

- Add names to unnamed points on an alignment
- 1. Start InRoads opening the file **12345DES_Horizontal Alignments.dgn** from the **C:\Projects\12345\Design\Drawings\Reference_Files** directory.
- 2. Select File > Project Options from the InRoads main menu and review the settings in the Geometry tab.

Tolerances	Factors Abl	previations	Rail	Sight Distance
Precision	General	Units and	d Format	Geometry
Plotting Heigh	nt:	0.00		Help
Seed Alignme	nt Name:	1		
Seed Point N	ame:	1		
Curve Defin	ition			
Horizontal:	Arc	•	🔳 Alwa	ys Confirm
Vertical:	Parabolic	-	🔳 Alwa	ys Confirm
Measure:	Along Arc	O Along (Chord	
Degree of C	urve Length:	100.00		
Unit Station	Length:	100.00		
Define Transi	tions By:	Length) C	onstant
Spiral Definition	on:	Clothoid		-
Cubic Parabo	la Definition Is:	New Sout	th Wales	•
ICS Coordina	te Sequence:	Northing/	Easting	-
Vertical Angle	Reference:	Zenith		•
Angular Mode	:	Bearings		-
Point Names	During Edits:	Do Not As	ssian	~
🔲 On Horizo	ntal Edits Reco		-	nts
⊂ Default Acc	ess Modes			
	R	ead-Only	Read-Wr	ite
Horizontal A	lignments:	\bigcirc	۲	
Cogo Buffer	:	\bigcirc	۲	

Note: If *Point Name During Edits* is set to **Assign** on the *Geometry* tab of the *Options* dialog box, alignment key-points are generated with a name based on the next available ID as specified in the *Seed Point Name* field. The specified seed point name can be alpha, numeric, or alphanumeric characters. The assigned name is also reserved in the Cogo buffer. However the point is not written to the Cogo Buffer automatically.

For descriptions of each of the items in the **Geometry** tab, refer to the *Practical Guide for Using InRoads*.

3. Load the geometry project **12345DES_Design.alg** from the folder **C:\Projects\12345\Design\InRoads**.

Alignment key-points (PC, PI, PT, CC, etc) exist in one of three states:

- Unnamed
- ♦ Named
- ♦ Cogo Points
- 4. Review the horizontal alignment and notice that many points on the alignment are not named.

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	I	Review Check Integrity Hilite]

Geometry Project:	12345_D	lesign 🗸 🗸	Mode		Close
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		t Name: 12: intion: SH	345_Design 86 Design Alignmen	its 🚺	Append
Horizontal Al	ignmen	t Name: SH			Display
		Style: ALC		NORTHING	Print
Element: Line	ar		Named Point	NOKIMINO	Help
	POB (PC (1000)	100+00.00 111+08.62	1558417.74 1558450.09	
		rection: Length:	N 88^19'40" E 1108.62		Select
Element: Circ	rular		Unnamed Point		First
Liement. Ciit	PC (PI (CC (- }	111+08.62 113+47.31	1558450.09 1558457.06	< Previous
	PT () Radius:	115+85.98 21120.00	1537339.09 1558458.63	Next >

In the next series of steps, the alignment points are named and added to the Cogo buffer.

- 5. Select Geometry > Horizontal Curve Set > Events.
- 6. In the *Horizontal Events* dialog box, toggle on **Alignment Point to Cogo** in the *Add As* section.
- 7. Key in *200* for the *Seed Name*:
- 8. Proposed Alignment for Description:.
- 9. Select **ALG_PRO** for the *Style:*.
- 10. Click Apply.

efine By:	Single Point	~			Apply
Add As		Locate By			Close
O Station and	l Offset	Name:			
O Northing ar	nd Easting	Northing	0.00	+	Help
Cogo Point		Easting	0.00		
Alignment I	Point to Cogo				•
Seed Name	e: 200	Station		Offset	S
Description	Proposed Alignm	Start		First	
A company of the second second		100+00.0	0	+ 0.00	+
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Add Vertica	al Event Points	366+60.5	0	+ 0.00	+
Compute Ele	vation from Active	Vertical Alignmer	đ.		
N Station	Offset	Northing	Easting	Elevation	Style
					82.

A *Results* dialog box appears with the new point name and the associated coordinates of the point. All alignment key points that were not previously assigned a name are written to the Cogo buffer beginning with the ID number of 200.

Results			
1000	1558417.74	3267409.40	Close
200	1558450.09	3268517.55	
201	1537339.09	3269133.91	Save As.
202	1558458.63	3268994.82	Save As
203	1558467.52	3270345.09	Annual
204	1555467.58	3270364.85	Append
205	1558402.30	3270987.32	
206	1558117.51	3272329.96	Display
207	1547356.90	3270047.57	-
208	1557965.30	3272956.51	Print
209	1557001.57	3276471.06	
210	1585933.56	3284404.53	Help
1	155/0/0 0/	2274400 00	

- *Note:* The command **Geometry > Utilities > Assign Names** can also be used to add, delete, or rename geometry points. However, names added using this command are not added to the Cogo Buffer.
- 11. Close the Results and Horizontal Events dialog boxes.

Lab 5.2 - Create New Geometry

Next we will create a new geometry project and a placeholder for horizontal alignment data.

Section Objectives:

- Create a geometry project and place holders for horizontal geometry data.
- 1. From the InRoads main menu **File > New**.

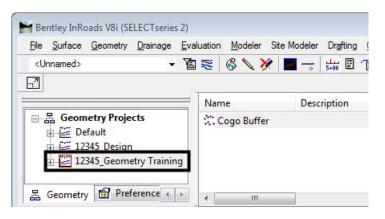
lame:	Geometry Project	Apply
	Default	Styles
)escription:		Help
Style:		
Curve Definition:]
	2 12 1 2 2	
bristing	Description	
Default	CI I OC Destan Alternatio	
12345_Design	SH 86 Design Alignments	
	SH 86 Design Alignments	

- 2. **<D>** the **Geometry** tab.
- 3. For the *Type*, select Geometry Project.
- 4. In the Name field, key in 12345_Geometry Training.

Mew 🗧		
Surface Geomet	TY Site Modeler	
Type:	Geometry Project 🔹	Apply
Name:	12345_Geometry Training	Help
Description:	Geometry Training class	
Style:	.	
Curve Definition:	-	
Name	Description	
Default		
12345_Design	SH 86 Design Alig	
1	Close	

5. In the *Description* field, key in *Geometry Training class*.

- **Note:** The lower portion of the *New* dialog displays geometry projects that are currently loaded.
- 6. **<D> Apply** (Do not Close the New dialog box yet). This creates the geometry project where all new alignment data for this class will be stored. At this point, it is held in RAM (Random Access Memory).
- 7. **Verify** that the new geometry project was created.



- 8. Use the following data to create a place holder for horizontal geometry data.
 - *Type:* Horizontal Alignment
 - ◆ Name: Design Alt 1
 - Description: Alignment by PI method
 - ♦ Style: ALG_PRO

🚼 New		- 0 <mark>x</mark>				
Surface Geometr	Y Site Modeler					
Туре:	Horizontal Alignment					
Name:	Design Alt 1	Help				
Description:	Alignment by PI method					
Style:	ALG_PRO	ALG_PRO 👻				
Curve Definition:	Arc					
Name	Description S	ityle				
L	Close					

• Curve Definition: ARC

9. **<D>** the **Apply** then the **Close** buttons.

	1 1	CR XX		-
7				
·1		ame	Description	
□ 品 Geometry Projects	**	Cogo Buffer		
Default 12345_Design 12345_Geometry Traini Cogo Buffer Design Alt 1		Design Alt 1	Alignment b	by PI method

- 10. Verify the horizontal alignment is created in the active geometry project.
- 11. **<R>** on the **12345_Geometry Training** geometry project in the InRoads Explorer pane and **<D> Save** from the right click menu.
- 12. Verify that the directory path is set to C:\Projects\12345\Design\InRoads.
- 13. Key in *12345_Geometry Training* for the *File name*.
- 14. **<D> Save** then **Cancel** to save the file and dismiss the Save As dialog box.

The following exercises will step you through creating an alignment using the Horizontal Curve Set, or PI method. While these exercises are based on a roadway alignment, the tools and logic apply to any new alignment whether it is for drainage, utilities, pavement marking, bridge geometry, parcels, or any other purpose.

Lab 5.3 - Create Alignment Tangents

Section Objectives:

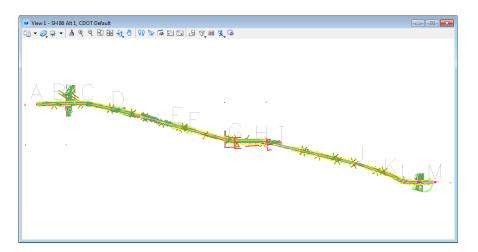
- Create horizontal alignments from PI to PI.
- 1. From the MicroStation pull-down menu select **Utilities > Saved Views**.
- 2. From the *Saved Views* dialog box **<D>** saved view name **SH 86 ALT 1**.

Saved Views - View 1	-	- • •
😤 Active File 🔻 🏷 🖵 🏹	🚰 🗙 🌮 📭 🕞	
Type Show Status Name	Description	🕵 Clip V
🔄 🛛 🛜 SH 86 Alt 1	Alternate Layout	
٠ I	11	4

3. **<D>** the **Apply** button.

Points A-M represent the required location of alignment PI's.

Horizontal curve set commands will be used to create the horizontal alignment. The next series of steps are used to construct the tangents.



4. Before beginning, verify that the **Design Alt 1** alignment is *Active*. Any geometry data entered will be added to this alignment.

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<u>File Surface Geometry Drainage Eva</u>	luation <u>M</u> odeler Site M	odeler Dr <u>a</u> fting <u>Q</u> uantities	<u>T</u> ools <u>H</u> elp
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62			
	Name	Description	By Whom
□ ☐ Geometry Projects □ ☑ Default □ ☑ 12345 Design □ ☑ 12345_Geometry Training □ ☑ 12345_Geometry Training □ ☑ Design Alt 1	Cogo Buffer Design Alt 1	Alignment by PI method	cferree cferree
品 Geometry 🛍 Preference ↔ →	٠ III		۰.
Toggles Locate Features/Locate Graphics	mode		at

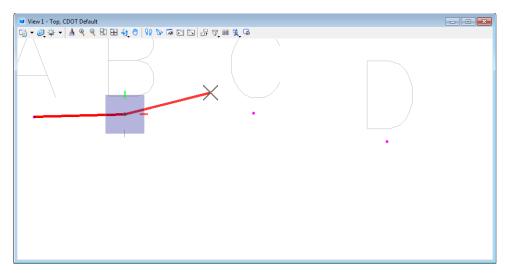
5. To clear the MicroStation view, toggle **Off** the Reference Display for the **12345SURV_Topo100Scale01.dgn** in the *References* dialog box.

References (1 of 1 unique, 0 di	splayed)		
<u>T</u> ools <u>S</u> ettings			
1 🗄 🕂 隆 🕵 🗅 🛒 🕏) 🧇 🔁 🔁 🔂	🛃 🛱 📴 🕥 🗴 🗉	lite Mode: Boundaries 👻
Slot 🕅 File Name	Model Descriptio	n Log Orientation Pres	entation 💽 🎜 🦎 🔓
1 12345SURV_Topo 100.d	gn CDOT Default Global Ori	Coincident - World Wire	eframe 🗸 🗸
Scale 1.000000 :	1.000000 Bot	ation 00°00'00''	
Offset X 0.000	<u>Y</u> 0.000 <u>Z</u>	0.000	
- 🖬 🛃 🍋 🏭 📆 🌛 🐓 🛛	🏭 🗞 闷 👰 🔝 No Nestir	Allow Overrides	▼ Depth: 1
Ne <u>w</u> Level Display: Config Variable	<u>G</u> eoreferenced: No	•	

6. Select **Geometry > Horizontal Curve Set > Add PI** from the Inroads main menu. You are prompted in the MicroStation status bar to *Identify Alignment End*.

Note: There is not a dialog box for this command.

7. **<T>** then **<D>** at point **A** (tentative or snap, and Data point). The alignment interactively displays as you move the cursor.



8. Repeat step 7 for points **B** through **M**.



- 9. **<R>** (reset) when complete.
- 10. If the alignment created does not pass through points A-M, use the *Insert*, *Move*, or *Delete* PI commands from the Horizontal Curve Set tools to correct the locations.

eometry Project: 12345_Geometry Tra v orizontal Alignment: Design Alt 1 v	Mode O Curve Sets	Alignment O Eleme	nt		Close Save As
Project Name: 1234 Description: Geom Horizontal Alignment Name: Desi Description: Alig Style: ALG	etry Training cla gn Alt 1 nment by PI metho	sŝ			Append Display
00,10	STATION	NORTHING	EASTING		Print
Element: Linear POB () PI () Tangent Direction: Tangent Length:	0+00.00 13+47.31 N 88^19'40" E 1347.31	1558417.74 1558457.06	3267409.40 3268756.14		Help Select First
Element: Linear PI () PI () Tangent Direction: Tangent Length:	13+47.31 32+60.94 N 89^37'22" E 1913.63	1558457.06 1558469.66	3268756.14 3270669173	~	< Previous Next >
()	1		>		Last

11. Review the new alignment using **Geometry > Review Horizontal**

Following is a summary of the PI locations

PI	NORTHING	EASTING	BEARING	DISTANCE	STA.
А	1,558,417.74	3,267,409.40			0+00.00
В	1,558,457.06	3,268,756.14	N 88°19'39.62" E	1,347.31'	13+47.30
С	1,558,469.66	3,270,669.73	N 89°37'21.60" E	1,913.63'	32+60.94
D	1,558,050.59	3,272,645.47	S 78°01'28.88" E	2,019.69'	52+80.63
Е	1,556,982.55	3,276,540.43	S 74°39'56.80" E	4,038.75'	93+19.38
F	1,556,716.98	3,277,527.47	S 74°56'25.98" E	1,022.14'	103+41.51
G	1,555,931.76	3,280,408.64	S 74°45'18.96" E	2,986.25'	133+27.77
Н	1,555,939.60	3,282,135.29	N 89°44'23.81" E	1,726.67'	150+54.44
I	1,555,699.32	3,283,343.64	S 78°45'12.06" E	1,232.01'	162+86.44
J	1,554,474.27	3,288,508.48	S 76°39'23.63" E	5,308.14'	215+94.58
Κ	1,553,821.34	3,290,431.45	S 71°14'44.01" E	2,030.79'	236+25.37
L	1,553,315.19	3,291,416.57	S 62°48'22.55" E	1,107.55'	247+32.92
М	1,553,346.54	3,293,367.43	N 89°04'46.05" E	1,951.11'	266+84.03

Note: Results may vary based on the specific PI locations defined by the user.

Lab 5.4 - Define Alignment Curves

The *Define Horizontal Curve Set* command is used to create curves between alignment tangents or to revise existing curve definition. The *Previous* and *Next* buttons are used to step sequentially through the alignment. The Select button can be used to graphically identify an alignment location for editing. As alignment components are selected, they highlight in the MicroStation view.

Section Objectives:

- Add curves to horizontal alignments using various methods
- Use the Curve Calculator to determine the radius of a curve

- 1. Select **Geometry > Horizontal Curve Set > Define Curve.** The first two tangents A-B and B-C highlight.
- 2. Key in *Radius 1: 21120*.

🚰 Define Horizontal	Curve S	Set		_ 🗆 🔀
Horizontal PI				Apply
Define By: Known F	^o l Coordina	tes	~	Close
Direction Back:	N 88	^19'40'' E		
Length Back:	1347	.31	-	Undo
Point Name:				Rate Calc
Northing:	1558	457.06	+	Design Calc
Easting:	3268	756.14		Curve Calc
Direction Ahead:	N 89	^37'22'' E	+	Report
Length Ahead:	1913	.63	+	Help
				neip
- Horizontal Curve Curve Set Type:	⊙ SCS	⊖ scscs		
	~ ~	O Constant		
Leading Transition:			0.00	
Radius 1:	Clothoid	*	0.00	<u>+</u>
			21120.00	
Compound Transition:	Clothoid	×	0.00	<u>+</u>
Radius 2:			0.00	-+-
Trailing Transition:	Clothoid	v	0.00	<u>+</u>
Define By: 💿 Radius				
○ Tangent	to Spiral	Point Name:		
◯ Spiral to	Tangent	Northing:	1558457.	.06 -+-
O Point on	Curve	Easting: 326875		.14
🔿 Angle up	to PCC (PC	C to PCC)	0^00'00	•
⊖ Angle afte	er PCC (PC	C to PT)		
First < Previo	ous	Next >	Last	Select

- 3. **<D>** the **Apply** button. The curve is created and displays.
- 4. **<D>** the **Next** button. Tangents B-C and C-D highlight.
- 5. Key in Radius 1: 3000.
- 6. **<D>** the **Apply** button.
- 7. Repeat steps 4-6 for the curves at locations:
 - D Radius = 11,000.00
 - E Radius = 3,000.00
 - F Radius = 3,000.00

For the first 5 curves, radii were input to define the curves. For the curve located at point G, the degree of curve is the known component (along with the external deflection angle). The Curve Calc... button is used to solve the curve data.

- 8. **<D>** the **Next** button to define the curve at point G.
- 9. **<D>** the **Curve Calc...** button.
- 10. Set Compute: to Simple Curve.

The calculation is based on a 5 degree 30 minute 17 second curve.

- 11. Toggle on *DOC*: and key in *5 30 07*.
- 12. Verify that the *Angle* field is toggled on.

Marcurve Calculator					×
	Curve Lock Radius:	0.00			
	DOC:	5 30 07			
	Length:	0.00			
	🔽 Angle:	15^30'18"			
	Chord:	0.00			
	Tangent:	0.00			
	External:	0.00			
	Ordinate:	0.00			
	Compute: Sim	nple Curve 🔹 🔻			
	Curve Definition	n: Arc			
ОК	Compute	Results	Help	Cancel	

13. **<D> Compute**.

Notice the changes that occur in the dialog box. The values in the unlocked fields are modified based on the locked fields.

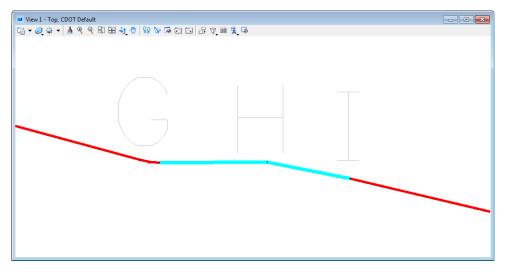
Kurve Calculator	
Curve Lock Radius:	1041.37
DOC:	5^30'07"
Ength:	281.81
📝 Angle:	15^30'18"
Chord:	280.95
Tanger	it: 141.77
Externa	l: 9.61
Crdinate	e: 9.52
Compute:	Simple Curve
OK Compute	Results Help Cancel

	Define Horizontal Curve Set					
Horizontal PI Define By: Known	PI Coordina	ites	•	Apply		
Direction Back:	S 74	^45'18'' E	+	Close		
Length Back:	2986	.25	+	Undo		
Point Name:				Rate Calc		
Northing:	orthing: 1555931.76		+	Design Calc		
Easting:	3280	408.64		Curve Calc		
Direction Ahead:	N 89	^44'23'' E	+	Report		
Length Ahead:	1726	6.67	+	Help		
Leading Transition: Radius 1:	Clothoid	•	0.00	+		
Radius 1:			1041.37	 +		
Compound Transition:		1	_			
Compound Transition:	Clothoid		0.00	+		
Radius 2:			0.00	+ +		
Radius 2: Trailing Transition:	Clothoid	▼	0.00	+		
Radius 2: Trailing Transition: Define By: (a) Radius	Clothoid	Paint Manage	0.00	+ +		
Radius 2: Trailing Transition: Define By:	Clothoid to Spiral	Point Name:	0.00 0.00 0.00	+ +		
Radius 2: Trailing Transition: Define By:	Clothoid to Spiral Tangent	Northing:	0.00 0.00 0.00	• • • •		
Radius 2: Trailing Transition: Define By: Radius Tangent Spiral to Point on	Clothoid to Spiral Tangent Curve	Northing: Easting:	0.00 0.00 0.00 1555969 3280271	.04 ↔		
Radius 2: Trailing Transition: Define By: Radius Tangent Spiral to Point on Angle up	Clothoid to Spiral Tangent Curve to PCC (P	Northing: Easting: C to PCC)	0.00 0.00 0.00	.04 ↔		
Radius 2: Trailing Transition: Define By: Radius Tangent Spiral to Point on	Clothoid to Spiral Tangent Curve to PCC (P	Northing: Easting: C to PCC)	0.00 0.00 0.00 1555969 3280271	.04 ↔		

14. **<D> OK**. The *Curve Calculator* dialog box is dismissed and the calculated radius is added to the *Radius 1* field in the parent dialog box.

15. **<D> Apply** and the curve will be created.

The next curve (location H) will also be calculated using the degree-of-curve. However a shortcut will be used to generate the input for the Radius 1 field. 16. **<D> Next** to select the tangents on either side of point H.



17. In the *Radius 1:* Field Key in *D 2-23-14*. The key in stands for D.O.C. 2[^] 23' 14".

Horizontal PI					Apply	_
Define By:	Known PI Co	oordina	tes	•		
Direction Back:		N 89	^44'23'' E	+	Close	
Length Back:		1726	.67	+	Undo	
Point Name:					Rate Calo	c
Northing:		1555	939.60	+	Design Ca	lc
Easting:		3282	135.29		Curve Cal	c
Direction Ahead	:	S 78′	^45'12'' E		Report.	
Length Ahead:		1232	.01	-ф-	Help	_
Radius 1:				d 2-23-14	4	+
Compound Tran	isition: Clo	othoid	-	0.00		+
Radius 2:				0.00		+
				0.00		+
Trailing Transitio	n: Clo	othoid	-	0.00		
Trailing Transitio Define By:)		othoid	•	0.00		
Define By: 🔘 F			▼ Point Name:	0.00		
Define By: () F	ladius	òpiral	Point Name: Northing:	1555939	.60	+
Define By: T S	ladius angent to S	òpiral gent				
Define By: F	ladius angent to S ipiral to Tanj	òpiral gent ve	Northing: Easting:	1555939	.29	
Define By: F S A	adius angent to S piral to Tan oint on Curv	òpiral gent ve PCC (PC	Northing: Easting: C to PCC)	1555939 3282135	.29	+

- 18. Press the keyboard **<TAB>** key to leave the field. The radius (2400.10) will compute for the selected location.
- 19. **<D> Apply** to form the curve.
- 20. If time permits, complete the remainder of the curves using the data listed below:

- I Radius = 15,000.00
- J Radius = 5,000.00
- K Radius = 3,000.00
- L DOC = 3-34-52
- 21. Review the alignment data select **Geometry > Review Horizontal**.

Lab 5.5 - Alignment Stationing

Section Objectives:

• Change the assigned stationing of an alignment.

The default station value assigned to the start of a new alignment is 0+00. Redefine the beginning station to 100+00.00

- 1. Select Geometry > Horizontal Curve Set > Stationing.
- 2. In the *Stationing* dialog box, key in *100+00*. (Can be entered as 10000 and then tab out of the field) in the *Starting Station* field.
- 3. **<D>** the **Apply** button.

🐂 Stationing				- • ×
Horizontal Alignment:	Design Alt	1 🔹	ŧ	Apply
Starting Station:	100+00.00			Import
Name:			1	Report
Northing:	1558417.7	4	+	
Easting:	3267409.4	0		Close
Vertical and Superel	evation Alig	nments		Help
 Synchronize Star Maintain Station 	-			
Station Equations				
Back Station		Ahead Statio	n	
	New	Edit		Delete

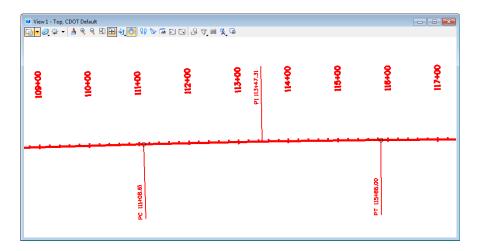
- 4. Verify your results using both of these methods:
 - Geometry > Review Horizontal
 - Tools > Tracking > Horizontal Alignments

- Miew Stationing - • • Horizontal Alignment: Design Alt 1 • + 🔄 View Stationing 🔶 General Limits **Regular Stations** Station Cardinal Stations Start: 100+00.00 Pls -Station Equations 366+60.60 Event Points Radius + A Drop Station Equation Name Transition Radii Vertical Stations Planarize Preferences.. Close Help Apply
- 5. Select **Geometry > View Geometry > Stationing** from the InRoads main menu.

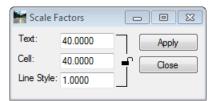
- 6. **<D>** the **Preferences** button.
- 7. Highlight the **Proposed-100 Ft Interval** preference.
- 8. **<D> Load** and **Close**.

Freferences	×
Name:	Close
Existing-100 Pt Interval Right Existing-500 Pt Interval Existing-500 Pt Interval Left	Load
Existing-500 Pt Interval Right OTHER-100 Pt Interval	Save
Proposed-100 Ft Interval	Save As
Proposed-100 Ft Interval Left Proposed-100 Ft Interval Right	Delete
Pmnoead.500 Et Interval III	Help
Active Preference: CDOT	

9. **<D>** the **Apply** button from the *View Stationing* dialog box. Stationing is displayed.



10. Experiment with changing the global scale factor value for text and redisplaying the stationing.



Lab 5.6 - Annotating an Alignment

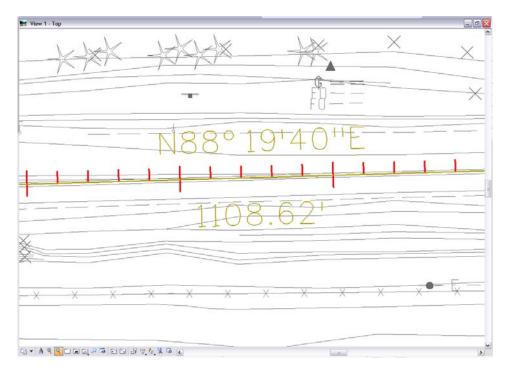
Section Objectives:

• Annotate an alignment.

1. Select Geometry > View Geometry > Horizontal Annotation from the InRoads main menu.

in Tabling Style	s	
Apply Style	Active Overwrite	Filter
0		Help
Horizontal Alignment:	ALG_EXISTING	×
Cogo Points:	Default	<u> </u>
Horizontal Alignments		o Points
nclude: Design Alt		<u>+</u>
Selected:	Se	ected:
Name Descrip Design Al Alignmen		ame Descr Style
7		
Display	x Linestring	← Annotate
Display Points		Points
Display Points On-Alignment	Event Points	Points Elements
Display ✓ Points ✓ On-Alignment ☐ Off-Alignment		Points Elements Duplicates
☐ Off-Alignment ☑ Elements	Event Points	Points Elements Duplicates Dual Dimensions
Display ✓ Points ✓ On-Alignment ☐ Off-Alignment	Event Points	Points Elements Duplicates
Display Points On-Alignment Off-Alignment Elements	Event Points	Points Elements Duplicates Dual Dimensions

2. Verify the settings as shown above and click **Apply** to display the alignment annotation.



3. **Review** the results in MicroStation.

Challenge Exercise:

- 1. Use Geometry>Copy Geometry to copy alignment Design ALT 1 to a new horizontal alignment named Design ALT 1 Modified.
- 2. Perform the following actions to the copied alignment:
 - Move a PI
 - Redefine one or more horizontal curves
 - Define alignment stationing to end at station 382+00
 - Redisplay stationing at a 500 foot interval
 - Introduce 2 station equations; one overlap and one gap.
 - Revert the alignment to a simple PI at point B (remove the curve definition)
 - Transpose the direction of the alignment

Lab 5.7 - Horizontal Alignment from Graphics

Alignments can be created from existing MicroStation graphics. In this exercise a chained MicroStation element will be used to create an alignment.

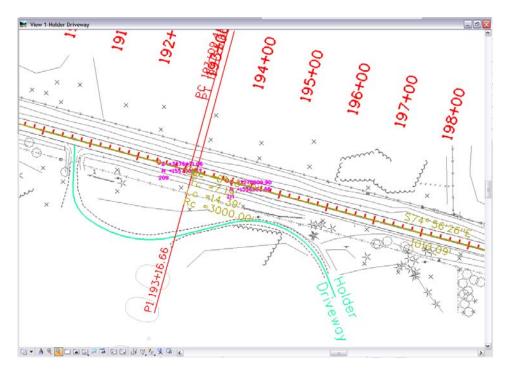
Section Objectives:

- Create a new horizontal alignment from MicroStation graphics.
- 1. From the MicroStation pull-down menu select **Utilities > Saved Views**.

2. From the *Saved Views* dialog box, highlight Holder Driveway.



3. **<D>** the **Apply** button then **Close**.



- 4. Select File > Import > Geometry. The Import Geometry dialog box will open.
- 5. Fill in the following information on the **From Graphics** tab:
- 6. Set the Type: to Horizontal Alignment
- 7. Key in *Holder Driveway* for the *Name*.
- 8. Key in *Driveway at Sta 190+80 RT* for the *Description*:

- 9. Set the Style: to *ALG_SECONDARY*.
- 10. Verify the *Geometry Project:* is set to **1234_Geometry Training.**
- 11. **<D>** the **Apply** button. The *Import Geometry* dialog box is minimized.

From Graphics	ICS Vertical from Surface			
Туре:	Horizontal Alignment	Apply		
- Geometry				
Name:	Holder Driveway			
Description:	Drive at Sta 190+80 RT			
Style:	ALG_SECONDARY	Help		
Horizontal Cu	rve Definition: Arc			
Vertical Curv	e Definition: Parabolic 🗸			
Horizontal Ali				
	nts No Duplicate Cogo Points			
Join Elemer	nts No Duplicate Cogo Points d Elements Added to Single Alignment s			
Join Elemer	nts No Duplicate Cogo Points d Elements Added to Single Alignment s			
Join Elemer All Selected Attribute Tag	nts No Duplicate Cogo Points d Elements Added to Single Alignment s Data			

- 12. You are prompted to *Identify Element*. **<D>** on the MicroStation graphic drawn in the center of the driveway.
- 13. **<D>** again to accept the highlighted graphics in the MicroStation view.
- 14. **<R>** in the MicroStation view to terminate the command. The *Import Geometry* dialog box is redisplayed. The MicroStation graphics have been imported as an alignment.

Note: The geometry name field increments for additional selection(s).

15. **<D>** the **Close** button to dismiss the *Import Geometry* dialog box.

16. **Verify** the alignment was created.

Roads XM Edition			_ 🗆 🛛
<u>File Surface Geometry Drainage Eval</u>	uation <u>M</u> odeler I	Dr <u>a</u> fting <u>T</u> ools <u>H</u> elp	
<unnamed> 💌 🚡</unnamed>	😤 🗞 🎉	· 🗾 5+00 🗉	
	Name	Style	Descri
😑 📇 Geometry Projects 🔺	Cogo Buffer		
Cogo Buffer Design Alt 1 Holder Driveway Holder Driveway	🖌 Default	Default	
🖁 Geometry 🔊 Preferences 🔹	<		>
Changes the snap mode to Element/Point/None	2		

17. Review the alignment using **Geometry > Review Horizontal**.

Aorizontal Alignment: 12345_Geometry Tri >	Sets 💿 Alignment	O Element		Close Save As
Project Name: 12345_Geometry Description: Geometry Train: Horizontal Alignment Name: Holder Drivewa Description: Drive at Sta 1 Style: ALG_SECONDARY	ing class y 90+80 RT			Append Display
ST	ATION NORT	HING EAS	STING	- THE
PC ()) 0+4 Tangent Direction: S 2^35'	DO.OO 155703 36.63 155694 41" W 36.63			Help Select First
PI () 1+: CC () PCC () 1+:	36.63 155694 25.77 155691 155694 58.77 155688 75.00	0.62 327629 6.32 327636	93.09 59.79	< Previous Next >

- 18. When finished **Close** the *Review Horizontal Alignment* dialog box.
- 19. Time permitting, display the alignment graphics, stationing, and curve information.

Lab 5.8 - Extend Alignment

The alignment *Holder Driveway* does not intersect the reference line alignment *Design Alt 1*. Standard practice necessitates the driveway alignment to commence at the main-line reference line.

Section Objectives:

- Learn one of the tools used to modify existing alignments.
- 1. Select Geometry > Utilities > and hold.

Note: If the commands for Trim and Extend Alignment are not listed in the menu, this means that they are not enabled. These 2 commands are an extension of the Horizontal & Vertical Elements command set which must be enabled.



- 2. Select Tools > Application ADD-Ins.
- 3. Enable Horizontal and Vertical Elements Add-In.

vailable:									C		
GENIO Translator Add-In								6		OK	
									<u></u>	Cano	-I
Global Scale Factors Add-In										Caric	e
Graphics Translator Add-In	1							-		Help	
Horizontal and Vertical Elements Add-In	1									neit	
Hydrology and Hydraulics Add-In	10.63										
								1	<u> </u>		
											hear
The Horizontal and Vertical Elements Add- creating and modifying alignments. This mand circular components, or elements, inst guive sets. These components are then c	ethod ead of	differs by loc	from the ating,	he Pl r adding	nethoo , and	l of de insertir	sign be	ecause its of in	you d	lefine lin	
creating and modifying alignments. This m and circular components, or elements, inst curve sets. These components are then c	ethod ead of	differs by loc ted and	from ti ating, d fit tog	he Pl r adding	nethod , and to fom	l of de insertir n an al	sign be	ecause its of in	you d	lefine lin	
creating and modifying alignments. This m and circular components, or elements, inst curve sets. These components are then c Command	ethod ead of comput	differs by loc ted and	from the ating,	he Plin adding gether	nethod , and to fom	l of de insertir	sign be	ecause its of in	e you d ntersec	lefine lin	d
reating and modifying alignments. This m and circular components, or elements, inst surve sets. These components are then c Command Geometry>Horizontal Element>Add Fix	ethod ead of comput	differs by loc ted and X	from ti ating, d fit tog	he Plin adding gether The Plin Adding	nethod , and to fom	l of de insertir n an al	sign be	ecause its of in	e you d ntersec	lefine lin	d
reating and modifying alignments. This m and circular components, or elements, inst curve sets. These components are then o Command Geometry>Horizontal Element>Add Fix Geometry>Horizontal Element>Add Fix	ethod ead of comput	differs by loc ted and X X X	from ti ating, d fit tog	ne Plin adding gether X X	nethod a, and to form X X X	l of de insertin n an al	sign be	ecause its of in	e you d ntersec X X X	lefine lin	d
reating and modifying alignments. This m and circular components, or elements, inst curve sets. These components are then c Command Geometry>Horizontal Element>Add Fix Geometry>Horizontal Element>Add Fix Geometry>Horizontal Element>Add Fix	ethod ead of comput X X X X	differs by loc ted and X X X X X	from ti ating, d fit tog	he PIr adding gether X X X X	nethod , and to fom X X X X	l of de insertin n an al	sign be	ecause its of in	e you d ntersec X X X X	lefine lin	d
creating and modifying alignments. This m and circular components, or elements, inst curve sets. These components are then c Command Geometry>Horizontal Element>Add Fix Geometry>Horizontal Element>Add Fix Geometry>Horizontal Element>Add Fix Geometry>Horizontal Element>Add Fix	ethod ead of comput X X X X X X X	differs by loc ted and X X X X X	from ti ating, d fit tog	he PIr adding gether X X X X	nethod , and to fom X X X X	l of de insertin n an al	sign be	ecause its of in	e you d ntersec X X X X X X X	lefine lin	d
creating and modifying alignments. This m and circular components, or elements, inst curve sets. These components are then c Command Geometry>Horizontal Element>Add Fix Geometry>Horizontal Element>Add Fix Geometry>Horizontal Element>Add Fix Geometry>Horizontal Element>Add Fix Geometry>Horizontal Element>Add Fix	ethod ead of comput X X X X X X X X X	differs by loc ted and X X X X X X X X X X X X X X	from ti ating, d fit tog	he PIr adding gether X X X X X X X X X X X	x X X X X X X X X X X X X X X X X X X X	l of de insertin n an al	sign be	ecause its of in	e you d itersec X X X X X X X X X X X	lefine lin	d
creating and modifying alignments. This m	ethod ead of comput X X X X X X X	differs by loc ted and X X X X X	from ti ating, d fit tog	he PIr adding gether X X X X	nethod , and to fom X X X X	l of de insertin n an al	sign be	ecause its of in	e you d ntersec X X X X X X X	lefine lin	d

- Create/Edit Alignment by Cogo Points...

 Join...

 Im Alignment

 Extend Alignment

 Patial Delete Alignment

 Im Multicenter Curve...

 Cul-de-sac...

 Parallel Horizontal Alignment...

 Parallel Vertical Alignment...

 Transpose...

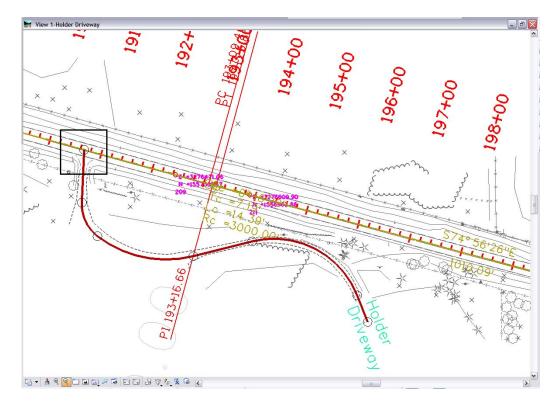
 Im Verse Direction...

 Image: Assign Names...

 Assign Names...

 Assign Checks...
- 4. Once enabled, Select Geometry > Utilities > Extend Alignment.

- 5. At the prompt: *Identify Alignment to extend to*, **<D>** on the alignment **Design Alt 1**.
- 6. At the prompt: *Identify Alignment to extend*, **<D>** on the alignment **Holder Driveway**.
- 7. **<D>** to *accept* the presented solution.



- **Note:** The alignment-alignment intersection is now the initial point of the driveway alignment. Because the alignment was edited (extended) from its beginning, the initial station value was recalculated to -0+12.41. Because the original beginning point retains its station value (0+00), the new beginning point is given a negative station value.
- 8. From the InRoads main menu, select **Geometry > Horizontal Curve Set > Stationing** define the driveway beginning station as **3+25**.

Challenge Exercises:

- Display stationing at a 100 foot interval for Holder Drive.
- Display alignment annotation for Holder Drive.
- Recall saved view Drive @ 180+00.
- Import the graphics representing the driveway centerline into an alignment named Drive 180+00.
- Use the command **Geometry > Utilities > Trim Alignment** to remove the portion of the driveway alignment that lies north of the main-line reference line.
- **Note:** The order selecting alignments is not important when using the trim alignment command. The location of the data point in response to *Identify portion to clip* determines both the alignment and the portion of that alignment that is eliminated.

Lab 5.9 - Saving Geometry

Alignments cannot be saved individually. They are saved when the geometry project is saved. Due to the fact InRoads works on geometry that is loaded in memory, the geometry project must be saved at appropriate times.

Section Objectives:

- Save InRoads design data.
- 1. From the InRoads main menu, select File > Save > Geometry Project. The *Save As* dialog box is displayed with the *Save as type:* set to Geometry (*.alg).
- 2. Verify you are in the correct project directory; C:\Projects\12345\Design\InRoads.



- 3. The file name should match the *Active:* name at the bottom of the *Save As* dialog box. If necessary, use *Active* drop-down menu and reselect the desired name to ensure the saved file name will match the geometry project name.
 - **Note:** Geometry projects have both an internal name that appears in the dialog boxes in InRoads and a name on the hard drive that has an.ALG extension. To minimize any confusion between these two names, ensure that the saved Geometry name in the project folder matches the Geometry name displayed in InRoads explorer.
- 4. **<D>** the **Save** button and then the **Cancel** button. The file will be saved to disk and the *Save As* dialog is dismissed.

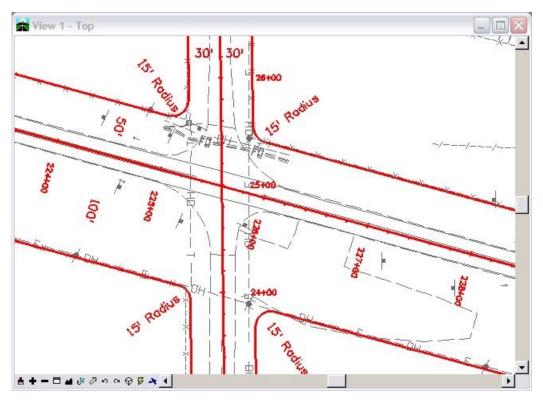
Lab 5.10 - Creating Parallel Horizontal Alignments

Offset alignments can be created to generate geometry for elements such as right-of-way limits, easement limits, under-drains, retaining walls, bridge decks, etc.

Section Objectives:

• Learn additional tools for creating alignments.

In this lab horizontal alignments are created to define the right-of-way limits for the mainline road and the side road. The Side Road has a right-of-way width of 60' (30' on each side of centerline). The mainline alignment has a total right-of-way width of 150'; 50' feet north of the reference line and 100' south. At the intersection of the right-of-way lines a radius of 15' is required.



The workflow will consist of using an assortment of geometry commands:

- **Copying Geometry** used to combine geometry residing in two different geometry projects into one project
- Multi-Center Curve to create radius returns
- Parallel Horizontal Alignment to offset alignments
- Join Alignments to connect separate alignments
- Join Elements to simplify geometry

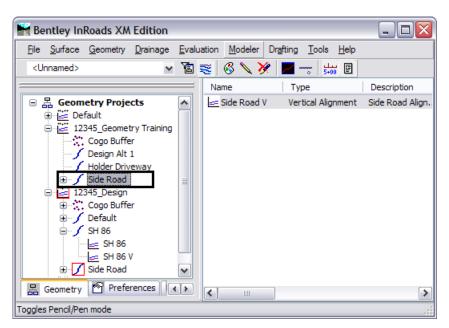
The first step is to create alignments relative to both the mainline alignment (SH 86) and the side road alignment (Side Road). These two horizontal alignments reside in two different geometry projects. To work efficiently, they should reside in a single geometry project. The *Copy Geometry* command is used to achieve this result.

Bentley InRoads XM Edition	
<u>File Surface Geometry Drainage Evaluation Modeler Drafting Tools Help</u>	
<unnamed> 🖌 👔 😴 🚳 🔪 🏏 🔛 🗒</unnamed>	
Name Type	Description
□ □	
Hard Geometry Preferences	>
Ready	

- 1. Select **Geometry>Copy Geometry** from the Inroads main menu.
- 2. In the From area, select **12345_Design** for the geometry project.
- 3. Highlight the alignment **Side Road** from list.
- 4. Verify that **Include All Children** is toggled on.
- 5. In the *To* area, Select **12345_Geometry Training** for the *Geometry Project*.
- 6. Key in *Side Road* for the *Horizontal Alignment* name.
- 7. Key in *Side Road Alignment* for the *Description*.
- 8. Select **ALG_PRO** for the *Style*.

- I I X Mag Copy Geometry Horizontals Projects Verticals Cogo Points From Apply Geometry Project: 12345_Design V Help + Name Description Style Default Default Proposed SH 86 ALG PRO SH 86 Side Road Side Road Alignm ALG PRO ✓ Include All Children Geometry Project: 12345_Geometry Training ¥ Horizontal Alignment: Side Road Description: Side Road Alignment Style: ALG_PRO Y Close
- 9. **<D> Apply** then **Close** to copy the alignment and dismiss the dialog box.

- 10. Verify the alignment was copied.
- 11. Copy alignment **SH 86** as **SH 86 ALT 1** if you feel the mainline alignment created in an earlier lab exercise may contain errors



12. Set the geometry project **12345_Geometry Training** as *Active*.

The next step is to generate the radius returns. This is done by using the Multicenter Curve command. Begin by creating the radius returns north of the mainline alignment.

- 13. From the *Saved Views* dialog box, **<D>** saved view name **Side Road**.
- 14. Click Apply.
- 15. Select **Geometry > Utilities > MultiCenter Curve** from the InRoads main menu.

Multicen	ter Curve	_		
Main Adva	anced			
Curve Type:	One Center	*	[Help
Radii		_		
Radius 1:	15.00	+	~ Widths	
Radius 2:	40.00	+	Width 1: 30.00	+
Radius 3:	120.00	+	Width 2: 50.00	+
Define By			·	
 Offsets 	at Shifted PC/PT	⊖ Offs	ets at PCC/PCC OL	ength
Use Se	cond Set of Values			
Offset 1:	2.00	+	Length 1: 0.00	ф
Offset 2:	2.00	<u></u>	Length 2: 0.00	- † -
	I HBUN	Alignmen	Vidth 2	
L				

16. Select **One Center**.

17. Input the following values:

- ♦ Radius: 15
- ♦ Width 1: 30
- ♦ Width 2: 50

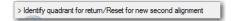
18. **<D>** the **Apply** button. The following prompts are displayed.

> Identify first alignment/Reset

19. In the MicroStation view **<D>** on the **Side Road** alignment.

> Identify second alignment/Reset for new first alignment

20. **<D>** on the **Design ALT 1** alignment.



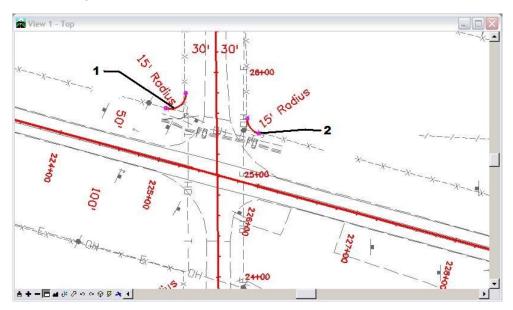
21. **<D>** in the *Northwest* quadrant

Accept/Reject

- 22. **<D>** to accept and create an alignment representing the radius return.
- 23. To add the radius returns to the remaining quadrants, **<D>** in the quadrant then **<D>** again to **Accept**.

New alignments will be assigned names based on the seed alignment name specified in **Tools > Options [Geometry]**.

Two new alignments are created, *1* and *2*.



Hentley InRoads XM Edition			_ 🗆 🔀
<u>File Surface Geometry Drainage Evalu</u>	iation <u>M</u> odeler Dr <u>a</u>	fting <u>T</u> ools <u>H</u> elp	
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	Name	Туре	Description
😑 📇 Geometry Projects 🔺	side Road V	Vertical Alignment	Side Road Align.
🖁 🗄 Geometry 🔊 Preferences 🔹	<		>
Toggles the Feature Filter Lock			

Note: Your stationing graphics may appear at a different location than shown above.

The next steps will be to offset the mainline and side road alignments so they match up with the returns that were just created. This is done using the *Parallel Horizontal Alignment* command.

- 24. From the MicroStation drop-down menu, select **Utilities > Keyin**. The key in window is needed to input the desired station limits and offset distances.
 - **Note:** Stations and offsets can be identified graphically. However, using key-in's provides greater accuracy.

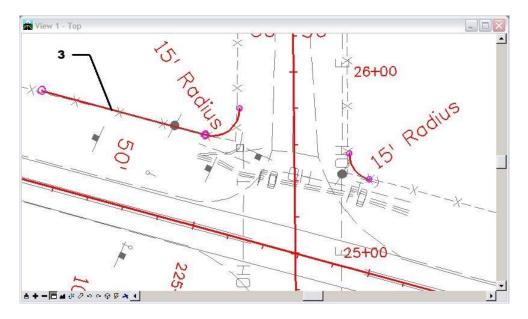
Key-in		X
	v 🛱 🕰	•

- 25. From the InRoads main menu select Geometry > Utilities > Parallel Horizontal Alignment....
- 26. In the Parallel Horizontal Alignment dialog box, toggle on Interactive By Station
- 27. **<D>** the **Apply** button.
- 28. In the MicroStation view **<D>** on the mainline alignment.
- 29. At the prompt *Identify First Station/Key in Station*, key in *224+00* in the MicroStation Key-in window.
- 30. Press the *Enter* key.

😽 Key-in	🛛
22400	💽 🛱 🕰 🗸

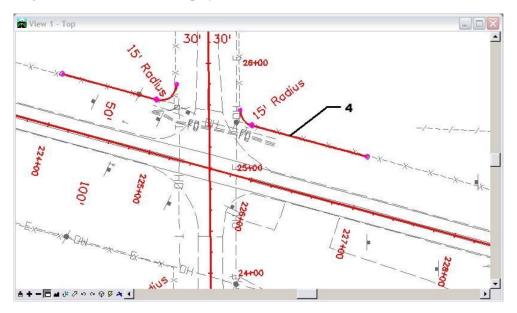
31. At the prompt *Identify Second Station/Key in Station*, key in *224+93.20* in the MicroStation Key-in window.

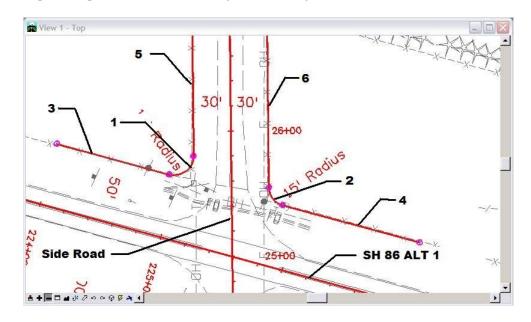
- 32. Press the *Enter* key.
- 33. For *Identify Location:* key in *-50*(50' to the left) in the MicroStation Key-in window.
- 34. Press the *Enter* key.
- 35. **<D>** the in the view window to accept the solution. Alignment 3 is created and displayed.



- 36. Repeat the **Geometry > Utilities > Parallel Horizontal by Station** command to the east of the side road using the following data:
 - ◆ Station limits of: 225+86.76 to 227+00, 50' left of Design Alt 1

Alignment 4 is created and displayed.





37. Repeat the process to create the alignments along the Side Road north of the radius returns.

Next use the Join Alignment command to connect the alignments created in the previous steps single alignments for each quadrant.

Join alignments 3, 1, & 5 to create the Northwest quadrant's right-of-way limits.

38. Select Geometry > Utilities > Join.

🚼 Join	_ 🗆 🗙
✓ Delete Original Alignments	Apply
	Close
	Help

39. toggle on *Delete Original Alignments*.

Note: The first alignment identified (3) will become the final alignment name and alignments (1) and (5) will be deleted upon completion of the command.

40. **<D>** the **Apply** button and follow the prompts.

> Identify initial alignment

41. **<D>** on alignment **3**.

> Identify alignment to parallel/Skip

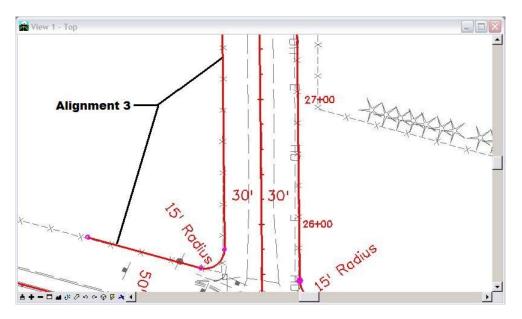
42. **<D>** alignment **1**.



43. **<D>** on alignment **5**.

> Accept/Reject

- 44. **<D>** to accept the results.
- 45. Reset $\langle \mathbf{R} \rangle \langle \mathbf{R} \rangle$ to exit the command.



Alignment 3 is now the combination of the alignments 3, 1, and 5. Alignments 1 and 5 have been removed from the geometry project.

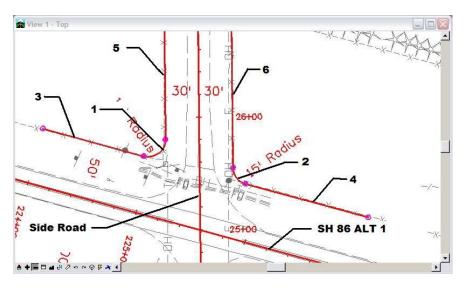
🕌 Bentley InRoads XM Edition	on		_ 🗆 🛛
<u>File Surface G</u> eometry <u>D</u> raina	age <u>E</u> valuation <u>M</u> odeler	Dr <u>a</u> fting <u>T</u> ools <u>H</u> elp	
<unnamed></unnamed>	💌 🛅 📚 🤞 🔪 🌶	🗶 🗾 🛶 🛄	
	Name	Туре	Description
Design Alt 1	▲ <u></u> 2	Vertical Alignment	
Holder Driveway			
. Side Road			
4	=		
6			
🗐 📴 12345_Design			
E Cogo Buffer			
⊡…∫ Default ⊡…∫ SH 86	-		
🖁 🖁 Geometry 🔊 Preferences			>
Toggles Pencil/Pen mode			

Colorado Department of Transportation

46. **Review** alignment **3**.

eometry Project: 12345_Geometry Iorizontal Alignment: 3) Alignment 🔿 Element			Close Save As
Description Horizontal Alignment Name Description	1:				Append Display
Style	e: Default STATION	NORTHING	EASTING	=	Print
Element: Linear POB (PC (Tangent Directic Tangent Lengt		1556223.24 1556198.73	3279529.29 3279619.21		Help Select
Non-collinear					First
Element: Circular PC (FI (CC () 223+06.80) 223+26.65	1556198.73 1556193.52 1556213.21	3279619.21 3279638.36 3279623.15	~	< Previous Next > Last

47. Using the same steps above, join alignments 6, 2, and 4 (in that order) to create the northeast quadrant's right-of-way limits; begin with alignment **6**.

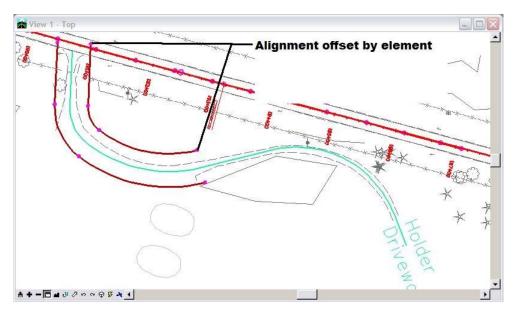


Once the above step is completed, alignments 3 and 6 define the right-of-way limits on the north side of the intersection.

Another method of creating parallel alignments is by element instead of by station.

48. Select Geometry > Utilities > Parallel Horizontal Alignment.

Parallel Horizontal Alignment *by Element* differs from *by Station* in that you can select the limits of the alignment to offset by selecting alignment components (tangents or curves) to define the desired limits.



LAB 6 - Profiles and Vertical Alignments

Once the horizontal alignment is defined, then the profile and vertical alignment can be created. Profiles are a graphic representation of a surface along a specified path (alignment, graphic element, etc.). Profiles are also used to create and display vertical alignments.

Chapter Objectives:

- Review an existing vertical alignment.
- Create a profile.
- Update the profile with a variety of features.
- Display profile annotation data.
- Use vertical alignment tracking.
- Create a new vertical alignment.

The following files are used in this lab:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Projects\12345\Design\InRoads\12345DES_Design.alg
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm

Lab 6.1 - Reviewing Vertical Alignments

Section Objectives:

• Examine the Review Vertical Geometry window and explore the functionality of the dialog box.

Reviewing vertical alignments is similar to reviewing horizontal alignments. The *Review Vertical Alignment* dialog box allows you to easily change between multiple Geometry Projects, Horizontal, and Vertical alignments.

Review Vertical Alignment			- • •	
Geometry Project: 12345_Design Horizontal Alignment: SH 86 Vertical Alignment: SH 86 V	Mode Alignment C Bement		Close Save As Append	
Horizontal Alignment Name: S Description: F Style: A Vertical Alignment Name: S Description: F	H 86 Design Alignments H 86 Proposed SH 86 LLG_PRO	[Display Display Print Help	
	STATION	ELEVATION	Select	
Element: Linear POB PVC Tangent Grade: Tangent Length:	100+00.00 107+50.00 -3.76 750.00	6630.07 6601.88	First < Previous Next >	
Element: Parabola PVC PVI PVT Length: Headlight Sight Distance: Exit Grade: Factor (g2 - g1) / L: K = 1 / (g2 - g1): Middle Ordinate:	$\begin{array}{c} 107{+}50.00\\ 109{+}00.00\\ 110{+}50.00\\ 300.00\\ 621.28\\ -3.76\\ -1.03\\ 0.91\\ 109.84\\ 1.02 \end{array}$	6601.88 6596.24 6594.70	Last]

1. Select **Geometry > Review Vertical** from the InRoads main menu.

The review dialog box can also be opened with the right-click menu.

New Set Active Copy	
Delete	
Empty deler D	r <u>a</u> fting <u>Q</u> uantities <u>T</u> ools <u>H</u> elp
View Jiew	
Edit	
Review	
Check Integrity	
Hilite	
Circular Definition	
/ Parabola Definition	
	Set Active Copy Delete Empty View Edit Review Check Integrity Hilite Circular Definition

Section Summary:

• Reviewing vertical alignments works the same as reviewing horizontal alignments.

Lab 6.2 - Creating Profiles

Before a vertical alignment can be displayed graphically, a profile must be created. These are referred to as profile sets in InRoads. A profile set can be created from a horizontal alignment, a MicroStation element, or a series of data points. A profile can contain DTM surfaces, vertical alignments and DTM features. Once a profile set has been created, items displayed can be turned on or off and elements can be updated based on current data.

Section Objectives:

- Examine the profile dialog box.
- Select profile Preferences.
- Display vertical alignment annotation.

The DTM **12345Surv_Surface_Existing** surface will be used to display an existing ground-line

- 1. In the InRoads explorer, select the **Geometry** tab, verify that **12345_Design** is the *active* geometry project and that the horizontal alignment **SH86** is the *active* alignment.
- 2. Select **Evaluation > Profile > Create Profile** from the InRoads main menu. The *Create Profile* dialog will appear.

Create Profile Create Profile General Source Include Offsets Controls	Set Name: SH 86 Direction Left to Right Right to Left	Exaggeratio Vertical: Horizontal:	1.0000	
Axes Grid Details	Surfaces: Object Default 12345Surv_Surface	Name Default T_Existing_Ground Pro	BYL BYL All None	
		Apply Prefere	ences Close	Help

- 3. **<D>** the **Preferences** button. The *Preferences* dialog box is displayed.
- 4. Highlight the **2x vertical** preference.

Preferences	X
Name:	Close
10x Vertical 10xVert_Drain 1x Vertical	Load
1xVert_Drain	Save
5x Vert_Drain	Save As
5xVert_Drain CDOT	Delete
Default SS Drain	+ Help
Active Preference: CDOT	

- 5. **<D>** the **Load** then **Close** buttons. Notice that the *Exaggeration* has changed to 2.00.
 - **Note:** Load preferences before making any other menu settings. Loading Preferences resets all menu settings to those predefined in the preference.

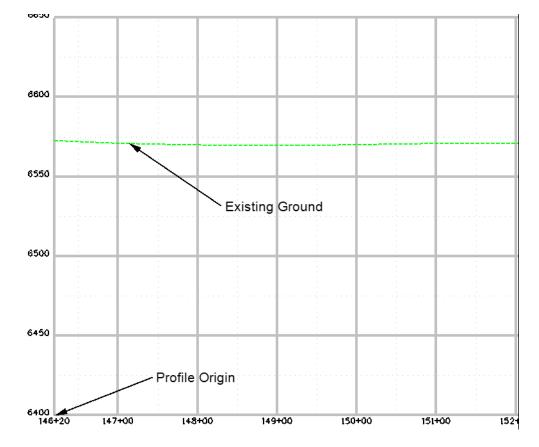
6. In the *Surfaces* area of the dialog box, Verify that the **12345SURV_Surface_Existing** surface is toggled on.

🖌 Create Profile				
Create Profile General Source Include Offsets Controls Axes	Set Name: SH 86 Direction	Exaggera Vertical: Horizontal	2.0000	
Grid Details ASCII	Sulfaces: Object Default 12345Surv_Sulface		RYI BYI All Nor roperties	
		Apply	rences Close	Help

7. **<D>** the **Source** leaf. Verify that the **SH 86** alignment is selected.

Kreate Profile		
Create Profile General → Source → Include → Offsets → Controls → Grid	Create: Alignment: Graphics Alignment: Multipoint Alignment:	Window and Data VINDow and Data VINDow and Data VINDow and Data VINDow and Data
ASCI	O ASCII File	
		Apply Preferences Close Help

8. **<D>** the **Apply** button. The *Create Profile* dialog box is temporarily minimized.



 You are prompted by MicroStation to 'Identify location'. <D> in the MicroStation view. The Profile window is placed and the *Create Profiles* dialog box is restored.

Note: For convenience, we are displaying the profile in the current drawing. Normally, Profiles and cross sections are created in their own dgn files. Consult the directory structure and file naming convention for your specific discipline to determine standards relating to profile display.

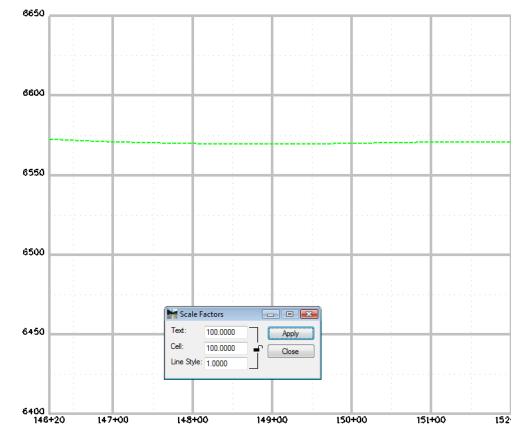
Lab 6.3 - Viewing Vertical Alignments and Annotation

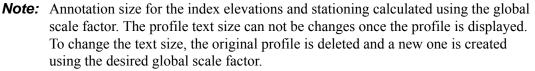
Once a profile is created from a horizontal alignment, vertical alignments associated with that horizontal alignment can be displayed.

Section Objectives:

- Display the vertical alignment line i a profile
- Display vertical alignment annotation
- 1. Select **Geometry > View Geometry > Active Vertical** to display a graphic of the active vertical alignment.

♦ Alternately in the *Workspace Bar* under the *Geometry* tab you can <R> on the Vertical Alignment and select *View* just as you did with Horizontal Alignments.





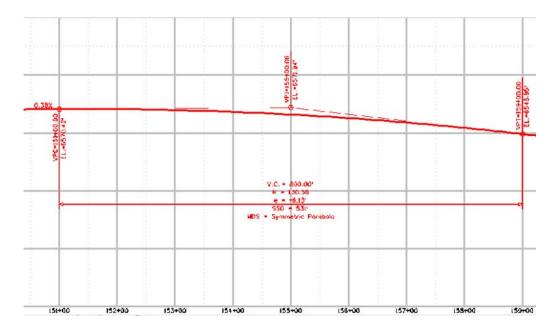
Vertical alignment annotation is used to display the vertical alignment line and other data in a profile set.

2. Select Geometry > View Geometry > Vertical Annotation from the InRoads main menu. This displays the *View Vertical Annotation* dialog box.

3. Verify the appropriate *Horizontal*, *Vertical Alignments*, and *Profile Set* are correctly identified.

Kiew Vertical Annotation	
Main Points Curves Tangents Affixes	
Horizontal Alignment: SH 86 -	Help
Vertical Alignment: SH 86 V 🗸 🔶	
Profile Set: SH 86 🗸	
Station	
Start: 100+00.00	
Stop: 366+60.50 +	
Apply Preferences Close	

4. **<D>** the **Apply** button.

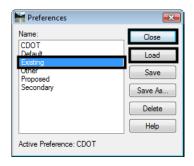


Take some time and investigate the remaining tabs along the top of the *View Vertical Annotation* dialog box and the individual settings for each.

5. **<D>** the **Points** tab. Note the settings in the *Symbology* portion of the dialog box. By default, the *Proposed* preferences are used.

🕌 View Vertical Ar	- • ×		
Main Points C	urves Tangents	Affixes	
Point Type: PV]	Help
Justification: Cer			пор
	Position	Precision	Format
Station:	1	0.12	▼ SS+SS.SS ▼
Elevation:	-1	0.12	•
Curve Data			
Leaders]
		mum Length	Deflection Angle
Segment 1:	0.00		90^00'00''
Segment 2:	0.00		0^00'00''
Point Annotation	Location: Convex	• •]	
Drop Station E	nuation Name		
Rotate Symbol	-		
	s Symbology with P	oint's Style	
Symbology:	o ojinoologji marri	on to otylo	
Object	Nar	ne	*
PVC Text	ALG	PRO_Vert_Dim	BYL
PVI Text	ALG	PRO_Vert_Dim	BYL
VT Text		_PRO_Vert_Dim	BYL
PVCC Text		_PRO_Vert_Dim	BYL -
		DDO Vort Dim	
	Apply Pre	eferences	Close

6. **<D>** the **Preferences** button.



- 7. **<D>** the **Existing** preference.
- 8. **<D>** the **Load** then **Close** buttons.

View Vertical A	nnotation			
Main Points (urves Tangen	ts Affixes		
Point Type: PV	1	•	Help	
Justification: Ce	nter	•		
	Position	Precision	Format	
Station:	1	0.12	▼ SS+SS.SS ▼	
Elevation:	-1	0.12	•	
Curve Data				
Leaders				
		1inimum Length	Deflection Angle	
Segment 1:	0.00		90^00'00''	
Segment 2:	0.00		0^00'00''	
Point Annotation	Location: Conv	vex 🔻		
Drop Station E	ouation Name			
Rotate Symbol				
	s Symbology with	Deint's Chile		
Symbology:	s symbology with	I Point's Style		
<u> </u>	N	Vame		
Object		LG EXISTING Vert	DVI D	
		LG_EXISTING_Vent		
PVT Text		ALG_EXISTING_VertBYL		
PVCC Text		LG_EXISTING_Vert		
		C EVICTING Vot		
	Apply	Preferences	Close	

9. Note the change in the defined *Symbology*.

- 10. **<D>** the **Apply** button. Review the results in the MicroStation drawing. Notice that the data remains the same, however the symbology (level, color, etc.) is changed.
- 11. For practice, continue to *Load* and *Display* additional preferences. Investigate what levels the elements are being placed on. The various preferences determine the location of graphics.

Section Summary:

- Use the Preferences to make the major settings in the Create Profile and Vertical Alignment Annotation dialog boxes.
- View Active Vertical only displays the geometry elements that make up the vertical alignment.
- Vertical Alignment Annotation displays the geometry elements and text data that describe the alignment.

Lab 6.4 - Updating Profiles

When a profile is created the user has the option to display items such as: multiple surfaces, profile lines offset from the horizontal alignment, and features such as underground utilities and pipes. However, the Create Profile command does not allow the user to specify which features are displayed.

The Update Profile command should be used to add, remove, or update data within an existing profile set. This command allows the user to specify which features will be affected by the command and can also be used to update and surface data that has changed since the profile was created.

Section Objectives:

- Use the Update Profile command to add features to the display.
- Illustrate how Global Scale Factors affect cell size.
- Examine how Feature Filters affect dialog box lists.
- 1. From the InRoads main menu, select **Evaluation > Profile > Update Profile.** The *Update Profile* dialog box is displayed.

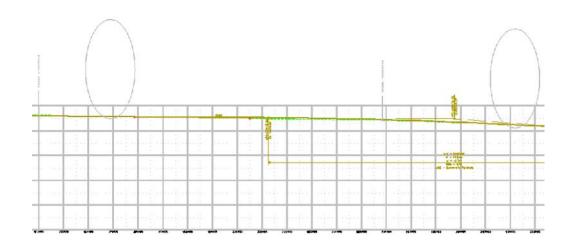
🚼 Update Profile			- • •
Profile Set:			
SH 86 🔹 🛨	Mode: 💿 Refresh 🛛 🔘 Display C)n 🔘 Display Off	
📋 Update Profile	Suffaces:		
	Name	Description	<u>+</u>
	12345Surv_Surface_Existing	Existing Ground from mul	
	Show Data Outside Elevation R	lange	
]	Apply Close	Help
		reprij Close	

- 2. Verify SH 86 is the active *Profile Set*.
- 3. In the *Mode* section toggle on **Display On**.
- 4. **<D>** the **Crossing Features** leaf.
- 5. In the *Surfaces* section highlight **12345SUR_Surface**.

🐂 Update Profile				
Profile Set:	Mode: © Refresh (Surfaces: Name Default 12345Sury_Surface_E	De	isplay Off scription ting Ground from mul]
	T_Billboard Sele	•	or More	
				Styles Filter
		A	pply Close	Help

6. **<R>** in the *Crossing Features* list and **<D> Select All** from the right click menu.

7. **<D>** the **Apply** button. Using MicroStation viewing tools locate a crossing culvert.



Profile and cross section displays are drawn at true horizontal scale. A vertical exaggeration is applied to cells displayed in profiles or cross sections based on the vertical scale applied to the grid.

Note: Two classes of elements can be displayed on profiles; 1) True scale items such as culverts and 2) items represented by text such as utility crossings, flow-lines, ROW, etc.

For True Scale items:

The global scale factor for cells should be set to 1.

For Informational items:

The global scale factor should be set equal to the plot scale.

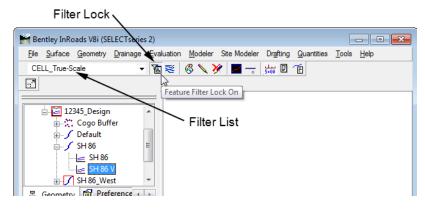
Lab 6.5 - Refreshing a Profile Display

First, true-scale items such as the culverts.

- 1. Select Tools > Global Scale Factors.
- 2. **<D>** on the **Scale Factor Lock** icon so that it is in the open position. This allows modification to the cell scale only. This allows annotation and other commands to remain unaffected by the scale factor that is used specific for cells.

Scale F	actors]
Text:	100.0000	Apply	
Cell:	1.0000	Close	
Line Style:	1.0000		

- 3. In the *Cell* field, key in **1**.
- 4. **<D>** the **Apply** then **Close** buttons in the *Global Scale Factor* dialog box.
- 5. From the *Locks* toolbar, select **CELL_True-Scale** from the *Feature Filter* list.
- 6. Toggle on the *Feature Filter* lock.

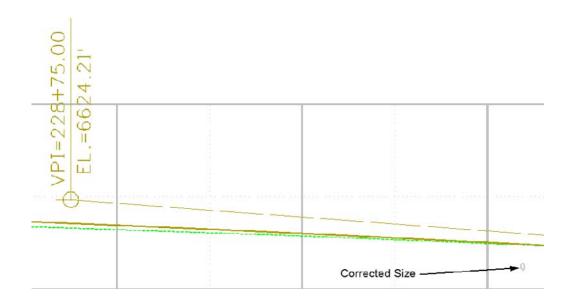


- 7. Close and reopen the *Update Profile* dialog box.
- 8. Verify SH 86 is still the active *Profile Set*.
- 9. In the *Mode* section toggle on **Refresh**.
- 10. **<D>** the Crossing Features leaf.
- 11. Highlight the **12345SURV_Surface** in the *Surfaces* area.

- ኵ Update Profile - • • Profile Set + Mode Refreships 💿 Display On 🛛 💿 Display Off SH 86 Surfaces: 🔄 Update Profile Surface Name Description Offsets Crossing Features Crossing Features: ŧ Name Style Description Culvert Corr Steel Culvert Corr Steel Pip Culvert Corr Steel Pip Styles. Filter Apply Close Help
- 12. Select all of the *Crossing Features* listed.

13. **<D>** the **Apply** button.

14. Use MicroStation viewing tools to locate a crossing culvert and review the results.



- 15. Use MicroStation Measuring tools to verify pipe size(s).
- 16. From the *Locks* toolbar select **CELL_Plot-Scale** from the Feature Filter list.



Note: Verify that the feature filter is toggled on.

17. Change the InRoads Scale Factor to **100** for cells.

🐂 Scale F	actors	
Text:	100.0000	Apply
Cell:	100.0000	Close
Line Style:	1.0000	

Note: This is the desired plot scale change accordingly.

18. Close and reopen the Update Profile dialog box.

🖌 Update Profile				
Profile Set: SH 86	Surfaces:		Display Off	
 Offsets 	Name 12345Surv_Surface_		escription isting Ground from mul	ב
	Crossing Features:			
	T_Elect Overhead Li. T_Traffic No Pass Ri.	T_Elect Overhea T_Traffic No Pass	Description Bridge Electrical Overhead L Electrical Overhead L Traffic Control No Pa Traffic Control No Pa	
				Styles Filter
,			Apply Close	Help

- 19. Verify **SH 86** is still the active Profile Set. Use the target button next to the Profile Set to graphically change the active profile set.
- 20. In the Mode section toggle the radio **Refresh** button.
- 21. **<D>** the **Crossing Features** leaf.
- 22. **<D>** the surface name **12345SURV_Surface**.
- 23. Select all of the *Crossing Features* listed.
- 24. **<D>** the **Apply** button.
- 25. Turn **Off** the *Feature Filter* lock.

🗑 Be	ntley InRo	oads V8i (SE	LECTserie	s 2)			
<u>F</u> ile	<u>S</u> urface	<u>G</u> eometry	<u>D</u> rainage	<u>Evaluation</u>	<u>M</u> odeler	Site Modeler	Dr <u>a</u> fting
CE	LL_Plot-So	ale	-	/道 😴	i 🔨 🗞	🗶 📕 🛶	2 🗉 🔄
-7				100			

Section Summary:

- Update Profile is the better tool to use when adding features to a profile. With Update Profile the user can choose which features to display. With Create Profile, all features that can be displayed (based on feature style settings) are displayed.
- There are two types of feature cells used in profiles; true scale cells that use a global scale factor of 1 and plot scale cell that use a global scale factor the same as the plot scale.

Lab 6.6 - Annotating a Feature in a Profile

Features that have been displayed in profiles (or cross sections) can be annotated with information extracted from the surface model.

Section Objectives:

- Annotate the true scale features in the profile.
- 1. Using MicroStation commands, window into any culvert displayed in the profile created in the previous lab.
- 2. From the *Locks* toolbar select **CELL_PLOT-Scale** filter and verify the feature filter is toggled **On**.

ſ	M	Bei	ntley InRo	oads V8i (SE	LECTseries	; 2)			
	1	File	<u>S</u> urface	<u>G</u> eometry	<u>D</u> rainage	Evaluation	Modeler	Site Modeler	Dr <u>a</u> fting
		CEI	L_True-S	cale	•	<u>ک</u>	i 🔨 🗞	🗶 📕 🛶	2 🗊 🗊
		7				Leostur	e Eilter I.e.	-k On b	

3. Select **Evaluation > Profile > Annotate Feature** from the InRoads main menu. The *Annotate Feature In Profile* dialog box is displayed.

🕌 Annotate Feature In Profile		- • 💌
Profile Set: SH 86 Annotate Feature In Profile Caneral Annotate Points Line Segments Frame	Annotate Projected Line Segments Projected Points Every Vertex At Interval: 0.00 Crossing Points Location Object Axis Frame	
	Apply Preferences	Close Help

4. Select the *Annotate* leaf. Notice that the features are already highlighted. Also, there is a drop down menu that is used for selecting the surface that contains the features to be annotated.

Annotate Feature In Profile				
Profile Set: SH 86	Surface: 12345SU Features:	RV_Surfac ▼		
Annotate Feature In Profile General Annotate Points Cine Segments Frame	T_Cul Corr Stl 24"54	T_Cul Corr Stl 24"	Description Culvert Corr Steel Pip Culvert Corr Steel Pip Culvert Corr Steel Pip	*
		Apply Pr	eferences) Close	Styles Filter

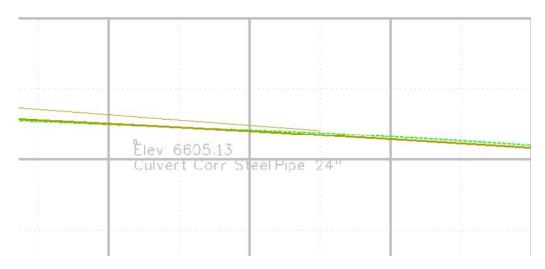
5. **<D>** the **Apply** button and review the results.

Élev 6605.13	

- 6. **<D>** the **Points** branch.
- 7. Toggle on the **Feature Description**.

🕌 Annotate Feature In Profile								- • 💌
Profile Set:	Jus	tification: Top Left		•				
SH 86 🔻 🕈		Object	Column	Row	Prefix	Suffix	Precision	Format
Annotate Feature In Profile		Index	1	1				
General		Centerline Station	1	2	CL Stn		0.12	SS+SS.SS
Appotate		Feature Station	1	3	Fea Stn		0.12	SS+SS.SS
		Left Horizontal Offset	1	4	Off		0.12	
🔤 🍁 General		Right Horizontal Offset			Off			
Line Segments	\boxtimes	Elevation	1	5	Elev		0.12	
Frame		Feature Name	1	6				
	\boxtimes	Feature Description	1	7				
		Feature Style	1	8				
		Drop Station Equation N	ame					
			Apply	Prefe	erences		Close	Help

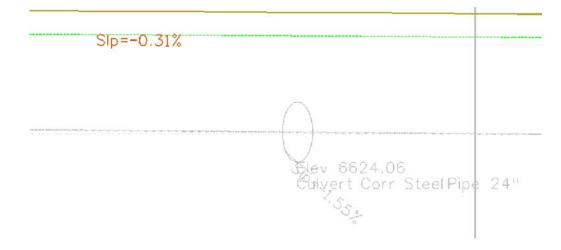
8. **<D>** the **Apply** button and review the results in your profile.



9. Experiment with enabling other options in the *Point* branch and redisplaying the annotation.

Challenge Exercise:

Update your profile to show *projected features*. Annotate the projected features.



Section Summary:

- Only features displayed in the profile can be annotated.
- Set the global scale factor for text to the plot scale before executing the command.

Lab 6.7 - Annotating a Profile

In addition to annotating vertical alignments, profiles can be annotated with both existing and design information.

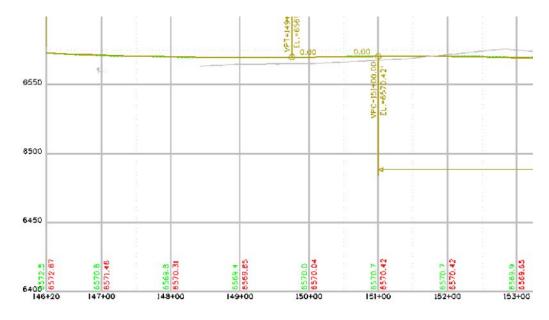
Section Objectives:

• Add Existing and proposed elevation information to the profile.

- Add Cut Depth and fill height information to the profile.
- 1. Select **Evaluation > Profile > Annotate Profile** from the InRoads main menu.

🕌 Annotate Profile								×
Profile Set:		Horizontal Alignment:	SH 86					
SH 86 🔹 🚽	₽	Vertical Alignment:	SH 86 V 👻	A	nnotate at:			
	•	Surface:	12345Surv Surface -	5	Station Intervals Onl	у	•]
····· General Selection		Cant Alignment:		St	tart Station:	146+19.97		+
Station		Conidor:	•	9	top Station:	242+60 12		
Cumulative Station		Super Control Lines:			rofiles:	242+00.12		+
Station Interval	=	Super Control Lines.		_	146+19.97 - 242+60	12		+
					10110.07 212100			Ľ
Curvature								
Existing								
Cut Depth								
Fill Height				L				
Deflection Grade and Distance						All	None	ļ
Vertical Ordinate								
Horizontal Slew	-							
Vertical Slew								
			Apply		Preferences	Close	Help	

2. **<D> Apply**. The existing and proposed grades annotate the profile.



3. Take some time and review the leaves of the *Annotate Profile* dialog box. Investigate the individual settings for each.

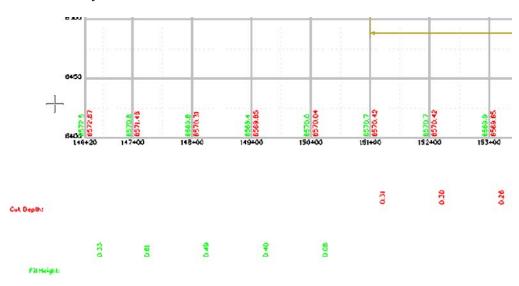
🚰 Annotate Profile			
Profile Set: SH 86 Annotate Profile General Currelative Station Currelative Station Station Interval Station Interval Station Number Superelevation Curvature Superelevation Curvature Fill Height Grade and Distance Vertical Stew Vertical Stew	Available: Cumulative Station Station Interval Station Number Superelevation Curvature Cut Depth Fill Height Deflection Grade and Distance Vertical Ordinate Horizontal Slew Vertical Slew Sight Distance Vertical Cardinal Vertical Cardinal Vertical Cardinal Vertical Cardinal Vertical Alignment Cant Alignment Speed Rail Elevations	Selected: Ad-> 1 Existing <-Remove	
		Apply Preferences Close	Help

4. Now go back and **<D>** the **Selection** leaf.

- **Note:** The dialog box shows two categories; *Available* and *Selected. Available* lists the items that can be annotated in a profile, *Selected* identifies the items chosen for annotation.
- 5. **<D>** the item **Cut Depth** from the Available list.
- 6. **<D>** the **Add** button. Cut Depth will be added to the *Selected* list.

Profile Set:	Available:	Selected:	
SH 86	Cumulative Station Station Interval Station Number Superelevation Curcet re Curcet re Curcet re Curcet re Curcet re Curcet re Deflection Grade and Distance Vertical Ordinate	Add-> 1 Existing 2 Proposed All None love Up ve Down	

- 7. **<D>** the item **Fill Height** from the Available list.
- 8. **<D>** the **Add** button. Fill Height will be added to the Selected list.
 - **Note:** Make sure that *Existing* and *Proposed* remain in the 1 and 2 slots. To move a selected item, highlight the item and **<D>** the **Move Up** or **Move Down** buttons
- 9. **<D>** the **Apply** button and review the profile display.



Note: You may have to zoom out to view the additional annotation.

Section Summary:

- Annotate Profile is used to place existing surface elevations and vertical alignment elevations on the profile set.
- Other data related to profiles can also be displayed.
- When displaying additional data, make sure Existing and Proposed stay at the top of the list.
- Change the settings on the Frame leaf to move additional data closer to the profile window.

Lab 6.8 - Vertical Alignment Tracking

Vertical alignments can be interactively queried similar to horizontal alignments.

Section Objectives:

- Examine Vertical Alignment tracking in the profile.
- Examine the vertical alignment data in Horizontal Alignment tracking.

The next series of steps illustrates Vertical Alignment tracking.

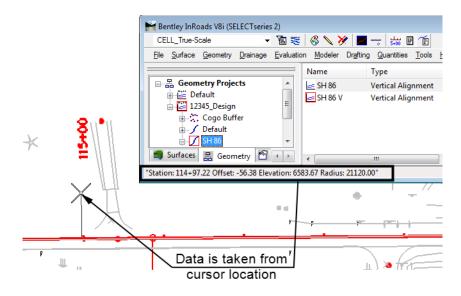
1. Select **Tools > Tracking > Vertical Alignments** from the InRoads main menu.

- Hentley InRoads V8i (SELECTseries 2) CELL_True-Scale - 🚡 📚 🚳 📏 🏏 📕 File Surface Geometry Drainage Evaluation Modeler Drafting Qua Data Type V.C. = 800.001 K = 147.36 e = 5.43' SSO = 612' Surfaces ℜ Breakline Fe... 🛓 🥌 Default 鯼 Contour Fea... ···· 12345S Exterior Feat... MDS = Symmetric Parabola 🕅 Inferred Brea... Interior Feat... VPT-149-75.00 ELL-6569.941 *,* Random Fea... 需 Surfaces 🔚 Geometry 📉 🕡 "Station: 149+17.31 Offset: 10.58 Elevation: 6569.83 Grade: -0.01%" 0.00 +00.00+ Š. Data taken from cursor location
- 2. Move the cursor inside the Profile Set window and review the output in the InRoads Status bar.

Note: As you move your cursor in the profile set window InRoads displays vertical alignment information in the status field. There is *not* an option to write this information to the MicroStation file.

This series of steps illustrates tracking vertical data in the plan view

- 3. Select Tools > Tracking > Horizontal Alignment.
- 4. Move the cursor along the active horizontal alignment and review the readout in the InRoads Status bar.



Results displayed are the station and offset relative to the active horizontal alignment. The elevation is relative to the active vertical alignment.

Section Summary:

• Tracking is used to gain information that is related to the horizontal and vertical alignments.

Lab 6.9 - Create a Vertical Alignment

Vertical alignments define an elevation path for the proposed design to follow. It is stored under the parent horizontal alignment.

Section Summary:

- Create a new vertical alignment slot.
- Add PIs to the vertical alignment.
- Define the vertical curves.

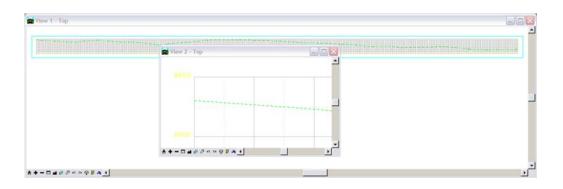
Create a slot in the active geometry project for your vertical alignment.

- 1. Select **File > New**.
- 2. **<D>** the **Geometry** tab.
- 3. Set the *Type* to Vertical Alignment.
- 4. Key in SH 86 V Alt1 for the Name.

- 5. Key in *Alternate vertical alignment* for the *Description*.
- 6. Set the *Style* to ALG_PRO_Vert.
- 7. Verify that the *Curve Definition* is set to **Parabolic**.
- 8. Select **Apply** then **Close**

Гуре: Name:	Vertical Alignment		Apply
Description:	Alternate vertical ali	gnment	Help
Style:	ALG_PRO_Vert	-	
Curve Definition:	Parabolic	•	
Name	Description	Style	
Name SH 86 SH 86 V	Description Proposed SH 86 Proposed SH 86	Default	O Vert

9. Set up your MicroStation windows so the entire profile is visible in one window, then open another MicroStation window and Zoom in to the beginning of the profile as shown.



Next, add PVIs to the Vertical Alignment.

10. Verify that the *Write Mode* is set **Pencil**.

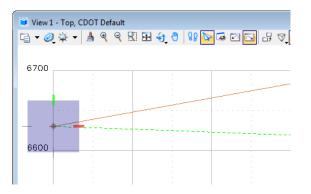
e Be	ntley InRo	oads V8i (SE	LECTseries	; 2)			
<u>F</u> ile	<u>S</u> urface	<u>G</u> eometry	<u>D</u> rainage	_		Site Modeler	
CE	LL_True-S	cale	•	7 😽	68 🔨	🎽 📕 🦟	5+00 E 🕑

11. Select **Geometry > Vertical Curve Set > Add PI** from the InRoads main menu.

🕌 Add Vertical	PI	
Dynamics		Apply
Station:	0.00	Close
Elevation:	0.00	Help
Grade:	0.00%	

12. Select Apply.

13. For the first PVI, snap to the beginning of the ground line in the window where you are zoomed in.



14. In the MicroStation key in field, enter the following commands: (Be certain to use the % sign in the key-in.)



♦ dg=900,-3.76%

- *dg=400,1.03%*
- dg=425,-4.29%
- ♦ se=11725,6574.78

The dg = key-ins place a PI at the specified distance and grade from the previous point. The se = key-in places a PI at the specified station and elevation.

- 15. **<R>** twice to exit, then **Close** the *Add Vertical PI* dialog box.
- 16. Update the view.

The vertical alignment is displayed permanently in the design file. Because Pencil mode is active, the tangents will automatically update when the curves are added.

17. Select Geometry > Vertical Curve Set > Define Curve from the InRoads main menu.

Vertical PI Define PVI By:			Apply
Denne F VI by.	Station and Elevation	•	Close
Station:	109+00.00	+	
Elevation:	6596.24	Ť	Undo
Entrance Grade:	-3.76%	+	Design Cal
Exit Grade:	-1.03%	-	Report
Vertical Curve Calculate By: Length:	Length of Curve	•	
Adjacent Curves Update By:	Length of Curve]	

The Define Vertical Curve dialog box is automatically displayed ready to accept input for the first curve on the vertical alignment. To step to other curve sets, you can use *Previous* and *Next*, or *First* and *Last*.

- 18. Under the *Vertical Curve* area, set *Calculate By* to Length of Curve.
- 19. Key in *300* for the *Length*.
- 20. Select **Design Calc**.

ethod: Look	tup Speed	•	ОК
ASHTO Standar	d: 🔘 1990	2001	Cancel
Curve Design			Preferences
Range:	Opper	Lower	Frerences
Speed:	20	•	Help
K Value:	20.00		
Length:	54.63		
Curve Type:	Crest	Sag	
Type: Distance:	 Stopping 125.00 	Passing	
Friction:	0.40		
Deceleration:	11.20		
Eye Height:	3.50		
Lyo Holght.	2.00		
Object Height:			

21. Click in the *Table Name* field and Browse to the C:\Workspace\Workspace-CDOT_V8i\ Standards-Global \ InRoads\Design Checks folder and select the file Vertical Design Checks.txt.

Rrowse							X
Look in:	🔒 Design Che	cks		•	G 🦻	P 🗉	-
Recent Places Desktop Cdot User Computer		Date modif Design Checks esign Checks.bt	txt	Size			
Network	File name: Files of type:	*.txt Text Files (*.t	xt)			•	Open Cancel Help

22. Verify that the length of curve meets your design criteria.

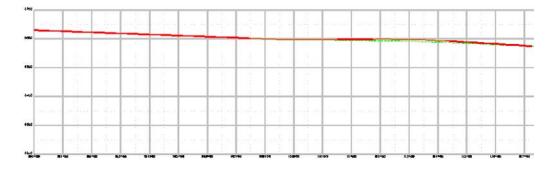
🕌 Vertical Desigr	n Calculator		
Method: Look	up Speed	•	ОК
AASHTO Standard	: 🔘 1990	2001	Cancel
Curve Design Range:	Opper	C Lower	Preferences
Speed:	60	•	Help
K Value:	136.00		
Length:	371.47		
Curve Type:	Crest	Sag	
Headlight Sight [)istance		
Туре:	Stopping	Passing	
Distance:	570.00		
Friction:	0.29		
Deceleration:	11.20		
Eye Height:	3.50		
Object Height:	2.00		
Table Name:			
C:\Workspace\W	orkspace-CD(OT_XM\Standar	ds-Global \InR

23. **<D> Cancel** when done. Do not accept the minimum curve, just verify that yours meets the criteria.

24. Select Apply

Vertical PI		Apply
Define PVI By:	Station and Elevation 🔹	
Station:	109+00.00	Close
Elevation:	6596.24	Undo
Entrance Grade:	-3.76% +	Design Calc
Exit Grade:	-1.03% +	Report
Vertical Curve		Help
Calculate By:	Length of Curve 🔹	
Length:	300.00	
Adjacent Curves Update By:	Length of Curve	
Distance:	0.00 +	I

- 25. Select **Next** to move to the second intersection of tangents.
- 26. Verify that *Calculate By:* is set to Length of Curve.
- 27. Key in *250* for the *Length*.
- 28. Select **Design Calc**.
- 29. Verify that the length of curve meets your design criteria.
- 30. Select Apply.
- 31. Close the **Define Vertical Curve Set** dialog box.



32. Save the geometry project.

33. Close InRoads and MicroStation.Labs for InRoads V8i SS2

Section Summary:

- Vertical alignments are defined in the profile window.
- Vertical PIs can be added by data point or key in.
- The Define Curve dialog box can also be used to adjust PI stations and elevations.

Chapter Summary:

- Use the review vertical alignment command to examine vertical alignment data when a profile is not required.
- Profiles are required to view vertical alignments graphically.
- Use Update Profile to add, remove, or revise data in a profile set.
- Annotate Feature in Profile only affects features displayed in the profile.
- Annotate Profile is used to display existing surface and vertical alignment elevations in the profile.
- Vertical Alignment Tracking displays Station, Offset, Elevation, and Grade information in the InRoads main dialog box.
- Typically, vertical alignments are defined by locating all of the VPIs then placing the curves.

LAB 7 - Introduction to DTMs

This lab demonstrates the commands used for sorting and reviewing surface data. The lab will also demonstrate how to set some surface properties and explains how different features behave within the terrain model.

Chapter Objectives:

- Illustrate how different Feature Types affect the triangulated model
- Describe how to set the Symbology for Cross Sections and Profile display
- Illustrate how to create and use Feature Filters
- Describe how to display surface features and the surface perimeter
- Describe how to set up and display contours

The files used in this lab are:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model_Intro-DTM.dgn
- C:\Projects\12345\Design\InRoads\12345_Intro-DTM.dtm

Lab 7.1 - How Feature Types Work

Section Objectives:

• Illustrate how different feature types work within the DTM.

This lab illustrates how different feature types work within the dtm.

- 1. Open MicroStation and InRoads using the drawing: C:\Projects\12345\Design \Drawings\Reference_Files\12345DES_Model_Intro-DTM.dgn.
- From the InRoads dialog box, open the dtm: C:\Projects\12345\Design\InRoads\12345_Intro-DTM.dtm

First, all of the features within the dtm are displayed.

3. From the InRoads menu, select Surface > View Surface > Features. The View Features dialog box is displayed.

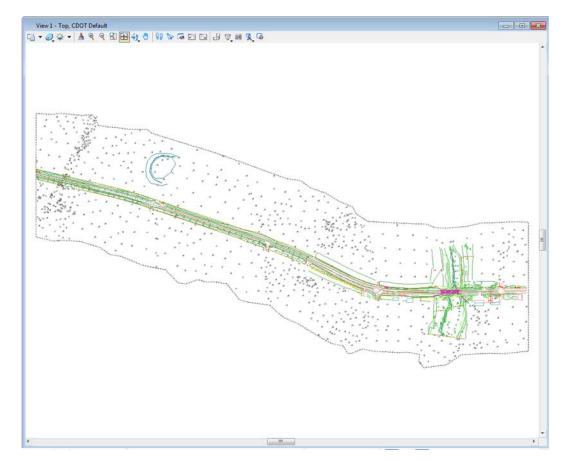
Bent	ley InRoads V8i (S	ELECTserie	s 2)						
File g	Surface Geometry	<u>D</u> rainage	<u>E</u> valuation	Modeler	Site Modeler	Drafting	<u>Q</u> uantities	<u>T</u> ools	<u>H</u> elp
<u< td=""><td><u>V</u>iew Surface</td><td></td><td></td><td>• C</td><td><u>P</u>erimeter</td><td></td><td></td><td></td><td></td></u<>	<u>V</u> iew Surface			• C	<u>P</u> erimeter				
	Update <u>3</u> -D/Pla	n Surface Di	splay		<u>T</u> riangles		Fe	eatures	
i 🗖	Fit <u>S</u> urface			12	Contours			398	
1	🚯 <u>T</u> riangulate Surf	ace			Label Contours Features		_	0	
	Design Surface				Components			1	
	Edit Surface			• 🔏	<u>A</u> nnotate Featur	e		0	
	<u>F</u> eature			• ₩	Surface Elevatio	ins		1	
2	Surface Properti	es			Slope Vectors			121	
a 6	Active Surface			_	Single Point		•	521	•
	Copy Surface			1	T <u>w</u> o Point Slope		H		
spia 3	Delete Surface.				View Crossing S	egments	·		

- 4. In the *View Features* dialog box, right click in the *Features* list and choose **Select All** from the menu.
- 5. **<D>** the **Apply** button. All of the features in the dtm are displayed.

Surface:	12345_	Intro-DTM	-				Apply	
Fence Mode:	Inside		*			(Close Filter t Style	
eatures: Name		Style		Des	scription		Help	+
Dam Toe Dam Top2		T_Dams T_Dams		Crea	ted by Ger	nerate		
Dam Top3 Exterior Bound	lary		lounc		Select All		Ctrl	+A
Pond Edge T_Billboard Ur T_Bin Walls	nder 10	T_Edge of \ T_Billboard	Natei Unde		Select No Invert Sele		Ctrl	+N
T_Bin Walls85	54							

6. Dismiss the *View Features* dialog box.

7. If necessary, do a **Fit View** to see the displayed features.

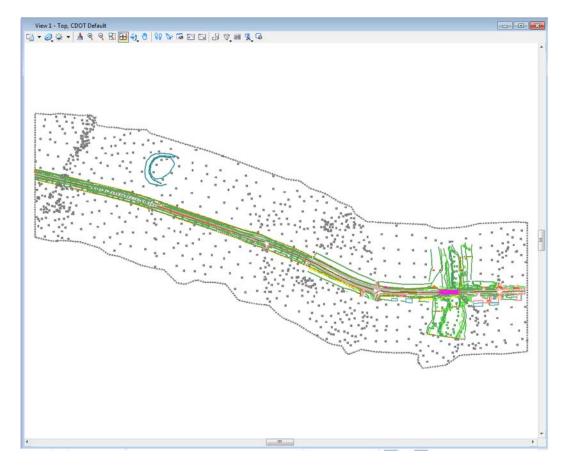


Using the Line Weights view attribute will make it easier to see the features when the triangles are displayed.

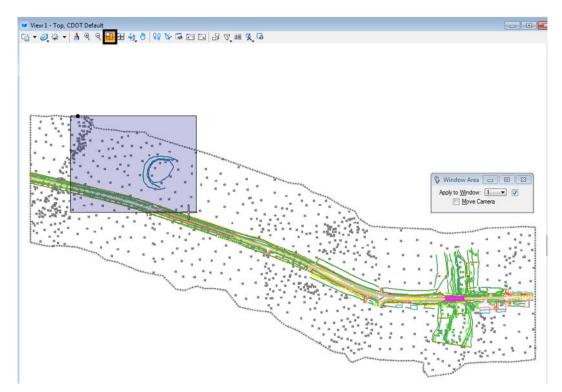
View 1 - Top, CDOT Defau	it \ 81 ⊞ €1 <mark>0</mark> 89 ≫ ⊊ ⊡
View Attributes - View 1	
View Number: 1 - 🖓	¥
Presentation	
Display Style: (Wirefra	ame Display) 🔻 🤇
🔒 ACS Triad	E Fill
Background	III Grid
Boundary Display	🏹 Level Overrides
Camera	Line Styles
💫 Clip Back	Line Weights
Clip Front	😵 Pattern/Bump Maps
🔽 Clip Volume	Patterns
Constructions	i Default Lighting
Dimensions	🟹 Tags
💴 Data Fields	A Text
Displayset	li⊱ Text Nodes
Fast Cells	Transparency
G Fast Curves	
Global Brightness: 🐺 🧹	+ \$
🛃 View Setup	^
Saved Views: Select	- E - 🤇
Models: CDOT Defa	ult 👻

8. **<D>** the *View Attributes* icon and toggle on Line Weights.

9. Notice that the feature lines are thicker now. When the triangles that make up the surface are displayed, the features will still be visible underneath.



10. Window area around the pond at the upper left of the DTM.

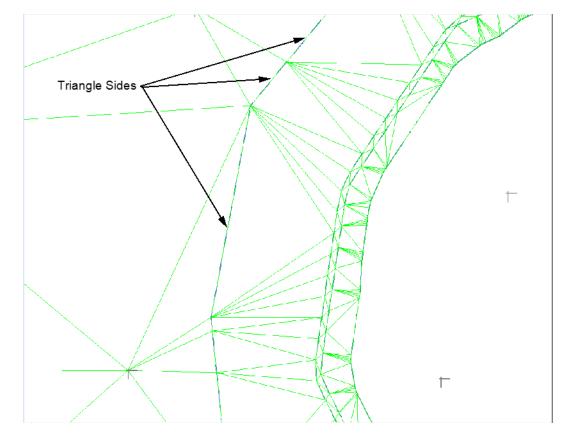


11. From the InRoads menu, select **Surface > View Surface > Triangles**.

🔛 Ben	ntley InRoads V8i (SELECTseries 2)		- • ×
File	<u>Surface</u> <u>Geometry</u> <u>Drainage</u> <u>Evaluation</u>	Modeler Site Modeler Drafting Quantitie	es <u>T</u> ools <u>H</u> elp
<0	<u>V</u> iew Surface	Perimeter	
	™ Update <u>3</u> -D/Plan Surface Display Sit Surface	Triangles	eatures 🔺
		Label Contours	398
	Triangulate Surface		0
	Desig <u>n</u> Surface	• 🖅 Components	1
	Edit Surface	Annotate Feature	0
	<u>F</u> eature	Surface Elevations	1
•	Surface Properties	Slope <u>V</u> ectors	121
	Active Surface	Single Point	521 -
	Copy Surface	₩ Two Point Slope	-
	Molete Surface	Q View Crossing Segments	.#

12. Dismiss the **View Triangles** dialog box.

13. Notice around the toe of the pond dam that the triangle sides match the feature. InRoads forms linear terrain features by creating triangle edges along those features. All breakline, interior, and exterior features are formed in this manner.

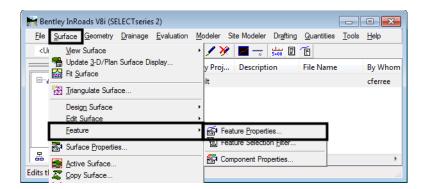


Next the difference between breakline, interior, and exterior features are illustrated.

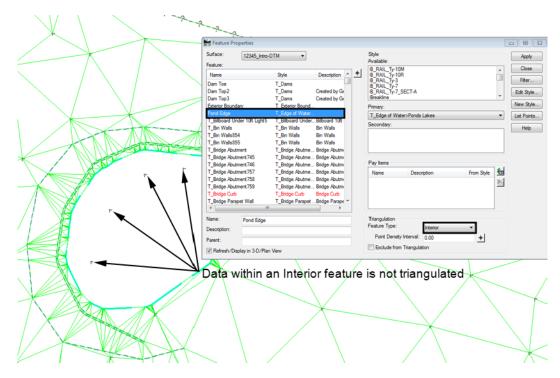
14. On the InRoads *Locks* toolbar, turn on the **Feature Highlight** lock. This will highlight the feature being discussed.

Bentley InRoads V8i (SELECTseries 2)							
<u>File</u> <u>Surface</u> <u>Geometry</u> <u>Drainage</u> <u>Eva</u>	uation <u>M</u> odeler Site Modeler Dr <u>a</u> fting <u>Q</u> uantities <u>T</u> ools	<u>H</u> elp					
<unnamed> 🗾 👻</unnamed>	🧝 🚳 🖊 🎉 🗮 🛶 📠 🖳 🖀						
	Geometry Proj Description File Name	By Whom					
	Default	cferree					
品 Geometry 💼 Preference 4 ト	4						

15. From the InRoads menu bar, select **Surface > Feature > Feature Properties**. From here, the features can be selected and the properties that make them different can be seen.

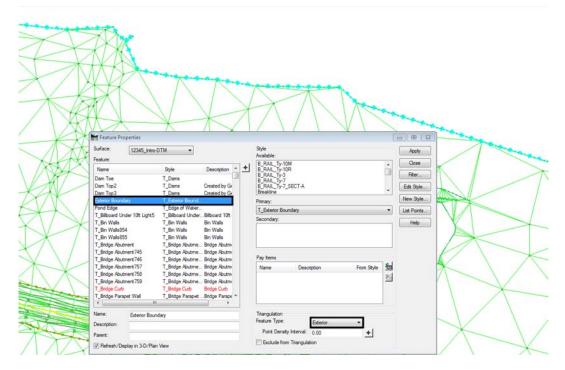


- 16. In the *Feature Properties* dialog box, highlight the **Pond Edge** feature from the *Feature* list.
- 17. Notice that there are no triangles displayed inside the feature. This is because the *Interior* feature type denotes an area of unknown elevation, which is not triangulated by the program.



18. In the *Feature Properties* dialog box, highlight the **Exterior Boundary** feature from the *Feature* list.

19. Notice that there are no triangles outside of the *Exterior Boundary* feature. An Exterior feature type denotes the limits of data and does not allow triangulation to occur outside those limits. This prevents triangles from being built in areas where no data was collected.



Note: There can be only one Exterior type feature in a DTM. There can be any number of Interior type features in a DTM.

Section Summary:

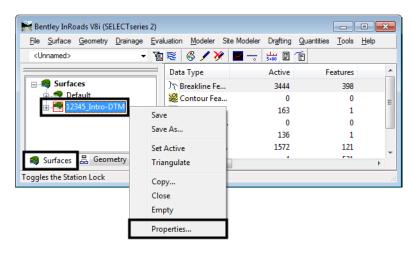
- Breakline features are defined by triangle sides in the surface (triangulated model)
- Interior features are closed shape breaklines that describe the limits of an area of unknown elevation. They can also be used in design surfaces to indicate an area where no construction occurs, for example on a project that has widening on both sides of the pavement but no overlay.
- Exterior features are closed shape breaklines that describe the limits of data for a surface

Lab 7.2 - Set the Symbology for Cross Sections and Profile Display

The symbology for a data line for a surface displayed in a profile or cross sections is controlled by the surface properties. This lab illustrates how to change those settings.

Section Objectives:

- Describe how to set the symbology for profile or cross sections display
- 1. From the InRoads Explorer, select the **Surfaces** tab.
- 2. **<R>** on the **12345_Intro-DTM** surface and select **Properties** from the menu.



- 3. In the *Surface Properties* dialog box, select the **Advanced** tab.
- 4. Select **T_Existing_Ground** from the *Symbology* drop down menu in the *Cross Section* area.
- 5. Set the *Symbology* in the *Profiles* area to **T_Existing_Ground** also.

- Manual Surface Properties - • • Main Advanced Surface: 12345_Intro-DTM • Cross Section: Help Symbology: T_Existing_Ground Use Features Only Profiles Symbology: T_Existing_Ground Lock Symbologies • Offset Distance Offset Distance Symbology Color Symbology Color 1: 0.00 9: 0.00 Default -Default -2: 0.00 10: 0.00 Default • -Default 3: 11: 0.00 0.00 Default • Default 4: 12: 0.00 0.00 Default -Default • 5: 0.00 13: 0.00 Default -Default -6: 0.00 14: 0.00 Default -Default -7: 15: 0.00 0.00 Default • Default -8: 0.00 Default 16: 0.00 Default -• Apply Close
- 6. **<D>** the **Apply** button to accept the changes.

7. Close the Surface Properties dialog box.

Section Summary:

- Symbology settings for Cross Section and Profile display are stored in the Surface Properties.
- The symbology For Cross Section and Profile should be set the same for a surface in order to maintain consistency.

Lab 7.3 - Feature Filters

Feature Filters are used to reduce the number of features displayed in dialog boxes and menus to make it easier to find the desired feature. Feature Filters use predefined criteria to determine if a feature will be displayed.

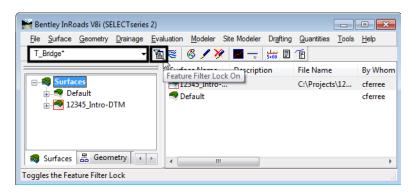
First, lets examine how an existing filter works.

1. Select **Surface > Feature > Feature Properties** from the InRoads menu.

Surface: Feature:	12345_Intro-I	TM V		Style Available:			Apply
Name Dam Toe Dam Top2 Dam Top3 Exterior Bound Pond Edge	der 10ft Light5 4 5 ment ment745 ment746 ment757 ment758 ment759	T_Bridge Abutme T_Bridge Abutme T_Bridge Abutme T_Bridge Abutme T_Bridge Abutme T_Bridge Abutme T_Bridge Curb (C T_Bridge Parapet	Billboard 10ft Bin Walls Bin Walls Bin Walls Bridge Abutm Bridge Abutm Bridge Abutm Bridge Abutm Bridge Abutm Bridge Abutm Bridge Abutm	B_RAIL_Ty-1(B_RAIL_Ty-1B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL_Ty-1C_TY-7 B_RAIL)R	From Style	Close Filter Edit Style New Style List Points Help
Name: Description: Parent: V Refresh/Dis	T_Bridge 751 Bridge play in 3-D/Plan			Triangulation Feature Type: Point Densit	0.00	•	

2. Notice that the Feature list contains all of the DTM's features.

- 3. On the InRoads *Locks* toolbar, set the Filter Name to **T_Bridge*.**
- 4. Toggle on the Feature Filter Lock.



Feature Properties Surface: 12345_Intro Feature: Name T_Bridge Abutment T_Bridge Abutment 745 T_Bridge Abutment 745 T_Bridge Abutment 757 T_Bridge Abutment 757 T_Bridge Abutment 759 T_Bridge Abutment 759 T_Bridge Pier T_Bridge Pier T_Bridge Pier T_Bridge Pier T_Bridge Pier T_Bridge 751 Name: T_Bridge 75	Style Description T_Bridge Abutme Bridge Abutment T_Bridge Curb (C Bridge Curb T_Bridge Pier Bridge Pier T_Bridge Pier T_Bridge Pier T_Bridge Bridge	Style Available: B_RAIL_Ty-10R B_RAIL_Ty-3 B_RAIL_Ty-7 B_RAIL_Ty-7_SECT-A Breakline Primary: T_Bridge Secondary: Image: Secondary: Secondary: Image: Secondary: Seco	Apply Close Filter Edit Style New Style List Points Help
Name: T_Bridge75 Description: Bridge Parent: V Refresh/Display in 3-D/Pla	1	Triangulation Feature Type: Breakline Point Density Interval: 0.00 C Exclude from Triangulation	

5. Notice that the Feature list contains only features that have a style name containing T_Bridge in it.

To see what makes this filter work:

6. **<D>** the **Filter** button on the *Feature Properties* dialog box. This displays the *Feature Selection Filter* dialog box.

Feature Properties				- • ×
Surface: 12345_Intr Feature:	o-DTM ▼		Style Available: B. RAIL_Ty-10M	Apply Close
Name	Style D	escription +		Filter
T_Bridge Abutment T_Bridge Abutment 745 T_Bridge Abutment 746 T_Bridge Abutment 757 T_Bridge Abutment 758 T_Bridge Abutment 759 T_Bridge Curb T_Bridge Parapet Wall	T_Bridge Abutme Brid T_Bridge Abutme Brid T_Bridge Abutme Brid T_Bridge Abutme Brid T_Bridge Abutme Brid T_Bridge Abutme Brid T_Bridge Carb(C Brid T_Bridge Parapet Brid	dge Abutment dge Abutment dge Abutment dge Abutment dge Abutment dge Curb	B_RAIL_Ty-3 B_RAIL_Ty-7 B_RAIL_Ty-7_SECT-A Breakline Primary: T_Bridge Secondary:	Filter Edit Style New Style List Points Help

7. Notice in the Rules area, that there are two entries, or rules.

OK Cancel Save Save As Delete Help
Save Save As Delete
Save As Delete
Delete
Help
Move Up
Move Down
Delete Rule
Clear All

The first rule, "Exclude All Features", causes no features to be added to the list. The second rule, "Include Style T_Bridge*", adds the features with the targeted style to the list. The "*" in the second rule allows and feature that has a style name that starts with "T_Bridge" to be added to the list.

To illustrate this concept better, a new rule will be created to look for the pond features

- In the *Feature Selection Filter* dialog box, <D> the Save As button. This displays the Save Filter As dialog box.
- 9. In the *Save Filter As* dialog box, Key in *Pond* and *<D>OK*.

Feature	Selection Filte	r		23
Filter Name:	T_Bridge*		• ОК	
Start With:	o Ali	None	Cance	
Build Sele Attribute:	Name		Save	
Value:			Save As	i
Mode:	Include	Exclude	Delete	•
	Add Rule	Replace Rule	Help	
🖬 Save	Filter As	—		
Name: Pond		ОК	Move U	Jp
Pond		Cancel	Move Do	wn
		Help	Delete R	ule
			Clear A	JI
Current Res	ults:			
T_Bridge A T_Bridge A T_Bridge A T_Bridge A T_Bridge C	Noutment 745 Noutment 746 Noutment 757 Noutment 758 Noutment 759		E	

Feature	e Selection Filter		
Filter Name	e: Pond		• ОК
Start With:	0	None	Cancel
-Build Sel Attribute:			- Save
Value:	T_Bridge*		Save As
Mode:	Include	Exclude	Delete
	Add Rule	Replace Rule	Help
	tyle = T_Bridge*		Move Down
	yic – i _biluge		
Current Re			Delete Rule
Current Re T_Bridge T_Bridge T_Bridge T_Bridge T_Bridge	sults: Abutment Abutment745 Abutment746 Abutment757 Abutment758 Abutment759		Move Down Delete Rule Clear All

10. Highlight the "Include Style T_Bridge*" rule then <D> the Delete Rule button.

The remaining rule, *Exclude All Features*, is a result of the *Start With* toggle at the top of the dialog box. Because the toggle is currently set to None, the *Exclude All Features* rule is used.

11. Notice in the *Feature Selection Filter* dialog box, that the *Current Results* area is empty. This area shows which features in the active surface pass through the filter in its current state. Because the filter excludes all of the features, nothing is displayed in the *Current Results* area.

Feature	Selection Filte	r	_	. • 💌
Filter Name:	Pond		•	ОК
Start With: ⊂ Build Selee	All Ction	None		Cancel
Attribute:	Style		•	Save
Value:	T_Bridge*		•	Save As
Mode:	Include	Exclude		Delete
	Add Rule	Replace Rule		Help
Rules: Exclude All				Move Up Move Down Delete Rule Clear All

Next, a rule is added to search for DAM in the feature name.

- 12. In the *Feature Selection Filter* dialog box, select **Name** from the *Attribute* drop down menu.
- 13. In the *Value* field, key in *Dam**.
- 14. Verify that **Include** is toggled on for the *Mode*.
- 15. **<D>** the **Add Rule** button. Notice that three features appear in the *Current Results* area.

Feature Selection Filter	- • ×
Filter Name: Pond	ок
Start With: O All O None	Cancel
Attribute: Name -	Save
Value: Dam*	Save As
Mode: Include Exclude	Delete
Add Rule Replace Rule	Help
Exclude All Features Include Name = Dam* Current Results: Dam Toe Dam Top2 Dam Top3	Move Up Move Down Delete Rule Clear All

Finally, a style rule is added to find the edge of water for the pond.

- 16. In the *Feature Selection Filter* dialog box, select **Style** from the *Attribute* drop down menu.
- 17. In the *Value* field, select **T_Edge of Water>Ponds Lakes** from the drop down menu.

Note: The key in T_Edge of Water* could also be used.

<D> the Add Rule button. Notice that the Pond Edge feature is added to the *Current Results* area.

Feature Selection Filter	- • •
Filter Name: Pond 🗸	ОК
Start With: O All O None	Cancel
Attribute: Style	Save
Value: T_Edge of Water>Ponds Lakes 🗸	Save As
Mode: Include Exclude	Delete
Add Rule Replace Rule	Help
Rules: Exclude All Features Include Name = Dam* Include Style = T_Edge of Water>Ponds Lakes	Move Up Move Down Delete Rule Clear All
Current Results: Dam Toe Dam Top2 Dam Top3 Pond Edge	

- 19. **<D>** the **OK** button to dismiss the *Feature Selection Filter* dialog box.
- 20. Notice that in the Feature Properties dialog box, only the three dam feature and the Pond Edge feature are present.

Feature Pro	perties		- • •
Surface: 12345_Intro-DTM		Style Available: B_RAIL_Ty-10M B_RAIL_Ty-10R B_RAIL_Ty-3 B_RAIL_Ty-7 B_RAIL_TY-7	Apply Close Filter Edit Style New Style List Points Help
		Pay Items Name Description From Style	
Name: Description: Parent:	T_Bridge 751 Bridge play in 3-D/Plan View	Triangulation Feature Type: Breakline Point Density Interval: 0.00 COMPARIANCE 0.00 COMPARIANCE 0.00	

This will be the case for any dialog box that displays features so long as the Feature Filter Lock is toggled on.

21. On the InRoads *Locks* toolbar, toggle off the **Feature Filter Lock**. Notice that all the features in the DTM are displayed again.

🚔 Bentley InRoads V8i (SEL	ECTseries 2)		
<u>File</u> <u>Surface</u> <u>G</u> eometry	Drainage Evaluation Modeler Site Mode	eler Dr <u>a</u> fting <u>Q</u> uantities <u>T</u> ools <u>H</u> elp	
Pond	- 📵 💐 🚳 🖌 🏏 🗖 -		
	LAN CONTRACT		
Feature Properties	Feature Filter Lock Off	nption Pile Name by Whom	- 0 X
reature Properties		l	
Surface: 12345_Int	ro-DTM 🔻	Style	Apply
Feature:		Available:	
Name	Style	+ B_RAIL_Ty-10M B_RAIL_Ty-10R	Close
Dam Toe	T Dams	B_RAIL_Ty-3	Filter
Dam Top2	T Dams	B_RAIL_Ty-7 B_RAIL_Ty-7_SECT-A	
Dam Top3	T_Dams	Breakline	Edit Style
Exterior Boundary	T Exterior Boundary	Primary:	New Style
Pond Edge	T_Edge of Water>Ponds Lakes	T Bridge	List Points
T_Billboard Under 10ft Light	5 T_Billboard Under 10ft Light	Secondary:	
T_Bin Walls	T_Bin Walls	Secondary.	Help
T_Bin Walls854	T_Bin Walls		
T_Bin Walls855	T_Bin Walls		
T_Bridge Abutment	T_Bridge Abutment		
T_Bridge Abutment 745 T Bridge Abutment 746	T_Bridge Abutment T Bridge Abutment	Pay Items	
T_Bridge Abutment 757	T_Bridge Abutment	Name Description From Style	
T_Bridge Abutment 758	T_Bridge Abutment		
T_Bridge Abutment 759	T_Bridge Abutment	10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
T_Bridge Curb	T_Bridge Curb (CW)		
T_Bridge Parapet Wall	T_Bridge Parapet Wall		
<	4		
Name: T_Bridge7	51	Triangulation	
Description: Bridge		Feature Type: Breakline	
- Dhage		Point Density Interval: 0.00 -+	
Parent:		Exclude from Triangulation	
✓ Refresh/Display in 3-D/P	lan View		

- 22. **<D> Close** on the *Feature Properties* dialog box to dismiss it.
- 23. On the InRoads *Locks* toolbar, set the filter name to **<Unnamed>**.

Section Summary:

- Feature Filters are used to limit the number of features displayed in a dialog box to make it easier to find the desired feature.
- Feature Filters are only applied when the Feature Filter Lock is toggled on.
- Feature Filters are stored as part of the XIN file and will be overwritten when the computer is logged on, unless the XIN file is saved to a different location.

Lab 7.4 - Displaying Surface Data

There are many ways to view DTM or surface data. This lab demonstrates three methods of displaying surface data to the MicroStation file; View Perimeter, View Features, and View Contours.

Section Objectives:

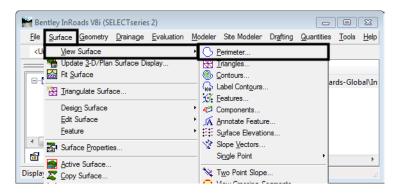
- Describe how to display a surface's perimeter
- Describe how to display features from a DTM
- Illustrate how to display contours at different intervals using predefined preferences

First, any pre-existing graphics are removed.

- 1. From the MicroStation menu bar, select Edit > Select All.
- Select **Delete** from the MicroStation Main Task toolbar or press the *Delete* key on the keyboard.

The perimeter (limits of triangulated data) is displayed.

 From the InRoads Menu, select Surface > View Surface > Perimeter. The View Perimeter dialog box is displayed.



- 4. Verify that the **12345_Intro-DTM** surface is selected.
- 5. **<D>** the **Apply** button.

🦌 View Perimete	r	×
Surface: 12345	_Intro-DTM ▼	Apply
		Close
		Preferences
Symbology:		Help
Object	Name	
Perimeter		BYL

6. **<D>** the **Close** button to dismiss the *View Perimeter* dialog box.

- 7. Fit the view if necessary to see the perimeter. Below is an example of the perimeter.

Next, the dam features are displayed.

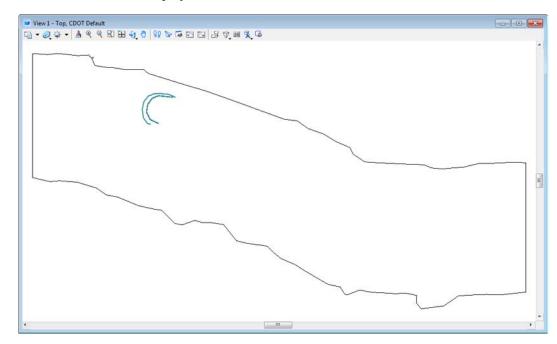
8. From the InRoads Menu, select **Surface > View Surface > Features**. The *View Features* dialog box is displayed.

🔚 Bentley InRoads V8i (SELECTseries 2)		
File Surface Geometry Drainage Evaluation	Modeler Site Modeler Drafting	<u>Q</u> uantities <u>T</u> ools <u>H</u> elp
<u <u="">V</u> iew Surface	Perimeter	
Update <u>3</u> -D/Plan Surface Display	Triangles	
Fit Surface	Contours	
Triangulate Surface	Label Contours	ards-Global\In
	<u>F</u> eatures	
Design Surface	▲Components	
Edit Surface	Annotate Feature	
<u>F</u> eature	Surface Elevations	
Surface Properties	Slope Vectors	
		• •
Display Copy Surface	₩ Two Point Slope	
Copy Surrace		11

- 9. Verify that the **12345_Intro-DTM** surface is selected.
- 10. Highlight the top three features in the list (<D> on the top feature, Hold the Shift key, then <D> on the third feature).

- Miew Features × Surface: 12345_Intro-DTM Apply Fence Mode: Ignore Close Filter. Edit Style ... Help Features: † Name Style Description . Dam Exterior Bound T_Exterior Bound Pond Edge T_Edge of Water.. T_Billboard Under 10.... T_Billboard Under....Billboard 10ft or Less T_Bin Walls T_Bin Walls Bin Walls T_Bin Walls854 T Bin Walls Bin Walls T_Bin Walls855 T Bin Walls Bin Walls T_Bridge Abutment T_Bridge Abutme... Bridge Abutment T_Bridge Abutment7... T_Bridge Abutme... Bridge Abutment
- 11. **<D>** the **Apply** button. The three features that make up the pond dam are displayed.

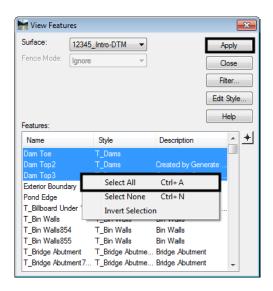
Below is the finished display.



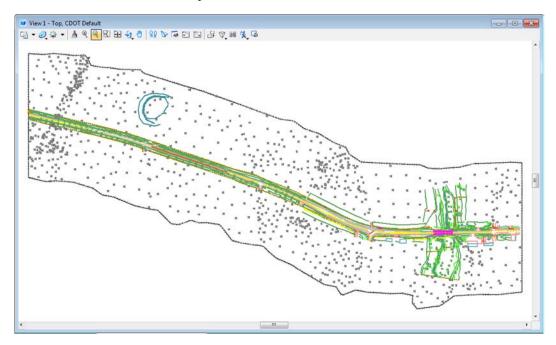
Display all of the features in the DTM.

12. In the *View Features* dialog box, **<R>** in the *Features* list and choose **Select All** from the right click menu.

13. **<D>** the **Apply** button.



Below is an illustration of the updated view.



14. **<D>** the **Close** button to dismiss the *View Features* dialog box.

Finally, contours for the surface are displayed. In order for the contours to be clearly visible, the current data in the MicroStation file will be deleted.

- 15. From the MicroStation menu bar, select **Edit > Select All**.
- Select **Delete** from the MicroStation Main Task toolbar or press the **Delete** key on the keyboard.

17. From the InRoads main menu, select **Surface > View Surface > Contours**. This displays the *View Contours* dialog box.

🚟 Ber	ntley InRoads V8i (SELECTseries 2)		
<u>F</u> ile	Surface Geometry Drainage Evaluation	Modeler Site Modeler Drafting Quantitie	es <u>T</u> ools <u>H</u> elp
<u< td=""><td><u>V</u>iew Surface</td><td><u>P</u>erimeter</td><td></td></u<>	<u>V</u> iew Surface	<u>P</u> erimeter	
	Update <u>3</u> -D/Plan Surface Display	R Triangles	
	🔛 Fit <u>S</u> urface	Contours	
	📉 <u>T</u> riangulate Surface	label Cont <u>o</u> urs ∭ <u>F</u> eatures	Ī
	Design Surface	• Components	
	Edit Surface	Annotate Feature	
6	<u>F</u> eature	Surface Elevations	
Display	Surface Properties	Slope Vectors	.d

First, contours with a 10' major interval will be displayed.

In the *View Contours* dialog box, <D> the Preferences button. This displays the *Preferences* dialog box.

🔛 View	Contours				- • •
Main	Advanced	Labels			
Surfac	e:	12345_li	ntro-DTM	-	Help
Fence	Mode:	Ignore		-	
Interva	l:	2.00			
Minors	per Major:	4		-	
Symbo	logy:				
0	Object		Name		
M 🖂 🛛	ajor Contours				BYL
M 🖂 🛛	inor Contours				BYL
M	ajor Labels				BYL
M	inor Labels				BYL
M	ajor Depressio	n Co			
M 🖂 🛛	inor Depressio	n Co			
	Apply	Prefer	ences	Cle	ose

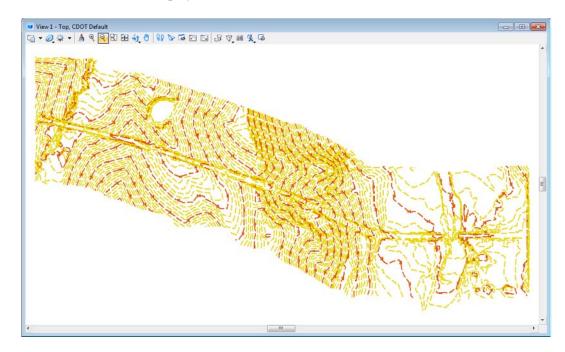
- 19. In the Preferences dialog box, highlight Existing 10' Mjr 2' Minor in the Name list.
- 20. **<D>** the **Load** button to apply the preference, then **<D>** the **Close** button to dismiss the *Preferences* dialog box.

Preferences	×
Name:	Close
CDOT A	Load
Existing Existing 1' Mir - 0.2 Minor Existing 10' Mir - 2' Minor	Save
Existing 100 Mjr - 20 Minor Existing 5' Mjr - 1' Minor	Save As
Proposed Proposed 1' Mir - 0.2' Minor	Delete
Pronoced 10' Mir - 2' Minor	Help
Active Preference: Default	

21. In the *View Contours* dialog box, **<D>** the **Apply** button.

🐂 View Contours				
Main Advanced L	abels			
Surface:	12345_I	ntro-DTM 👻	Hel	p
Fence Mode:	Ignore	Ŧ		
Interval:	2.00			
Minors per Major:	4	. <u></u> T		
Symbology:				
Object		Name		
Major Contours		DTM_Ex_Conte	our_Major	BYL
Minor Contours		DTM_Ex_Conte	our_Minor	BYL
Major Labels DTM_Ex_Contour_Text BYL		BYL		
Minor Labels DTM_Ex_Contour_Text BYL		BYL		
Major Depression Co DTM_Ex_Contour_Major BYL		BYL		
Minor Depression	Co	DTM_Ex_Conte	our_Minor	BYL
Apply Preferences Close				

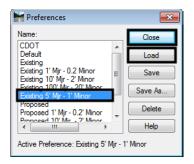
22. Examine the contours displayed. Below is an illustration of the contours.



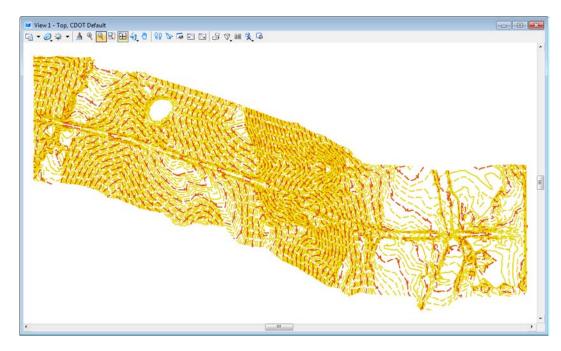
Finally, the contours will be changed to a 5' major interval.

- 23. In the *View Contours* dialog box, **<D>** the **Preferences** button. This displays the *Preferences* dialog box.
- 24. In the Preferences dialog box, highlight Existing 5' Mjr 1' Minor in the Name list.

25. **<D>** the **Load** button to apply the preference, then **<D>** the **Close** button to dismiss the *Preferences* dialog box.



- 26. n the *View Contours* dialog box, **<D>** the **Apply** button.
- 27. Examine the contours displayed. Below is an illustration of the contours.



Because the Write Lock is set to Pencil Mode, the previous contours do not have to be deleted prior to displaying the new ones.

Section Summary:

- Data like the Perimeter, Contours, or Triangles is derived from the surface, the triangle mesh stored in the DTM.
- View Features can be used to display the Triangulated and Untriangulated data contained within the DTM.

Chapter Summary:

- Of the 5 different Feature Types Random, Breakline, and Exterior are used on almost every existing DTM
- The Exterior feature describes the limit of triangulated data for a surface

- Interior features describe an area of unknown elevation
- The Symbology for Cross Sections and Profile is set in the Surface Properties dialog box
- Cross Sections and Profile symbology should be set the same for a surface in order to maintain the consistency of appearance
- Feature Filters are used to reduce the number of features displayed in menu lists
- Feature Filters are used to limit feature lists to items of interest to the user
- Only features that pass the filter can be displayed, selected, edited, etc.
- There are a variety of standard preferences that control the display contours

LAB 8 - Building Components

This lab demonstrates the various methods of creating components, setting component and point properties, and illustrating how point constraints work. There are three basic options used to create components; simple, constrained/unconstrained, and end condition.

Chapter Objectives:

- Build a simple component
- Build a constrained component
- Build an end condition component
- Demonstrate the commonly used constraints; horizontal, vertical, slope, and vector/offset

Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\Preferences\CDOT_Civil.xin
- C:\Projects\12345\Design\InRoads\12345DES_Geometry.alg
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\12345DES.ird
- C:\Projects\12345\Design\InRoads\DES12345_Templates.itl

Lab 8.1 - Build A Simple Component

Use the simple option to build a regular closed shape component with horizontal and slope constraints such as those used for building pavement components.

- 1. Open MicroStation and InRoads using the **12345DES_Model.dgn** file found in the directory *C:\Projects\12345\Design\Drawings\Reference_Files*.
- 2. Select **File > Open** from the InRoads menu bar.
- 3. Select the *C:\Projects\12345\Design\InRoads\DES12345_Templates.itl* from the available files.
- 4. **<D> Open** then **<D> Cancel** the *Open* dialog box.
- 5. Select **Modeler > Create Template** from the InRoads menu bar.

Setting up *Template Options* makes point placement easier. For this lab, affixes will be turned off so that the component can be used on either side of the template. The step value will be set so to a small value so that when creating a template, components will snap to the correct points.

6. Select **Tools > Options** from the *Create Template* menu bar.

🕌 Create Templat	e
File Edit Add	Tools
Template Library:	Template Library Organizer
C:\Projects\12	Apply Feature Name Override
	Apply Component Name Override
	Options
	Dynamic Settings
	Template Library Report (itl File)

- 7. Toggle off *Apply Affixes*.
- 8. Set the X and Y Step Options to O. 10.
- 9. **<D>OK**.

🕌 Template Options	X
Naming Options Component Seed Name:	OK Cancel
From Style	Cancel
Specify:	Preferences
Point Seed Name:	Help
Apply Affixes	
Prefix Suffix Left: LT_	1
]
Right: RT_	
Step Options	
X: 0.10 Y: 0.10	Slope: 0.00%

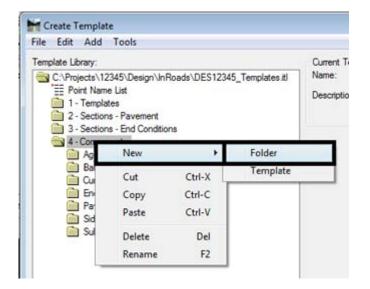
The next series of steps creates a new project specific folder to store the components that will be created in the lab. Creating project specific folders in the template library makes easier to find project specific components.

10. **<D> <D>** on the root folder in the Template Library pane to expand the folder structure.

11. **<D> <D>** on the **4** - *Components* folder to expand the folder.

MiCreate Template File Edit Add Tools			
CVPreact:/1245/Design/in/Poech/DE512145_Templates.tl CVPreact:/1245/Design/in/Poech/DE512145_Templates.tl T=TPRK.Hone:Ust. Templates	Current Template Name : Description:	Daplay & Components Constraints Daplay Port Names Display All Components	Clese Holp
Cuth & Subfer Components End Conditiona Povemento Subferses Subferses Subferses			

12. **<R>** on the **4** – **Components** and select **New > Folder** from the right click menu.



13. Key in *12345 Components* for the folder name.

Components are the building blocks of templates. Create a pavement component using the *Simple* option. This option is used because it automatically sets up the constraints of the component.

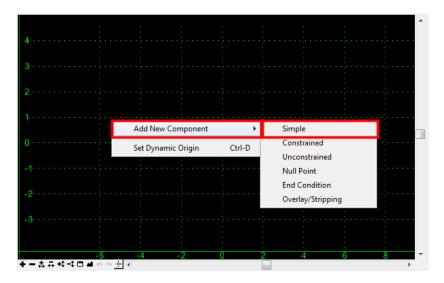
- 14. **<R>** on the **12345** Components folder and select **New > Template** from the right click menu.
- 15. Key in *CONC_Lane_12"x12'* for the component name.

🔁 4 - Components
🚞 Aggregate Bases
📄 Barriers & Misc Components
🚞 Curb & Gutter Components
End Conditions
Pavements
🚞 Sidewalks & Bike Paths
🚞 Subbases
12245 Componente
CONC_Lane_12"x12"

╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋	Dynamic Settings 🛛
	X: 0.00 Step: 0.10
	Y: 0.00 Step: 0.10
	Point Name:
	Point Style:
	Apply Affixes
	hs= 🔻
	Set Dynamic Origin

16. **<D>** on the *Dynamic Settings* button to display the *Dynamic Settings* tool settings box.

17. **<R>** In the Template View window and Select **Add New Component > Simple** from the right click menu.



The next steps define the style that the component will use, the point names, and the origin of the component.

- 18. In the *Current Component* area, key in *CONC_Lane_12"x12'* into the *Name* field.
- 19. Set the Style to **D_CONC_Pvmt_12in** using the drop down menu.
- 20. Key in **1** for the **Thickness.**

Note: This is where the values of all the constraints are set. If needed, these values can be modified later.

- Current Component -			
Name: CONC_Lane_12"x12"		Style:	D_CONC_Pvmt_12in
Slope:	-2.00%		
Thickness:	1.00		
Width:	12.00	•	

- 21. Move the pointer into the magenta square (this is the template origin and is usually at the coordinate 0,0). Adjust the pointer location until the *Dynamic Settings* readout is *0.00* for both *X* and *Y*.
- 22. **<D>** to place the element.

0.2					Dynan	nic Setti	ngs		
-0:0					X:	0.00	Step:	0.00	
					Y:	-0.00	Step:	0.00	
-0:2			••••••		Point	Name:			-
					Point	Style:			-
-0:4					Ap	oply Affix	es		
-0:6					hs=		•		
						Set [Dynamic Orig	jin	
-0:8			• • • • •						
-1:0			3	÷.,					
-0.6	-0.4	-0.2	-0.0	0.2	0.4	0.6	0.8 1.	0 1.2	1.4

- 23. **<D> <D>** on the origin.
- 24. Select *Conc_Centerline-Top* from the *Name* drop down menu.

25. **<D> Apply**.

Point Properties	
Name:	Conc_Centerline-Tc 🔻 🔶 Apply
Use Feature Name Override:	Close
Surface Feature Style:	Centerline
Alternate Surface:	_
	Next >
	Member of:
	CONC_Lane12'x12'
Constraints Type: None	1 Constraint 2
Label: Style Constraint: (i) Horizontal (i) Vertical	Both Range: 0.00

26. **<D> Next** and rename the remaining points as shown below using the *Name* pull-down menu.

Centerline	-Тор	
		Conc_Laneline-Top
ABC Centerline	f op	 ABC_Laneline-Top

This completes the creation of a simple, closed shaped component with horizontal and slope constraints.

Lab 8.2 - Build a Constrained Component

In addition to building regular closed shape components, irregular and/or open shaped components can be created using the constrained or unconstrained options for adding components. They can also be used to build linear, non-end condition components. Use the constrained option to define horizontal and/or vertical constraints (such as a horizontal or vertical offset from another point). Use the unconstrained method to define points that don't depend on other points for their placement.

- 1. **<R>** on the **12345** Components folder and select **New > Template** from the right click menu.
- 2. Key in *CONC_Shoulder_12"x8'* for the component name.

3. **<R>** In the Template View window and Select **Add New Component > Constrained** from the right click menu.

Add New Component			imple		
Template Documentation Link			onstraine	ed	
Check Point Connectivity			nconstra	ined	
Delete Components			lull Point		
Change Template Origin		E	nd Condi	ition	
Delete Constraints from All Points		0	verlay/St	tripping	
Set Dynamic Origin Ctrl-D					

- 4. In the *Current Component* area, key in *CONC_Shoulder_12"x8'* into the *Name* field.
- 5. Set the Style to **D_CONC_Pvmt_12in** using the drop down menu.

╪╼⋨⋳┿╪ <mark>⋶</mark> ⋬⋼⋴∳ <mark></mark> ∢			
Current Component	Style:		_
Name: CONC_Shoulder_12'x8'	Style.	D_CONC_Pvmt_12in	•

When placing constrained or unconstrained components, each point of the component must be placed individually. Use the *Dynamic Settings* dialog box is to enter point names, styles, and locations.

6. Select *Conc_Laneline-Top* from the *Point Name* drop down menu on the *Dynamic Settings* dialog box.

Dynamic Setting	gs 🛛 🖻			
X: 0.00	Step: 0.10			
Y: 0.00	Step: 0.10			
Point Name:	Conc_Laneline-T(👻			
Point Style:				
Apply Affixes	Apply Affixes			
hs= 🔻				
Set Dynamic Origin				

- 7. Move the pointer on to the template origin and **<D>**.
- 8. *Dynamic Settings* dialog box, Select *Conc_EOP-Top* from the *Point Name* drop down menu.
- 9. Change the key in mode to *hs=* (horizontal distance and slope).

10. Key in *8,-.02* in the key in field. This is the horizontal distance and slope from the previously placed point.

Dynamic Setting	gs	×
X: 5.62	Step:	0.10
Y: -0.88	Step:	0.10
Point Name:	Conc_EC)P-Top 👻
Point Style:	D_EOP	•
Apply Affixes	;	
hs=	8,02	

- 11. Press the *Enter* key to place the point.
- 12. Select *ABC_EOP-Top* from the *Point Name* drop down menu.
- 13. Change the key in mode to *dl=* (horizontal and vertical distance from the last entered point).
- 14. Key in *O*, *1* in the key in field. This is the horizontal distance and vertical distance from the previously placed point.

Dynamic Setting	15 🖾
X: 8.12	Step: 0.10
Y: -3.03	Step: 0.10
Point Name:	ABC_EOP-Top 👻
Point Style:	D_EOP
Apply Affixes	
dl= 🔻	0,-1
Set Dyr	namic Origin

- 15. Press the *Enter* key to place the point.
- 16. Select *ABC_Laneline-Top* from the *Point Name* drop down menu.
- 17. Change the key in mode back to *hs=* (horizontal distance and slope).

18. Key in -*8,-.02* in the key in field.

Dynamic Setting	gs 🖾	
X: -0.03	Step: 0.10	
Y: -1.03	Step: 0.10	
Point Name:	ABC_Laneline-To 👻	
Point Style:	D_EOP 👻	
Apply Affixes	1	
hs=	-8,02	
Set Dy	mamic Origin	

- 19. Press the *Enter* key to place the point.
- 20. **<R>** anywhere. This dialog box is where you define if the shape is closed or not.
- 21. Verify that *Closed Shape* is toggled **On.**
- 22. Select *Finish* from the right click menu to complete the component.

	Finish	Enter
<	Closed Shape	Ctrl-L
	Mirror	Ctrl-M
	Undo Last Cancel	ESC
	Set Dynamic Origin	Ctrl-D

You should now understand how to create a constrained, closed shaped component. By reviewing the steps above, now you should also be able to also create unconstrained and open shaped components simply by choosing different options from the dialog boxes that were introduced.

Lab 8.3 - Build an End Condition Component

In theses next steps you will use the end condition option to create a linear component that can seek a target. This lab will focus on the point property called *End Condition is Infinite*. Once you understand the steps to evaluate the effects of this property on and end condition, use the same steps to test the effects of other end condition point properties. Many of these properties determine how the component will behave when a target is found.

1. Create a new template as described in the previous lab and name it 6to1_Fill.

2. **<R>** In the Template View window and Select **Add New Component > End Condition** from the right click menu.

Add New C	omponent	+	Simple
Set Dynami	c Origin	Ctrl-D	Constrained
			Unconstrained Null Point
			End Condition
			Overlay/Stripping

- 3. Key in *6 to 1 Fill* for the *Name*.
- 4. Select **D_Toe-of-Fill** for the **Style**.

Additional component properties are required for end conditions. These determine what the end condition attempts to tie to (the Target) and the order in which it is processed (the Priority).

5. **<D>** on the *Target Type* drop down menu. Examine the options available.

Target Type:	Style XYZ 👻
Surface	Surface
	Elevation Feature XY
	Feature Elevation
Horiz	Alignment XY
Offsets: 0.00	Augriment Elevation
	Alignment XYZ Style XY
io back, ENTER: Fir	nis Style Elevation
	Style XYZ

- 6. Select *Surface* from the *Target Type* drop down menu.
- 7. **<D>** on the *Surface* drop down menu. Notice that either Active or a particular surface can be selected.
- 8. Select *Active* from the drop down menu. This will allow the end condition to solve regardless of the surface specified in Roadway Designer.

9. Key in **1** for the *Priority*.

Current Component		-	
Name: 6 to 1 Fill		Style: D_Toe	⊷of-Fill 🔻
Target Type:	Surface 👻	Priority:	1
Surface	✓ <active></active>	Benching Count:	0
		From Datum:	0.00
Horizon	tal Vertical	Step Elevation:	0.00
Offsets: 0.00	0.00	Rounding Length	0.00

Note: This example illustrates an end section with one component. When there are several components defined in an end condition, they are evaluated in order of their assigned *priority*. A component with a priority of 1 will be evaluated before a component with a priority of 2.

Next, additional point properties, such as point names, will be defined for the end condition. Use the *Dynamic Settings* dialog box to finish defining these properties.

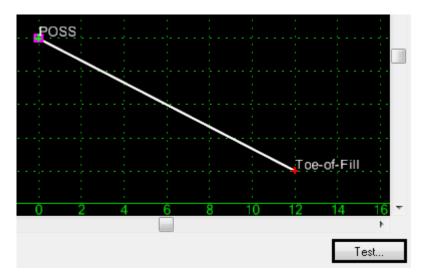
- 10. In the *Dynamic Settings* dialog box, select *POSS* for the *Point Name*.
- 11. Move the pointer on to the template origin and **<D>**.
- 12. In the *Dynamic Settings* dialog box, toggle on *End Condition is Infinite*. This option allows a component to "stretch" until a target is found.
- 13. Select *Toe-of-Fill* for the *Point Name*.
- 14. Change the key in mode to *hs=.*
- 15. Key in 12,-.1667. and press Enter. (This value could also be typed in as 12,-1:6).

Dynamic Setting	js 🗵
X: 0.67	Step: 0.00
Y: -4.30	Step: 0.00
Check for Int	erception
V Place Point a	at Interception
End Condition	n is Infinite
Do Not Cons	truct
Point Name:	Toe-of-Fill ←
Point Style:	D_Toe-of-Fill ▼
Apply Affixes	
Apply Affixes	12,1667

16. **<R>** and select *Finish* from the right click menu.

The steps above created a component that will seek a target at a -1:6 slope for a horizontal distance up to 12 feet. However, because the option *End Condition is Infinite* was toggled *On*, the component ignores the horizontal distance criteria and will seek a target beyond the 12 foot limitation.

17. In the *Create Template* dialog box, **<D>** the *Test* button located to the bottom right of the Template View window as shown below.



18. In the *Test End Conditions* dialog box, **<D>** the **Draw** button.



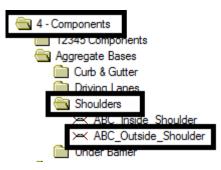
- 19. Move the pointer up and down in the view area to see how the end condition performs.
 - Note: The dotted line in the *Test End Condition* view window shows the component at the defined slope and length. As the proposed surface moves beyond the limits of the defined component, the result of the *End Condition is Infinite* toggled **On** is that the end condition solution expands beyond the original limits of the component. **<D> Close**.
- 20. **<D> <D>** on the *Toe-of-Fill* point.

- 21. Toggle off *End Condition is Infinite*.
- 22. **<D> Apply** and **<D> Close**.
- 23. **<D> Test**.
- 24. In the *Test End Conditions* dialog box, **<D> Draw** and notice how the end condition behaves.
- 25. **<D> Close**.
 - **Note:** When the *End Condition is Infinite* option is **Off**, the end condition solution is limited to the limits of the originally defined component.
- 26. Select **File > Save** the *Create Template* dialog box.

Lab 8.4 - How Point Constraints Work

Point constraints are used to form a relationship between points. This relationship is used to change the shape of the components based on events that occur within the corridor. The following steps will demonstrate how to assign and modify point controls, and how to evaluate a component by making changes to point controls. change, create the impact of

- 1. Verify the *Create Template* dialog box is open.
- 2. Open the folder *4 Components > Aggregate Bases > Shoulders*.
- 3. **<D> <D> on the ABC_Outside_Shoulder** component.



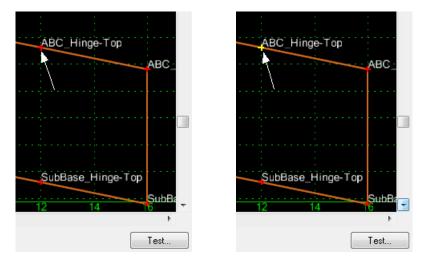
- 4. **<D> <D>** on the **ABC_Hinge-Top** point.
- 5. In the **Point Properties** dialog box, notice that this point has both a *Horizontal* and *Slope* constraint.

6. Change the *Slope* constraint to **None** and **<D> Apply**. This will allow the point to move up and down independent of any other point.

Point Properties		×
Name:	ABC_Hinge-Top 👻	+ Apply
Use Feature Name Override:	ABC_Hinge-Top	Close
Surface Feature Style:	D_HINGE -	< Previous
Alternate Surface:	-	Next >
	Member of:	Help
	ABC_Outside_Shou	lder
Constraints Constraint	1 Cons	traint 2
Type: Horizontal	▼ None	-
Parent 1: ABC_Shoulder-	Top 🔻 🕂	
Value: 12.00	=	
Label:	•	
Style Constraint:	-	
Horizontal O Vertical	Both Range: 0.00	

7. **<D> Close**.

8. Notice in the *Create Template* view window how the point symbol (+) changes from red to yellow. This color change means the point has changed from fully constrained to partially constrained.



9. **<R>** on the **ABC_Hinge-Top** point and select **Move Point** from the menu.

Note: The *Move Point* command will not appear in the menu if the point is fully constrained.

10. Because the point still has a *Horizontal* constraint, it will only move up and down while maintaining the 12 foot offset from the constraint point, *ABC_Shoulder-Top*.

- 11. **<R>** to exit the **Move** command.
- 12. **<D> <D>** on the **Subbase_Hinge-Top** point.
- 13. Notice that *Subbase_Hinge-Top* is constrained both horizontally and vertically to *ABC_Hinge-Top*. Therefore, if ABC_Hinge-Top moves, Subbase_Hinge-Top will follow according to what is entered in the constraint *Value:* field. The next few step will demonstrate how this works.
- 14. **<D> Close**.
- 15. **<R>** on the **ABC_Hinge-Top** point and select **Move Point** from the menu.
- Notice how the point *Subbase_Hinge-Top* stays 0.5 feet directly below point *ABC_Hinge-Top*. This is because the point has a *Horizontal* constraint of **0** and a *Vertical* constraint of **- 0.5**. from ABC_Hinge-Top.
- 17. **<R>** to exit the **Move** command.

The point *ABC_EOP-Top* is also fully constrained by *ABC_Hinge-Top*. The difference with this point it that it that the second constraint is by *Vector-Offset* instead of Vertical.

- 18. **<D> <D>** on the **ABC_EOP-Top** to look at the *Vector/Offset* constraint.
- 19. Notice that this type of constraint uses two parent points instead of one. The slope between the two parent points determines the "vector" at which the point will be placed.
- 20. **<D> Close**.
- Move the point *ABC_Hinge-Top* again and notice how the point *ABC_EOP-Top* moves with it. The *Vector/Offset* constraint forces the point *ABC_EOP-Top* to maintain the same slope defined by *ABC_Shoulder-Top* and *ABC_Hinge-Top*.
- 22. **<R>** to exit the **Move** command.

The next few steps demonstrate how ABC_Hinge-Top behave with a vertical constraint and without a horizontal constraint.

- 23. **<D> <D>** on the **ABC_Hinge-Top** point.
- 24. Change the **None** constraint back to **Slope**.

Name:	ABC_Hinge-Top	- + Apply	
Use Feature Name Override:	ABC_Hinge-Top	Close	
Surface Feature Style:	D_HINGE	Previou	10
Alternate Surface:		▼	
		Next >	
	Member of:	Help	
	ABC_Outside_	Shoulder	
Constraints Constraint	1	Constraint 2	
Type: None	Slope		
Parent 1:	ABC	Shoulder-Top 🔻	+
		Rollover Values	
Value:	-2.00		=
Labal			_
Label:		· · · ·	
Style Constraint:			

25. Set the **Parent 1** to *ABC_Shoulder-Top* and change the **Horizontal** constraint to **None**.

26. **<D> Apply**.

- *Note:* When you click *Apply*, the two constraints will switch places. This is because the *None* constraint will always end up as *Constraint 2*.
- 27. <D> Close.
- 28. Move the point ABC_Hinge-Top again an notice that now the point only moves to the left and right. The *Slope* constraint forces it to maintain a -2.0% slope from the point *ABC_Shoulder-Top*.
- 29. **<R>** to exit the **Move** command.
- 30. Reset the point *ABC_Hinge-Top* back to its original setup. **<D> <D>** on the point, change the **None** constraint back to **Horizontal**, and set **Parent 1:** to *ABC_Shoulder-Top*.
- 31. **<D> Apply**.
- 32. **<D> Close**.

Chapter Summary:

- Use a simple component to quickly generate an unconstrained closed shape. *Lab* 8.1 -*Build A Simple Component* showed how to modify point names in using the Point Properties dialog.
- The next lab, *Lab 8.2 -Build a Constrained Component*, demonstrated how to create a constrained component from scratch using the Dynamic Settings dialog box and various methods for the key-in.

- *Lab 8.3 -Build an End Condition Component* explored the special features of an end condition component. For end condition components there are additional options in the Dynamic Settings dialog box which determine how end condition points in relation to a target.
- In *Lab 8.4 -How Point Constraints Work* several constraint options were explored including Horizontal, Vertical and Vector-Offset. This lab demonstrated how changing the constraint method affects the points position and how points react to the Parent it is constrained to.

LAB 9 - Building Sections

This lab demonstrates how to create the sub-assemblies known as sections and illustrates the use of parent components and display rules.

Chapter Objectives:

- Build a section with existing components using the drag and drop method
- Build an end condition section and reset the priorities so that it functions properly
- Build a section from new and existing components
- Set up the parent/child relationship between components and demonstrate how it works
- Create display rules, apply them to components, and demonstrate their functionality

Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\Preferences\ CDOT_Civil.xin
- C:\Projects\12345\12345\Design\InRoads\DES12345_Templates.itl (This file was modified in Lab 1)

Lab 9.1 - Build a Lane Section

This example demonstrates how to assemble basic components into sections using the drag and drop method. This lab builds on the concepts and used data from *Lab 1 - Building Components*. Open the *Create Template* dialog box.

- 1. Select **Tools > Options** from the *Create Template* menu bar.
- 2. Make sure that *Apply Affixes* is toggled off and the X and Y Step Options are set to 0.10.

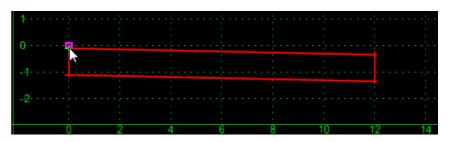
Naming Option	15	ОК
Components		-
Seed Name:		Cancel
From Sty	/le	Preferences
O Specify:	(I I I I I I I I I I I I I I I I I I I	
	·	Help
Points		
Seed Name:	-	
Apply Affixe		
_ Арру Апосе	is Defix Sulfix	
Left	LT_	
Flight:	RT_	
Step Options		

- 3. **<D> <D>** on the root folder in the Template Library pane to expand the folder structure.
- 4. Expand the **2** Sections Pavement folder.
- 5. Create a new folder under 2 Sections Pavement called 12345 Sections.

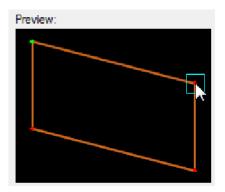


- 6. Create a new template in the **12345 Sections** folder. Name it **Conc_Driving_Lane**.
- 7. Expand the *4 Components* folder. Also expand the *12345 Components* folder created in Lab 1.
- 8. **<D>** on the *Conc_Lane_12"x12'* component. The component is displayed in the Preview window.
 - Preview:
- 9. **<D> and hold** on the component's origin (the green dot).

10. **Drag** the component into the template view and **drop** (release the data button) it on the new section's origin.

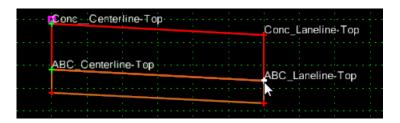


- 11. Expand the *4 Components >Aggregate Bases > Driving Lanes* folder.
- 12. **<D>** on the **ABC_Lane** component.



13. **<D> and hold** on the upper right point of the component in the preview window.

14. **Drag** the component into the Template View and move the pointer on to the lower right corner of the concrete component and **Drop**. The "+" on the concrete component turns white when to pointer is on it.



Note: Steps 14 and 15 were done to show that components do not have to be placed by the origin.

This completes the Conc_Driving_Lane section. This section is now ready to use to create a complete template. This lab illustrates how to build a "backbone" section from existing components. It also shows that components do not have to be placed by their origin, they can be placed using any point on the component.

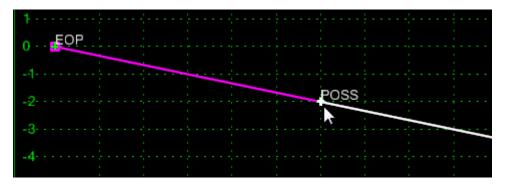
Lab 9.2 - Build an End Condition Section

This example demonstrates the construction of an end condition. End conditions are more complicated than a simple component and require additional editing to make complete. The drag and drop method will be used to create a new end condition section and the end condition priorities will be modified so that the section operates properly.

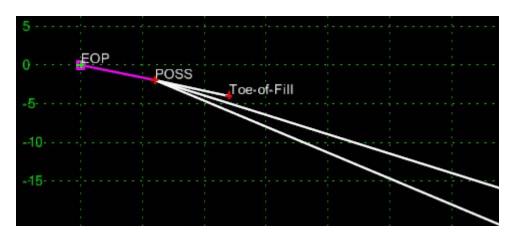
- 1. Create a new template in the **12345** Sections folder named **12345_End-Condition**.
- 2. Expand the 4 Components >End Condition > Z-Slope > High Speed folder.
- 3. **<D>** on the *Z***-***Slope***_12_6_to_1** component.
- 4. **<D> and hold** the component's origin in the preview window.

- 5. **Drag and Drop** the component on the origin in the Template View.

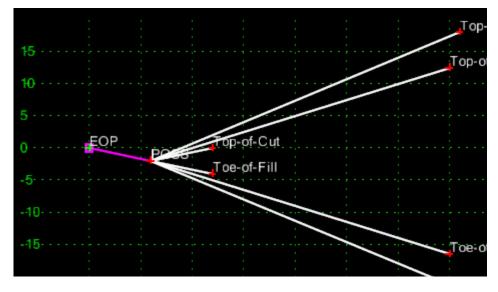
- 6. Expand the **4** Components >End Condition > Fill Slope Components folder.
- 7. **<D>** on the *Fill_6_to_1* component.
- 8. **Drag and Drop** the component on to the *POSS* point.



9. Repeat steps 8 and 9 using *Fill_4_to_1* and *Fill_3_to_1*.



10. Expand the **4** – *Components* >*End Condition* > *Cut Slope Components* folder.



11. Drag and Drop the *Cut_6_to_1*, *Cut_4_to_1* and *Cut_3_to_1* components on to the *POSS* point.

- 12. **<D> <D>** on the *Fill 6/1* component.
- 13. Verify that the *Priority* is set to *1*.
- 14. **<D> Next.** This shows the properties for the **Fill_4/1** component.
- 15. Set the *Priority* is set to *2*. <D> Apply.

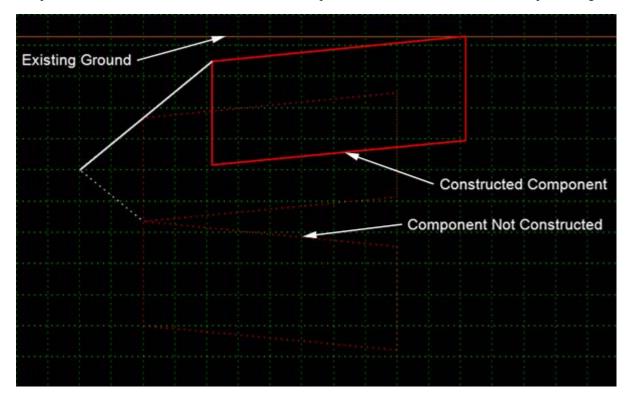
		_	-
Fil_4/1		+	Apply
		(Close
D_Toe-of-Fill	•	, i	< Previous
	• •		
		Edit	Next >
oulation			Help
-			
	Priority	0	
Surface		2	
A			
Active>	Benching Count:	0	
< <active></active>	From Datum:	0.00	
	D_Toe-of-Fill	D_Toe-of-Fill	D_Toe-of-Fill

- 16. Set the remaining priorities as follows
 - Fill_3/1 = 3
 - ♦ Cut_6/1 = 4
 - ♦ Cut_4/1 = 5
 - ♦ Cut_3/1 = 6

- 17. Close the Component Properties dialog box
- 18. **<D>** the **Test** button.
- In the *Test End Conditions* dialog box, <D> Draw and notice how the end condition behaves.
- 20. **<D> Close**.

Lab 9.3 - Using Parent Components

This example places a sidewalk at the end of a cut or fill slope. It illustrates how the parent/child relationship between components can be used. The sidewalk position end conditions are parents to the sidewalk components. This "turns off" the sidewalk when its parent end condition does not intercept the target surface.



1. Create a new template in the **12345** *Sections* folder named *Parent Component Example*.

The end condition component is used to locate the position of the sidewalk. It contains two segments. The first segment matches the sidewalk's width and slope. The second segment intercepts the target surface where the actual sidewalk goes. The Do Not Construct point property is used so that the points will be located but the end condition component will not be added to the finished template.

- Add New Component
 Simple

 Template Documentation Link...
 Constrained

 Check Point Connectivity...
 Unconstrained

 Delete Components
 Null Point

 Change Template Origin
 End Condition

 Delete Constraints from All Points
 Overlay/Stripping

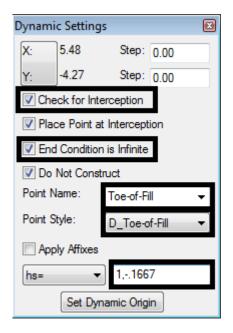
 Set Dynamic Origin
 Ctrl-D
- 2. **<R>** in the Template View and select **Add New Component > End Condition**.

- 3. Key in *Fill* for the component *Name*.
- 4. Select **D_Toe-of-Fill** for the **Style**.
- 5. Key in **1** for the *Priority*.
- 6. In the *Dynamic Settings* dialog box, set the *Point Name* to **POSS**.
- 7. Place the point on the template origin.
- 8. In the *Dynamic Settings* dialog box, toggle off *Check for Interception*.
- 9. Verify *End Condition is Infinite* is toggled off.
- 10. Toggle on *Do Not Construct*.
- 11. Key in *Sidewalk_Position* for the *Point Name*.
- 12. Select **D_CONC_Sw** for the *Point Style*.
- 13. Set the key in mode to **hs=**.
- 14. Key in *4,-.02* and press *Enter*.

Note: Because the **Do Not Construct** was toggled on, a line from POSS to Sidewalk Position is not created.

Dynamic Settings 🛛 🔯					
X:	5.14	Step:	0.00		
Y:	1.85	Step:	0.00		
C +	neck for Int	erception			
V Pla	ace Point a	t Intercept	ion		
🔳 Er	End Condition is Infinite				
V Do	Do Not Construct				
Point	Point Name: Sidewalk_Positior -				
Point Style: D_CONC_Sw -					
Apply Affixes					
hs= 🕶 4,02					
Set Dynamic Origin					

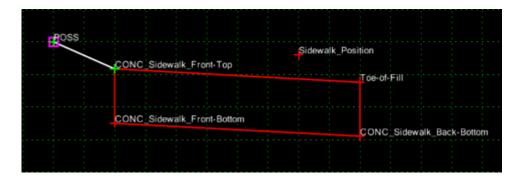
- 15. In the *Dynamic Settings* dialog box, toggle on *Check for Interception*.
- 16. Toggle on *End Condition is Infinite*.
- 17. Set the *Point Name* to **Toe-of-Fill**.
- 18. Key in *1,-.1667* and press *Enter*.



19. **<R>** in the template view and select **Finish**.

The Sidewalk and fill slope components that will be used as part of the template are built from the toe located by the end condition back to the POSS.

- 20. Expand the *4 Components >Sidewalks & Bike Paths > Sidewalks* folder.
- 21. **<D>** on the **4"_CONC_Sidewalk** component.
- 22. **<D> and hold** on the upper right point in the Preview.
- 23. Drag and Drop the component on the *Toe-of-Fill* point.
- 24. **<D> <D>** on the **CONC_Sidewalk_Front-Top** point.
- 25. Set Constraint 1 *Type*: to **Horizontal**, the *Parent 1*: field to **Toe-of-Fill**, and key in *-4.00* for the *Value*.
- Set Constraint 2 *Type*: to Slope constraint, the *Parent 1*: field to Toe-of-Fill, and key in -2.00% for the *Value*.
- 27. **<D> Apply** and **Close**.
- 28. **<R>** in the template view and select **Add New Component > Unconstrained.**
- 29. Key in *Fill_6_to_1* for the component *Name*.
- 30. Select **D_Toe-of-Fill** for the *Style*.
- 31. Place the first point on the **POSS** (also the template origin).
- 32. Place the second point on the *CONC_Sidewalk_Front-Top* point.
- 33. **<R>** and select **Finish**. The illustration below shows the template completed to this point.



The cut components work the same as the fill components built above.

- 34. **<R>** in the template view and select **Add New Component > End Condition.**
- 35. Key in *Cut* for the component *Name*.
- 36. Set the *Style* to **D_Top-of-Cut**.

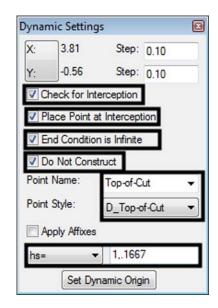
37. Key in *2* for the *Priority*.

- 38. In the *Dynamic Settings* dialog box, set the *Point Name* to **POSS**.
- 39. Place the point on the **POSS**.
- 40. In the *Dynamic Settings* dialog box, toggle off *Check for Interception*.
- 41. Toggle on *Do Not Construct*.
- 42. Key in *Sidewalk_Position1* for the *Point Name*.
- 43. Select **D_CONC_Sw** for the *Point Style*.
- 44. Key in *4,.02* and press *Enter*.

Dynar	nic Setting	gs	×	
X:	3.80	Step:	0.10	
Y:	0.10	Step:	0.10	
	heck for Int	terception		
✓ P	lace Point a	at Intercept	tion	
E	nd Conditio	n is Infinite		
VD	o Not Cons	struct		
Point	Name:	Sidewalk	<_Positior ▼	
Point	Point Style: D_CONC_Sw -			
Apply Affixes				
hs=		4,.02		
Set Dynamic Origin				

- 45. In the Dynamic Settings dialog box, toggle on Check for Interception.
- 46. Toggle on *End Condition is Infinite*.
- 47. Set the *Point Name* to **Top-of-Cut**.

48. Key in *1,.1667* and press *Enter*.



- 49. **<R>** and select **Finish**.
- 50. **<D>** on the **4"_CONC_Sidewalk** component.
- 51. **<D> and hold** on the upper right point in the Preview.
- 52. Drag and Drop the component on the *Top-of-Cut* point.
- 53. **<R>** and select **Finish**.
- 54. **<D> <D>** on the **CONC_Sidewalk_Front-Top1** point.
- 55. Set *Constraint 1* to Horizontal and make the *Parent 1* Top-of-Cut.
- 56. Set *Constraint 2* to **Slope** and make the *Parent 1* **Top-of-Cut**.
- 57. Key in **2.00%** for the slope **Value**.
- 58. **<D> Apply**.
- 59. **<D> Close**.
- 60. **<R>** in the template view and select **Add New Component > Constrained.**
- 61. Key in *Cut_6_to_1* for the component *Name*.
- 62. Select **D_Top-of-Cut** for the *Style*.
- 63. Place the first point on the **POSS** (also the template origin).

- Constraint 1
 Constraint 2

 Type:
 Horizontal
 Image: Constraint 2
 Slope
 Image: Constraint 2

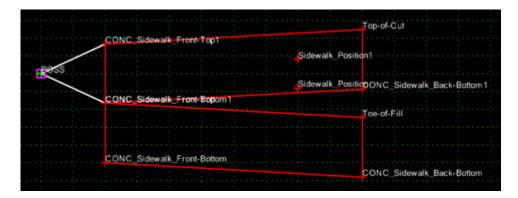
 Parent 1:
 Top-of-Cut
 Image: Constraint 2
 Slope
 Image: Constraint 2

 Value:
 -4.00
 Constraint 2
 Slope
 Image: Constraint 2

 Value:
 -4.00
 2.00%
 Image: Constraint 2
 Image: Constraint 2
 Image: Constraint 2

 Label:
 Image: Constraint 2
 Image: Constraint
- 64. Place the second point on the CONC_Sidewalk_Front-Top1 point.

65. **<R>** and select **Finish**. The completed template is shown below.



66. **<D>** the **Test** button.

In the **Test End Conditions** dialog box, **<D> Draw** and notice how the template behaves. Notice that both sidewalks remain visible and a third is added as the ground line is moved. This is because there is no relationship between the hidden end conditions and the sidewalk components.

67. **<D> Close**.

The steps below set up the parent/child relationships that will turn off the components for the end condition that is not used.

- 68. **<D> <D>** on the **Cut_6_to_1** Component.
- 69. Set the Parent Component to CONC_Sidewalk-4".

70. **<D> Apply**.

🕌 Component Prope	erties		—
Name:	Cut_6_to1	+	Apply
Description:			Close
Style:	D_Top-of-Cut Close Shape		< Previous
Parent Component:	CONC_Sidewalk-4" 👻 🕈		Next >
Display Rules:		Edit	
Exclude from triangu	ulation		Help

- 71. **<D>** the **Next** button until *Fill_6_to_1* is listed.
- 72. Set the Parent Component to CONC_Sidewalk-4".
- 73. **<D> Apply**.
- 74. **<D>** the **Next** button until **CONC_Sidewalk-4**" is listed.
- 75. Set the *Parent Component* to Fill.
- 76. <D> Apply.
- 77. **<D>** the **Next** button until **CONC_Sidewalk-4"1** is listed.
- 78. Set the *Parent Component* to Cut.
- 79. **<D> Apply**.
- 80. **<D>** the **Test** button.
- 81. In the *Test End Conditions* dialog box, **<D> Draw** and notice how the end condition behaves; only the components that are children of the end condition solution are displayed.

Lab 9.4 - Using Display Rules

Display rules turn on or off the display of components based on user defined criteria. In this example, display rules are used to exchange the normal end condition for a guardrail end condition.

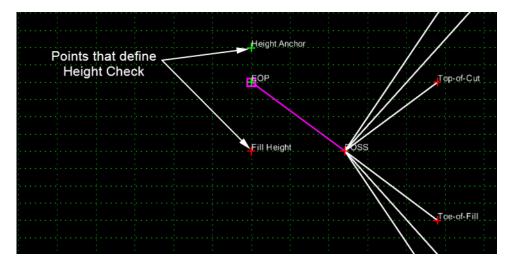
The typical section created in this lab contains two separate end conditions, the standard Z12_6_to_1 section and an end condition used with guardrail. Both end conditions could apply at any given template drop. To determine which end condition will be used, the *Height Check* component is added to the template. This component determines the fill height from the edge of pavement to the existing ground. If the fill height exceeds the maximum value the guardrail end condition is used.

The standard end condition section is added to the template.

- 1. Create a new template in the 12345 Sections folder. named Display Rules Example.
- 2. Expand the *3 Sections End Sections > Z-Slope End Conditions > High Speed End Conditions* folder.

- 3. **<D>** on the **Z12_6_to_1** Section.
- 4. **<D> and Hold** the section's origin in the *Preview* window.
- 5. **Drag and Drop** the section on the new template's origin.

Height Check is an end condition component. It runs vertically through the template origin (which will also contain the EOP point) to intercept the existing ground. The distance between the Fill Height point and the EOP is used to determine if the guardrail is used.



- 6. **<R>** in the Template View and select **Add New Component > End Condition**.
- 7. Key in *Height Check* for the *Name*.
- 8. Select **Default** for the *Style*.

Current Component					
Name: Height Check		Style: Defau	ilt 👻		
Target Type:	Surface 👻	Priority:	1		
Surface	✓ <active></active>	Benching Count:	0		
		From Datum:	0.00		
Horizon	tal Vertical	Step Elevation:	0.00		
Offsets: 0.00	0.00	Rounding Length	0.00		

- 9. In the *Dynamic Settings* dialog box, key in *Height Anchor* for the *Point Name*.
- 10. Select **Default** for the *Point Style*.
- 11. Set the key in mode to **XY=**.

12. Key in *O*, *1* and press *Enter*.

Dynami	c Settin	gs	×
X:	1.81	Step:	0.00
Y:	-0.36	Step:	0.00
Point N	Point Name: Height Anchor 👻		
Point Style:		Default	•
Apply Affixes			
xy= 🔻 0,1			
Set Dynamic Origin			

This point sets the Height Check end condition over the EOP so that the fill height can be checked vertically at this point.

- 13. Key in *Fill Height* for the *Point Name*.
- 14. Toggle on Check for Interception, Place Point at Interception, End Condition is Infinite, and Do Not Construct.
- 15. Key in *O*, -2 and press *Enter*.

Dynami	c Setting	js			
X:	8.62	Step:	0.00		
Y:	0.21	Step:	0.00		
Che	eck for Int	erception			
🔽 Plac	ce Point a	t Intercept	ion		
🔽 End	Condition	n is Infinite			
🔽 Do	Do Not Construct				
Point Name: Fill Height -					
Point S	ityle:	Default	_		
Apply Affixes					
xy= • 0,-2					
Set Dynamic Origin					

This sets the starting location for the Fill Height point. This point intercepts the existing ground directly under the EOP to determine the fill height. The 2 foot distance below the template origin is an arbitrary value, so long as the Fill Height point is placed below the Height Anchor point the template will work properly.

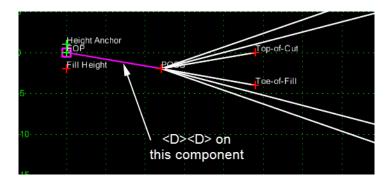
- 16. **<R>** and select **Finish**.
- 17. Select **File > Save**. (This is an intermediate save to prevent loss of information.)

The Z-Slope_12_6_to_1 component will be set to a child of the Height Check so that its display can be turned on and off based on the fill height.

18. Toggle on *Display All Components*.

Create Template				
File Edit Add Tools				
Template Library:	Current Terr	plate	Display	
C:\Projects\12345\Design\InRr E Point Name List I - Templates	Name: Parent_Component_Example Description:	Parent_Component_Example	 Components (Constraints
			Display Point N	lames
2 - Sections - Pavement			Display All Components	
12345 Sections			14	1.1

19. **<D> <D>** on the **Z-Slope_12_6_to_1** component.



20. In the Component Properties dialog box, set the Parent Component to Height Check.

The Display Rule sets the criteria for the component to be displayed.

21. **<D> Edit** to display the *Component Display Conditional Expression* dialog box.

🕌 Component Prope	X		
Name:	Z-Slope_12_6_to_1	+	Apply
Description:			Close
Style:	D_SHOULDER-Emb 👻 🔲 Close Shape		< Previous
Parent Component:	Height Check 🔻 🕂		Next >
Display Rules:	HeightCheck	Edit	
Exclude from triangu		Help	

22. In the *Component Display Conditional Expression* dialog box, **<D> Add**. The *Display Rule* dialog box is displayed.

The Display Rule determines when the Z-Slope_12_6_to_1 component is displayed. It is set so that when the fill height at the edge of pavement is more than 12 feet, the normal end condition is turned off.

23. In the *Display Rule* dialog box, key in *Height Check* for the *Name*.

- 24. Key in *Fill height check for guardrail* in the *Description* field.
- 25. Set the *Type* to **Vertical**.
- 26. Set *Between* to Fill Height.
- 27. Set And to EOP.
- 28. Set the expression to >.
- 29. Key in **-12** in the value field.
- 30. **<D> OK**.

ኵ Display R	ule		
Name:	HeightCheck		ОК
Description:	Fill height check for guardrail		Cancel
Type:	Vertical		Help
Between:	Fill Height	+	<u> </u>
And:	EOP 🔹	+	
	> -12.00		

- 31. Back in the *Component Display Conditional Expression* dialog box, highlight the **Height Check** entry in the *Template Display Rules* area.
- 32. **<D>** the **Selected Rule** button.
- 33. **<D> OK**.

Conditional Ex HeightCheck	pression for Z-Slope_1	12_6_to_1 Component			_	OK Cance Help
AND (DR NOT	() Selected Rule				
and the second second			1.000	1.222.222	2010	i i
nipiate Displa Name leightCheck	Type Vertical	Expression EOP - Fill Height	Test c	Value 12.00	Resuit True	

34. In the *Component Properties* dialog box, **<D> Apply**.

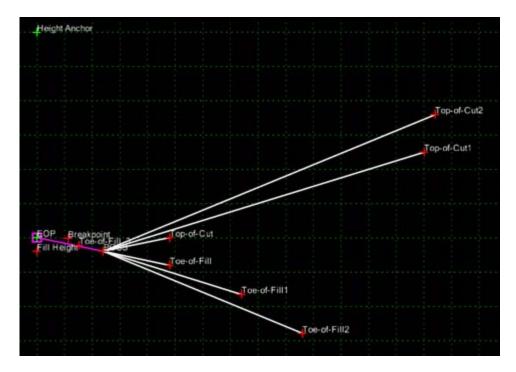
Component Prop	erties	23
Name:	Z-Slope_12_6_to_1	+ Apply
Description:		Close
Style:	D_SHOULDER-Emb 💌 🔲 Close Shape	< Previous
Parent Component:	Height Check 🔹 🛨	Next >
Display Rules:	HeightCheck	Edit
Exclude from triangu	ulation	Help

35. **<D> Close**.

As defined in the Z12_6_to_1 Section, the 3 to 1 fill slope will never be used. This is because the guardrail component is activated before the 4 to 1 option reaches its maximum distance. By changing the value on the horizontal constraint to 32 on the 4 to 1 slope, it will reach its maximum length before the guardrail end condition is used.

36. **<D> <D> on the Toe-of-Fill1 point**.

- 37. Change the *Value* of the *Horizontal Constraint* to **32**.
- 38. **<D> Apply**.
- 39. **<D> Close**. The template looks like the illustration below.

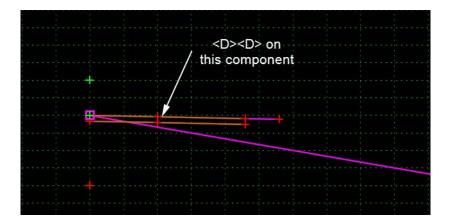


^{40.} **<D> Test**.

- 41. **<D> Draw**. Notice that once the ground line drops 12 feet below the EOP, the **Z-Slope_12_6_to_1** component disappears.
- 42. **<D> Close** to return to the *Create Template* dialog box.

Now we will add the Normal_Paved_Installation-6ft-Shoulder component to the template. This component uses the Height Check display rule along with the NOT operator to display the guardrail components only when the standard end condition is not used.

- 43. Expand the 4 Components > Barriers & Misc Components > Guardrail Widening folder.
- 44. **<D>** on **Normal_Paved_Installation-6ft-Shoulder** in the library tree view.
- 45. **<D> and Hold** on the component's origin (the upper left point) in the *Preview* window.
- 46. Drag and Drop the section on the *EOP* point in the template view.
- 47. **<D> <D>** on the **HMA_GRAIL-Widening_Normal_6ff-Shoulder** component.

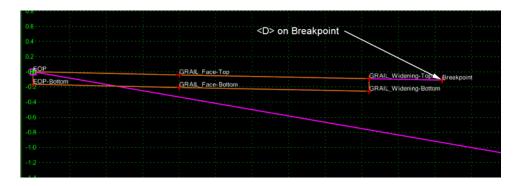


- 48. **<D>** the **Edit** button for the *Display Rules*.
- 49. In the *Component Display Conditional Expression* dialog box, **<D>** the **NOT** button.
- 50. Highlight Height Check in the *Template Display Rules* area, then **<D>** the **Selected Rule** button.
- 51. **<D> OK**.
- 52. In the *Component Properties* dialog box, **<D> Apply** and **Close**.

Because the display rules don't work well with end conditions, this component is used to locate the toe of the fill slope from the end of the guardrail section.

- 53. Zoom in around the guardrail widening component placed above.
- 54. **<R>** in the Template View and select **Add New Component > End Condition**.
- 55. Key in *Fill_2_to_1* for the *Name*.
- 56. Select **Default** for the *Style*.

57. **<D>** on the **Breakpoint** point.



- 58. In the *Dynamic Settings* dialog box, Key in *Toe-of-Fill_3* for the *Point Name*.
- 59. Toggle on Check for Interception, Place Point at Interception, End Condition is Infinite, and Do Not Construct.
- 60. Set the key in mode to **hs=**
- 61. Key in *2,-.5* and press *Enter*.

Dynam	nic Setting	gs	×			
X:	5.90	Step:	0.10			
Y:	0.70	Step:	0.10			
🔽 Ch	eck for Int	terception				
🔽 Pla	ace Point a	at Intercept	ion			
🔽 En	End Condition is Infinite					
🔽 Do	Do Not Construct					
Point Name: Toe-of-Fill_Check -						
Point Style: D_Toe-of-Fill						
Apply Affixes						
hs= 2,5						
	Set Dy	mamic Orig	in			

62. **<R>** and select **Finish**.

The final component actually constructs the fill slope in the template. It will be made a child of the guardrail widening component so that it displays only when the guardrail widening component is displayed.

- 63. **<R>** in the Template View and select **Add New Component > Constrained**
- 64. Key in *Fill_2_to_1* for the *Name*.
- 65. Set the *Style* to **D_Toe-of-Fill**.

- 66. **<D>** on the **Breakpoint** point.
- 67. **<D>** on the *Toe-of-Fill_3* point.
- 68. **<R>** and select **Finish.**
- 69. **<D> <D>** on the **Fill_2_to_1** component.
- 70. Set the Parent Component to HMA_GRAIL-Widening_Normal_6ff-Shoulder.
- 71. **<D> Apply**.
- 72. <D> Close.
- 73. **<D> Test**.
- 74. **<D> Draw**. Notice that when the **Z-Slope_12_6_to_1** component disappears the guardrail component and its children are shown.

Chapter Summary:

- All four exercises used the drag and drop method to add components to a section.
- In *Lab 9.2 -Build an End Condition Section*, the special properties of end condition components were illustrated. Setting the end condition priority determines the processing order of end condition components.
- Lab 9.3 -Using Parent Components and Lab 9.4 -Using Display Rules built sections from new and existing components. A variety of methods can be used to put data into a template.
- Lab 9.3 -Using Parent Components and Lab 9.4 -Using Display Rules used the parent/ child relationship between components to display the proper solution. This groups components so that if the parent is displayed then the children are also displayed.
- In *Lab 9.4 -Using Display Rules* display rules were created to turn on and off components that are not part of the solution. Display Rules set criteria used to determine if a component will be displayed.

LAB 10 - Modifying Templates

This lab demonstrates how to modify existing templates by changing point constraints, deleting existing components and adding new ones.

Chapter Objectives:

- Modify pavement lift thickness.
- Add a sub-base component to the template.
- Add an additional lane to one side of a template.
- Add a median barrier to a divided highway template.

Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\ Preferences\CDOT_Civil.xin
- C:\Projects\12345\Design\InRoads\DES12345_Templates.itl (This file was modified in Lab 1)

Lab 10.1 - Modify pavement lift thickness

This exercise demonstrates how to modify point constraints in order to change the lift thickness on an existing template. The HMA_Crowned_B10 template from the template library will be modified so that the bottom lift of asphalt will be 4 inches thick.

- 1. Open the *Create Template* dialog box.
- 2. **<D> <D>** on the root folder and expand the **1–** *Templates* folder.
- 3. **<D> <D>** on the **HMA_Crowned_B10** template.
- 4. **<D> <D> on the ABC_Centerline-Top** point to display the Point Properties dialog box.

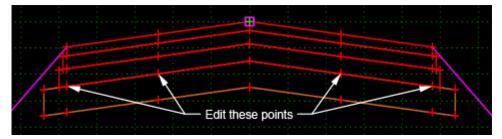
1							-
						the second s	
	and the second s		Delet			and the second se	
		<u> </u>	Point				
			Name	: ABC_Center	fine-Top		
			Style:	Centerline			
			Officer	0.00			
			Offset	: 0.00			
			Elevat	ion: -0.67			
			Const	raints:			
			Marin Marin	Internet			
1 A A A A A A A A A A A A A A A A A A A			PROFIL	conical			
			Verti	cal			

- 5. Key in **-0.33** for the *Value* of the *Vertical* constraint.
- 6. **<D>** Apply.

7. **<D> Close**.

Point Properties	X
Name:	ABC_Centerline-Top 👻 🔶 Apply
Use Feature Name Override:	ABC_Centerline-Top Close
Surface Feature Style:	Centerline
Alternate Surface:	▼ Next >
	Member of:
	ABC HMA_Lift3
Constraints Constraint	: 1 Constraint 2
Type: Horizontal	▼ Vertical ▼
Parent 1: HMA_Lift3_Cer	nterlin 🔻 🕂 HMA_Lift3_Centerlin 💌 🕈
Value: 0.00	= -0.33
Label:	• •
Style Constraint:	V
Horizontal Overtical	OBoth Range: 0.00

- 8. Repeat steps 4 through 7 for the following points:
 - ◆ RT_ABC_Laneline-Top
 - ◆ RT_ABC_Hinge-Top
 - ◆ LT_ABC_Laneline-Top
 - ◆ LT_ABC_Hinge-Top



Note: The two outside points (HMA_Lift3_EOP-Bottom and ABC_EOP-Top) do not need to be modified. This is because they are built with Vector/Offset constraints which keeps them in line with the other points on that row.

Lab 10.2 - Add a sub-base component to the template

This exercise show how to add and modify a component to an existing template in order to add a sub-base component to the bottom of the HMA_Crowned_B10 template used above. The sub-base will be added as a new component instead of using one from the library in order to minimize the amount of editing.

1. **<D> <D>** on the **HMA_Crowned_B10** template (if it is not already displayed).

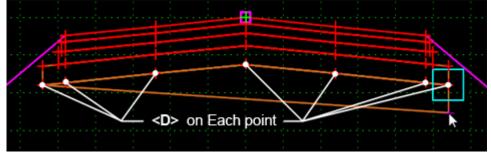
Add New Component	+	Simple
Template Documentation Link		Constrained
Check Point Connectivity		Unconstrained
Delete Components		Null Point
Change Template Origin		End Condition
Delete Constraints from All Points		Overlay/Stripping
Set Dynamic Origin	Ctrl-D	

2. **<R>** in the template view and select **New Component > Constrained** from the menu.

- 3. Key in *SubBase_2 ft* in the *Name* field.
- 4. Set the *Style* to **D_SUBBASE**.

		+-+++	မ်ားစလက်•	•
Current Co	mponent		-	
Name: Su	ubBase_2ft		Style:	D_SUBBASE -
			-	

- 5. Starting at the left, **<D>** on the points across the bottom of the ABC component.
- 6. After placing the first point, **<R>** and verify that *Closed Shape* is checked on.



The next steps build the bottom of the subbase. The points are placed in the approximate location. There final position is set by editing the point constraints.

- 7. Place a point approximately below each of the points just entered, working back from right to left.
- 8. **<R>** in the template view and select **Finish** from the menu.
- 9. **<D> <D>** on the lower left corner of the new sub-base component.
- 10. In the *Point Properties* dialog box, change the *Name* to *LT_SubBase_EOP-Bottom*.
 - **Note:** The name is the same as the point above it, except that the word Top is replaced with the word Bottom.

- 11. Set the *Parent 1* for both constraints to the point directly above (in this case LT_SubBase_EOP-Top).
- 12. Key in **0** for the *Horizontal* constraint value.
- 13. Key in **-2** for the *Vertical* constraint value.
- 14. **<D> Apply**.
- 15. **<D> Close**.

🕌 Point Properties	
Name:	LT_SubBase_EOP-E 🚽 💠 Apply
🔲 Use Feature Name Override:	6 Close
Surface Feature Style:	D_EOP
Alternate Surface:	
	Next >
	Member of:
	SubBase_2 ft
a	
Constraints Constraint	1 Constraint 2
Type: Horizontal	▼ Vertical ▼
Parent 1: LT_SubBase_E	OP-1 ▼ + LT_SubBase_EOP-1 ▼ +
Value: 0.00	= -2.00 =
Label:	• •
Style Constraint:	Ŧ
Horizontal O Vertical	◯ Both Range: 0.00

16. Repeat steps 8 through 14 for the remaining points across the bottom of the sub-base component.

The finished template is illustrated below:

1-11		 	
	÷ , ÷	:	
+			

Lab 10.3 - Add an Additional Lane to One Side of a Template

This exercise demonstrates how to add new components to an existing template in order to add an addition travel lane. Using the template HMA_Urban_4Lane from the template library, the right curb, ABC, and End Conditions will be deleted and a new lane with curb and gutter will be added.

- 1. **<D> <D>** on the **HMA_Urban_4Lane** template.
- 2. Toggle on *Display All Components*.

 Display Omponents 	Constraints				
V Display Point Names					
Display All Components					

Affixes are used so that point names added to the template are updated to reflect their location with respect to the control line.

- 3. Select **Tools > Options** from the *Create Template* menu bar.
- 4. Toggle on Apply Affixes.

5. **<D>OK**.

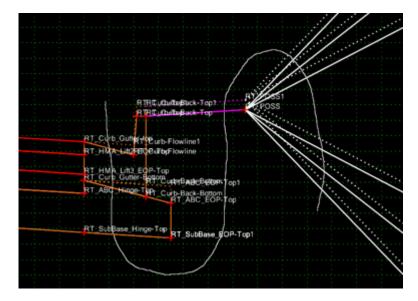
Template Options	— ×
Naming Options Component Seed Name:	OK
From Style	Cancel
© Specify:	Preferences
Point Seed Name:	Help
Apply Affixes	
Prefix Suffix Left: LT_	
Right: RT_	
Step Options	
X: 0.10 Y: 0.10 Slope	.000%

The existing curb and gutter on the right side of the template and its ABC component must be removed from the template to make room for the new lane.

6. **<R>** in the template view and select **Delete Components** from the menu.

Add New Component	۱.
Template Documentation Link	
Check Point Connectivity	
Delete Components	
Change Template Origin Delete Constraints from All Points	
Set Dynamic Origin	Ctrl-D

7. **<D> and hold**, then draw a line through the curb, sub-base, and end conditions components on the right side of the template as shown below. Release the mouse button to complete the delete.



The exposed points still have names used by the curb and gutter component. These must be changed to reflect the new role of the point.

- 8. Rename the points at the right end of the template as follows:
 - *RT_HMA_Lift1_Laneline-Top1*
 - *RT_HMA_Lift2_Laneline-Top1*
 - *RT_HMA_Lift3_Laneline-Top1*
 - *RT_ABC_Laneline-Top1*

The template library contains a three lift asphalt driving lane section with curb and gutter attached. Use this section to complete the backbone of the template.

- 9. Expand the **2** Sections Pavement > Curb & Gutter Sections folder in the template library explorer.
- 10. **<D>** on the **C/G_Type2-IIB** section.
- 11. **<D> and Hold** on the section's origin in the *Preview* window.

		· · · · · · · · · · · · · · · · · · ·
RT_HMA_Lift1_Laneline-Top RT_HMA_Lift2_Laneline-Top	HMA Lift1 Laneline-Top1	++
RT_HMA_Lift3_Laneline-Top	HMA_Lift1_Laneline-Top1 HMA_Lift2_Laneline-Top1	
RT_ABC_Laneline-Top	RT_HMA_Lift3_Laneline-Top1	
RT_SubBase_Laneline-Top	RT_ABC_Laneline-Top1	

12. Drag and Drop the section onto the RT_HMA_Lift1_Laneline-Top1 point.

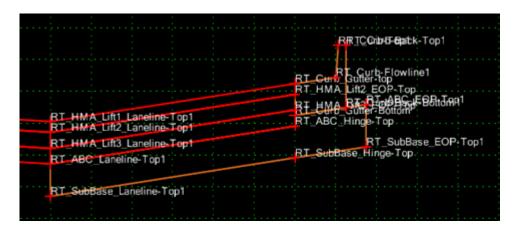
The new section that was added accommodates a design decision on when to generate a gutter with a normal slope and when to generate the gutter with a slope to match the driving lanes. This section has two curb components. Therefore, two end condition sections are required, one attached to each curb. These next steps show how to modify the criteria for the design decision.

- 13. Zoom in on the right curb components, there are two (one is shown with dotted lines).
- 14. **<D> <D>** on the **RT_Curb_Gutter-top** point.
- 15. Change the *Slope* constraint *Value* to *5.00%*. This is done so that hidden (dotted) curb component is displayed. It will also allow the points to merge as desired in the following steps.

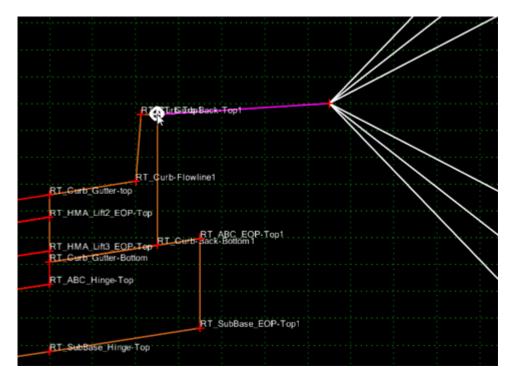
Constraint	S			
	Constraint 1		Constraint 2	
Type:	Horizontal	-	Slope 👻	
Parent 1:	RT_HMA_Lift1_Lan	• +	RT_HMA_Lift1_Lan 💌	₽
			Rollover Values	
Value:	12.00		5.00%	
Label:	Curb_Gutter-top-Hori	-	Curb_Gutter-top-Slop 👻	

16. **<D> Apply**.

17. **<D> Close**.



- Expand the *3 Sections End Conditions > Curb & Gutter Sections* folder in the template library explorer.
- 19. **<D>** on the **Bench_4_6_to_1** section to display it in the Preview window.
- 20. **<D> and Hold** on the section's origin in the *Preview* window.
- 21. Drag and Drop the section on to the RT_Curb_Back-Top1 point.



- 22. **<D> <D>** on the **RT_Benching** component that was just placed.
- 23. Set the *Parent Component* to **RT_C/G_Type2-IIB1**.
- 24. **<D> Apply**.

25. **<D> Close**.

		Poss			
RT (Rith Cint Post T	Component Pro	perties			1
	Name: Description:	RT_Benching	+	Apply Close	
RT_Curb-Flowline1	Style: Parent Component:	D_SHOULDER-Emb Close Shape RT_C/G_Type2-IIB		< Previous Next >	/
Tap	Display Rules:	gulation	Edit	Help	

- 26. **<D> <D> on the RT_Curb_Gutter-top** point.
- 27. Change the *Slope* constraint *Value* to *-2.00%*. This is done so that the hidden (dotted) curb component is displayed. It will also allow the points to merge as desired in the following steps.
- 28. **<D> Apply**.
- 29. **<D> Close**.
- 30. **<D> and Hold** on the **Bench_4_6_to_1** section's origin in the *Preview* window.
- 31. Drag and Drop the section on to the *RT_Curb_Back-Top* point.

					RT100s
	RT Cuffett Gode				PTOSS1
	RT_Curb-Flowline1				\sim
N-Top	RT_Curb-Flowline				
∿-Top ≋om					
		Back-Bottom			
			C_ECP-Top		

- 32. **<D> <D>** on the **RT_Benching1** component that was just placed.
- 33. Set the Parent Component to RT_C/G_Type2-IIB.
- 34. **<D> Apply**.
- 35. **<D> Close**.

Note: Applying the Parent Component settings to the Benching components will make the proper end condition display based on the pavement cross slope.

Finally, the missing ABC component is added under the new driving lane.

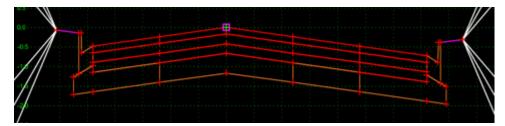
- 36. Expand the *4 Components* > *Aggregate Bases* > *Driving Lanes* folder in the template library explorer.
- 37. **<D>** on the **ABC_Lane** component to display it in the Preview window.
- 38. **<D> and Hold** on the section's origin in the *Preview* window.
- 39. Drag and Drop the section on to the *RT_ABC_Laneline-Top* point.

RT_HMA_Lift1_Laneline-Top RT_HMA_Lift2_Laneline-Top		 	 	-	PT	ниа	Lift1 Lanelin	e Tool
RT_HMA_Lift3_Laneline-Top			••••		The second second		Lift2 Lanelin	
T ABC Laneline Top					RT	нма	Lift3_Lanelin	e-Top1
	1	 	 		RT	ABC	aneline-Top	51
RT_SubBase_Laneline-Top								
		 	 		RT	SubBa	se_Laneline	Top1

40. **<R>** on the vertical line between *RT_ABC_Laneline-Top* and *RT_SubBase_Laneline-Top* and select **Merge Components** from the menu.

RT RT	_HMA_Lift1_Laneline-Top _HMA_Lift2_Laneline-Top _HMA_Lift3_Laneline-Top _ABC_Laneline-Top	
	Add New Component Template Documentation Link Check Point Connectivity Delete Components Change Template Origin Delete Constraints from All Points Edit Component	•
	Insert point Add Point Merge Components	
	Unmerge Component Points Set Component Display Rules Delete Component Set Dynamic Origin	Ctrl-D

The finished template is illustrated below:

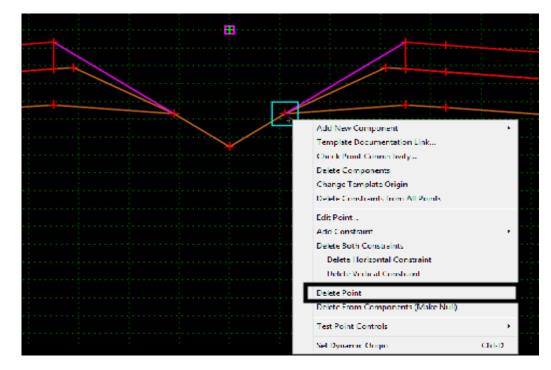


Lab 10.4 - Add a Median Barrier to a Divided Highway Template

In order to add a median barrier to the CONC_Divided_TypeA_4Lane template, the slope components will be deleted, the ABC components will be modified, a Guardrail_Type 7-CE component will be added, and the pavements will be tied to the barrier.

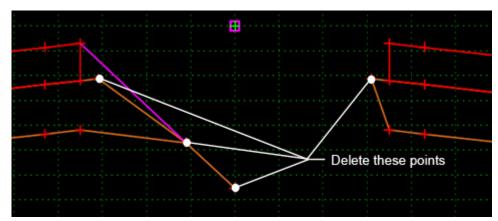
To start the process, the points that define the median ditch are deleted, removing the ditch from the template.

1. **<D> <D> on the CONC_Divided_TypeA_4Lane** template.



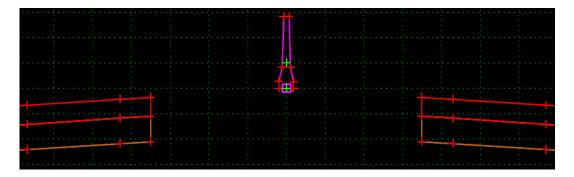
2. <R> on the RT_Median_POSS point and select Delete Point.

- 3. In the **Delete Point** dialog box, **<D> All.**
- 4. **<D> OK**. This deletes the point from *RT_SubBase_Shoulder* and deletes the *Z-Slope_12_6_to_12* and *RT_Median* components.
- 5. **<R>** on the **RT_Inside_SubBase_EOP-Top2** point and select **Delete Point**.
- 6. Using the same method as the steps above, delete the following points:
 - ♦ LT_Median_POSS
 - ◆ LT_SubBase_EOP-Top
 - ♦ Median_Flowline



Place a Type-7 barrier in the template. In this case, the center bottom of the barrier is placed on the template origin.

- Toggle off Apply Affixes (either on the *Dynamic Settings* dialog or from *Tools* > *Options*).
- 8. Expand the **4 Components** > **Barriers & Misc Components** > **Guardrail Type 7** folder in the template library explorer.
- 9. **<D>** on the **Guardrail_Type 7-CE** component to highlight it; do not make it active.
- 10. In the *Preview* window, **<D> and Hold** on the component's *Insertion Point* (The green + sign in the middle of the barrier).
- 11. **Drag and Drop** the component to the template's origin.



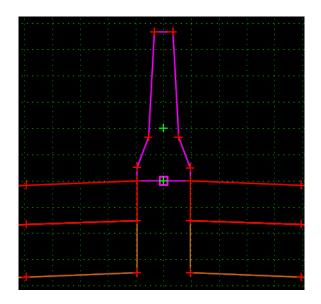
Now the pavement edges need to be attached to the barrier. This is done by modifying the constraints for the those points.

- 12. **<D> <D>** on the point **RT_Inside_Conc_EOP-Top**.
- 13. Set the *Parent 1* for both constraints to **RT_Connect**.
- 14. Key in **O** for the **Value** of both constraints.
- 15. **<D> Apply**.

16. **<D> Close**.

Point Pio	perties			×
Name:		RT_Inside_Co	onc_EC 👻 🔶	Apply
🔲 Use Featu	ure Name Override:	RT_Inside_Co	onc_EOP-1	Close
Surface Feat	ure Style:	D_EOP		< Previous
Alternate Surf	ace:			
				Next >
		Member		Help
Constraints			NC_Pvmt_Lane-La	yoi
CONSUMITIES	Constraint	1	Constraint 2	
Туре:	Horizontal		Slope	
Type: Parent 1:	Horizontal RT_Connect	• • +	Slope RT_Connect	• • +
	Tionzonita	▼ ▼ +		• • +
	Tionzonita	• • •	RT_Connect	• • +
Parent 1:	RT_Connect		RT_Connect	• •
Parent 1: Value:	RT_Connect 0.00 RT_Inside_EOF		RT_Connect	• •

17. Repeat steps 12 through 15 for point LT_Inside_Conc_EOP-Top using LT_Connect as the *Parent 1* point.



18. Zoom in to the area under the barrier.

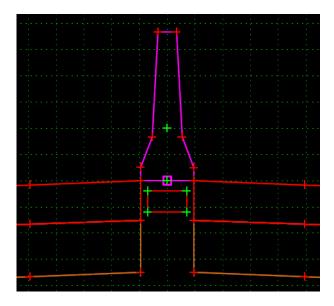
The next series of steps places a concrete component under the barrier. This component is placed independent of other points in the template. It is then constrained so that it will move with the barrier.

- 19. **<R>** and select Add New Component **>** Unconstrained.
- 20. Key in *CONC_Under_ Barrier* for the component *Name*.

21. Select **D_CONC_Pvmt** for the *Style*.

	╡╋┙╕╬╡		
	Component		
Name:	CONC_Under_Barrier	Style:	D_CONC_Pvmt

- 22. In the Dynamic Settings dialog box, key in *RT_ CONC_Under_Barrier-Top* for the *Point Name.*
- 23. **<D>** under the right edge of the barrier but not on any existing point or component.
- 24. In the Dynamic Settings dialog box, key in *RT_ ABC_Under_Barrier-Top* for the *Point Name.*
- 25. **<D>** below the **RT**_ *CONC_Under_Barrier-Top* point that was just placed.
- 26. In the Dynamic Settings dialog box, key in *LT_ABC_Under_Barrier-Top* for the *Point Name.*
- 27. **<D>** to the left of the point that was just placed.
- In the Dynamic Settings dialog box, key in *LT_ CONC_Under_Barrier-Top* for the *Point Name.*
- 29. **<D>** above the point that was just placed.
- 30. **<R>** and select **Finish**.



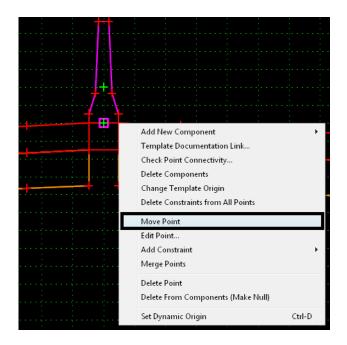
- 31. **<D> <D>** on the **RT_ CONC_Under_Barrier-Top** point.
- 32. Set the *Constraint 1 Type* to Horizontal.
- 33. Set the *Constraint 2 Type* to Vertical.

- 34. Set the *Constraint 1 Parent 1* to **RT_Barrier-Bottom**.
- 35. Set the *Constraint 2 Parent 1* to **RT_Barrier-Bottom**.
- 36. Key in **O** for the **Value** of both constraints.
- 37. **<D> Apply**.
- 38. **<D> Close**.

🚰 Point Properties	
Name:	RT_CONC_Under_E 👻 🔶 Apply
Use Feature Name Ov	remide: RT_CONC_Under_Barriv Close
Surface Feature Style:	D_CONC_Pvmt
Alternate Surface:	▼ Next >
	Member of:
	CONC_Under_Barrier
Constraints	nstraint 1 Constraint 2
Type: Horizonta	
Parent 1: RT_Con	nect 🔻 🕈 RT_Barrier-Bottom 🔻 🕈
Value: 0.00	= 0.00
Label:	
Style Constraint:	
Horizontal O V	ertical 🔘 Both Range: 0.00

- 39. **<D> <D> on the LT_ CONC_Under_Barrier-Top** point.
- 40. Set the *Constraint 1 Type* to Horizontal.
- 41. Set the *Constraint 2 Type* to Vertical.
- 42. Set the *Constraint 1 Parent 1* to LT_Barrier-Bottom.
- 43. Set the *Constraint 2 Parent 1* to LT_Barrier-Bottom.
- 44. Key in **O** for the **Value** of both constraints.
- 45. **<D> Apply**.
- 46. **<D> Close**.
- 47. **<D> <D> on the RT_ ABC_Under_Barrier-Top** point.
- 48. Set the *Constraint 1 Type* to Horizontal.

- 49. Set the *Constraint 2 Type* to Vertical.
- 50. Set the Parent 1 to RT_ CONC_Under_Barrier-Top for both constraints.
- 51. Key in **O** for the **Value** of the **Horizontal** constraint.
- 52. Key in -0.75 for the Value of the Vertical constraint.
- 53. **<D> Apply**.
- 54. **<D> Close**.
- 55. **<D> <D>** on the **LT_ ABC_Under_Barrier-Top** point.
- 56. Set the *Constraint 1 Type* to Horizontal.
- 57. Set the *Constraint 2 Type* to Vertical.
- 58. Set the Parent 1 to LT_ CONC_Under_Barrier-Top for both constraints.
- 59. Key in *O* for the *Value* of the *Horizontal* constraint.
- 60. Key in -0.75 for the Value of the Vertical constraint.
- 61. **<D> Apply**.
- 62. **<D> Close**.



63. **<R>** on the **RT_Connect** point and select **Move Point**.

64. **<D>** on **RT_V_Control** in the box that pops up listing all available points at this location.

Point Selection	Point Selection
RT_V_Control	RT_Inside_Conc_EOP-Top
RT_Connect VS	
RT_CONC_Under_Barrier-Top	
RT_Barrier-Bottom	

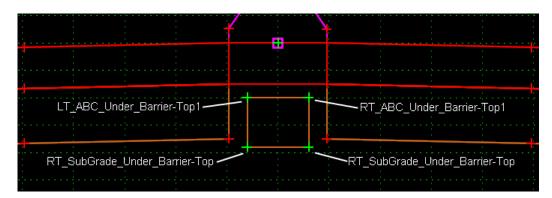
- *Note:* If more than four points are available, **<ESC>** on your keyboard pages down in the list.
- 65. Move the pointer up and down and notice how the components behave.
- 66. $<\mathbf{R}>$ to end the Move command

- **Note:** This barrier has both a variable height *and* a variable width. If the height is 34" or less, the base is 23" wide. As the height increases above 34" the base varies from 23" to a maximum of 26.75". The maximum height is 40".
- *Important!* Since the barrier width is variable, the adjacent shoulder, lanes, etc. are 'pushed out' as the barrier widens. A decision must be made if this is acceptable, or if you want another solution, such as varying the width of the shoulder to accommodate the widened barrier. If so, change the Parent of the Horizontal Constraint on the inside shoulder point to the V_Control point. Since it does not widen with the barrier, the shoulder will be variable width. The maximum variation is 3.75".

An ABC component can be added under the barrier in a similar manner to the concrete component described above.

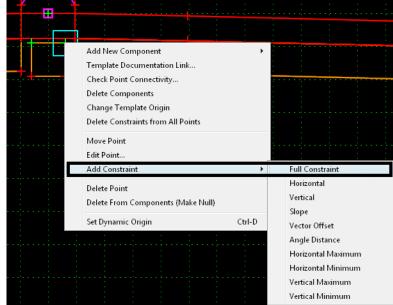
- 67. **<R>** and select **Add New Component > Unconstrained**.
- 68. Key in *ABC_Under_ Barrier* for the component *Name*.

69. Select **D_ABC_Class 6** for the *Style*.



- 70. In the Dynamic Settings dialog box, key in *RT_ ABC_Under_Barrier-Top1* for the *Point Name.*
- 71. **<D>** under the right edge of the component just added but not on any existing point or component.
- 72. Continue adding the other three points (as was done with the concrete component) Naming them:
 - RT_SubGrade_Under_Barrier-Top
 - LT_ SubGrade_Under_Barrier-Top
 - LT_ ABC_Under_Barrier-Top1
- 73. **<R>** and select **Finish**.
- 74. **<D> <D> on RT_ SubGrade_Under_Barrier-Top.**
- 75. Set the Parent 1 to *RT_ ABC_Under_Barrier-Top1* on both constraints.
- 76. Key in **O** for the **Value** of the **Horizontal** constraint.
- 77. Key in 1.00 for the Value of the Vertical constraint.
- 78. **<D> Apply**.
- 79. **<D> Close**.
- 80. Repeat steps 71 through 76 for *LT_SubGrade_Under_Barrier-Top*, using *LT_ABC_Under_Barrier-Top1* as the *Parent 1* point.

81. <R> on the RT_ ABC_Under_Barrier-Top1 point and select Add Constraint > Full Constraint.

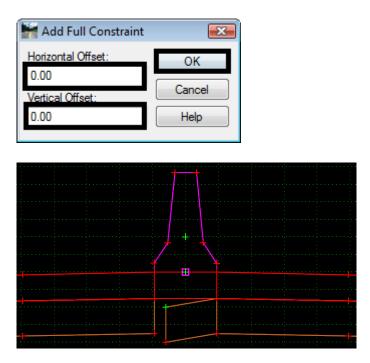


- 82. **<D>** on the **RT_ ABC_Under_Barrier-Top.**
- 83. **<D>** on **RT_ABC_Under_Barrier-Top** on the *Point Selection* dialog box.

Point Selection
RT_ABC_Under_Barrier-Top
SubBase_Hinge-Top

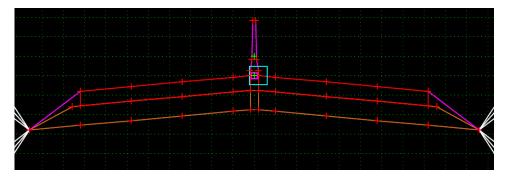
84. In the *Add Full Constraint* dialog box, key in *O* for both offsets.

85. **<D> OK**.



86. Repeat steps 79 through 82 for the point LT_ ABC_Under_Barrier-Top1, selecting point LT_ ABC_Under_Barrier-Top in the *Point Selection* dialog box.

The template is now completed.



Chapter Summary:

- In some cases, only minor alterations can change a standard template into a project specific one. In *Lab 10.1 -Modify pavement lift thickness* point constraints were changed to modify the thickness of a pavement lift.
- Other minor modifications include the addition of components. In *Lab 10.2 -Add a sub-base component to the template* a new component was created to add a sub-base component to the template.
- There are some case when major modifications can be made to an existing template. In *Lab* 10.3 -Add an Additional Lane to One Side of a Template components were deleted from an existing template and new components were added from the template library to add an additional lane to one side of a template.
- Editing a template does not always require deleting and/or adding whole components. Sometimes the desired results can be achieved working with the points on components. In *Lab 10.4 -Add a Median Barrier to a Divided Highway Template* components and specific component points were deleted, new components from the library and ones built from scratch were added and point constraints were modified to add a median barrier to a divided highway template.

LAB 11 - Corridors and Template Drops

This lab demonstrates the initial procedures used when starting Roadway Designer. The exercises below define the path and cross section for the design model and determine what information is displayed in the Roadway Designer views.

Chapter Objectives:

- Create a corridor using a horizontal and vertical alignment
- Develop initial template drops
- Generate additional template drop details

Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\ Preferences\CDOT_Civil.xin
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\12345DES Geometry.alg
- C:\Projects\12345\Design\InRoads\DES12345 Templates.itl

Lab 11.1 - Create a Corridor

The first step in creating a design model is to create a corridor. The corridor defines where the model is located, both horizontally and vertically. The corridor in this example runs the total length of the alignment so no station limits are needed.

- 1. Select the **Geometry** tab in the *InRoads Explorer*.
- 2. <R> Geometry Projects, select Open, and select the 12345DES_Geometry.alg file from the \12345\Design\InRoads directory.

🚔 Bentley InRoads V8i (SELE	CTseries 2)					
<u>File S</u> urface <u>G</u> eometry <u>D</u> r	ainage <u>E</u> valuation <u>M</u> odeler Site Modeler Dr <u>a</u> fting <u>Q</u> uantiti	es <u>T</u> ools <u>H</u> elp				
<unnamed></unnamed>	- Te 📚 🤞 🖊 🏏 🧮 🖅 🐜 🗉 Te					
	Geometry Proj Description File Nat	me By WI				
		cferre				
🕂 📄 Default	New					
	Open					
	Active					
	Close All					
	Empty All					
器 Geometry M Preference + > + # #						
Toggles the Feature Filter Lock						

- 3. Verify that *SH 86* is the active horizontal alignment and *SH 86 V* is the active vertical alignment.
- 4. Select **Modeler > Roadway Designer** from the InRoads menu bar.

5. Select **Corridor > Corridor Management** from the Roadway Designer menu bar or

 Roadway Designer

 File
 Corridor
 Superelevation
 Tools
 Overlay Tools

 Image: Corridor Management...
 Corridor Management...
 Template Drops...
 Image: Corridor Management...

 Image: Corridor Management...
 Template Drops...
 Image: Corridor Management...
 Image: Corridor Management...

 Image: Corridor Management...
 Template Drops...
 Image: Corridor Management...
 Image: Corridor Management...

 Image: Corridor Management...
 Point Controls...
 Image: Corridor Management...
 Image: Corridor Management...

 Image: Corridor Management...
 End Condition Exceptions...
 Image: Corridor Management...
 Image: Corridor Management...

 Image: Corridor Management...
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 Image: Corridor Management...
 Image: Corridor Management....

<D> the corridor management button

- 6. In the *Manage Corridors* dialog box, key in *12345DES* in the *Name* field.
- 7. Select **D_Finished-Grade** for the *Surface Symbology*.
- 8. **<D> Add**.
- 9. **<D> Close**.

Manage Corridors					- • •
Name: 12345DES			Limits		Add
Surface Symbology:	D_Finished-Grad	de 🔻	Start:		Close
Туре:	Alignment	•	203+80.28	-	Change
Horizontal Alignment:	SH 86	•	Stop:	_	Сору
Vertical Alignment:	SH 86 V	-	260+43.16	+	Copy From
PI Rounding Tangent:	0.00				
Corridors:					Help
Name T	ype	Source Name	Start Station	Stop	Station
					Delete
					/

Note: By default, the **Type** is set to **Alignment** and the **Horizontal Alignment** and **Vertical Alignment** are set to the active alignments, though any alignment can be selected. Notice that data is now displayed in the Roadway Designer views.

Lab 11.2 - Develop Initial Template Drops

Design model cross sections are developed by applying templates along a corridor. A template drop needs to be defined at any location where the cross section of the corridor changes. Template drops are assigned to the corridor through the Template Drops dialog box. This exercise uses a single template drop that runs the entire length of the corridor. The starting station for the template drop defaults to the beginning of the alignment. Therefore, all that needs to be done is to select the desired template and set the interval.

1. Select **Corridor > Template Drops** from the Roadway Designer menu bar or **<D>** the

template drops button 🗮.

🖌 Roadway Designer -					
File	Corridor Superelevation Tools Overlay Tools				
	Co	rridor Management			
	Te	mplate Drops			
	Po	int Controls			
	En	d Condition Exceptions			
	Dis	splay References			
	Se	condary Alignments			
	Ke	y Stations			
	Cre	eate Surface			

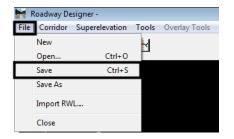
- 2. In the *Template Drops* dialog box, key in *25* for the *Interval*.
- 3. Expand the **1- Templates** folder in the *Library Templates* area. of the *Template Drops* dialog box.
- 4. **<D>** on the **HMA_Crowned_B10** template.
- 5. **<D> Add**.

6. **<D> Close**.

Templat	e Drops			- • •
Comidor:	2345DES	-		Add
Station:	03+80.28	+		Close
Interval:	5.00	+		Change
Library Temp	lates:			Copy
1	CONC_Danied		-	1
	HMA_Crowned HMA_Ful_Dep HMA_Ful_Dep HMA_Urban_4 Sections - Paver Sections - End (Typer-4Lane th_Widening_2Lane Lane ment		
() (2·	HMA_DV0000_ HMA_Ful_Dep HMA_Urban_4 Sections - Pave Sections - End (Typer-4Lane th_Widening_2Lane Lane ment	-	
2- 2-	HMA_DV0000_ HMA_Ful_Dep HMA_Urban_4 Sections - Pave Sections - End (Typer-4Lane th_Widening_2Lane Lane ment	Revised In	Lbray
2- Current Tem	HMA_Full_Dep HMA_Full_Dep HMA_Urban_4 Sections - Pave Sections - End (plate Drops:	Typer_4Lane th_Widening_2Lane Lane ment Conditione	~	Lbrary C:\Projects\12345
2 - 2 - 2 - 3 Current Tem Station	HMA_EVII_Dep HMA_FuII_Dep HMA_Urban_4 Sections - Pave Sections - End (plate Drops: Interval	Typer_4Lane th_Widening_2Lane Lane ment Conditione Template	Revised In	A CONTRACTOR OF THE OWNER OF THE

This is a good spot to save the roadway designer (IRD) file.

7. Select **File > Save** from the Roadway Designer menu bar.



- 8. Verify that the file is being saved to the directory C:\Projects\12345\Design\InRoads\.
- 9. In the *File name* field, key in *12345DES.ird*.

🚔 Save As				×
Save in:	퉬 InRoads	•	G 🤌 📂 🎞 -	
(Ha	Name	Date modified	Туре	Size
Recent Places	🐌 Lab - Interchange Data 🐌 Lab - Intersections Data	8/24/2009 4:13 PM 8/24/2009 4:13 PM	File Folder File Folder	
	Combined Surfaces.ird	8/3/2009 7:17 AM	IRD File	13
Desktop				
Chris Ferree				
Computer				_
	•	III		•
Network	File name: 12345DES.in	rd		Save
	Save as type: Roadway De	esign (*.ird)		Cancel
				Help
			0	ptions

10. **<D> Save** then **<D> Cancel**.

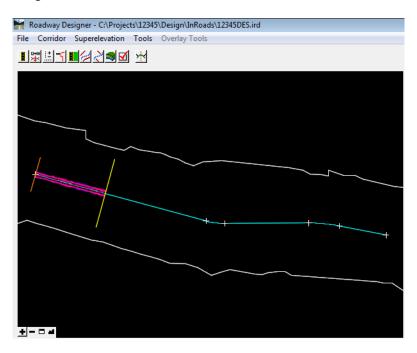
The template data is displayed in the cross section view of the Roadway Design. Notice, in the template view of the Roadway Designer, that the end conditions have already been solved.

There are two options for scrolling through the design, 1) using the station arrows below the template view and 2) using the station line in the plan view.

11. To navigate to a specific station **<D>** on the station arrows to scroll through the stations or type in the station to review.

+-44+	-1 🗆 🖬	+-□▲ <	-40 -20		Þ
Corridor:	12345DES 👻	Station:	< 203+80.28		Process All
Active Surface:	12345 existing ground 🔹 🖃	Interval:	25.00	lis [Process Visible Range
		Template:	HMA_Crowned_B10	Display Mode:	Normal
					 Superelevation Overlay

 To get a quick overview of how the template is working through the corridor, <D> and Hold on the yellow station line. Move the pointer back and forth to scroll through the design.



The model is now ready to be evaluated.

Lab 11.3 - Generate Additional Details for Template Drops

Between the regular station intervals defined by a template drop, design data is generated using straight line interpolation. In order to generate precise data at "stations of interest" other than a regular station (i.e. stations for drainage structures), those stations need to be identified as an *Event Points* and then processed using the Roadway Designer. Other standard "stations of interest" that are usually not at regular station intervals are *Cardinal Points*.

The Roadway Designer Options dialog box determines which of the "stations of interest" get processed and what information is added to the template view window. The data generated by the Roadway Designer options provides the designer additional real time information that is useful in the evaluation and analysis of the proposed design.

This exercise will demonstrate several of the options including:

- Processing cardinal and event points
- Displaying cut and fill information
- and Generating a report of component and point information.

The first series of steps tell the Roadway Designer to process the horizontal cardinal and event points.

- 1. From the Roadway Designer menu bar, select **Tools > Options**.
- 2. In the *Roadway Designer Options* dialog box, toggle on Horizontal Cardinal Points and Horizontal Event Points.

3. **<D>OK**.

Roadway Designer Options	X
Include Critical Sections	ок
Vertical Cardinal Points	Cancel
Horizontal Event Points	Preferences
Vertical Event Points	Help
External Control Points	
Display Reference Graphics	Superelevation Display
Transition Graphics	Station Result Reporting Options
Triangulated Surface	End Condition Failures
Cut and Fill Graphics	Display Rule Values
Cut and Fill Values	Point Control Usage
Net Volume	Component Information
Null Points	Point Information
Curve Set ID	
Cardinal Points	
Cross Section Tracking	Process Aliases Automatically

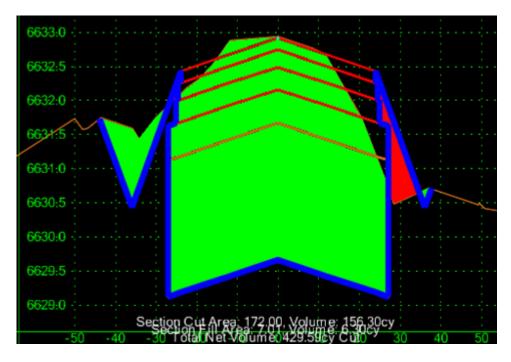
4. Scroll through the stations and notice that some stations do not fall on even intervals. These are the cardinal and event points.

+	1 🖬 🗧	
<u>k <</u>	204+49.33	+ K <
	25.00	
	HMA_Crowned_B10	

The following series of steps adds volume information to the template view of the Roadway Designer.

- 5. Open the *Roadway Designer Options* dialog box again.
- 6. Toggle on Cut and Fill Graphics, Cut and Fill Values, and Net Volume.

7. **<D>OK**.



8. Scroll through the stations and notice that Cut and Fill areas are shown graphically and areas and volumes are shown in text format at the bottom of the template view.

The final series of steps illustrates what is included in the default processing report and shows what information can be added to the report.

9. **<D>** the **Process All** button.

+				+
Station: K	215+25.00	+ < <	E	Process All
Interval:	25.00]		Process Visible Range
Template:	HMA_Crowned_B10]	Display Mode:	Normal
				Superelevation
				Overlay
				h

- 10. This displays the *Results* dialog box. Some of the information displayed includes:
 - Stations where end conditions failed to intercept their target
 - Results of display rule calculations, and
 - Which point controls were used for each station processed.

This information should be used to determine problems areas of the model and what modifications should be made to the template or corridor controls.

Roadway Designer Results			1	Close Save As
Station: 203+80.28				
oint Control Usage:	-	C		Append.
Point Mode	Туре	Controlled by	n l	Display
				Print
itation: 203+87.30				Help
oint Control Usage: oint Mode	Туре	Controlled by		

- 11. **<D> Close** on the *Result* dialog box.
- 12. Open the *Roadway Designer Options* dialog box again.
- 13. Toggle on Component Information and Point Information.
- 14. **<D> OK**.

http://www.commons.com/www.commons.com/www.commons.com/www.cow/www.com/www.com/www.com/www.com/www.com/www.com/www.com/www.com/www.com/www.co	•
Include Critical Sections Vertical Cardinal Points Vertical Cardinal Points Vertical Event Points Vertical Event Points External Control Points	OK Cancel Preferences Help
Display Carlot Reference Graphics Transition Graphics Triangulated Surface Cut and Fill Graphics Cut and Fill Values	Superelevation Display Key Station Lines Station Result Reporting Options End Condition Failures Display Rule Values Point Control Usage
Net Volume Null Points Curve Set ID V Cardinal Points Cross Section Tracking	Component Information Point Information Process Aliases Automatically

15. **<D>** the **Process All** button.

16. This report list detailed information about every component and point in the model. Like the previous report, this information can be used to help troubleshoot problems with templates and corridor controls.

Roadway Designer Results Station: 203+80.28 Point Control Usage:			-	Close Save As. Append.
Point Mode	Туре	Controlled by		Display
Components: Name	Displayed			Print
ABC HMA_Lift1 HMA_Lift2 HMA_Lift3 LT_Cut_6/1 LT_SubBase_2ft LT_Z-Slope_12_6_to_1 RT_Cut_6/1 RT_Z-Slope_12_6_to_1	True True True True True True True True	en diseus bien americas di		Help

- **Note:** The Results dialog box is limited to a report of up to approximately 16,000 lines. This equals about 220 template drops (about a mile at a 25' interval) when using the HMA_Crowned_B10 template.
- 17. **<D> Close** on the *Result* dialog box.
- 18. Select **File > Save** from the Roadway Designer menu bar.
- 19. In the *Save As* dialog box, key in *12345DES* for the file name.

20. **<D> Save**.

Save As		
Save in:)) InRoads	+ 🕲 🤌 🗁 🛄 +
(Piz)	Name	
Recent Places		No items match your search.
Desktop		
CDOT User		
Computer		
2	File name:	12345DES - Save
Network	Save as type:	Roadway Design (*.ird)
		Help
		Options

- 21. **<D> Cancel** to dismiss the *Save As* dialog box.
- 22. **<D> Close** to dismiss the Roadway Designer window.

Chapter Summary:

- A corridor defines the horizontal and vertical location of the design. In *Lab 11.1 Create a Corridor* a corridor was created using the active horizontal and vertical alignment.
- Templates define the prism of the project. These are processed at specific intervals along the corridor. In *Lab 11.2 -Develop Initial Template Drops* Template Drops for a two lane road template were added to the corridor.
- The options in Roadway Designer allow the user to see design evaluation information in real time. The user can also specify that geometry points are processed with template drops. In *Lab 11.3 Generate Additional Details for Template Drops* various settings for the Roadway Designer options were used to add specific stations for processing, display volume information in the designer's template view, and add more detail to the processing report.

LAB 12 - The Superelevation Wizard

This lab demonstrates the use of the Superelevation Wizard. The wizard is the easiest way to add superelevation to a corridor.

Chapter Objectives:

- Use the Superelevation Wizard to enter data into the corridor.
- Edit a Superelevation Control Line.

Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\ Preferences\CDOT_Civil.xin
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\12345DES Geometry.alg
- C:\Projects\12345\Design\InRoads\DES12345_Templates.itl

Lab 12.1 - Using the Superelevation Wizard

This lab uses the DES12345 corridor built in the previous lab. There are two main steps to using superelevation:

- Select the superelevation rate table and
- Calculate the rate for each curve
- 1. Select **Modeler > Roadway Designer** from the InRoads menu bar.
- 2. From the Roadway Designer dialog box, select **Superelevation > Create Super**elevation Wizard > Table from the menu bar. The Table Wizard is displayed.

🕌 Roadway Des	igner - C:\Projects\12345\Design\InRoads\12345DES.in	d .
File Corridor	Superelevation Tools Overlay Tools	
₩ ±	Create Superelevation Wizard	Table
	Create Single Control Line	AASHTO
	Apply Shoulder Rollover Lock	Fixed Length
	Import Superelevation from ASCII Import Superelevation from Alignment	6630
	Superelevation Report	6629

3. **<D>** the **Browse** button and select:

C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\Superelevation Tables\AASHTO 2004\06_55.sup.

4. **<D>** the **Load Values From Table** button. The superelevation table has been selected.

5. **<D> Next**.

Ger Tab	neral Superelevati ole: C:\Worksp % Runoff on Tar	ace\Workspace-		ards-Global\InRo rpolate Table Va	·
	Specify Runout: Non-Linear Curve ontal Curve Sets:	0.00		on Lengths Are: Runoff () To	tal Transition
ID	Start Station	Stop Station	Superelevati	Table	Design
1 2	231+75.30 248+08.02	234+72.97 252+90.13	6.00% 4.40%	06_55.sup 06_55.sup	0.00 0.00

On this screen the template points that define the superelevation range and pivot points are identified. It doesn't matter which station is active when these points are selected.

- 6. On the *Superelevation Section Definitions* dialog box, **<D> Add**. This displays the *Add Superelevation Section* dialog box.
- 7. **<D>** the target button for the *Crown Point*. Then **<D>** on the finish grade centerline point.
- 8. **<D>** the target button for the *Left Range Point*. Then **<D>** on the finish grade left edge of pavement point.
- 9. **<D>** the target button for the *Right Range Point*. Then **<D>** on the finish grade right edge of pavement point.
- 10. **<D> OK**.

lame:	Section1		OK						6	Close	He
rown Point:	HMA_Lift1_Centerli	n 🔻 🕂 🗖	Cancel								
eft Range Poin	LT_HMA_LA1_EO		Help	631.5					1		
ight Range Poi	nt: RT_HMA_Lift1_EO	F - +	nep			1					
ivot Direction:	From Crown Point	•		Colline .							
umber of lanes				630:5	-t-	*****	and the second	in second			
unoff Length N		1.00	X		1 T						\land
lunoff Length N Limits		1.00		630:0	17-						\mathbf{N}
		1.00		630:0	Æ						
Limits		1.00									
Limits	lutiplication Factor:	1.00		630:0	<u>/</u>						

11. **<D> Next** on the *Superelevation Section Definitions* dialog box. This displays the *Superelevation Controls* dialog box.

This dialog box is mainly for informational purposes. It is provide so that the superelevation control line properties can be reviewed/updated before they are applied.

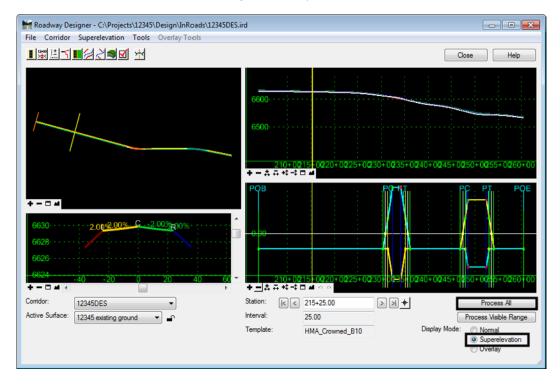
12. **<D>** the **Finish** button to complete the superelevation entry.

13. Toggle on Superelevation for the *Display Mode* on the *Roadway Designer* dialog box.

This adds the superelevation view window to the Roadway Designer dialog box.

- 14. **<D>** the **Process All** button. If it appears, Close the Results window.
- 15. **<D>** the **Fit button** for the *Plan View* and the *Superelevation Control Line* views.

The illustration below shows the data generated by the *Superelevation Wizard*.



The data in the plan view is color coded to show different cross slopes. The colors that represent the cross-slope values are:

- Green-Blue for slopes from 0.5% to 10% to the right with dark blue representing slopes greater than 10% to the right
- Yellow-Red colors for slopes from 0.5% to 10% to the left with dark red representing slopes greater than 10% to the left

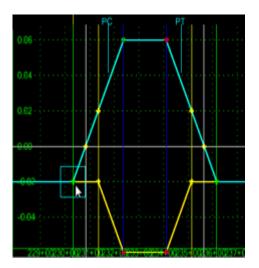
• White for slopes less than 0.5%

16. Select **File > Save** from the Roadway Designer menu bar.

Lab 12.2 - Edit a Superelevation Control Line

In this exercise the superelevation stations for the first curve are edited to even stations. This illustrates the procedure for editing superelevation. There are a couple of methods for editing superelevation stations:

- Edit the superelevation points from the superelevation view and
- Use the Edit Curve Set Stations tool
- 1. This first example is to edit the superelevation points directly from the view window. **<D> <D>** on the first superelevation point.



 The *Point Selection* dialog box is displayed. <D> <D> on the Section1 RT_HMA_Lift1_Laneline-Top-RT_HMA_Lift1_EOP-Top - 230+32.50.

Point Selection	
Section 1 RT_HMA_Lift 1_Laneline-Top-RT_HMA_Lift 1_EOP-Top - 230+32	
Section1 LT_HMA_Lift1_Laneline-Top-LT_HMA_Lift1_EOP-Top - 230+32	
Section 1 HMA_Lift 1_Centerline-Top-LT_HMA_Lift 1_Laneline-Top - 230+32	
Section 1 HMA_Lift 1_Centerline-Top-RT_HMA_Lift 1_Laneline-Top - 230+32	

- 3. The *Superelevation Point Properties* dialog box is displayed. Key in *230+32.00* in the *Station* field.
- 4. **<D> Apply**.
- 5. **<D> Close**.

The other method is to use the Edit Curve Set Stations command. The dialog box may be more use since it uses common terminology used to define superelevation stations such as Full Super, Reverse Crown, Super Runoff, and Normal Crown.

6. **<R>** in the Superelevation Control Line view and select **Edit Curve Set Stations** from the menu. The *Superelevation Control Curve Set Station Edit* dialog box displays.

Superelevation Display List
Create Superelevation Wizard
Create Single Control Line
Edit Curve Set Stations
Rename Superelevation Section
Apply Shoulder Rollover Lock
Import Superelevation
Import Superelevation from Alignment
Delete Points

- 7. Set the *Curve Set* to *1*. This can be done with a key in or by using the arrow buttons.
- 8. **<D>** the upper "+" button to display additional stations. Continue to display additional stations until the *Normal Crown* at station *230+32.00* appears at the top of the list.
- 9. **<D>** the lower "+" button until the *Normal Crown* at station *236*+*15*.77 is displayed.

🕍 Superelevati	on Control Cu	rve Set Station	Edit				-X
Section Name:	Section1				•		Apply
Curve Set:	< < 1	K<	Show Cur	ve Set Informa	ation		Undo
Type	Constrained	Station	Cross Slope	Length	Grade	+	
Normal Crown		203+80.28	-2.00%		-0.28%	H	Close
Normal Crown		230+32.50	-2.00%	2652.22	-2.48%		Help
Super Runoff	\boxtimes	230+83.50	-0.00%	51.00	-2.60%		<u> </u>
Reverse Crown	\boxtimes	231+34.50	2.00%	51.00	-2.73%		
Full Super		232+36.50	6.00%	102.00	-2.97%		
Full Super	\square	234+11.77	6.00%	175.27	-3.40%		
Reverse Crown	\square	235+13.77	2.00%	102.00	-3.64%		
Super Runoff		235+64.77	-0.00%	51.00	-3.77%		
Normal Crown		236+15.77	-2.00%	51.00	-3.89%		
 Design Check 	Data				Þ	•	
Table:							Runoff
Table:							Total Transition

- 10. **Toggle off** the *Constrained* toggle for Super Runoff at station **230+83.12**. Superelevation station that have a *Grey* background cannot be changed without turning off the *Constrained* toggle.
- 11. Round the Station value from **230+83.12** to **230+83.00**. Be sure to use the Tab key to accept the new value.
 - **Note:** The rounding of stations is a design decision. Consult the Project Manager for guidance with this change.
- 12. Repeat steps 10 and 11 as needed and round the other stations as indicated below.
 - ◆ Reverse Crown *231+34.00*
 - ◆ Full Super *232+37.00*
 - ◆ Full Super *234 + 12.00*
 - Reverse Crown *235 + 14.00*
 - ◆ Super Runoff *235 + 65.00*
 - Normal Crown *236 + 16.00*
- 13. **<D> Apply**.
- 14. **<D> Close**. This dismisses the *Superelevation Control Curve Set Station Edit* dialog box.

🐂 Superelevatio	on Control Cu	rve Set Station	Edit				×
Section Name:	Section1				•		Apply
Curve Set:	< < 1	>>	Show Cur	ve Set Informa	ation		Undo
Туре	Constrained	Station	Cross Slope	Length	Grade	+	Class
Normal Crown		203+80.00	-2.00%		-0.28%	ī	Close
Normal Crown		230+32.50	-2.00%	2652.50	-2.48%		Help
Super Runoff	\square	230+83.50	-0.00%	51.00	-2.60%		
Reverse Crown	\square	231+34.50	2.00%	51.00	-2.73%		
Full Super		232+36.50	6.00%	102.00	-2.97%		
Full Super	\square	234+11.77	6.00%	175.27	-3.40%		
Reverse Crown	\square	235+13.88	2.00%	102.12	-3.64%		
Super Runoff	\square	235+64.94	-0.00%	51.06	-3.77%		
Normal Crown		236+16.00	-2.00%	51.06	-3.89%		
Design Check	Data				٩	•	
	Data						Runoff
Table:							Total Transition

- **Note:** If the constraints are toggled back on, the stations will revert back to those calculated by the wizard.
- 15. **<D>** the **Process All** button. The computer will now apply the template drops and superelevation to all the stations in the corridor.
- 16. Scroll through the first curve to see how the superelevation works.
- 17. Select **File > Save** from the Roadway Designer menu bar.
- 18. **<D> Close**.

Chapter Summary:

- Lab 12.1 -Using the Superelevation Wizard demonstrated how to use the Superelevation Wizard to define the location of the Crown and Range points using the cross section view window. These points are used to determine how the template superelevates through a curve.
- Lab 12.2 -Edit a Superelevation Control Line showed two methods to edit a Superelevation Control Line; 1) manually and 2) using the Edit Curve Stations... dialog box. It is important to remember that editing superelevation stations is a design decision based on standard design criteria from the AASHTO manual and project specific conditions.

LAB 13 - Point Controls, Secondary Alignments, and Parametric Constraints

This lab demonstrates the use of various controls to modify a template during processing. It will highlight various settings in point controls, illustrate the effects of a secondary alignment, and demonstrate the use of parametric constraints.

Chapter Objectives:

- Create a Horizontal Point Control to add an additional lane using offsets.
- Create a Horizontal and Vertical Point Control to add a scab-on detour.
- Create a Horizontal Point Control using a Secondary Alignment.
- Use Parametric Constraints to widen the road surface.

Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\Preferences\CDOT_Civil.xin
- C:\Projects\12345\Design\InRoads\12345DES_Geometry.alg
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\12345DES.ird
- C:\Projects\12345\Design\InRoads\DES12345_Templates.itl

Lab 13.1 - Adding an Additional Lane with Offset Point Controls

In this exercise the corridor created in the previous lab is modified by adding an additional lane to the right side of the template using a standard point control. This control is based on the centerline (SH 86) alignment and uses offset distances from this alignment to modify the template. Three control entries are required to complete the transition.

- 1. Select **Modeler > Roadway Designer** from InRoads.
- 2. Verify that the *12345DES* corridor is active.

The first point control transitions from two lanes to three lanes.

3. In the *Roadway Designer* dialog box, select Corridor > Point Controls from the menu

bar or $\langle D \rangle$ the point controls button $\exists \exists$.

4. In the *Point Controls* dialog box, select **RT_HMA_Lift1_EOP-Top** for the point. Use the

drop down menu or **<D>** the "target" to button and then **<D>** the point in the template view to make the selection.

5. Toggle on **Horizontal** for the *Mode*.

6. Set the *Horizontal Alignment* to SH 86.

Point Contro	ls		- • •
Corridor: 12345 Point: Mode Horizontal	DES RT_HMA_Lift1_EOF Vertical Both	Station Limits Start: 203+80.28 \$\$top: 260+43.16	Add Close Change
Control Type: Horizontal Alignm	Alignment	Horizontal Offsets Start: 0.00 + Stop: 0.00 +	Help

- 7. Key in *220+00.00* in the *Station Limits Start* field.
- 8. Key in 222+50.00 in the Station Limits Stop field.
- 9. Key in **24** in the **Horizontal Offsets Start** field.
- 10. Key in **36** in the **Horizontal Offsets Stop** field.
- 11. **<D> Add**. The entry is added to the *Horizontal and Vertical Controls* list.

This creates the beginning transition for the additional lane.

Corridor: 12345DE	ç					
Point: Mode	RT_HMA_Lift1_E0	OF • + Sta		+ +		Add Close Change
Control Type:	Alignment		orizontal Offsets			Help
Horizontal Alignment:	SH 86	• + Sta	art: 24.00 20: 36.00	+		
		Sic	op: 0.00	+		
Horizontal and Vertic	1 al Controls:	12				
Horizontal and Vertic	al Controls:	Start Station	Stop Station	Mode	Туре	Control
Horizontal and Vertic E. P. Name X 1 LT_HMA_	al Controls:	Start Station 203+80.28	Stop Station 260+43.16	Mode	Superelevation	Section 1 LT_HMA_Lft
Horizontal and Vertic E. P. Name X 1 LT_HMA_ X 1 LT_HMA_	uft 1_EOP-Top	Start Station 203+80.28 203+80.28	Stop Station 260+43.16 260+43.16	Mode Vetical Vetical	Superelevation Superelevation	Section 1 LT_HMA_Lf Section 1 HMA_Lft 1_0
X 1 LT_HMA_ X 1 LT_HMA_ X 1 RT_HMA	Lift 1_EOP-Top Lift 1_Laneline-Top Lift 1_Laneline-Top	Start Station 203+80.28 203+80.28 203+80.28 203+80.28	Stop Station 260+43.16 260+43.16 260+43.16	Mode Vertical Vertical	Superelevation Superelevation Superelevation	Section 1 LT_HMA_Lift Section 1 HMA_Lift 1_0 Section 1 HMA_Lift 1_0
Horizontal and Vertic E. P. Name X 1 LT_HMA_ X 1 LT_HMA_ X 1 RT_HMA_ X 1 RT_HMA_ X 1 RT_HMA	Lift 1_EOP-Top Lift 1_EOP-Top Lift 1_Laneline-Top Lift 1_Laneline-Top Lift 1_EOP-Top	Start Station 203+80.28 203+80.28 203+80.28 203+80.28 203+80.28	Stop Station 260+43.16 260+43.16 260+43.16 260+43.16	Mode Vertical Vertical Vertical	Superelevation Superelevation Superelevation Superelevation	Section 1 LT_HMA_Lift Section 1 HMA_Lift 1_(Section 1 HMA_Lift 1_(Section 1 RT_HMA_Lift 1_(
Horizontal and Vertic E. P. Name X 1 LT_HMA_ X 1 LT_HMA_ X 1 RT_HMA_ X 1 RT_HMA_ X 1 RT_HMA	Lift 1_EOP-Top Lift 1_Laneline-Top Lift 1_Laneline-Top	Start Station 203+80.28 203+80.28 203+80.28 203+80.28	Stop Station 260+43.16 260+43.16 260+43.16	Mode Vertical Vertical	Superelevation Superelevation Superelevation	Section 1 LT_HMA_Lift Section 1 HMA_Lift 1_0 Section 1 HMA_Lift 1_0

The Point, Mode, Control Type, and Horizontal Alignment stay the same for the two remaining entries. Only the Stations and Offsets change. the second point control maintains the third lane.

12. Key in 222+50.00 in the Station Limits Start field.

- 13. Key in *229+00.00* in the *Station Limits Stop* field.
- 14. Key in **36.00** in the Horizontal Offsets Start field.
- 15. Key in **36.00** in the Horizontal Offsets Stop field.
- 16. **<D> Add**. This entry maintains the full width of the additional lane.

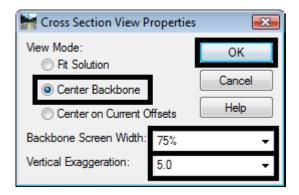
The third point control transitions from three lanes back to two lanes.

- 17. Key in *229+00.00* in the *Station Limits Start* field.
- 18. Key in 231+50.00 in the Station Limits Stop field.
- 19. Key in **36.00** in the Horizontal Offsets Start field.
- 20. Key in **24.00** in the Horizontal Offsets Stop field.
- 21. **<D> Add**. This entry transitions the template back to its normal width.
- 22. **<D> Close** to dismiss the *Point Controls* dialog box.

Ena	Priority	Name	Start Station	Stop Station	Mode	Туре	Control	
(1	RT_HMA_Lift1	220+00.00	222+50.00	Horizontal	Alignment	SH 86	
(1	RT_HMA_Lift1	222+50.00	229+00.00	Horizontal	Alignment	SH 86	
(1	RT_HMA_Lift1	229+00.00	231+50.00	Horizontal	Alignment	SH 86	

This series of steps sets the display in the template view to a specific size. This makes it easier to see the transitions occur when scrolling through the stations.

- 23. **<R>** in the template view of the Roadway Designer dialog box and select **Display Properties** from the menu.
- 24. Toggle on Center Backbone.
- 25. Key in **75%** (.75) for the *Backbone Screen Width*.
- 26. Select 5 for the Vertical Exaggeration.
- 27. **<D> OK**. This makes the template change easier to see when scrolling through the stations.



- 28. Scroll through the stations between 220+00.00 and 231+50.00 and notice how the template behaves.
- 29. Select **File > Save** from the Roadway Designer menu bar.

Lab 13.2 - Creating a Scab-On Detour using Point Controls

In this exercise a scab-on detour is added to the left side of the existing pavement from station 206+00 to 215+00. This requires a new corridor, template drop, and two sets of point controls. One is a horizontal and vertical control that follows the existing edge of pavement. The second is a horizontal offset control that transitions the detour to its full width.

1. Select Corridor > Corridor Management from the Roadway Designer menu bar or

<D> the Manage Corridors button

- 2. In the *Manage Corridors* dialog box, key in *Scab-on Detour* for the *Name*.
- 3. Toggle on the *Station Limits*.
- 4. Key in *206+00.00* for the *Start* station.
- 5. Key in *215+00.00* for the *Stop* station.
- 6. **<D> Add**.
- 7. **<D> Close**.

Manage Corri Name: Scab-on [Limits V Station	Add
Type:	Alignmen		Start:	Close
Horizontal Alignme Vertical Alignment:	51100	<u>+</u> ▼	206+00.00 Stop:	Change Copy
PI Rounding Tang	ent: 0.00		215+00.00	+ Copy From
Corridors:				Help
Corridors: Name	Туре	Source Name	Start Station	Help Stop Station
	Type Alignment	Source Name SH 86	Start Station 203+80.28	
Name				Stop Station

This corridor could have been built on the edge of pavement feature from the dtm, but by using the alignment it will be easier to locate stations.

- 8. Select Corridor > Template Drops from the Roadway Designer menu bar or <D> the
 Template Drops button
- 9. In the *Template Drops* dialog box, key in *206+00.00* for the *Station*.
- 10. Key in *25* for the *Interval*.
- Expand the C:\Projects\12345\Design\InRoads\DES12345-Templates.itl >

 Templates folder in the *Library Templates* area and highlight the Scab-on Detour template.
- 12. **<D> Add**.
- 13. **<D> Close**.

🕌 Templat	e Drops			- • •
Corridor:	Scab-on Det	tour 🔻		Add
Station:	206+00.00		+	Close
Interval:	25.00		+	
Library Temp	olates:		_	Change
	HMA_Full_ Scab-On D Sections - E Component	ded_TypeA_4Lane Depth_Widening_2La on_4Lane Detour avement End Conditions s	ne	Copy Help
Station	Interval	Template	Revised	Library
206+00.00	25.00	Scab-On Detour	ITL	C:\Projects\12345\Design\ln
Synchroniz	e with Libra	Ŋ		Edit Delete

The first point control moves the origin of the template from the SH 86 alignment to the left edge of pavement feature in the 12345 Existing Ground surface.

- 14. In the Roadway Designer dialog box, select **Corridor > Point Controls** from the menu bar or **<D>** the point controls button.
- 15. In the *Point Controls* dialog box, select HMA_Lift1_Shoulder-Top for the *Point*.

- 16. Toggle on **Both** for the *Mode*.
- 17. Select **Feature** for the *Control Type*.
- 18. Select **T_Traffic Single Solid White386** for the feature (This is the 18th T_Traffic Single Solid in the pull down list).
 - Note: Creating a feature filter will make it easier to locate the desired feature. The filter should *Start With* None, use the Name *Attribute*, and have a *Value* of *386*. See the module "*Initial Surface Procedures*" of the "*Practical Guide for InRoads V8i*" for more information in feature filters.
 - **Note:** The 12345 existing ground surface is the only dtm loaded so it is selected by default.
- 19. **<D> Add**.

Comdor: Scab-on	Detour						Add
Point:	HMA_Lift1_Shoulder -	+ Station I					Cose
Mode	the Carl Contractor		06+00.00	++			
🕐 Horizontal	🕑 Vertical 🛛 🥥 Both	Stop: 2	15+00.00	+			Change
Control Type:	Feature +	Horizont	al Offsets				Help
Surface:	12345 existing groun ·	Start: 0	00	+			
Feature:	T_Traffic Single Solk ·	+ Stop: 0	00	+			
Use as Seconda		Vertical	Offsets				
		Start: 0	00	+			
		Stop: 0	00	*			
Priority:	1						
Horizontal and Verti	cal Controls:						
Enabled Priority	Name	Start Station	Stop Station	Mode	Type	Control	
K 1	HMA_Lift1_Shoulder-Top	205+00.00	215+00.00	Both	Feature	12345 existing ground T_Traffic Sin	gle Solid White 38
<u> </u>	HHA_DIT_Shoubertop	205*00.00	215*00.00	boun	reature	12349 examp ground 1_manc and	ye sola wikesa
*			m				

Notice that the template has moved to approximately 12 feet to the left. Next, a horizontal point control is created that transitions the detour to its full width.

- 20. In the *Point Controls dialog* box, set the *Point* to LT_HMA_Lift1_EOP-Top.
- 21. Toggle on Horizontal for the *Mode*.
- 22. Set the *Control Type* to Alignment.
- 23. Set the *Horizontal Alignment* to SH 86.
- 24. In the *Station Limits* area, key in *206+00.00* for the *Start* station.
- 25. Key in *208+50.00* for the *Stop* station.
- 26. In the Horizontal Offsets area, key in -11.93 for the Start offset.
- 27. Key in *-24.00* for the *Stop* offset.

28. **<D> Add**.

The Point, Mode, Control Type, and Horizontal Alignment stay the same for the two remaining entries. Only the Stations and Offsets change. The steps below create a point control that maintains the detour's full width.

- 29. Key in 208+50.00 in the Station Limits Start field.
- 30. Key in 212+50.00 in the Station Limits Stop field.
- 31. Key in -24.00 in the Horizontal Offsets Start field.
- 32. Key in -24.00 in the Horizontal Offsets Stop field.
- 33. **<D> Add**. This entry maintains the full width of the additional lane.

The final point control transitions from the full width to the end of the detour.

- 34. Key in *212+50.00* in the *Station Limits Start* field.
- 35. Key in *215+00.00* in the *Station Limits Stop* field.
- 36. Key in -24 in the Horizontal Offsets Start field.
- 37. Key in -12.22 in the Horizontal Offsets Stop field.
 - **Note:** The offset distances entered are measured from the specified Horizontal alignment and not from the origin of the template.
- 38. **<D> Add**.

Enabled	Priority	Name	Start Station	Stop Station	Mode	Туре	Control
x	1	HMA_Lift1_Shoulder-Top	206+00.00	215+00.00	Both	Feature	12345 existing ground:
×	1	LT_HMA_LIR1_EOP-Top	206+00.00	208+50.00	Horizontal	Alignment	SH 86
x	1	LT_HMA_Lft1_EOP-Top	208+50.00	212+50.00	Horizontal	Alignment	SH 86
x	1	LT_HMA_LIT1_EOP-Top	212+50.00	215+00.00	Horizontal	Alignment	SH 86

39. **<D> Close** to dismiss the *Point Controls* dialog box.

Scroll through the stations and notice how the template behaves. From station 206+00 to station 208+50 the template expands from the existing edge of pavement until it reaches its full width. Then it maintains that width from station 208+50 to station 212+50. Finally, it contracts back to the pavement edge from station 212+50 to station 215+00.

40. Select **File > Save** from the Roadway Designer menu bar.

Lab 13.3 - Using Horizontal Point Control and a Secondary Alignment

Alignments other than the design centerline can be used for horizontal controls. Typically, they are used to modify the width of the template. They can also be used to change the direction (in relation to the design centerline) that the template components are placed. When an alignment is used in this manner, it is called a secondary alignment.

This exercise uses a secondary alignment to create the beginning of an off ramp. A new corridor is created using the SH 86 alignment.

- Select Corridor > Corridor Management from the Roadway Designer menu bar or <D> the Corridor Management button.
- 2. In the *Manage Corridors* dialog box, key in *Off Ramp* for the *Name*.
- 3. Toggle on the *Station Limits*.
- 4. Key in *205+00.00* for the *Start* station.
- 5. Key in *215+00.00* for the *Stop* station.
- 6. **<D> Add**.
- 7. **<D> Close**.

Type: Alignment Start: Close Horizontal Alignment: SH 86 + + Start: 205+00.00 + Change Vertical Alignment: SH 86 • + Stop: Copy Copy PI Rounding Tangent: 0.00 • • Help Copy Copy Corridors: - - - + Help Help Corridors: - - - Start Station Stop Station Scab-on Detour Alignment SH 86 206+00.00 215+00.00 12345DES Alignment SH 86 203+80.28 260+43.16	Name: Off Ramp			Limits V Station	Add
Horizontal Alignment: SH 86 + 205+00.00 + Change Vertical Alignment: SH 86 V • • Stop: 205+00.00 + Change PI Rounding Tangent: 0.00 • • • • Copy Copy Corridors: 0.00 • <th>Туре:</th> <th>Alignment</th> <th>•</th> <th></th> <th>Close</th>	Туре:	Alignment	•		Close
PI Rounding Tangent: 0.00 Corridors: Name Type Source Name Start Station Stop Station Scab-on Detour Alignment SH 86 206+00.00 215+00.00 12345DES Alignment SH 86 203+80.28 260+43.16	Horizontal Alignme	nt: SH 86	+		+ Change
Comidons: Name Type Source Name Start Station Stop Station Scab-on Detour Alignment SH 86 206+00.00 215+00.00 12345DES Alignment SH 86 203+80.28 260+43.16	Vertical Alignment:	SH 86 V	•		Сору
Low Help Corridors: Help Name Type Source Name Start Station Stop Station Scab-on Detour Alignment SH 86 206+00.00 215+00.00 12345DES Alignment SH 86 203+80.28 260+43.16	PI Rounding Tang	anti a sa		215+00.00	+
12345DES Alignment SH 86 203+80.28 260+43.16		enc. 0.00			Copy From.
	Corridors:		Source Name		Copy From
Off Ramp Alignment SH 86 205+00.00 215+00.00	Comidors: Name	Туре		Start Station	Copy From Help Stop Station
	Corridors: Name Scab-on Detour	Type Alignment	SH 86	Start Station 206+00.00	Stop Station 215+00.00

A single template drop is required for this corridor.

- 8. Select **Corridor > Template Drops** from the Roadway Designer menu bar or **<D>** the **Template Drops** button.
- 9. In the *Template Drops* dialog box, key in *205+00.00* for the *Start* station.

- 10. Key in *25* for the *Interval*.
- Expand the C:\Projects\12345\Design\InRoads\DES12345-Templates.itl >

 Templates folder in the *Library Templates* area and highlight the CONC_4Lane_Right-Side_Only template.
- 12. **<D> Add**.
- 13. **<D> Close**.

🕌 Templat	e Drops				
Comidor:	Off Ramp		•		Add
Station:	205+00.00		-		Close
Interval:	25.00		-		Change
Library Temp					
	Templates CONC 41 as	e_Right-Side_Or	- A		Сору
	_	ie_Night-Side_Or ied_TypeA_4car		1	Help
\sim	CONC_Ram	p	E		/
	HMA_Crown HMA Divide	ed_B10 ed_TypeA_4Lane	, L		
×	HMA_Full_D	epth_Widening_			~~~
	HMA_Urban	-	-		
•			•	′	
Current Tem	plate Drops:				
Station	Interval	Template	Rev	vised Libra	ary
205+00.00	25.00	CONC_4Lane_F	Right ITL	C:\Pr	rojects\12345\De
•					+
Synchroniz	e with Library			Edit	Delete
			_		

A horizontal point control is used to widen the template and reposition its components perpendicular to the Off Ramp alignment.

- In the Roadway Designer dialog box, select Corridor > Point Controls from the menu bar or <D> the point controls button.
- 15. In the *Point Controls* dialog box, select **RT_Conc_Shoulder-Top** for the *Point*.
- 16. Toggle on **Horizontal** for the *Mode*.
- 17. Select Alignment for the *Control Type*.
- 18. Select **Off Ramp** for the *Horizontal Alignment*.

- 19. In the Station Limits area, key in *205+00.00* for the *Start* station.
- 20. Key in *215+00.00* for the *Stop* station.
- 21. Make sure the *Horizontal Offsets* are set to *O*.
- 22. Toggle on Use as Secondary Alignment.
- 23. **<D> Add**.
- 24. **<D> Close**.

Control Type: Alignment Horizontal Alignment: Off Ramp	Ider v Both v v	Station Limits Start: 205+00 Stop: 215+00 Horizontal Offs Start: 0.00 Stop: 0.00 Vertical Offset Start: 0.00 Stop: 0.00).00 sets		Add Close Change Help
Horizontal and Vertical Controls:	Start Station	Stop Station	Mode	Туре	Control
X 1 RT_Conc_Shoulder-Top	205+00.00	215+00.00	Horizontal	Alignment	Off Ramp
•					•
				(Delete

- 25. Scroll through the stations between **205+00.00** and **215+00.00** and notice how the template behaves. The orange line in the plan view and the template view represents the Off Ramp alignment. Notice how the template line (the yellow line in the plan view) outside the Off Ramp alignment changes so that it is perpendicular to the Off Ramp alignment.
- 26. Select **File > Save** from the *Roadway Designer* menu bar.

Lab 13.4 - Using Parametric Constraints to Widen the Road Surface

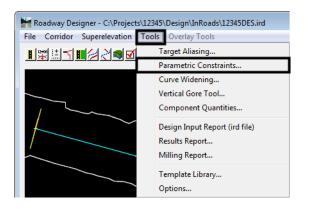
Parametric Constraints are used to modify the value of the constraint. This option allows greater flexibility of what can be modified during processing as slopes and vector/offsets can be modified in addition to the usual horizontal and vertical controls. In this exercise, the **Horizontal Constraint** of a template point is modified to widen the template on the left side. This is done in a similar manner to the first exercise.

The corridor used in Lab 6.1 is also used here.

1. In the Roadway Designer dialog box, select **12345DES** for the corridor.

+- <u></u> +++	-+ 🗆 🖬	+	•				4
Corridor:	12345DES 🔻	Station:	<mark> <</mark> <	203+80.28	→ K <		Process All
Active Surface:	12345 existing ground 🔹 🖃	Interval:		25.00			Process Visible Range
		Template:		HMA_Crowned_B10		Display Mode:	Normal
							 Superelevation Overlay

2. Select **Tools > Parametric Constraints** from the Roadway Designer menu bar.



- 3. In the *Parametric Constraints* dialog box, select LT_EOP-Top-Horiz for the *Constraint Label*.
- 4. Key in -36 for the Stop Value (the Start Value stays the same for this entry).
- 5. In the *Station Limits* area, key in *237+00.00* for the *Start* station.
- 6. Key in *239+50.00* for the *Stop* station.
- 7. **<D> Add**.

Parametric Co	onstraints				- • •
Corridor:	12345DES		Station Limits	.	Add
Constraint Label:	LT_EOP-Top-Horiz	-	Start: 237+00.00	+	Close
Start Value:	-24.00		Stop: 239+50.00	+	Change
Stop Value:	-36.00				
Override Values:					Help
Name	Start Value	Stop Value	Start Station	Stop S	tation
LT_EOP-Top-Ho	ri24.00	-36.00	237+00.00	239+50	.00
Export	Import				Delete

- 8. Key in -36 for the Start Value (the Stop Value stays at -36).
- 9. In the *Station Limits* area, key in *239+50.00* for the *Start* station.
- 10. Key in *252+50.00* for the *Stop* station.
- 11. **<D> Add**.
- 12. Key in -24 for the Stop Value (the Start Value stays at -36).
- 13. In the *Station Limits* area, key in *252+50.00* for the *Start* station.
- 14. Key in *255+00.00* for the *Stop* station.
- 15. **<D> Add**.
- 16. **<D> Close**. This dismisses the *Parametric Constraints* dialog box.

Parametric Co	onstraints			- • •	
Corridor:	12345DES		Station Limits	Add	
Constraint Label:	LT_EOP-Top-Horiz	-	Start: 252+50.00	+ Close	
Start Value:	-36.00		Stop: 255+00.00	Change	
Stop Value:	-24.00			Help	
Override Values:				нер	
Name	Start Value	Stop Val	ue Start Station	Stop Station	
LT_EOP-Top-Hori	z -24.00	-36.00	237+00.00	239+50.00	
LT_EOP-Top-Hori	z -36.00	-36.00	239+50.00	252+50.00	
LT_EOP-Top-Hor	z -36.00	-24.00	252+50.00	255+00.00	
•				+	
Export	Import			Delete	

- 17. Scroll through the stations between 237+00.00 and 255+00.00 and notice how the template behaves.
- 18. Select **File > Save** from the *Roadway Designer* menu bar.
- 19. **<D> Close** to dismiss the Roadway Designer dialog box.

Chapter Summary:

- In *Lab 13.1 -Adding an Additional Lane with Offset Point Controls* Horizontal Point Controls were used to add an additional lane to the design. The control was based off the design centerline with offset distances measured from that alignment.
- Lab 13.2 -Creating a Scab-On Detour using Point Controls a Horizontal and Vertical Point Control was created to locate a template on the edge of the existing pavement. The edge of pavement feature from the existing ground surface was used to locate the template. A horizontal control based off the design centerline was also used to transition the template, creating the scab-on detour.

- In *Lab 13.3 Using Horizontal Point Control and a Secondary Alignment* a Horizontal Point Control using a Secondary Alignment was created. By changing the angle of the components outside of the secondary alignment, their shape is maintained around curves making this option ideal for ramps and street returns.
- Lab 13.4 -Using Parametric Constraints to Widen the Road Surface used Parametric Constraints to widen the road surface. The results were similar to those achieved in the first exercise but a different method was used.

LAB 14 - Template Transitions and End Condition Overrides

This lab demonstrates how template transitions and end condition overrides are set up. Template transitions are used to make a smooth change from one template to another. End condition overrides are used to make changes in end conditions without having to create a new template.

Chapter Objectives:

- Set up a template to template transition.
- Create an end condition transition.
- Create an end condition override.

Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\Preferences\CDOT_Civil.xin
- C:\Projects\12345\Design\InRoads\12345DES_Geometry.alg
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\12345DES.ird
- C:\Projects\12345\Design\InRoads\DES12345_Templates.itl

Lab 14.1 - Set Up a Template to Template Transition

In this exercise a new corridor is defined with two template drops. The transition area is identified in the plan view by a colored block at the transition location. The transition between the templates is defined using this block.

- 1. Select **Modeler > Roadway Designer** from the InRoads menu bar.
- 2. Select **Corridor > Corridor Management** from the Roadway Designer menu bar or

<D> the corridor management button **!!**.

- 3. In the *Manage Corridors* dialog box, key in *Template Transition* in the Name field.
- 4. **<D> Add**.

5. **<D> Close**.

Manage Corridor	5			- • •
Name: Template Tran	nsition		its Station	Add
Type:	Alignment	•	Start	Close
Horizontal Alignment:	SH 86	+ +	203+80.28	+ Change
Vertical Alignment:	SH 86 V	-	Stop:	Сору
PI Rounding Tangent:	0.00		260+43.16	+ Copy From
Conidors: Name	Туре	Source Name	Start Station	Help Stop Station
12345DES	Alignment	SH 86	203+80.28	260+43.16
Off Ramp	Alignment	SH 86	205+00.00	215+00.00
Scab-on Detour	Alignment	SH 86	206+00.00	215+00.00
Template Transition	Alignment	SH 86	203+80.28	260+43.16
•		III		4
				Delete

Next, the template drops are defined. The first template requires two template drops, one at the beginning of the project and the second at the beginning of the transition.

6. Select **Corridor > Template Drops** from the Roadway Designer menu bar or **<D>** the

template drops button 避.

- 7. Select *Template Transition* for the corridor name.
- 8. Key in *25* for the *Interval*.
- 9. Expand the 1- Templates folder in the *Library Templates* area.
- 10. **<D>** on the **12345_HMA_2Lane** template.
- 11. **<D> Add**.
- 12. In the *Template Drops* dialog box, key in *208+00.00* for the *Station*.
- 13. **<D>** on the **12345_HMA_2Lane** template.

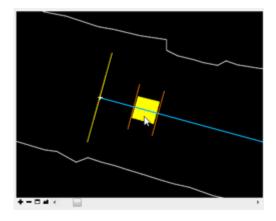
14. **<D> Add**.

🐂 Temp	late Drops			
Corridor:	Template	Transition	•	Add
Station:	208+00.00)	+	Close
Interval:	25.00		+	
Library Te	mplates:			Change
- -	1 Tomplato		-	Сору
2		IMA_2Lane	- ml	Help
	K CONC_F K HMA_Cr K HMA_Dr	owned_B10 vided_TypeA_4La	ane _	$> \langle$
		Template	Revise.	Library
	225.00			C:\Projects\12345\Desig
208+00.0		12345_HMA_2L	a ITL	C:\Projects\12345\Desig
•				

The final template drop is used from the end of the transition to the end of the project.

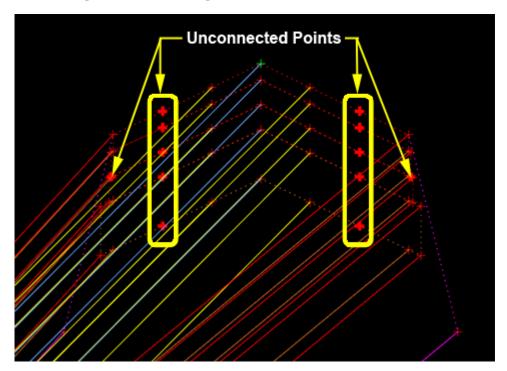
- 15. In the *Template Drops* dialog box, key in *211+00.00* for the *Station*.
- 16. **<D>** on the **12345_HMA_4Lane** template.
- 17. **<D> Add**.
- 18. **<D> Close**.
 - **Note:** Notice in the Plan view a yellow box has been displayed. This is the area of the transition. The yellow indicates that some of the points have been connected between the templates. Next, the remainder of the points are connected.

The color coding indicates that not all of the template points are connected. The steps blow connect the remaining unconnected points.

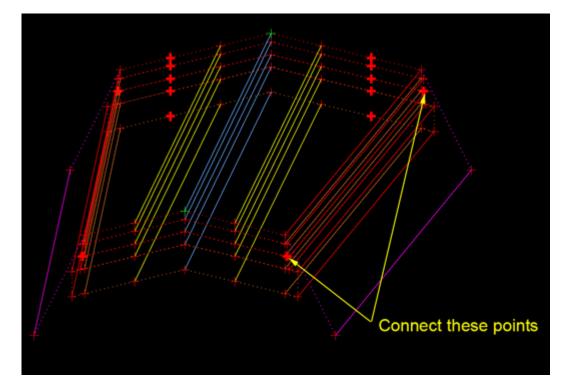


19. <D> <D> on the transition area. This displays the *Edit Transition – 208+00.00 to* 211+00.00 dialog box.

The display in the *Edit Transition – 208+00.00 to 211+00.00* dialog box shows the connections between points and the points that are not connected. The illustration below shows examples of unconnected points.



- 20. Zoom in on the bold "+" on the right side of the bottom template.
- 21. **<D>** on the "**+**". A line is attached to the "+" and the pointer.
- 22. Zoom out, then zoom in on the corresponding point on the upper template.

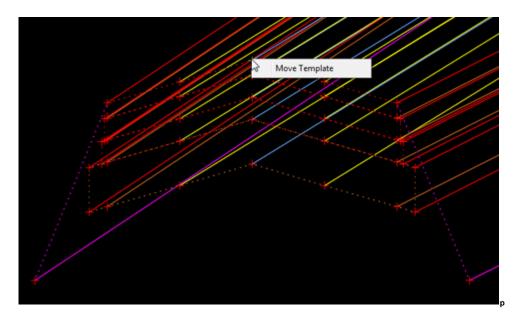


23. **<D>** on the "+". The line is now attached to the "+" and it is unbolded.

24. Repeat steps 19 through 22 on the left side.

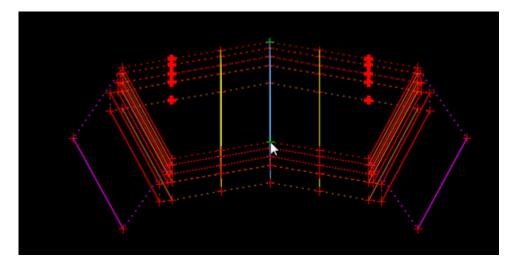
All of the points on the bottom template have been attached to points on the top template. However, points on the top template remain unconnected. These are connected to the appropriate laneline points of the bottom template.

25. **<R>** on the green "+" on the bottom template and select **Move Template**.

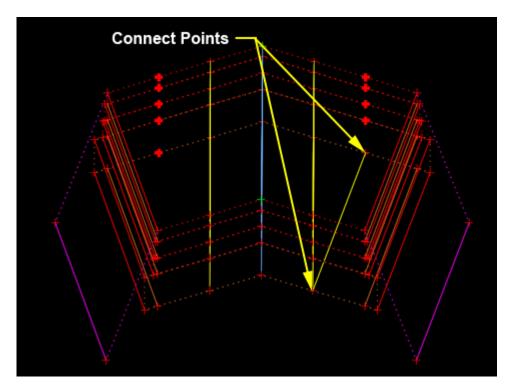


26. Move the bottom template so that it is easier to see the points to be connected.

27. **<D>** to complete the move.



28. Starting at the bottom of the template, connect the outside lanelines on the four lane template to the lanelines on the two lane template.

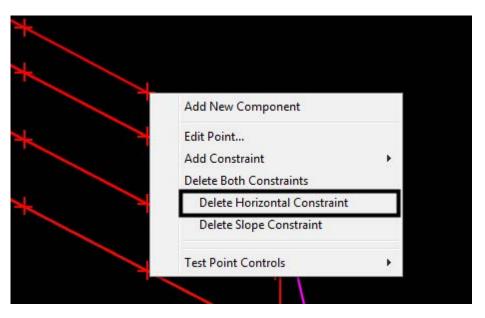


- 29. Connect the remaining points as shown below.

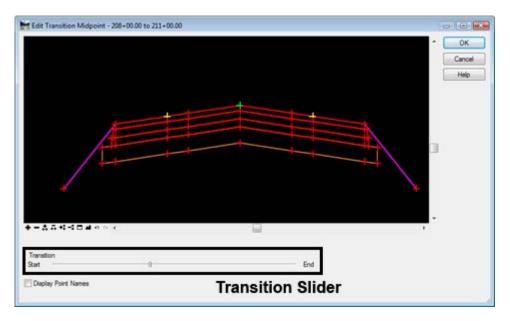
<D> OK. This displays the *Edit Transition Midpoint – 208+00.00 to 211+00.00* dialog box.

In order for the transition to function properly, the horizontal constraints on the lanelines must be deleted.

31. <R> on the RT_HMA_Lift1_Laneline-Top1 point and select Delete Horizontal Constraint from the menu.

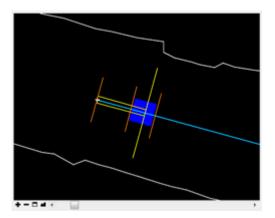


- 32. **<R>** on the LT_HMA_Lift1_Laneline-Top1 point and select Delete Horizontal Constraint from the menu.
- 33. Move the Transition slider and notice how the template behaves. The additional lane expands and contracts as the slider is moved back and forth.



34. **<D> OK** to complete the transition edit.

Notice in the plan view that the transition area is now dark blue. This signifies that all of the points are connected.



35. Select **File > Save** from the Roadway Designer menu bar.

Lab 14.2 - Set Up an End Condition Transition

In this exercise the transition between a cut slope and a fill slope between stations 219+75 to 220+00 is defined. This is done in a similar manner as the transition of two templates but it is accessed differently.

3.

1. In the *Roadway Designer* dialog box, use the station indicator to select station **219+75.00**.

+				
Station:	k<	219+75.00	+ < <	
Interval:	•	25.00		
Template:		12345_HMA_4Lane		

 Select Corridor > End Condition Exceptions from the Roadway Designer menu bar or <D> the End Condition Exceptions button 1.

Select Corridor > End Condition Exceptions fr	om the F

	Template Tra	nsition		Add
	n Range	Apply		Close
Start:	219+75.00	+ © Le	ft Override	Channel
Stop:	220+00.00	🔶 🔘 😽	ght Override	Change
		O Le	ft Transition	Help
Back	bone Only	Re	ght Transition	
nd Cor	dition Exception	ons:		
Start S	tation	Stop Station	Туре	
219+75	.00	220+00.00	Right Trans	tion

6. Highlight the entry.

In the End Condition Exceptions dialog box, note that the desired stations are alread	y
selected.	

- 4. Toggle on *Right Transition*.
- 5. **<D> Add**. This adds the data to the *End Condition Exceptions* list.

- -End Condition Exceptions Comdor: Template Transition Add Station Range Apply To Close Start: 219+75.00 Left Override Change Right Override Stop: 220+00.00 + Help C Left Transition Backbone Only Right Transition End Condition Exceptions: Start Station Type Stop Station 219+75.00 220+00.00 **Right Transition** Edit Delete
- 7. **<D> Edit**. This displays the *Edit Transition 219+75.00 to 220+00.00 Right* dialog box.

8. Connect the two bold "+" symbols.

Connect these points
*

- 9. **<D> OK**. This displays the *Edit Transition Midpoint 219+75.00 to 220+00.00 Right* dialog box.
- 10. Move the Transition slider and notice how the template behaves.
- 11. **<D> OK** to complete the transition edit.
- 12. **<D> Close** to dismiss the End Condition Exceptions dialog box.
- 13. Select **File > Save** from the Roadway Designer menu bar.
 - **Note:** This exercise illustrates the use of the End Condition transition command. Typically, these transitions occur in areas where there is a template change. The transitions between typical cuts and fills do not have to be defined.

Lab 14.3 - Set Up an End Condition Exception

With using end condition exceptions, end condition points and components can be added, deleted, and/or modified. In this exercise an end condition override is used to create a deeper ditch from station 203+80.28 to 206+50.00. The existing cut slope is deleted and a new end condition is added to extend the ditch foreslope and create the backslope.

- 1. In the *Roadway Designer* dialog box, use the station indicator to select station 203+80.28.
- Select Corridor > End Condition Exceptions from the Roadway Designer menu bar or <D> the End Condition Exceptions button.
- 3. In the *End Condition Exceptions* dialog box, key in *206+50.00* for the *Stop* station (the *Start* station is already set).
- 4. Toggle on *Right Override*.
- 5. **<D> Add**. This adds the data to the *End Condition Exceptions* list.

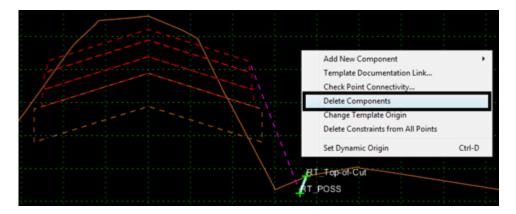
The steps below are used to actually modify the end condition data.

- 6. Highlight the entry.
- 7. **<D> Edit**. This displays the *Right Override 203+80.28 to 206+50.00* dialog box.

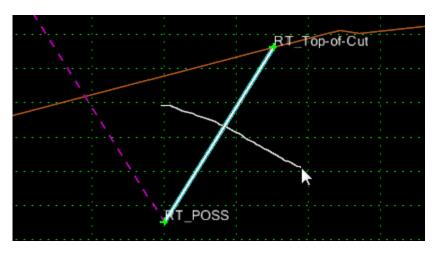
Hend Condition Exce	ptions			- 0 💌
Corridor: Template Trans	sition			Add
Station Range Start: 203+80.28	+	Apply To Ceft Over	ride	Close
Stop: 206+50.00			erride	Change
Backbone Only		C Left Trans		Help
End Condition Exception	15:			
Start Station	Stop Stati	on	Туре	
219+75.00	220+00.00	F	Right Trans	sition
203+80.28	206+50.00	F	Right Over	тide
		E	dit	Delete

The existing end condition components are deleted from the right side of the template. Deleting the existing components is done in the same way as in the Create Template dialog box. However, when using an end condition override, the backbone components can not be deleted.

8. In the *Right Override – 203+80.28 to 206+50.00* dialog box, **<R>** and select **Delete** Components.



- 9. Zoom in around the existing cut slope component.
- 10. **<D> and hold**, then drag a line through the existing cut slope component. Release the mouse button to complete the delete.



Note: The deleted component remains visible shown in light blue. However it is not incorporated into the model.

Next, the new ditch components are added. Adding new components is done in the same way as in the Create Template dialog box. However, when using an end condition override, only end condition components can be selected.

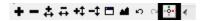
11. Select **Tools > Options** from the menu bar.

File Edit Add To	pols	
Template Library:	Template Library Organizer	
C:\Projects\12	Apply Feature Name Override	
	Options	
_	Dynamic Settings	
		_

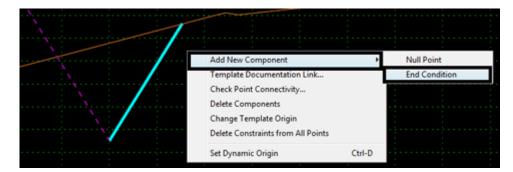
- 12. Toggle on Apply Affixes.
- 13. Key in *O. 10* for the *X* and *Y Step Options*.
- 14. **<D> OK**.

Template Options	×
Naming Options	ОК
Components	
Seed Name:	Cancel
From Style	Preferences
Specify:	
	Help
Points	
Seed Name:	
Apply Affixes Prefix Suffix Left: LT_ Right: RT_ Step Options	
X: 0.10 Y: 0.10 Slope	0.00%

15. **<D>** the **Dynamic Setting button** on the view control button bar. This displays the *Dynamic Settings* dialog box.



16. <R> in the template view and select New Component > End Condition from the menu.

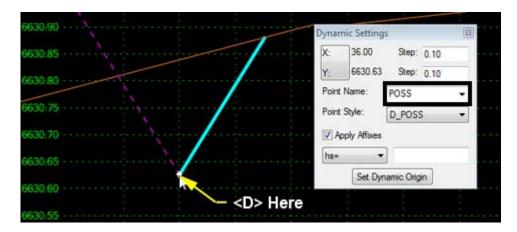


17. In the Current Component area, key in *Special Ditch* for the *Name*.

18. Select **D_Top-of-Cut** for the *Style*.

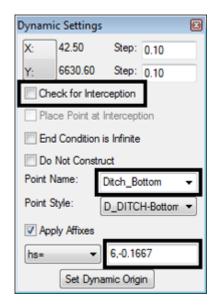
Current Component			
Name: Special Ditch		Style: D_Top-of-Cut	
Target Type:	Surface 👻	Priority:	1
Surface Active>		Benching Count:	0
		From Datum:	0.00
Horizon	tal Vertical	Step Elevation:	0.00
Offsets: 0.00	0.00	Rounding Length	0.00

- 19. In the *Dynamic Settings* dialog box, select **POSS** for the *Point Name*.
- 20. **<D>** on the *RT_POSS* point.



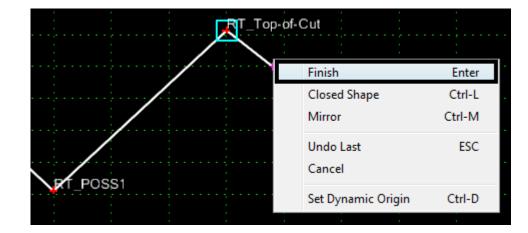
- 21. In the *Dynamic Settings* dialog box, toggle off **Check for Interception**.
- 22. Key in *Ditch_Bottom* for the *Point Name*.
- 23. Set the *Point Style* to **D_DITCH-Bottom.**

24. In the precision key-in field, key in *6,-0.1667*.



- 25. Press the *Enter* key.
- 26. In the *Dynamic Settings* dialog box, toggle on **Check for Interception**.
- 27. Toggle on End Condition is Infinite.
- 28. Select **Top-of-Cut** for the *Point Name*.
- 29. In the precision key-in field, key in 6,0.1667.
- 30. Press the *Enter* key.

Dynami	ic Settings		×
X:	69.81	Step:	0.10
Y:	6630.82	Step:	0.10
Che	ck for Inter	ception	
🔲 Pla	ce Point at I	ntercept	ion
V End	d Condition i	s Infinite	
📃 Do	Not Constru	ict	
Point N	lame:	Top-of-C	ut 👻
Point S	ityle:	D_Top-o	f-Cut 🔻
Apply Affixes			
hs=	•	6,0.166	67
Set Dynamic Origin			



31. **<R>** in the template view and select **Finish** from the menu.

- 32. **<D> OK**. This completes the edit of the override.
- 33. **<D> Close** to dismiss the End Condition Override dialog box.
- 34. Use the *Station* indicator to scroll through the affected stations. Notice the changes.
- 35. Select **File > Save** from the Roadway Designer menu bar.
- 36. **<D> Close** to exit the Roadway Designer.

Chapter Summary:

- In *Lab 14.1 -Set Up a Template to Template Transition* the process of setting up a template to template transition was demonstrated. This included the necessary template drops, connecting template points and changing point constraints.
- In *Lab 14.2 -Set Up an End Condition Transition* an end condition transition was built. This involved selecting station a for the transition and connecting end condition points.
- In *Lab 14.3 -Set Up an End Condition Exception* an end condition override was created. This involved selecting a station for the override, deleting existing end condition components, and adding a new component.

LAB 15 - Modifying Single Template Drops and Target Aliasing

This lab demonstrates the procedure for editing a single template drop and setting up a corridor for *target aliasing*. Modifying single template drops is used for making minor corrections to the design prior to creating a surface. Target aliasing is used to specify alternate targets for end condition interception.

Chapter Objectives:

- Modify a single template drop by moving a point.
- Add a parallel corridor and use target aliasing to tie to the original corridor as needed.

Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\Preferences\CDOT_Civil.xin
- C:\Projects\12345\Design\InRoads\12345DES_Geometry.alg
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\12345DES.ird
- C:\Projects\12345\Design\InRoads\DES12345_Templates.itl

Lab 15.1 - Modifying a Single Template Drop

At station 225+50.00 the design toe falls inside a small rise in the natural ground creating an area that pools water. This station is edited to move the toe to the top of that rise.

- 1. Select **Modeler > Roadway Designer** from the InRoads menu bar.
- 2. Select **12345DES** for the corridor (created in lab 4).

+-**	-1 🗆 🖬 <	- ·	+		
Comidor:	12345DES	-	Station: 📐	≤ 203+87.30	> > +
Active Surface:	12345 existing ground	-	Interval:	25.00	
			Template:	12345_HMA_2Lane	

3. Key in **225+50.00** in the Station indicator and press the Tab key.

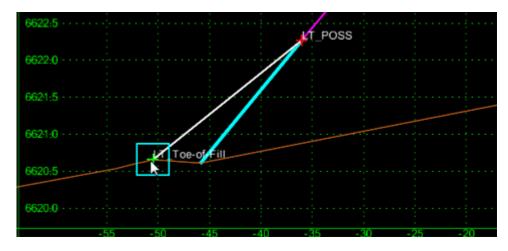
+		
Station: 🔣	< 225+50.00	► K <
Interval:	25.00	
Template:	12345_HMA_2Lane	

- Edit Station... Display Properties...
- 4. **<R>** in the template view and select **Edit Station** from the menu.

5. In the *Editing Template at Station 225+50.00 Only* dialog box, **<R>** on the LT_Toe-of-Fill point and select Move Point.



6. Move the pointer to the small rise approximately 50' to the left of the centerline. The point snaps to the ground line. **<D>** at that location to complete the move.



- 7. **<D> OK** to dismiss the *Editing Template at Station 225+50.00 Only* dialog box.
- 8. Select File > Save.

This method of modifying template drops should be used sparingly. If there are more than a couple of locations that require editing, modifying the template should be considered over editing single template drops.

Lab 15.2 - Target Aliasing

Target aliasing is used to define multiple targets for an end condition. In this exercise two parallel corridors are constructed. The first corridor ties to the existing ground exclusively. The second corridor ties to the existing ground or the first corridor. This lab uses the **12345DES** corridor created in lab 4 in addition to a new corridor created in this lab.

First, the offset corridor is created.

- Select Corridor > Corridor Management from the Roadway Designer menu bar or <D> the Corridor Management button.
- 2. In the Manage Corridors dialog box, key in *SH 86_Offset_Left* for the *Name*.
- 3. Verify that the Horizontal Alignment is SH 86 and the Vertical Alignment is SH 86 V.
- 4. **<D> Add**.

5. **<D> Close**.

ៅ Manage Corrido	rs			
Name: SH 86_Offse	t_Left	Limi	ts Station	Add
Type:	Alignment		Start:	Close
Horizontal Alignment:	SH 86	+	203+80.28	Change
Vertical Alignment:	SH 86 V	•	Stop:	Сору
PI Rounding Tangent	t: 0.00		260+43.16	Copy From
Corridors: Name	Туре	Source Name	Start Station	Help
			Start Station	Stop Station
Template Transitio		SH 86	203+80.28	Stop Station 260+43.16
Template Transitio Scab-on Detour				
	Alignment	SH 86	203+80.28	260+43.16
Scab-on Detour	Alignment Alignment	SH 86 SH 86	203+80.28 206+00.00	260+43.16 215+00.00
Scab-on Detour 12345DES	Alignment Alignment Alignment	SH 86 SH 86 SH 86	203+80.28 206+00.00 203+80.28	260+43.16 215+00.00 260+43.16

A template drop is added to the offset corridor.

- 6. Select **Corridor > Template Drops** from the Roadway Designer menu bar or **<D>** the Template Drops button.
- 7. In the *Template Drops* dialog box, key in *25* for the *Interval*.
- 8. Expand the **1 Templates** folder.
- 9. Highlight the **HMA_Crowned_B10** template.
- 10. **<D> Add**.

11. **<D> Close**.

🐂 Template	Drops			- • •
Corridor: SH	H 86_Offset_Left	•		Add
Station: 20	3+80.28	+		Close
Interval: 25	.00	-4-		Change
Library Templa	tes:			Сору
	emplates 12345_HMA_2L 12345_HMA_4L CONC_4Lane_R CONC_Divided_ CONC_Ramo HMA_Crowned_ HMA_Crowned_ HMA_Eull_Dent	ane light-Side_Only TypeA_4Lane B10	emplates.il	Help
Station	Interval	Template	Revised In	Library
203+80.28	25.00	HMA_Crowned_B10	ITL	C:\Projects\12345\Des
•		III		•
Synchronize	with Library		E	dit Delete

The corridor is built on the same alignment as the 12345DES alignment. A point control is used to move *SH 86_Offset_Left* corridor 80' to the left.

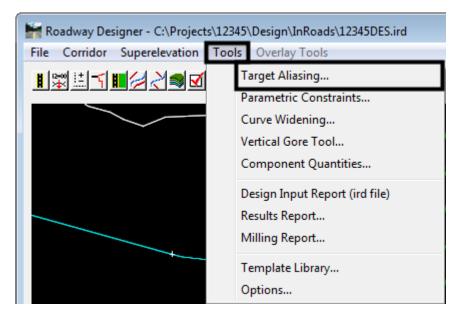
- 12. Select **Corridor > Point Controls** from the Roadway Designer menu bar or **<D>** the Point Controls button.
- 13. In the *Point Controls* dialog box, select **HMA_Lift1_Centerline-Top** for the *Point*.
- 14. Toggle on **Horizontal** for the Mode.
- 15. In the *Horizontal Offsets* area, key in *-80* for both the *Start* and *Stop* offsets.
- 16. **<D> Add**.

17. **<D> Close**.

Point Controls					- • ×
Corridor: SH 86_Offset_Left Point: HMA_Lift Mode Horizontal Vertical	ft1_Centerlin		ion Limits 203+80.28 260+43.16	+ +	Add Close Change
Control Type: Alignmer Horizontal Alignment: SH 86		↓ ↓ ↓ Start	zontal Offsets -80.00 -80.00	+ +	Help
Use as Secondary Alignmen	t	Star	ical Offsets 0.00 0.00	+	
Priority: 1 Horizontal and Vertical Controls:]				
En Pri Name	Start Station	Stop Station	Mode	Туре	Control
X 1 HMA_Lift1 2	203+80.28	260+43.16	Horizontal	Alignment	SH 86
					Delete

The final step is to add the target aliasing.

18. Select **Tools > Target Aliasing** from the Roadway Designer menu. The *Target Aliasing* dialog box is displayed.



- 19. In the *Target Aliasing* dialog box, Highlight **Corridor 12345DES** from the *Surface or Corridor* list.
- 20. **<D> Add**. The highlighted entry is moved to the Aliases list.

Target:	<active surface=""></active>	-		OK
Surface or Corrid			Aliases:	Cancel
Corridor - 12345DES		Add ->		
Comidor - On Namp Comidor - Scab-on Detour Comidor - Template Transition Surface - 12345 existing ground Surface - Default		<- Remove		Help
		Move Up		
		Move Down		

21. Highlight Surface - 12345 Existing Ground from the Surface or Corridor list.

22. **<D> Add**.

larget:	<active surface=""></active>	-		ОК
Surface or Corridor			Alases:	Cancel
Comidor - Off Ramp Comidor - Scab-on Detour		Add ->	Corridor - 12345DES Surface - 12345 existing ground	
Corridor - Template Surface - Default		<- Remove	and an and a second sec	Help
Surace - Deladir		Move Up		
		Move Down		

23. **<D> Cancel** to dismiss the *Target Aliasing* dialog box.

The order that aliases are listed is important because it determines the testing order. In this exercise, the end condition tests against the *Corridor – 12345DES* first. If it cannot tie to the corridor it tests against the *Surface – 12345 Existing Ground*.

- 24. Scroll through the stations and notice how the right end condition behaves.
- 25. Select **File > Save** from the Roadway Designer menu bar.
- 26. **<D> Close** to dismiss the Roadway Designer dialog box.

Chapter Summary:

- In *Lab 15.1 -Modifying a Single Template Drop* a single template drop was modified by moving a point.
- In*Lab 15.2 Target Aliasing* target aliasing was used to tie one corridor to another. This method also allowed the corridor to tie to the existing ground as needed.

LAB 16 - Creating Design Surfaces

This lab demonstrates the methods of creating design surfaces. These range from creating a single surface from a single corridor to creating multiple surfaces from multiple corridors to creating a single surface from multiple corridors.

Chapter Objectives:

- Create a surface from a single corridor.
- Create multiple surfaces from multiple corridors.
- Create an alternate surface for a corridor.
- Create a single surface by combining corridors.

Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\InRoads\12345DES_Geometry.alg
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\12345DES.ird (created in lab 4)
- C:\Projects\12345\Design\InRoads\DES12345_Templates.itl
- C:\Projects\12345\Design\InRoads\Combine Surfaces.ird

Lab 16.1 - Create a Surface (dtm) From a Single Corridor

Creating a surface from a single corridor uses the basic functionality of the *Create Surface* command. Here, a single design surface is created from the 12345DES corridor.

- 1. Select **Modeler > Roadway Designer** from the InRoads menu bar.
- 2. Select Corridor > Create Surface from the Roadway Designer menu bar or <D> the

Create Surface button 🔳.

- 3. In the *Create Surface* dialog box, key in **12345DES** for the *Name*. To avoid confusion later on, it is best to use the corridor name for the surface name.
- 4. Set the *Default Preference* to **Proposed**.
- 5. Verify that the following check boxes are toggled on:
 - **Empty Design Surface** (to ensure no residual data is used)
 - **Triangulate** (to create the triangulated model)
 - **Remove Loops** (to correct areas where template drops cross)
 - Add Exterior Boundary (to eliminate erroneous triangles in concave areas of the design model)
- 6. Set the exterior boundary style to Exterior Boundary or DTM_Exterior.
- 7. Highlight the **12345DES** corridor from the *Create Surface(s) From* list.

🕌 Create Surface
Name: 12345DES - Apply
Default Preference: Proposed Close
Create Surface(s) from: Preferences
12345DES Off Ramp Scab-on Detour
Scabon Detour SH 86_Offset_Left Template Transition
None
Clipping Options
General Options
New Surface for Each Corridor Create Alternate Surfaces
Empty Design Surface Process Visible Range Only
Include Null Points
☑ Triangulate
Features
Duplicate Names: Append Replace Rename Modify
Add Transverse Features
Style:
Add Exterior Boundary
Style: Exterior Boundary 👻
Densify using Chord Height Tolerance Display in Plan View
Horizontal Curves
Vertical Curves Components

8. **<D> Apply**. This creates the surface and displays the *Results* window.

- Examine the contents of the *Results* window then Close it. The information displayed will depend on the Option settings. These are found under Tools > Options on the Roadway Designer menu bar.
- 10. **<D> Close** to dismiss the *Create Surface* dialog box.
- 11. Minimize the **Roadway Designer** dialog box.

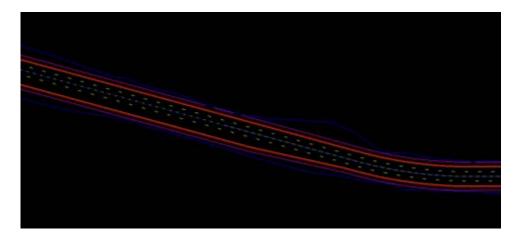
One method of reviewing the dtm is to display the features into the MicroStation file. Follow the steps below to display the features from the newly created surface.

12. From the *InRoads* menu bar, select **Surface > View Surface > Features**.

- 13. In the *View Features* dialog box, select **12345DES** for the *Surface*.
- 14. Verify that all features are highlighted in the *Features* list.
- 15. **<D> Apply**.

🐂 View Features			—
Surface: 12345	DES 🔻	- E	Apply
Fence Mode: [Ignore			Close
			Filter
			T III.GT
		E	Edit Style
			Help
Features:			
Name	Style	Description	<u>+</u>
ABC_Centerline-Top	Centerline	Created by roadway	y E
Exterior Boundary	Exterior Boundary	Created by roadway	y
HMA_Lift1_Centerlin	Centerline	Created by roadway	y
HMA_Lift2_Centerlin	Centerline	Created by roadway	y
HMA_Lift3_Centerlin	Centerline	Created by roadway	y
LT_ABC_EOP-Top	D_EOP	Created by roadway	y
LT_ABC_Hinge-Top	D_HINGE	Created by roadway	y
LT_ABC_Laneline-To.	D_LANELINE	Created by roadway	y
LT_ABC_Laneline-To.	D_LANELINE	Created by roadway	y
LT_HMA_LIft2_EOP	.D_EOP	Created by roadway	ý
LT_HMA_LIft2_EOP	.D_EOP	Created by roadway	Ý

- 16. **<D> Close** to dismiss the View Features dialog box.
- 17. Examine the displayed features.



DTMs created with the Roadway Designer have some properties that need to be set. These control how the surface is displayed and how it is used in volume calculations. Follow the steps below to make the settings changes.

- 18. In the *InRoads* main dialog box, select the **Surfaces** bottom tab.
- 19. **<R>** on **12345DES** and select **Properties** from the menu.



20. Notice the *Preference* and *Type* in the *Surface Properties* dialog box. The Preference controls some display properties and the Type determines how the surface is used when calculating volumes.

Surface Properties				
Main Advanced				
Surface:	12345DES -			
Name:	12345DES			
Description:	Created from roadway de			
Maximum Length:	0.00			
Preference:	Proposed			
Preference: Type:	Proposed			
	Design 👻			

- 21. **<D>** the **Advanced Tab**.
- 22. In both the *Cross Sections* and *Profiles* areas, set the *Symbology* to **D_Finished-Grade**.
- 23. **<D> Apply** to accept the changes.
- 24. **<D> Close** to dismiss the *Surface Properties* dialog box.

Lab 16.2 - Creating Multiple Surfaces from Multiple Corridors.

This exercise illustrates the process of creating multiple surfaces at one time.

When the surface properties were accessed in the previous lab, the active surface was set to the 12345DES surface. The active surface needs to be set to the 12345_Existing Ground surface in order for the corridors to process correctly.

- 1. Expand the **Roadway Designer** dialog box.
- 2. Set the *Active Surface* to **12345_Existing Ground**.

+)	+-++++	■ ▲ ⋈ ⋈ ∢	and a
Conidor:	12345DES	-	Station:	203+80.28	+ < <
Active Surface:	12345 existing ground	-	Interval:	25.00	
			Template:	12345_HMA_2Lane	

- 3. Select **Corridor > Create Surface** from the Roadway Designer menu bar or **<D>** the **Create Surface** button.
- 4. Toggle on the **New Surface for Each Corridor** check box. This disables the Name field and each new surface is named after its corridor.
- 5. Verify that the settings made in the previous lab are still in affect.
- 6. Highlight all of the corridors in the *Create Surface(s) From* list.
- 7. **<D> Apply**.

reate Surface			×
Name: Default Preference:	Proposed	•	Apply
Create Surface(s) from 12345DES Off Ramp Scab-on Detour SH 86, Offset_Left Template Transition	: ping Options	All None	Preferences
General Options Image: Construction of the second	face		nate Surfaces ible Range Only ops
Features Duplicate Names: Append Add Transverse F Style:	Features) Rename (O Modify
Style: Add Exterior Bou Style:	Default ndary Exterior Bounda	⇒ ary →	
Densify using Chord Horizontal Curves		E Fe	ay in Plan View atures omponents

8. Examine the contents of the *Results* window. Note the point control information from the previous labs. Close the *Results* window

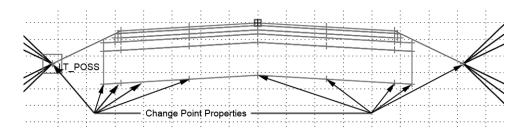
- 9. **<D> Close** to dismiss the *Create Surface* dialog box.
- 10. Minimize the Roadway Designer dialog box.
- 11. In the *InRoads* dialog box, notice that there is a new surface for each corridor (the 12345DES surface created in the first exercise was emptied and the data replaced with this run). InRoads uses the corridor name for the surface name when creating multiple surfaces.
- 12. Expand the *Roadway Designer* dialog box and select **File > Save** from the menu bar.
- 13. **<D> Close** to Dismiss the Roadway Designer dialog box.

Lab 16.3 - Create an Alternate Surface

The Alternate Surface option is used to create a surface from points specified in the template. This is in addition to the normal, finished grade surface that is created. This exercise illustrates the process of creating an alternate surface. The HMA_Crowned_B10 template is modified to create the alternate surface, the Template Drop is updated, and the surfaces are created.

In the first series of steps the template is updated to specify the points that are used for the alternate surface.

- 1. From the *InRoads* menu bar, select Modeler > Create Templates.
- 2. In the *Template Library* area, expand the *C:\Projects\12345\Design\InRoads\ DES12345_Templates.itl* folder.
- 3. Expand the **1 Templates** folder.
- 4. **<D> <D>** on the **HMA_Crowned_B10** template.
- 5. $\langle D \rangle \langle D \rangle$ on the LT_POSS point.
- 6. Toggle on the Alternate Surface check box.
- 7. In the Alternate Surface key in field, type Subgrade.
- 8. **<D> Apply**.
- 9. **<D> Close**.



- 10. Repeat steps 3 through 8 for the points indicated in the illustration above.
- 11. Select **File > Save** from the *Create Template* menu bar.
- 12. **<D> Close**.

The template is prepared to create the alternate surface. Next the template drop is updated.

- 13. From the *InRoads* menu bar, select **Modeler > Roadway Designer**.
- 14. Set the Corridor to SH 86_Left_Offset.

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Comidor:	SH 86_Offset_Left	•]		Station:	203+80.28	+ < <
Active Surface: 12345 existing gro	12345 existing ground	•		Interval:	25.00	
				Template:	HMA_Crowned_B10	7

- 15. Select Corridor > Template Drops from the *Roadway Designer* dialog box, or <D> the Template Drops button.
- 16. In the Template Drops dialog box, highlight the entry in the Current Template Drops list.
- 17. **<D> Synchronize With Library** button.
- 18. **<D> Close**.

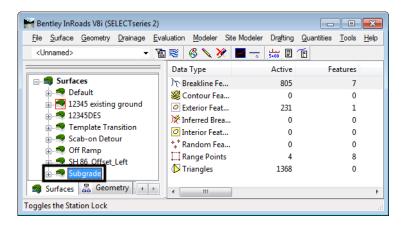
Everything is ready to create the alternate surface. The finished grade design surface and the alternate surface are created at the same time.

- 19. Select Corridor > Create Surface from the Roadway Designer menu bar or <D> the Create Surface button.
- 20. Toggle off the New Surface for Each Corridor check box.
- 21. In the *Create Surface* dialog box, key in SH 86_Left_Offset for the Name.
- 22. Highlight the SH 86_Left_Offset corridor from the Create Surface(s) From list.
- 23. Toggle on the Create Alternate Surfaces check box.

24. **<D> Apply**.

🐂 Create Surface		×
Name:	SH 86_Offset_Left	✓ Apply
Default Preference:	Proposed	Close
Create Surface(s) from	1:	Preferences
12345DES Off Ramp Scab-on Detour		Help
SCap-on Defour SH 86 Offset Left Template Transition		All
		one
Clip	ping Options	
General Options	-	
New Surface for Empty Design Su	Each Corridor	cess Visible Range Only
Include Null Poin		move Loops
Triangulate		
Features Duplicate Names:	Replace Rena	ame 🔿 Modify
Add Transverse		
Style:	Default	~
Add Exterior Bou	indary	
Style:	Exterior Boundary	▼
Densify using Chord		Display in Plan View
Horizontal Curve	3	Features
Vertical Curves		Components

- 25. Review the report displayed in the Results dialog box, then **<D> Close** the *Results* dialog box.
- 26. **<D> Close** to dismiss the *Create Surfaces* dialog box.
- 27. Select **File > Save** from the *Roadway Designer* menu bar.
- 28. Minimize the **Roadway Designer** dialog box.
- 29. Notice, in the InRoads dialog box, that the Subgrade surface has been created.



Lab 16.4 - Create a single surface from two corridors

Many design types have multiple corridors. Divided highways, intersections, and interchanges can use two or more corridors. Often, it is desirable to have a surface model of the entire project instead of a separate surface for each part. This exercise demonstrates how to a create single surface from two parallel corridors.

This exercise uses a different corridor than the previous exercises. The first steps load the Combine Surfaces.ird file.

- 1. Expand the **Roadway Designer** dialog box.
- 2. Select File > Open from the *Roadway Designer* menu bar.
- 3. Highlight the C:\Projects\12345\Design\InRoads\Combine Surfaces.ird file and <D> Open.
- 4. Scroll through the stations for both corridors. The 12345DES corridor is the initial phase of construction and is tied to the existing ground. The SH86_Offset_Left corridor is the second phase and ties to the 12345DES corridor on the right and the existing ground on the left.
- 5. Select the SH86_Offset_Left corridor.

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Corridor:	SH 86_Offset_Left	•		Station:	<u>k <</u>	260+00.00	+ < <
Active Surface:	12345 existing ground	•		Interval:		25.00	
				Template:		HMA_Crowned_B10]
				Template:		HMA_Crowned_B10	

- 6. Select **Tools > Target Aliasing** from the Roadway Designer menu bar.
- 7. Notice that aliases have been set up for this corridor. Target Aliasing is used to determine how corridors are clipped when combining corridors.

Carget: <a>Active Surface>	•		OK
Surface or Corridor Surface - 12345DES Surface - Default Surface - Off Ramp Surface - Scab-on Detour Surface - SH 86_Left_Offset Surface - SH 86_Offset_Left Surface - SH 86_Offset_Left Surface - Subgrade Surface - Template Transition	Add -> <- Remove Move Up Move Down	Aliases: Corridor - 12345DES Sulface - 12345 existing ground	Cancel Help

8. **<D> Cancel** to dismiss the *Target Aliasing* dialog box.

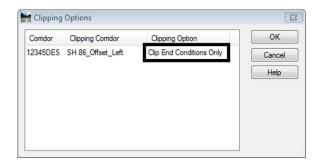
The next series of steps identifies the settings used in the Create Surface dialog box.

- 9. Select Corridor > Create Surface from the Roadway Designer menu bar or <D> the Create Surface button.
- 10. Key in SH 86_Combined for the Name.
- 11. Set the *Default Preference* to **Proposed**.
- 12. Verify that the following check boxes are toggled on:
 - Empty Design Surface
 - Add Exterior Boundary
 - Triangulate
 - Remove Loops
- 13. Set the exterior boundary style to Exterior Boundary or DTM_Exterior.
- 14. Highlight the **12345DES** and the **SH86_Offset_Left** corridors from the *Create Surface(s) From* list. Hold the **Ctrl** key and **<D>** on each corridor.

Clipping options determine how the two corridors will be combined into one surface. The option used here, Clip End Conditions Only, will delete overlapping end condition features from the 12345DES corridor.

15. **<D>** the **Clipping Options** button.

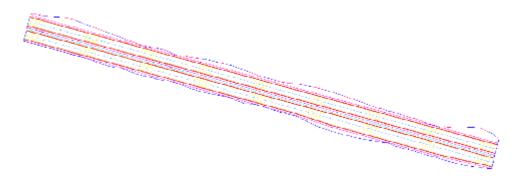
- In the *Clipping Options* dialog box, <D> on the entry in the *Clipping Option* column until it reads Clip End Conditions Only.
- 17. **<D> OK**. This dismisses the Clipping Options dialog box.



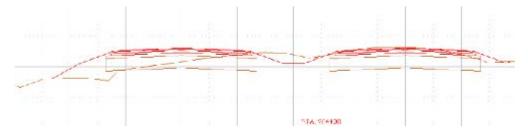
- 18. In the *Create Surface* dialog box, verify that **New Surface for Each Corridor** and **Create Alternate Surfaces** are toggle off.
- 19. **<D> Apply** to create the combined surface.
- 20. Review then **<D> Close** on the *Results* dialog box.
- 21. **<D> Close** to dismiss the *Create Surface* dialog box.
- 22. Select **File > Save** from the *Roadway Designer* menu bar.
- 23. **<D> Close** to dismiss the *Roadway Designer* dialog box.

The last series of steps displays the combined surface's features into the MicroStation file for review.

- 24. Delete any graphics displayed in the drawing.
- 25. From the InRoads Menu bar, select **Surface > View Surface > Features**.
- 26. In the *View Features* dialog box, select SH 86_Combined for the *Surface*.
- 27. Verify that all features are highlighted in the *Features* list.
- 28. **<D> Apply**.
- 29. **<D> Close** to dismiss the *View Features* dialog box. The illustration below shows the features in the combined surface.



Cross sections are discussed in the next chapter, however, below is a sample cross section of the combined surface.



30. In the *InRoads* dialog box, **<R>** on the **12345DES** Surface and select **Save** from the menu. This surface is used in the next lab.

Bentley InRoads V8i (SE					D (1)	0		<u>×</u>
<u>File</u> <u>Surface</u> <u>G</u> eometry	Drainage Ev	aluation M	odeler Sr	te Modeler	Drafting	Quantities	Lools	Help
<unnamed></unnamed>	- Y	1 💐 🚳	📏 🎘		بيل 5+00 🗐	Ē		
		Data Ty	pe		Active	Fea	tures	
E Surfaces		Dr Break	dine Fe		12514		64	
🗄 🥌 Default		🛛 🧏 Cont	our Fea		0		0	
	12345 existing ground				503		1	
🗄 🤝 12345DES	Save	24	d Brea		0		0	
			r Feat		0		0	
Gramp	Save As		om Fea		0		0	
SH 86 Offs	Set Active		Points		4		65	
Subgrade	te	jles		3952		0		
😂 Surfaces 🖁 🖁 Ge	Сору							
Toggles the Station Locl	Close							

Chapter Summary:

- In *Lab 16.1 Create a Surface (dtm) From a Single Corridor* a surface was created from a single corridor. The basic settings used when creating most surfaces were demonstrated.
- In *Lab 16.2 -Creating Multiple Surfaces from Multiple Corridors.* multiple surfaces were created from multiple corridors. When generating multiple surfaces, each surface is named after the corridor that created it.
- In *Lab 16.3 Create an Alternate Surface* an Alternate surface was created. The template was modified to identify which points are used to create the alternate surface. The template drops were updated and setting changed in the Create Surface command.
- In *Lab 16.4 Create a single surface from two corridors* a single surface created by two combining corridors. Target Aliasing was used to identify how corridors are clipped to create the combined surface.

LAB 17 - Cross Sections, Volumes, and Reports

This lab illustrates the changes in cross sections, volumes, and reporting from InRoads 2004 to InRoads V8i. These changes came about due to changes in the templates and dtm.

Chapter Objectives:

- Create and update a set of cross sections to show the design surface and components.
- Calculate End Area Volumes for the cross sections.
- Add an area of unsuitable material to the volume calculation.
- Use a volume exception when calculating End Area Volumes
- Examine the End Area Volume reports.
- Create a Station Base report to an alignment.
- Create a Station Base report to a feature.

Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\Preferences\CDOT_Civil.xin
- C:\Projects\12345\Design\InRoads\12345DES_Geometry.alg
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\12345DES.ird
- C:\Projects\12345\Design\InRoads\DES12345 Templates.itl

Lab 17.1 - Create Cross Sections

This lab demonstrates the changes made in the Create Cross Sections command and illustrates the changes made in the surface (dtm) from the 2004 edition to the V8i edition of InRoads.

Step 1 resets the text scale factor for InRoads so that the cross sections will display correctly.

- 1. Select **Tools > Options** and **<D>** the **Factors** tab and set the scale factors to *30*. This can also be done from the *Global Scale Factors* dialog box.
- 2. **<D> Apply**.
- 3. **<D> Close**.

The cross sections created in the following steps display the existing ground and the triangulated design surface only. This is to illustrate what features (template points) are used to create the triangulated surface model.

4. Select **Evaluation > Cross Section > Cross Sections** from the InRoads menu bar.

5. In the *Create Cross Section* dialog box, toggle on the **12345 Existing Ground** and the **12345DES** surfaces.

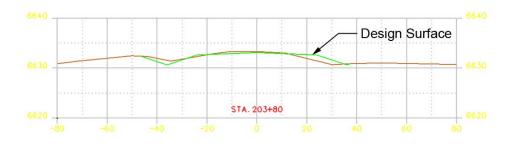
K Cross Sections				
File				
Cross Section Set:	Mode: Refresh (Start: Set Name: Create: Interval: Left Offset: Right Offset: Vertical Exaggeration: Show Data Outside Surfaces: Object Default 12345 existing grov 12345 DES	Stop: SH 86 Window and Data ▼ 50.00 -80.00 80.00 2.0000 Bevation Range Name Default	+ + + H	
		Apply	Preferences Clos	e Help

- 6. **<D> Include** in the *Create Cross Section* explorer.
- 7. Toggle off **Components**. This is done to illustrate what is stored as a surface. Normally, this toggle is left on. The components will be added to the cross sections in later steps.

K Cross Sections		- • -
File		
Cross Section Set:	Mode: Refresh Display On Display Off Start: Stop: Surface Crossing Features Adjust Range Projected Features Ahead Band: 10.00 Back Band: 10.00 Components Stom and Sanitary Crossing Structures Ahead Band: 10.00 Back Band: 10.00 B	
	Apply Preferences Close	Help

8. **<D> Apply**, then **<D>** in the MicroStation view window to place the cross sections.

- 9. **<D> Close** to dismiss the *Create Cross Section* dialog box.
- 10. Examine the first cross section. The design surface (12345DES) represents the upper most points of the template. The remaining features (created from the template points) are stored in the dtm as untriangulated features.

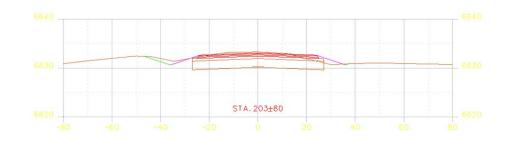


Next, the components are added to the cross sections using the Update Cross Section command.

- 11. Select **Evaluation > Cross Section > Cross Sections** from the InRoads menu bar.
- 12. Select the Update Cross Section folder from the dialog box explorer.
- 13. Toggle on the **Display On** radio button.
- 14. **<D> Components** leaf in the dialog box explorer.
- 15. Highlight **12345DES** in the *Surface* area.
- 16. **<R>** in the *Component* area and select **Select All** from the menu.
- 17. **<D> Apply**.

File					
Cross Section Set: SH 86 Create Cross Section Annotate Cross Section Constraints General Surfaces	1	3 Stop: 260+) Display Off 43.16 Description Existing Ground from mi Created from roadway of		
Components Crossing Heatures Projected Features Storm and Sanitary End-Area Volumes	Component: Name ABC HMA_Lift1 HMA_Lift2 HMA_Lift3	Style D_ABC_Class 6 D_HMA_Pvmt D_HMA_Pvmt D_HMA_Pvmt	Description Aggregate Base Cou Hot Mix Asphalt Pav Hot Mix Asphalt Pav Hot Mix Asphalt Pav	■ # 	
		Select All Select None Invert Selecti	Ctrl+A Ctrl+N on	Ed	iit Style
		Арр	Preferences.	Close	Help

- 18. **<D> Close** to dismiss the *Cross Sections* dialog box.
- 19. Examine the first cross section. The surfacing components are shown. End condition components are not shown in the cross sections because they are also part of the surface.



Lab 17.2 - Calculate End Area Volumes

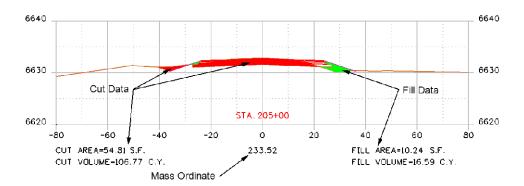
This exercise demonstrates the basic End Area Volume command. This command has changed due to changes in the dtm data, however, the concept is the same. The design surface (specified by the surface *Type* in the *Surface Properties*) is compared to the existing surface (also specified by the surface *Type*) to determine the amount of Cut and Fill.

- 1. Select **Evaluation >Cross Section > Cross Sections** from the InRoads menu bar.
- 2. Select the End Area Volumes folder form the dialog box explorer.
- 3. On the *General* leaf, notice the Surfaces selected. Surface 12345 Existing Ground has the Type of Existing and 12345DES has the type of Design.
- 4. Toggle off Create XML Report.
- 5. Toggle on **Cubic Yards**.

6. **<D>** Apply.

K Cross Sections		- • 💌
File		
Cross Section Set: SH 86 Create Cross Section Annotate Cross Section Undate Cross Section Undate Cross Section Compute Quantities Compute Quantities Unsuitable Materials by Feature Unsuitable Materials by Station Classifications Compaction/Expansion Volume Exceptions Added Quantities Forced Balance As Built Annotation Mass Haul Diagram	Mode: Refresh Display On Display Start: 203+80.28 Stop: 250+43.16 Surface Type I 2345 existing Existing I 2345DES Design I 2345DES Cubic Feet Cubic Yards Cubic Feet Create XML Report	y Off Method Standard Correct for Curvature Limits Static 203+80.28 Stop: 203+80.28 Stop: 203+80.28 Plot Mass Haul Diagram
	Apply	Preferences) Close Help

7. Examine the cross sections. Notice the various types of data shown in the illustration below.



Some materials shown in the template are computed as normal embankment. In this example, the D_SUBBASE material is included as embankment. The steps below change the settings for the subbase so that it can be included as embankment.

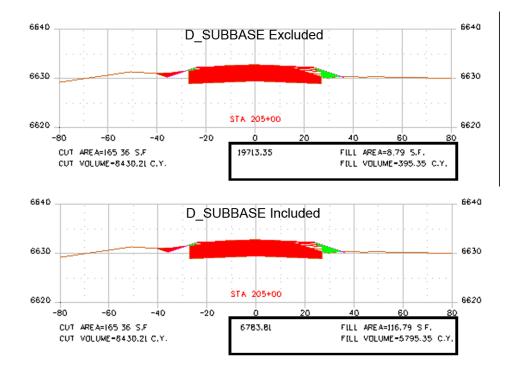
8. **<D>** on the **Classifications** leaf in the under the *End Area Volumes* folder.

9. **<D>** in the cell of the **D_SUBBASE** row and the **Mass Ordinate** column so that it reads **Include**.

rile								
File Cross Section Set: SH 86 Create Cross Section Annotate Cross Section Create Cross Section Compute Quantities Compute Quantities Compute Materials by Station Compaction/Expansion Compaction/Expansion Column Exceptions Added Quantities Forced Balance As Built Annotation	Mode: Refresi Start: 203+80.23 Object 12345 existing gro D_SUBBASE D_HMA_Pvmt D_ABC_Class 6	3 Stop	260+43. Parent 12345DE 12345DE	16	Exclude	Cut Fac 1.0000	Fill Fact Pa	
L Mass Haul Diagram	<		Apply		rences	Close		► Help

10. **<D> Apply**.

11. Examine the cross sections. Notice the change in the data.



Lab 17.3 - Unsuitable Material

The existing ground may contain material that cannot be used in the construction of the design project. This exercise demonstrates the use of the *Unsuitable Materials by Station* option.

The steps below set up the dialog box to use the unsuitable material options. The other settings remain the same.

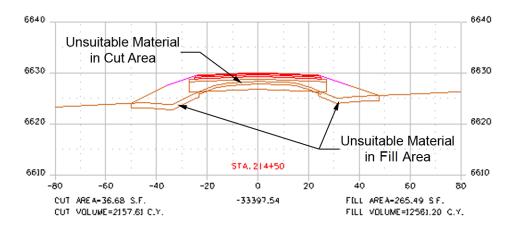
- 1. In the End Area Volumes folder, <D> Unsuitable Materials by Station.
- 2. Select **203+80.28** for the *Start Station*.
- 3. Select **260+43.16** for the *Stop Station*.
- 4. Key in *0.50* for the *Cut Depth*.
- 5. Key in *1.00* for the *Fill Depth*.
- 6. **<D> Add**. The data is placed in the Unsuitable Materials list.
 - **Note:** There is currently not a style for unsuitable material. That is why Default is used here.

Cross Sections						
File						
Cross Section Set: SH 86 Create Cross Section Annotate Cross Section Update Cross Section Compute Quantities Compute Quantities Unsuitable Materials by Station Cassifications Compaction/Expansion Compaction/Expansion Added Quantities Added Quantities As Built Annotation	Start: 203+80 Settings Start Station: Stop Station: Style:	203+80.28	y On Dis pp: 260+43.1			
Mass Haul Diagram	Unsuitable Mate	erials:				
	Start Station	Stop Station	Material	Cut Depth	Fill Depth	Add
	203+80.28	260+43.16	Default	0.50	1.00	Change Delete
			Apply	Preferences	Close	Help

- 7. **<D>** Annotation under the *End Area Volumes* folder.
- 8. *Toggle off* Cut Shape and Fill Shape. This is so that the unsuitable material shapes can be seen.

9. **<D> Apply**.

10. Examine the cross sections. Notice the change in the data. The cut and fill volumes have changed to account for the unsuitable material.



- 11. **<D> Close** on the *End Area Volumes* dialog box.
- 12. **<D> No** on the dialog box that is displayed.

Lab 17.4 - Volume Exceptions

Volume exceptions are used to omit specified cross sections from earthwork calculations. This allows the design model to be run continuously through the project and still account for the area where no earthwork is done. This option is commonly used at bridges. In the exercise, a set of custom cross sections is generated to show the beginning and end of the volume exception. Then the exception is set up in the End Area Volume command. The volume exception runs from station **208+15.83** to station **212+89.50**.

The first series of steps is used to set up the custom cross section set.

- 1. Select **Cross Section > Cross Sections** from the InRoads menu bar.
- 2. In the *Create Cross Section* folder, on the *General* leaf, verify that the **12345 Existing Ground** and **12345DES** surfaces are selected.
- 3. **<D> Include** in the *Create Cross Section* folder.
- 4. Toggle on **Components**.
- 5. **<D>** the **Custom** folder under the *Create Cross Section* folder.

The steps below are used to display cross sections normally, from the beginning of the project to station 208+00.

- 6. Key in *208+00.00* for the *Stop Station* (the Start Station is set to the beginning station by default).
- 7. Key in *50.00* for the *Interval*.
- 8. **<D> Add**.

Cross Section Set:	Mode: 🔘 Refresh 🔘 Display On	Display Off		
SH 86 👻	+ Start: 203+80.28 Stop:	260+43.16		
Create Cross Section	Station Type	Туре:	Station Range	•
General Source		Details Start Station:	203+80.28	+
Controls		Stop Station:	208+00.00	+
Custom		Interval:	50.00	+
Layout		Left Offset:	-100.00	+
Layout Axes		Right Offset:	100.00	+
Grid Details		Skew Angle:	0^00'00"	+
Annotate Cross Section Update Cross Section End-Area Volumes	Features	Storm ar	nd Sanitary Structures sing	
	Projected	Proje		
	Ahead Band: 0.00		d Band: 0.00	+
	Black Bland: 0.00	Back	Band: 0.00	+
	Add Update Gra	aphics	nt Save Sa	ave As

The steps below are used to display a single cross section at station 208+15.83and at station 212+89.50.

- 9. Set the *Type* to **Perpendicular**.
- 10. Key in *208+15.83* for the *Station*.

11. **<D> Add**.

K Cross Sections				- • •
File				
Cross Section Set: SH 86 -	Mode: O Refresh O Display On Start: 203+80.28 Stop:	Display Of 260+43.16	ff	
Create Cross Section	Station Type	Type:	Perpendicula	ar 🔻
General Source Include	203+80.28 Station Range 208+15.83 Perpendicular	Details Station:	208+15.83	+
Controls		Left Offse	et: -100.00	+
Custom		Right Off	set: 100.00	+
Layout Layout Layout Grid Grid Grid Grid Acces Cli or LandXML Anotate Cross Section				
Update Cross Section	Features Crossing		orm and Sanitary Structur Crossing	es
🛅 End-Area Volumes			Projected	
	Ahead Band: 0.00 Back Band: 0.00		Ahead Band: 0.00 Back Band: 0.00	<u>+</u>
	Add Update Gra	phics	Import Save	Save As
		Apply	references Close	e Help

12. Key in *212+89.50* for the *Station*. (all other settings remain the same)

13. **<D> Add**.

The steps below are used to display cross sections normally, from station 213+00 to the end of the project.

- 14. Set the *Type* to **Station Range**.
- 15. Key in *213+00.00* for the *Start Station*.
- 16. Key in *260+43.16* for the *Stop Station*.
- 17. Key in *50.00* for the *Interval*.

18. **<D> Add**.

ile				
ross Section Set:	Mode: 🕐 Refresh 💿 Display Or	🕖 Display Off		
5H 86 👻	+ Start: 203+80.28 Stop:	260+43.16		
Create Cross Section	Station Type	Туре:	Station Range	-
General Source	203+80.28 Station Range	Details		
Include	208+15.83 Perpendicular	Start Station:	213+00.00	+
- Controls	212+89.50 Perpendicular	Stop Station:	260+43.16	+
		Interval:	50.00	+
Layout		Left Offset:	-100.00	+
Layout		Right Offset:	100.00	+
Grid Details		Skew Angle:	0^00'00''	+
ASCII or LandXML Annotate Cross Section Update Cross Section	Features		d Sanitary Structures	
End-Area Volumes	Crossing	Crossi	-	
	Projected	Projec		
	Ahead Band: 0.00	-+ Ahead	d Band: 0.00	+
	Back Band: 0.00	🔶 🖶 Back	Band: 0.00	+
	Add Update Gra	aphics	t Save Sa	ve As

<D> Apply. <D> a blank area of the MicroStation view window to display the cross sections.

The data used for the custom cross section set can be saved for use at a later time. The steps below save the data.

20.

- 21. **<D> Save** to display the **Save As** dialog box.
- 22. In the Save AS dialog box, navigate to C:/Projects/12345/Design/InRoads/ directory.
- 23. Key in *SH 86.xsc* for the file name and *<D> Save*.

To exclude the material within the volume exception, end area volumes must be recalculated. The following steps create the volume exception and recalculate the volumes.

- 24. Select End Area Volumes from the dialog box explorer.
- 25. **<D> General** under the *End Area Volumes* folder.

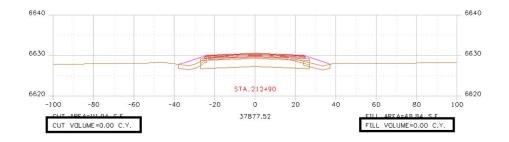
26. Select **SH 86_1** for the *Cross Section Set*. The other settings are correct.

K Cross Sections		
File		
Cross Section Set: SH 86_1 Create Cross Section Create Cross Section Update Cross Section Update Cross Section Update Cross Section Compute Quantities Unsuitable Materials by Feature Unsuitable Materials by Station Classifications Compaction/Expansion Volume Exceptions	Mode: Refresh ● Display On Display Start: 203+80.28 Stop: 260+43.16 Surface Type Image: Stop: 1/2 (Stop: ♥ 12345 existing Existing Design	Ay Off Method Standard Correct for Curvature Limits Station Range Start: 203+80.28
Added Quantities Forced Balance As Buit Annotation Mass Haul Diagram	Imperial Units © Cubic Yards © Cubic Feet © Create XML Report	Ignore Areas Smaller Than: 0.00
	Apply	Preferences Close Help

- 27. **<D> Volume Exceptions** in the *End Area Volumes* folder.
- 28. Select 208+15.83 for the Start Station.
- 29. Select **212+89.50** for the Stop Station.
- 30. **<D> Add**.

K Cross Sections			- • •
File			
Cross Section Set: SH 86_1 Create Cross Section Annotate Cross Section Update Cross Section Cross Section Cross Section Compute Quantities Unsuitable Materials by Feature Unsuitable Materials by Station Classifications Compaction/Expansion Volume Exceptions Added Quantities Forced Balance As Built Annotation	Mode: Refresh © Start: 203+80.28 Settings Start Station: 208+15, Stop Station: 212+89.		
Mass Haul Diagram	Volume Exceptions:		
	Start Station	Stop Station	Add
			Change Delete
		Apply Preferences) Close	e Help

- 31. **<D> Apply** to calculate the volumes.
- 32. Examine the cross section at station *212+89.50*. Notice the volumes listed for both cut and fill are 0.00. No earthwork was calculated between the stations *208+15.83* and *212+89.50*.



Lab 17.5 - Volume Reports

In addition to having volume information displayed on the cross sections, it can also be written to a tabular report. This exercise demonstrates how to create the report and the various templates used with the report.

The steps below create the XML data used for the report.

- 1. In the *End Area Volumes* folder, **<D>** the **General** leaf.
- 2. Select SH 86_1 for the Cross Section Set.
- 3. Toggle on Create XML Report.
- 4. **<D> Apply**. This displays the *Bentley InRoads Report Browser*.

The XML data is passed to the Bentley InRoads Report Browser so that it can be displayed in a useful manner. The steps below use several report templates to present the volume data in different ways.

- 5. In the *Bentley InRoads Report Browser*, **<D>** the *Evaluation* folder.
- 6. **<D>** the **EndAreaVolume.xsl** template.

Tools Help																
Workspace\Workspace-CDOT_XM\	NO Y									0.4	N N					
DataCollection * Evaluation	KXXX						End	Area V	olume F	Repor	π					
a: AverageCrossSlopeArea.xsl	XXX (R	eport Crea	ted: 3/26/2	009						
BasicEndAreaVolumeBalance								Time:	1:13pm							
All CrossSection xal	1	and Con	lon For	Name: S	L 00 1											
A: CrossSectionAllFeatures xsl	L C	2000		Name: S												
CrossSectionASCIIInputForm	$\sim \sim$							<u></u>			\sim					
CrossSectionASCIIInputForm =		2	nput Grid	Factor: 1	000000	Note: A	al units in t	his report an	e in feet, squa	re feet an	d cubic yard	s unless spe	cified othe	rwise.		
CrossSectionGradebook xsl	ICX X	X	$C \ge C$	\mathbf{X}	Station Q	mantitie			X.X.	XD		Added Q	uantities		XIX	XX
CrossSectionGradebookNE>	Baseline	() (Cut	oution a	uunuu	7	Fill	XX		Cut .	Huddod d				Mass
All CrossSectionGradebookWide All CrossSectionPoints xel	Station	Factor	Area		Adjusted	Factor									Adjusted	
	203+80.28			0.00	0.00	1.00	7.01	0.00	0.00	1.00	0.00	0.00	1.00	0.00	-	0.00
All CrossSectionPointsList xal								C 100		×			×	0.00	0.00	44.86
Cross Section Profile List xsl	204+00.00	1.00	175.71	128.86	128.86	1.00	7.03	5.12	5.12	1.00	0.00	0.00	1.00			
CrossSectionProfileList xsl CrossSectionStaking xsl			175.71	128.86 321.81	128.86	1.00	7.03	5.12	5.12	1.00	0.00	0.00	1.00	0.00		153.67
Cross Section Profile List xsl Cross Section Staking xsl Cross Section Staking Table xs	204+00.00	1.00														
CrossSectionProfileList xal CrossSectionStaking xal CrossSectionStaking Table xs CrossSectionSToCSV xal CrossSectionSurveyFormat xs	204+00.00 204+50.00	1.00	171.85	321.81	321.81	1.00	7.02	13.01	13.01	1.00	0.00	0.00	1.00	0.00	0.00	153.67
Cross Section Profile List xal Cross Section Staking Xal Cross Section Staking Table xa Cross Sections To CSV xal Cross Section Survey format xe	204+00.00 204+50.00 205+00.00	1.00 1.00 1.00	171.85 165.36	321.81 312.23	321.81 312.23	1.00 1.00	7.02 8.79	13.01 14.64	13.01 14.64	1.00	0.00	0.00	1.00	0.00	0.00 0.00 0.00	153.67 251.25
Cross Section Profile List xal Cross Section Staking xal Cross Section Staking Table xs Cross Sections To CSV xal Cross Section Survey Format x Cross Section Survey Format x	204+00.00 204+50.00 205+00.00 205+50.00	1.00 1.00 1.00 1.00	171.85 165.36 156.92	321.81 312.23 298.41	321.81 312.23 298.41	1.00 1.00 1.00	7.02 8.79 11.20	13.01 14.64 18.51	13.01 14.64 18.51	1.00 1.00 1.00	0.00 0.00 0.00	0.00 0.00 0.00	1.00 1.00 1.00	0.00 0.00 0.00	0.00 0.00 0.00	153.67 251.25 331.15
Cross Section Prof/eList xsl Cross Section Staking xal Cross Section Staking Table xa Cross Section Stravey Format x Cross Section Survey Format x Cross Section XYZ xsl Cross Section XYZ xsl	204+00.00 204+50.00 205+00.00 205+50.00 206+00.00	1.00 1.00 1.00 1.00 1.00	171.85 165.36 156.92 156.50	321.81 312.23 298.41 290.20	321.81 312.23 298.41 290.20	1.00 1.00 1.00 1.00	7.02 8.79 11.20	13.01 14.64 18.51 25.90	13.01 14.64 18.51 25.90	1.00 1.00 1.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	1.00 1.00 1.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00	153.67 251.25 331.15 395.46
CrossSectionProfileList xal CrossSectionStaking rables xi CrossSectionStaking Tables xi CrossSectionTiCCSVxal CrossSectionTiCCSVxal CrossSectionXVZ.xal CrossSectionXVZ.xal	204+00.00 204+50.00 205+00.00 205+50.00 206+00.00 206+50.00	1.00 1.00 1.00 1.00 1.00 1.00	171.85 165.36 156.92 156.50 157.81	321.81 312.23 298.41 290.20 291.02	321.81 312.23 298.41 290.20 291.02	1.00 1.00 1.00 1.00 1.00	7.02 8.79 11.20 16.77 26.59	13.01 14.64 18.51 25.90 40.14	13.01 14.64 18.51 25.90 40.14	1.00 1.00 1.00 1.00 1.00	0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00	1.00 1.00 1.00 1.00 1.00	0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00	153.67 251.25 331.15 395.46 446.34
Cross Section Profile List asl Cross Section Staking Table as Cross Section TacKing Table as Cross Sections TacKing Cross Sections TacKing Cross Section Survey Format as Cross Section Wide asl Cross Section XYZ asl Cross Section XYZ asl Cross Section XYZ asl	204+00.00 204+50.00 205+00.00 205+50.00 206+00.00 206+50.00 207+00.00	1.00 1.00 1.00 1.00 1.00 1.00 1.00	171.85 165.36 156.92 156.50 157.81 160.17	321.81 312.23 298.41 290.20 291.02 294.42	321.81 312.23 298.41 290.20 291.02 294.42	1.00 1.00 1.00 1.00 1.00 1.00	7.02 8.79 11.20 16.77 26.59 35.36	13.01 14.64 18.51 25.90 40.14 57.36	13.01 14.64 18.51 25.90 40.14 57.36	1.00 1.00 1.00 1.00 1.00 1.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00	1.00 1.00 1.00 1.00 1.00 1.00	0.00 0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00	153.67 251.25 331.15 395.46 446.34 483.40

7. Examine the report in the right pane of the browser. This report only has a grand total line.

- 8. **<D>** on the **EndAreaVolumePageTotals.xsl** template.
- 9. Examine the report in the right pane of the browser. This report only has page totals as well as a grand total line.
- 10. **<D>** on the **Volumes.xsl** template.
- 11. Examine the report in the right pane of the browser. This report lists areas and volumes for cut and fill along with the volumes for the components in the design dtm.

			$\sim \sim \sim$	Volumes	Report			
Report Created: 3/26/2009 Time: 1:32pm								
	ection Set Name: lignment Name: Input Grid Factor:	SH 86		iss specified otherwis				
Station	Туре	Area	Volume	Factor	Adjusted Volume	Included in Mass Ordinate?	Mass Ordinate	
203+80.28							0.	
	Normal Cut:	177.19	0.00	1.00	0.00	Yes		
	Normal Fill:	7.01	0.00	1.00	0.00	Yes		
	Added Cut:		0.00	1.00	0.00	Yes		
	Added Fill:		0.00	1.00	0.00	Yes		
	D_SUBBASE:	108.00	0.00	1.00	0.00	Yes		
	D_HMA_Pvmt:	36.75	0.00	1.00	0.00	No		
	ABC_Class 6:	27.00	0.00	1.00	0.00	No		
204+00.00							44.	
	Normal Cut:	175.71	128.86	1.00	128.86	Yes		
	Normal Fill:	7.03	5.12	1.00	5.12	Yes		
	Added Cut:		0.00	1.00	0.00	Yes		
	Added Fill:		0.00	1.00	0.00	Yes		
	D_SUBBASE:	108.00	78.87	1.00	78.87	Yes		
	D HMA Pvmt:	36,75	26.84	1.00	26.84	No		
	D_THVM_FVML.	00.10						

12. Close the *Bentley InRoads Report Browser* and all open dialog boxes (except the main InRoads dialog box).

Lab 17.6 - Station Base Reports

There are numerous other reports that can be generated from InRoads. they all function in a similar manner. This lab demonstrates the process of creating reports. The Geometry Station Base report is used for an example. The Station Base report measures the offset distance from the active alignment to a specified alignment (or feature) at given intervals along the active alignment. This report can be used to generate staking reports for items like sawcuts or curb flowlines. The steps below create the XML data file for the station base report, then uses several report templates to present the data in a variety of formats.

1. From the InRoads menu bar, select **Tools > XML Reports > Station Base**.

n <u>M</u> odeler Site Modeler Dr <u>a</u> fting <u>Q</u> uantities	Tools Help
A Geometry	XML Reports
Station Base	View XML Reports
BI Station Offset	Trac <u>k</u> ing ▶
_ · · · · · · · · · · · · · · · · · · ·	Named Symbology Manager
Stakeout	Preference Manager
E Egal Description	😤 Style Manager
In 🍓 Map Check	Copy Preferences
In 🔯 Intersecting Alignment Stations	Named Symbology Tools
Ri 🙀 Point Validation	n= Variable Manager
Ri 🚵 Surfaces	
Ti 🤮 Su <u>f</u> ace Check	Highlight All Pencil

2. In the *From* area of the *Station Base Report* dialog box, note that the alignment *SH 86* is selected. Measurements are made perpendicular to this alignment.

Station Base Report • General Include - Horizontal Alignments - Features	From Fhorizontal Alignment: Surface: Feature:	SH 86 12345DES	
	Limits Station Start: 203+80.28 Stop: 260+43.16	+ +	

- 3. **<D> Include** from the *Station Base Report* explorer.
- 4. In the *Interval* field, key in **100**.

Mase Report		- • •		
Station Base Report General Include Horizontal Alignments	Horizontal Points On-Alignment Event	Vertical Points		
E Features	Interval: 100.00 Interval: 50.00 Cardinal Points of Selected Align	+ 		
	Apply Preferences	Close Help		

5. **<D> Horizontal Alignments** from the *Station Base Report* explorer.

- 6. In the *Include* field, key in *Off Ramp*. Press the *Tab* key to accept the entry.
- 7. **<D> Apply**. This displays the *Bentley InRoads Report Browser*.

i Station Base Report							x
Station Base Report General	Include: Selected:	Off Ramp	0	+		Filter.	
	Name		Description		Style		
Features	Off Ramp			A	ILG_PRO		
	Арр	bly	Preferences	0	Close	Help	

- 8. In the *Bentley InRoads Report Browser*, **<D>** the **StationBaseSingle.xls**.
- 9. Examine the report in the right pane.

e Tools Help						
Workspace\Workspace-CDOT_XM\	スススス	たんえんぶ	- 人 人 入 人 人 フ	マススフ	人人人人の	ロネススネフ
Gistom	ICX XOX X	Project	: 12345DES_Geometry			
DetaCollection	X 2.0000	Description	SH 86 Design geometry			
Evaluation	Bas	eline (Active) Alignmen	- SH 86			
Geometry	Das				X.XXXXX	
ICS	I XXXXX		C:\Projects\12345\Design\InRoa	ds112345DES_Geom	atry.alg	
Images	NYYYY	Last Revised	: cferree 3/26/2009 6:20:33 AM			
Intersecting Alignment Stations		Input Grid Factor	: 1.0000000	Note: All units	in this report are in feet unless	specified otherwise
LegalDescription				<u> </u>		
LightRailManufacturing MapCheck		Baseline Alignme	nt		Offset Alignment	
Obsolete		Distance to			Distance to	
RoadwayDesign	Station	Offset Point	Radial Direction	Station	Offset Point	Radial Direction
Schemas		Onseronie	Rudual Direction	Judon	Onject Onic	Rudial Direction
Stakeout	Offset (Specified) Ali	000				
StationOffset	Unset (Specified) All	gnment: Of Ramp				
A) IHSDMLandXMLxsl	X X X X	ススススス	こん スーム スース	(C.X.X.X.)	ススススフ	くえええれい
A ProfileExistingProposedEeva	205+00.00	0.00	S 15°14'41" W	205+00.00	24.00	S 15"14'41" W
AP ProfileStationElevation xal AT ProfileStationElevationASCII:	206+00.00	0.00	S 15°14'41" W	206+00.00	24.00	S 15*14'41" W
A1 StationRaseCoordinates vs	207+00.00	0.00	S 15°14'41" W	207+00.00	24.00	S 15°14'41" W
All StationBaseSingle xsl	208+00.00	0.00	S 15°14'41" W	208+00.00	24.00	S 15"14'41" W
At StationBaseverticalLlearance	209+00.00	0.00	S 15°14'41" W	209+00.00	24.00	S 15"14'41" W
A] StationOffset xal						
A] StationOffsetAlongSingleAligr	210+00.00	0.00	S 15°14'41" W	210+00.00	24.00	S 15"14'41" W
A] StationOffsetAlongSingleAligr	211+00.00	0.00	S 15°14'41" W	211+00.00	24.00	S 15"14'41" W
A: StationOffsetWithVersine.xsl A: TransverseFeature.xsl	212+00.00	0.00	S 15°14'41" W	212+00.15	28.69	S 20°47'52" W
Superelevation	213+00.00	0.00	S 15°14'41" W	213+01.29	43.55	S 26"35"34" W
Sufaces	214+00.00	0.00	S 15°14'41" W	214+04.54	69.05	S 32"30'30" W
Survey						
Tabling	215+00.00	0.00	S 15°14'41" W	215+11.23	106.08	S 38°37'16" W
Template Library	216+00.00	0.00	S 15°14'41" W	216+23.10	156.12	S 45"01'52" W
Tumouts XIN *	217+00.00	0.00	S 15°14'41" W	217+42.70	221.59	S 51"53"01" W

This report is useful for determining the distance between two alignments. It can also be used to determine the distance from an alignment to a surface feature. The steps below create a station base report between an alignment and a surface feature.

- 10. Minimize the Bentley InRoads Report Browser.
- 11. In the Station Base Report dialog box, <D> Horizontal Alignments in the explorer.
- 12. **<D>** in the *Include* field then **<D>** the **Filter** button.
- 13. In the *Geometry Selection Filter* dialog box, verify that the *Selected* list is empty.

Name:	Ignore	▼ *				OK
Description:	Included	•				Cancel
Style:	Included	-				Preferences.
Fence Mode:	Ignore	-				
Available:				Selected:		Help
Name	Description	Style	Add ->	Name	Description	Style
SH86_Offs	SH 86 Centerline CL For left driving (500 501 502)	-	<- Remove <- Swap -> All None			

14. **<D> OK** to dismiss the *Geometry Selection Filter* dialog box.

- 15. **<D> Features** in the explorer.
- 16. Select **12345 Existing Ground** for the *Surface*.
- 17. In the *Features* list, Highlight **T_Edge of Oil497**.
- 18. **<D> Apply**.

Station Base Report General	Surface: 12345 Features:	existing groun 🔻	J	Filter
Horizontal Alignments	Name	Style	Description	<u> </u>
🕸 Features	T_Edge of Oil477	T_Edge of Oil	Edge of Oil	
	T_Edge of Oil488	T_Edge of Oil	Edge of Oil	
	T_Edge of Oil492	T_Edge of Oil	Edge of Oil	
	T Edge of Oil493	T Edge of Oil	Edge of Oil	
	T_Edge of Oil497	T_Edge of Oil	Edge of Oil	
	LEdge of OIDT1	I_Edge of Oil	Edge of Oil	
	T_Edge of Oil512	T_Edge of Oil	Edge of Oil	
	T_Edge of Oil595	T_Edge of Oil	Edge of Oil	-

19. In the *Bentley InRoads Report Browser*, **<D>** the **StationBaseSingle.xls**.

20. Examine the report in the right pane.

		Station Ba	se nepon		
		Report Created Time: 2			
	Project:	12345DES_Geometry			
	Description:	SH 86 Design geometry			
Baselin	ne (Active) Alignment:	SH 86			
	File Name:	C:\Projects\12345\Design	nVnRoads\12345DB	ES Geometry alg	
	Last Revised:	cferree 3/26/2009 6:20:33	3 AM		
	Input Grid Factor:	1.0000000	Note: All units in this	report are in feet unless :	specified otherwise.
	Baseline Alignme	ent	AAA.	Offset Alignme	ent
	Distance to			Distance to	
Station	Offset Point	Radial Direction	Station	Offset Point	Radial Direction
XXX		\overline{OOOO}	Station		Radial Direction
XXX	Offset Point	\overline{OOOO}			
ffset (Specified)	Offset Point	of Oil497	88	Offset Point	\$ 15°34'50" V
ffset (Specified) 226+50.00	Offset Point Alignment: T_Edge o 0.00	of Oil497 S 15°14'41'' W	0+35.23	Offset Point	S 15°34'50" \ S 15°00'34" \
ffset (Specified) 226+50.00 227+00.00	Offset Point Alignment: T_Edge o 0.00 0.00	of Oil497 S 15°14'41'' W S 15°14'41'' W	0+35.23 0+85.23	Offset Point -13.20 -13.36	S 15°34'50" \ S 15°00'34" \ S 15°34'39" \
ffset (Specified) 226+50.00 227+00.00 227+50.00	Offset Point Alignment: T_Edge o 0.00 0.00 0.00 0.00	of Oil497 S 15°14'41" W S 15°14'41" W S 15°14'41" W S 15°14'41" W	0+35.23 0+85.23 1+35.23	-13 20 -13.36 -13.11	S 15°34'50" \ S 15°00'34" \ S 15°34'39" \ S 15°20'33" \
ffset (Specified) 226+50.00 227+00.00 227+50.00 228+00.00	Offset Point Alignment: T_Edge o 0.00 0.00 0.00 0.00 0.00	of Oil497 S 15°14'41" W S 15°14'41" W S 15°14'41" W S 15°14'41" W S 15°14'41" W	0+35.23 0+85.23 1+35.23 1+85.23	-13 20 -13.36 -13.11 -12.99	S 15°34'50" V S 15°00'34" V S 15°34'39" V S 15°20'33" V S 15°16'24" V
ffset (Specified) 226+50.00 227+00.00 227+50.00 228+00.00 228+50.00	Offset Point Alignment: T_Edge o 0.00 0.00 0.00 0.00 0.00 0.00 0.00	of Oil497 S 15°14'41" W S 15°14'41" W S 15°14'41" W S 15°14'41" W S 15°14'41" W S 15°14'41" W	0+35 23 0+85 23 1+35 23 1+85 23 2+35 23	-13 20 -13.36 -13.11 -12.99 -12.94	S 15°34'50" V S 15°00'34" V S 15°34'39" V S 15°20'33" V S 15°16'24" V S 15°16'24" V S 15°01'46" V
fset (Specified) 226+50.00 227+00.00 227+50.00 228+00.00 228+50.00 229+00.00	Offset Point Alignment: T_Edge of 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	of Oil497 S 15°14'41" W S 15°14'41" W S 15°14'41" W S 15°14'41" W S 15°14'41" W S 15°14'41" W S 15°14'41" W	0+35 23 0+85 23 1+35 23 1+85 23 2+35 23 2+85 23	-13 20 -13 36 -13 11 -12 99 -12 94 -13.07	S 15°34'50" V S 15°00'34" V S 15°34'39" V S 15°20'33" V S 15°16'24" V S 15°16'24" V S 15°01'46" V S 15°09'46" V
fset (Specified) 226+50 00 227+00.00 227+50 00 228+00.00 228+50.00 229+00.00 229+50.00	Offset Point Alignment: T_Edge of 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	of Oil497 S 15°14'41" W S 15°14'41" W	0+35 23 0+85 23 1+35 23 1+85 23 2+35 23 2+85 23 3+35 23	-13 20 -13 36 -13 11 -12 99 -12 94 -13 07 -13 20	S 15°34'50'' V S 15°00'34'' V S 15°00'34'' V S 15°20'33'' V S 15°16'24'' V S 15°16'24'' V S 15°01'46'' V S 15°09'46'' V S 15°00'27'' V S 15°00'27'' V

- 21. Close the *Bentley InRoads Report Browser* and all open dialog boxes (except the main InRoads dialog box).
- 22. Save the InRoads project then close InRoads.

Chapter Summary:

- In *Lab 17.1 -Create Cross Sections* a set of cross sections was created showing the existing ground and design finished grade. These were updated to show the design components.
- In *Lab 17.2 -Calculate End Area Volumes* the cross sections generated above were used to calculate End Area Volumes. The ability to include or exclude components from the volume calculations was demonstrated.
- In *Lab 17.3 Unsuitable Material* an area of unsuitable material was defined using the station method. This was used to modify the volume calculation.
- In *Lab 17.4 Volume Exceptions* A set of custom cross sections was created, then a volume exception was defined.
- In *Lab 17.5 Volume Reports* the various templates for End Area Volume reports were examined.
- In *Lab 17.6 -Station Base Reports* the procedure for creating a Station Base report was demonstrated. Reports from alignment to alignment and alignment to feature were created

LAB 18 - Creating Plan Sheets

Creating Plan and Profile sheets is a repetitive and time consuming process. InRoads has automated this process. This lab demonstrates P and P sheet creation and editing with the InRoads Plan and Profile Generator command.

Chapter Objectives:

- Input data for the initial P and P sheet creation
- Prepare the seed files for the Plan and Profile Generator command
- Edit sheet extents and recreate sheets
- Move reference files within the sheet border
- Add a model file to a single sheet

Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\InRoads\12345DES_Geometry.alg
- C:\Projects\12345\Design\InRoads\12345DES.ird
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\12345DES.dtm
- C:\Projects\12345\Design\Drawings\Reference Files\12345DES_Prof.dgn
- C:\Projects\12345\Design\Drawings\Reference Files\12345DES_Model.dgn
 - **Note:** The 12345DES_Model.dgn file should have feature data displayed from previous labs. If this file is empty or if data not appropriate for plan sheets is near the SH 86 alignment, then all data in the file should be deleted and surface features from the 12345DES.dtm and the SH 86 alignment should be displayed prior to working the lab.

Lab 18.1 - Creating 100 Scale P and P Sheets

This lab illustrates the user input required to produce an initial set of P and P sheets.

1. Open the *C:\Projects\12345\Design\Drawings\Reference Files\12345DES_Prof.dgn* file in MicroStation.

The step below sets the scale factor so that text displayed by InRoads will be the proper size for a 100 scale plan set.

Select File > Project Options and <D> the Factors tab and set the scale factors to 100 for the *Text Scale Factor* and the *Cell Scale Factor*. Set the *Linestyle Scale Factor* to 1. This can also be done from the *Global Scale Factors* dialog box.

🛉 Project Op	tions		C			
Precision	Genera	al Units an	d Format	Geometry		
Tolerances	Factors	Abbreviations	Rail	Sight Distance		
Text Scale F	actor:	100.0000		Help		
Cell Scale Fa	actor:	100.0000				
Line Style So	cale Factor:	1.0000				
		(🕌 Scale I	Factors		
			Text:	100.0000		Apply
			Cell:	100.0000	÷	Close
			Line Style	1.0000		

3. **<D> Apply** then **Close**.

Preferences are predefined menu settings that are used to set up the dialog box for a particular style of plan sheet. In this case, a 100 scale plan and profile sheet with a 2 times vertical exaggeration is desired. The steps below select the desired preference.

- 4. From the InRoads menu bar, select **Drafting > Plan and Profile Generator**. The *Plan and Profile Generator* dialog box is displayed.
- 5. On the Plan and Profile Generator *Main* tab, **<D>** the **Preferences** button. This displays the *Preferences* dialog box.
- 6. From the Preferences dialog box, highlight 100 Scale P&P (2x Vert).
- 7. <D> Load.

Border and	Title	Symbo	ls and Details	_	Match Lin	es	Sheet Inde	x
Main	Plan Co	ntrols	Profile Con	trols	Sheet L	ayout	View Layo	out
Method			Horizontal	Alignment	:		Edit	
Plan Only			SH 86		-+	·		
Plan and	Profile		Geometry	Proiects in	this VDF:	-		
Profile Onl	by .]		
Plan Views			51				Help	
🔘 Use Plan	Views							
Use Static	on Limits						: Unless otherwi d. all measureme	
Profile Views						for th	is command are	
Use Profile	e Views					mode	el units.	
Ose Static	on Limits		-Station L	imits			6 h	
Sheets			Start:	203+80	20		efault)3+80.28	
🗸 Generate	Sheets					Τ.		
VDF In	formation Or	ıly	Stop:	260+43.		<u>+</u> 4	50+43.16	
VDF In	formation an	d Host Files	Length:	1400.00		+		
lan Views:			Total: 0	Profile Vi	🖬 Prefei	rences		
ln	Name	Start	Stop	Name	Name:			Clo
						le Full Pro le Full Pro		Lo
					100 Sca	le Full Pro	file 2x	
•			÷.			le Full Pro le P&P (1		Sa
						le P&P (2 le P&P (5		Save
		Apply	Prefere	nces	100 Sca	le ROW I	Plan Sheet	Del
						: Full Plan		
					•		- F	He

8. **<D> Close.** This dismisses the Preferences dialog box.

Preferences do not make all of the desired changes to menu settings, in particular those that are project specific. The steps below make the project specific changes to the menu settings.

- 9. Back on the *Main* tab, in the Station Limits area, key in *204+00.00* for the *Start* station.
- 10. key in *260+00.00* for the *Stop* station.

Sheets Gener	itation Limits rate Sheets DF Information Only DF Information and	Host Files	Station I Start: Stop: Length: otal: 0	204+00.00 260+00.00 1400.00 Profile Views:	Default + 203+8i + 260+4i +	0.28
In	Name	Start	Stop	Name	Start	Stop
		Apply		nces Clos	e	

Reference files that make up the plan portion of the sheets are selected from the Plan Controls tab. The following steps are used to select the desired files.

- 11. **<D>** the **Plan Controls** tab.
- 12. **<D>** the **Model Files** button. This displays the **Open Model File** dialog box.

Border and Tit		Symbols and Details	Match Lines	Sheet Index
Main	Plan Controls		Sheet Layout	View Layout
Seed View Name:	STA			Model Files
Width Left:	-200.00	.		
Width Right:	200.00	+		
Overlap:	0.00	+		
Boundary Chords:	6			Help
Force Rectang	ular Boundary			
Model Files:				

- 13. Highlight the C:\Projects\12345\Design\Drawings\Reference Files\12345DES_Model.dgn file.
- 14. **<D> Open**. The file is added to the *Model Files* list and the *Open Model File* dialog box is dismissed.
- 15. **<D>** the **Model Files** button. This displays the **Open Model File** dialog box.
- 16. Highlight the C:\Projects\12345\ROW_Survey\Drawings\Reference Files\12345SURV_Topo.dgn file.
- 17. **<D> Open**. The illustration below shows the *Plan Controls* tab with the two files added.

🕌 Plan and Profile	Genera	tor			- • ×
Border and Titl	е	Symb	ols and Details	Match Lines	Sheet Index
Main	Plan Co	ntrols	Profile Controls	Sheet Layout	View Layout
Seed View Name:	STA				Model Files
Width Left:	-200.0)	+		
Width Right:	200.00		+		
Overlap:	0.00		+		
Boundary Chords:	6				Help
	wings\F	_	2345DES_Model.dgn Files\12345SURV_Topo	o.dgn ▶	
		Apply	Preferences	Close	

The Profile controls tab determines how the profiles will be displayed. Most of the settings are by the selected preference, however, it is a good idea to check the Surface area and make sure it is set up as desired. In this exercise, only the existing ground is to be displayed in the profile so it is the only one toggled on. The highlighted surface is used to determine where elevation shifts occur. Because the existing ground is the only surface displayed, it is also used to determine elevation shifts.

18. **<D>** the **Profile Controls** tab.

- 19. Select SH 86 V as the *Vertical Alignment*.
- 20. Select **12345DES** as the *Corridor*.
- 21. In the Surface area, toggle off all surfaces except 12345 existing ground.
- 22. Verify that the surface **12345** existing ground is toggled on and highlighted.
- 23. **<D>** the **None** button to the right of the **Super Control Lines** list box to deselect all of the superelevation control lines.

The illustration below shows the tab as completed.

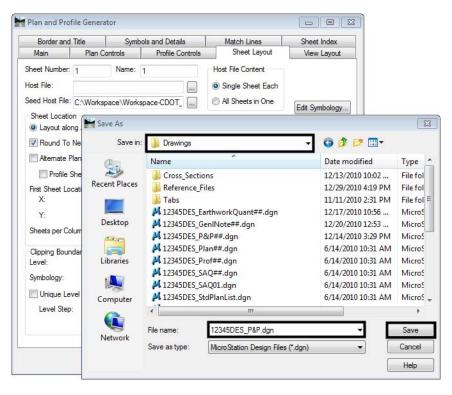
Main Seed View I Set Name: Profile Prefe Vertical Align Corridor:	Name: ST St erence: 2	Controls TA H 86	Section	Sheet Layout View Layou iontrol Lines: 11 HMA Lift1 Centerline-Ti
Set Name: Profile Prefe Vertical Aligr Corridor:	sirence: 2		Section	
Surface: Default 12345 e 12345D	12 existing groun	 Shift at Shift at 	Section	HIMA_Lift1_Centerline-T 11 LT_HMA_Lift1_Laneline 11 RT_HMA_Lift1_Laneline 11 RT_HMA_Lift1_Laneline Horizontal Spacing ◎ Left to Left
			Shift lighted surfaces vation shifts.	Vertical Spacing Bottom to Bottom Distance: 500.00 Example
Profile Heiał	ht: 20	0.00		Example
Profiles per (- Margins - Top: 12	20	Bottom:	25.00	

With the exception of the Host File, the Sheet Layout tab is set by the preference selected. The Host File is the base name that the finished sheets will be called. The host file name is incremented for each sheet created so that they will all have a unique name. In the steps below, the host file name is entered.

24. **<D>** the **Sheet Layout** tab.

25. **<D>** in the *Host File* field, then **<D>** the button. This displays the *Save As* dialog box.

- 26. In the Save As dialog box, navigate to the C:\Projects\12345\Design\Drawings\ folder.
- 27. In the File Name field, key in 12345DES_PnP.dgn.
- <D> the Save button. This dismisses the Save As dialog box adds the file name to the Host file field.



The Border and Title tab identifies the cell used for the sheet border. This tab should be checked to ensure that the proper border cell is being used. Also check to make sure that all of the toggles in the symbology area are turned off. If left on, erroneous data could be displayed on the sheets.

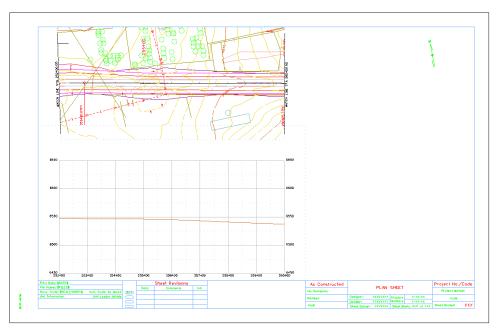
- 29. **<D>** the **Border and Title** tab.
- 30. Verify that the **Sheet_Design-Sheet** cell is selected for the cell *Name*.

Main	Plan Contr	ols	Profile Controls	Sheet Layout	View Layout
Border and	Title	Symbo	ls and Details	Match Lines	Sheet Index
Border					Browse
Cell			Reference File	e Name:	
Name:	SHEET_De	esian { 🔻	C:\Program F	iles\Workspace-CDOT\	
Retain C	Cell Levels for	-	Sheet Size:	B (11 x 17) 🔹	
0	evel for Each		Custom Width	16.00	Help
0			Custom Heigh	it 10.50	Tiop
	Level for Eac	h Sheet	Title Block Da		
Sheet Level:	1			ta Flic Hame.	
Level Step:	1				
Scale:	100.00			Edit	
ymbology:					
Object		Name		Location in Paper Ur	nits:
Rotation				×: 13.42	
Date				Y: 0.92	
User Text 1				User Text:	
User Text 2 User Text 3			H	Enter the Desinger	
User Text 4			H	E Station Format:	
User Text 5	5			S+SSS.SS	-
				•	
•		11	۴.	Use Sheet Level	

31. Verify that all of the check boxes in the *Symbology* area are toggled off.

- 32. **<D>** the **Apply** button.
- 33. **<D>** in the MicroStation view window.

The command creates a profile for each sheet (there are 5 sheets in this project) and then creates the sheets, each as a separate dgn file. The last sheet is shown below.



The plan and Profile generator offers an easy to move between generated sheets. Using the Sheet Index tab, sheets can be opened in without having to navigate through the MicroStation menus. Use the steps below to review the other sheets.

- 34. $\langle D \rangle$ the **Sheet Index** tab.
- 35. Highlight sheet **1** in the *Sheet Index* list.
- 36. **<D>** the **Show Sheet** button.

Main	Plan C	Controls	Profile Controls	Sheet Layout	View Layout
Borde	r and Title	Sym	bols and Details	Match Lines	Sheet Index
/DF File I				New	Open
Show S Clipping	heet Boundary Mode	e: 💿 Calcu	ılate 🔘 Use Existin	g	Save
Sheet Ind	ex:				Save As
Sheet	Sheet Name		Host File	Sheet Rotation	Help
1	1	C:\Projects	s\12345\Design\Drawi	ngs 105^00'00''	Create Plot Set
2 3	2 3	-	s\12345\Design\Drawi s\12345\Design\Drawi	-	T
4	4	-	s\12345\Design\Drawi	-	All
5	5	C:\Projects	s\12345\Design\Drawi	ngs 101^00'00''	None
Sheet Vie	Delete She	Re	generate Sheet	Show Sheet	
Sheet	View Ty	/pe	View Name	Anchor X	Anchor Y
1	Plan	S	TA 204+00.00	1.75	8.50
1	Profile	S	TA 204+00.00	1.75	1.75
					Edit

37. Repeat steps 31 and 32 for the remaining sheets.

Lab 18.2 - Creating 50 Scale P and P Sheets

To switch from 100 scale sheets to 50 scale requires some additional setting changes. Most of these are handled through the preferences, however the Annotation Scale for the profile and seed host file and the InRoads Scale Factors must be set before executing the command. This insures that the correct annotation scale is applied to each sheet.

The (MicroStation) annotation scale does not affect graphic elements displayed by InRoads but it will affect elements added with MicroStation commands.

This lab uses the same data as above to create a set of 50 scale P&P sheets.

In the steps below, the model properties are changed in the 3D-Seed_CDOT.dgn (seed host file). This will ensure that each P and P sheet created will have the proper annotation scale for the project.

1. Using the MicroStation menu bar, open the:

C:\Workspace\Workspace-CDOT_XM\Standards-Global\MicroStation\Seed\3D-Seed_CDOT.dgn

- <D> The Models button on the MicroStation *Primary* toolbar. This displays the Models dialog box.
- On the Models dialog box, <D> the Edit Model Properties button. This displays the Model Properties dialog box.
- 4. Set the *Annotation Scale* to **1**" = **50**' using the drop down menu.
- 5. **<D> OK**. This dismisses the *Model Properties* dialog box.

•		🗈 • 📑 • 🚳 • 🔄 •	€ • ≥ • × · ()	b 📝 🖥
	7 10 🛠 🕞	Models Active File Type 2D/3D Name CDOT Default	Description Master Model	
Lir	Ref Logical: 	T Default ar Model y tation Scale pdate Fields Automatically cell Cell Type: Graphic		
	<u>0</u> K	Cancel		

- 6. **<D> Yes** on the message window that is displayed. This has no effect because the drawing is empty.
- 7. Close the *Models* dialog box.
- 8. From the MicroStation menu bar, select **File > Save Settings**.

	i c	:\Works	pace\Work	space-CDO	T_V8i∖St	andards-G	ilobal\MicroSt	ation\Seed\3D-	Seed_CDOT	.dgn [3	D - V8 DGN] - MicroS
1:	<u>F</u> ile	e <u>E</u> dit	E <u>l</u> ement	<u>S</u> ettings	<u>T</u> ools	<u>U</u> tilities	Wor <u>k</u> space	<u>Applications</u>	<u>W</u> indow	<u>H</u> elp	CDOT Help
	1	New									Ctrl+N
I,	B	Open									Ctrl+O
		<u>C</u> lose									Ctrl+W
		Save									Ctrl+S
		Save <u>A</u>	5								
		Compr	ess								+
		Sa <u>v</u> e Se	ettings								Ctrl+F
	в	Item Br	ro <u>w</u> ser								
	Q	Project	Explorer								

Note: The changes to the seed file only last until the computer is logged off. At the next log in, the settings revert back their original state. The sheets created from the seed file maintain the changes.

The same setting made above must also be made in the dgn file that will contain the profile information. The following steps remove the data from the previous lab and update the model properties and InRoads scale factors for 50 scale sheets.

- 9. Open the C:\Projects\12345\Design\Drawings\Reference Files\12345DES_Prof.dgn file.
- 10. Select File > Save As from the MicroStation menu bar. Navigate to: C:\Projects\12345\Design\Drawings\Reference Files\
- 11. Key in *12345DES_Prof_50Scale.dgn* for the file name.
- 12. **<D> Save**.
- 13. Delete all of the data in the dgn file.
- 14. Repeat steps 2 through 8 above.

The dgn files are ready for the new scale. Next the InRoads settings are changed for 50 scale.

- 15. From the InRoads menu bar, select **Tools > Options** and **<D>** the **Factors** tab and set the scale factors to **50**. This can also be done from the **Global Scale Factors** dialog box.
- 16. **<D> Apply** and then **<D> Close** to dismiss the dialog box used.
- 17. Display the Plan and Profile Generator dialog box.
- 18. **<D>** the **Main** tab.
- 19. **<D>** the **Preferences** button. This displays the **Preferences** dialog box.
- 20. From the Preferences dialog box, highlight 50 Scale P&P (1x Vert).
- 21. <D> Load.
- 22. **<D> Close.** This dismisses the Preferences dialog box.

Freferences		×
Name:		Close
50 Scale Double Plan 50 Scale Double Profile 10x 50 Scale Double Profile 1x	^	Load
50 Scale Double Profile 2x 50 Scale Double Profile 5x		Save
50 Scale Full Plan Sheet 50 Scale Full Profile 1x		Save As
50 Scale P&P (1x Vert)	Ţ	Delete
		Help
Active Preference: 50 Scale PP) (1x	Vert)

Except for the Host File name, the user defined settings are still active and are used for this lab. To set the Host File name:

23. **<D>** the **Sheet Layout** tab.

- 24. **<D>** in the *Host File* field, then **<D>** the button. This displays the *Save As* dialog box.
- 25. In the Save As dialog box, navigate to the C:\Projects\12345\Design\Drawings\ folder.
- 26. In the File Name field, key in 12345DES_PnP_50Scale.dgn.
- <D> the Save button. This dismisses the Save As dialog box and adds the file name to the Host file field.
- 28. **<D>** the **Apply** button.
- 29. In the "Do you want to regenerate Plan Views?" message box, <D> Yes.
- 30. In the "Do you want to regenerate Profile Views?" message box, <D> Yes.
- 31. **<D>** in the MicroStation view window.

Nine 50 scale sheets are created. Follow the steps below to check that the correct annotation scale was used.

- <D> The Models button on the MicroStation *Primary* toolbar. This displays the Models dialog box.
- On the Models dialog box, <D> the Edit Model Properties button. The Model Properties dialog looks like the illustration below.

Model Properties	
<u>T</u> ype:	Design
<u>N</u> ame:	CDOT Default
Description:	Master Model
<u>R</u> ef Logical:	
4	1''=50' 🔹
Line Style Scale:	Annotation Scale
	Update Fields Automatically
Cell Properties	
Can be place	d as a cell Cell Type: Graphic 💌
Can be place	d as an annotation cell
<u></u>	K Cancel

- 34. **<D> Cancel** to dismiss the *Model Properties* dialog box.
- 35. Close the *Models* dialog box.

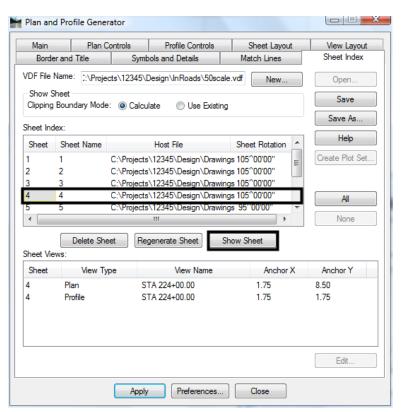
Lab 18.3 - Edit Sheet Extents

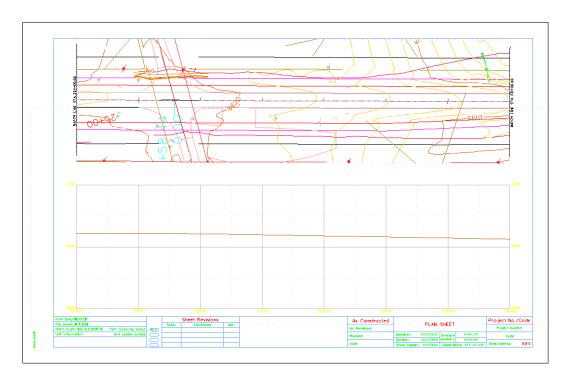
After examining the sheets created in the last lab, the intersection on sheet 4 should be centered on the sheet. In this lab, the sheet extents are changed to center the intersection.

First, view sheet 4 to determine the amount of shift required.

- 1. **<D>** the **Sheet Index** tab.
- 2. Highlight sheet **4** from the *Sheet Index* list.

3. **<D>** the **Show Sheet** button.





Examining sheet 4 shifting two stations (200 feet) to the left centers the intersection.

- 4. Open the C:\Projects\12345\Design\Drawing\Reference Files\12345DES_Prof.dgn file.
- 5. Delete the previously displayed profiles.

Plan and Profile Generator can be used to specify the station extents of any sheet. Here, sheet 4 is adjusted to center the intersection and the other sheets will automatically be changed to match. The steps below update the station extents on sheet 4.

- 6. **<D>** the **Main** tab.
- 7. Toggle on Use Plan Views.
- 8. Highlight sheet **4** in the *Plan Views* list.
- 9. **<D>** the **Edit** button. This displays the *Edit Plan View* dialog box.

Border and	Title	Symbols	and Details		Match Lin	es	Sheet Index
Main	Plan Cor	ntrols	Profile Con	trols	Sheet l	ayout	View Layout
Method			Horizontal	Alignment:			Edit
Plan Only			SH 86		-+	-	
Plan and F	Profile	Geometry	Projects in	this VDF:			
Profile Onl	у	-	S_Geomet		7		
Plan Views							Help
Ose Plan	Views						
Use Statio	n Limits						Unless otherwise all measurements
Profile Views						for this	command are in
Use Profile	e Views				modelu	model units.	
Ose Statio	n Limits		Station Limits			Default	
Sheets			Start:	204+00.0	0		+80.28
Generate	Sheets		Stop:	260+00 0	0	260	+43.16
OVDF In	formation On	ły	Length:	700.00		+	
VDF In	formation an	d Host Files		700.00		Ψ.	
Plan Views:		I	otal: 9	Profile Vie	ws:		Total: 9
ln	Name	Start	Stc 🔷	Name		Start	Stop
	17+00.00	217+00.00		STA 204		204+00.00	
	24+00.00	224+00.00		STA 210		210+00.00	
	21 <u>-00 00</u>	021±00 00	1 2387	CT∆ 217.	100 00	217±00 00	00 00±VCC

- 10. In the *Edit Plan View* dialog box, key in *222+00.00* for the *Start* station.
- 11. Key in *229+00.00* for the *Stop* station.

Edit Plan View . View Name: STA 224+00.00 Apply Start: 222+00.00 Stop: 229+00.00 Close Rotation: Overlap: 105^00'00" 0.00 Model Files ... Width Left Width Right: -100.00 100.00 < Previous Force Rectangular Boundary Boundary Chords: 6 Next > Model Files: C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgi Help C:\Projects\12345\ROW_Survey\Drawings\Reference_Files\12345SURV_ <. Ш ь Nested Attachments

12. **<D> Apply**. This displays the *Adjust Plan Views* dialog box.

The next steps update the remaining sheets to match the changes made to sheet 4.

- 13. In the *Adjust Plan Views* dialog box, toggle on **Adjust all views to maintain view** lengths.
- 14. **<D>** the **OK** button.

Adjust Plan Views	
View Adjustment	ОК
\bigcirc Do not adjust any other views	Help
Adjust only the neighboring view	
Adjust all views to maintain view lengths	

15. **<D> Yes** on the *"Update view names in corresponding sheets?"* Message box.

Bentley InRoads XM Edition	
Update view name in correspond	ing sheets?
Yes	No

Edit Plan	View	1	1000	×
View Name:	STA 222+00.00			Apply
Start:	222+00.00	Stop:	229+00.00	Close
Rotation:	105^00'00''	Overlap:	0.00	Model Files
Width Left	-100.00	Width Right:	100.00	
Force Re	ctangular Boundary Bo	undary Chords	: 6	< Previous
Model Files:				Next >
-		-	Files\12345DES_Model.dgr	Help
C:\Projects	s\12345\ROW_Survey\D	rawings\Refer	ence_Files\12345SURV_1	
•			4	
Nested A	ttachments			

16. In the *Edit Plan View* dialog box, **<D> Close**.

Reducing the start station by 2, shifts the intersection to the middle of the sheet. Toggling on *Adjust all views to maintain view lengths,* resets the stations on the remaining sheets.

Finally, the steps below regenerate the sheets.

- 17. On the *Plan and Profile Generator* dialog box, **<D> Apply**.
- 18. **<D> Yes** in the, *"Do you want to regenerate Profile Views?"* message.
- 19. **<D>** in the MicroStation view window.
- 20. After processing is complete, examine sheet 4 as described at the first of the lab. The illustration below shows how the sheet looks.

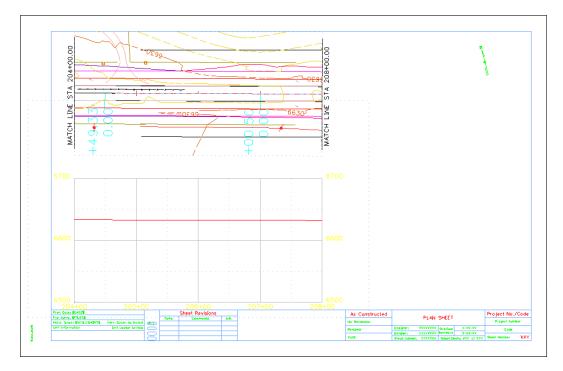


Lab 18.4 - Moving Reference Files Within the Sheet Border

After adjusting the sheets in the last lab, the first sheet has only 400 feet of data. The data is aligned with the left margin of the sheet border, but should be aligned with the right margin.

This lab demonstrates how to shift the data within the sheet border.

1. Examine sheet 1, as described at the first of the lab. The illustration below shows sheet 1. The reference files for the plan and profile need to be shifted 300 feet or 6" (paper scale) to the right.



- 2. On the Plan and Profile Generator's *Sheet Index* tab, highlight sheet **1** in the *Sheet Index* list.
- 3. In the *Sheet Views* list, highlight sheet 1 Plan.

Main	Plan C	Controls	Profile Controls		Sheet Layout	View Layout
Borde	er and Title	Symt	ols and Details	Ma	atch Lines	Sheet Index
/DF File	y, a rejo	cts\12345\	Design\InRoads\50	scale.vdf	New	Open
Show S	Sheet) Boundary Mode	: 💿 Calcu	ılate 💿 Use Exi	sting		Save
Sheet Inc	dex:					Save As
Sheet	Sheet Name		Host File	She	eet Rotation 🔺	Help
1	01	C:\Projects	s\12345\Design\Dra	wings 105	5^00'00'' _	Create Plot Set
2	02	C:\Projects	s\12345\Design\Dra	wings 105	~00'00"	
3	03	C:\Projects	s\12345\Design\Dra	awings 105	5^00'00''	
4	04	-	s\12345\Design\Dra			AI
5	05	C:\Projects	s\12345\Design\Dra	awings 99	^00'00'' ~	
•		None				
	Delete She	et	generate Sheet	Show S	iheet	
Sheet Vie						
Sheet	View Ty		View Name		Anchor X	Anchor Y
1	Plan	-	TA 204+00.00		1.75	8.50
1	Profile	S	TA 204+00.00		1.75	1.75
						E Ja
						Edit

4. **<D> Edit**. This displays the *Edit Sheet View* dialog box.

- 5. In the Anchor X field, key in 7.75.
- 6. **<D> OK**. This dismisses the *Edit Sheet View* dialog box.

🐂 Edit Shee	t View	<u> </u>
Sheet:	1	ОК
View Type:	Plan	Cancel
View Name:	STA 204+00.00	Help
Anchor X:	7.75	
Anchor Y:	8.50	

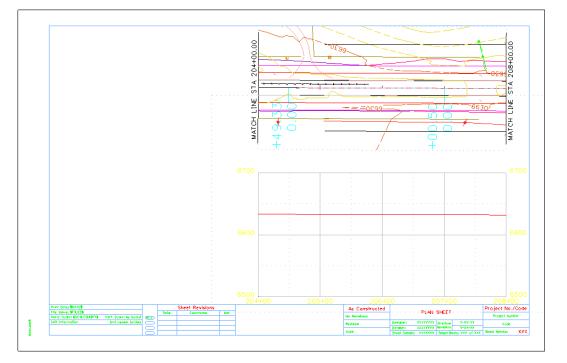
- 7. In the *Sheet Views* list, highlight sheet **1 Profile.**
- 8. **<D> Edit**. This displays the *Edit Sheet View* dialog box.
- 9. In the Anchor X field, key in 7.75.

10. **<D> OK**.

🐂 Edit Shee	et View	<u> </u>
Sheet:	1	ОК
View Type:	Profile	Cancel
View Name:	STA 204+00.00	Help
Anchor X:	7.75	
Anchor Y:	1.75	

- 11. **<D>** the **Regenerate Sheet** button.
- 12. **<D> Yes** on the message box that is displayed.

Plan an	d Profile Gene	rator						
Main	Plan (Controls	Profile Controls		Sheet Layou	t _	View Layout	
Borde	er and Title	Symt	ools and Details	M	atch Lines		Sheet Index	
VDF File	2. (110)0	ects\12345\	Design\lnRoads\50scal	e.vdf	New		Open	
- Show S Clipping	Sheet Boundary Mode	e: 💿 Calcu	ılate 🔘 Use Existing]			Save	
Sheet Ind	dex:						Save As	
Sheet	Sheet Name		Host File	She	et Rotation	*	Help	
1	01	C:\Projects	\12345\Design\Drawin	gs 105	5^00'00''	=	Create Plot Set	
2	02	-	12345\Design\Drawin	-				
3 4	03 04	-	s\12345\Design\Drawin s\12345\Design\Drawin	-				
4 5	04	-	12345\Design\Drawin	-		-	All	
4	0.5	C. W TOJECIA	III	iya 55	0000	-	None	
Sheet Vie Sheet	Delete Sh ews: View T		generate Sheet	ihow S	heet			
1 1	Plan Profile	<u> </u>		nd its	data will be	dele	ted and re-created. Do	you
						[Yes	No
		Apply	Preferences		Close			

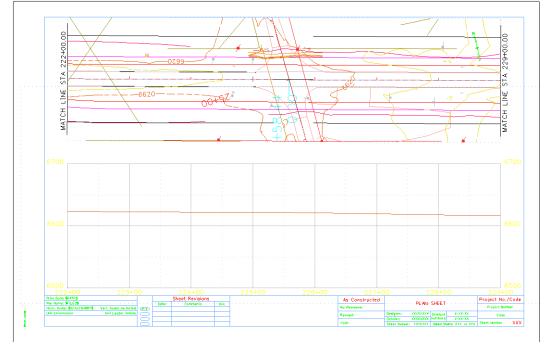


The sheet now looks like the illustration below.

Lab 18.5 - Adding a Model File to a Single Sheet

Many of the specialty groups create data that is included on the plan sheets. However, much of this information applies to a localized area and is contained on one or two sheets in the set (a bridge or intersection, for example).

This lab demonstrates how to attach a Model File to a single P&P Sheet. A traffic signal plan is added to Sheet 4.



1. Examine sheet 4, as described at the first of the lab. The illustration below shows sheet 4.

Additional models are added from the Edit options on the Main tab of the Plan and Profile Generator dialog box. The steps below illustrate this process.

- 2. **<D>** the **Main** tab.
- 3. Highlight sheet **4** in the *Plan Views* list.

Border and	Title	Symbol	and Details		Match L	ines	Sheet Index
Main	Plan Co	-	Profile Cor		Sheet	Layout	View Layout
Method			Horizonta	Alignment:			
Plan Only			SH 86			ф .	Edit
Plan and F	Profile			-			
0		Projects in					
Profile Onl	12345DE	ES_Geometr	Ŋ				
Plan Views			n l				Help
Use Plan	Views						
O Use Statio	on Limits						Unless otherwise all measurements
Profile Views			Š.				command are in
O Use Profile	e Views					model u	units.
O Use Statio	n Limits		Station	Limits			
Sheets			Start:	001.000		Defa	ault +80.28
Generate	Sheets			204+00.0	-	Ψ	
OVDF In	formation O	nly	Stop:	260+00.0	0	÷ 260	+43.16
VDF In	formation ar	nd Host Files	Length:	700.00			
Plan Views:		-	Fotal: 9	Profile Vie	ws:		Total: 9
ln	Name	Start	Stc 🔦	Name		Start	Stop
3 STA 2	15+00.00	215+00.0	222+	STA 204	+00.00	204+00.00	208+00.00
	22+00.00	222+00.0		STA 208		208+00.00	
	00 00±00	220×UU U	1 2367	STA 215 ∢	100 00	215±00 00	

4. **<D>** the **Edit** button. This displays the *Edit Plan View* dialog box.

5. In the *Edit Plan Views* dialog box, **<D>** the **Model Files** button.

🕌 Edit Plan	View			×
View Name:	STA 222+00.00			Apply
Start:	222+00.00	Stop:	229+00.00	Close
Rotation:	105^00'00''	Overlap:	0.00	Model Files
Width Left	-100.00	Width Right:	100.00	< Previous
Force Re	ectangular Boundary Bou	undary Chords:	6	
Model Files:				Next >
		_	iiles\12345DES_Model.dgi ence_Files\12345SURV_1	Help
•	III		۴.	
Nested A	ttachments			

- In the Open Model File dialog box, navigate to C:\Projects\12345\Traffic_ITS\Drawings\Reference_Files.
- 7. Highlight the **12345Signal01.dgn** file.
- 8. **<D> Open**.
- 9. Back in the *Edit Plan Views* dialog box, **<D> Apply.**

This change only occurs on sheet 4. Therefore. there is no need to update the other sheets.

- 10. **<D> No** in the message box that is displayed.
- 11. **<D> Close** to dismiss the *Edit Plan View* dialog box.

Edit Plan	n View			23
View Name	STA 222+00.00			Apply
Start:	222+00.00	Stop:	229+00.00	Close
Rotation:	105~00'00''	Overlap:	0.00	Model Files
Width Left	-100.00	Width Right:	100.00	< Previous
1000		oundary Chords:	6	Next >
100 C 100 C 100 C	s\12345\Design\Drawing s\12345\ROW_Survey\			
C:\Project	s\12345\Traffic_ITS\Dra	wings Bentley	InRoads XM Edition	Σ
R Nested /	III	Upda	te view name in corre	sponding sheets?
		_	Yes	No

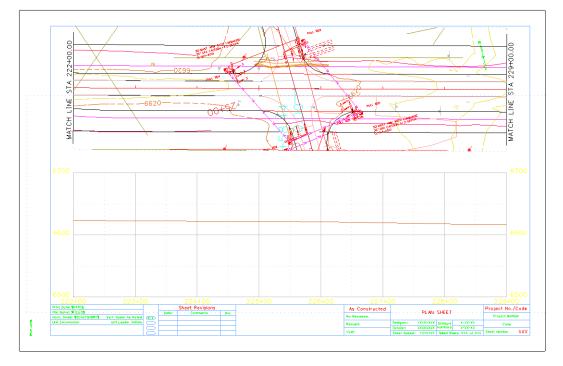
Since the added model file only affects on sheet (sheet 4), there is no need to generate a new complete set. Instead, only sheet 4 is updated. The steps below are used to update the sheet.

- 12. In the *Plan and Profile Generator* dialog box, **<D>** the **Sheet Index** tab.
- 13. In the *Sheet Views* list, highlight sheet **4**.
- 14. **<D>** the **Regenerate Sheet** button.

Main	Plan	Controls	Profile Controls	Sheet Layout	View Layout
Borde	er and Title	Symb	ools and Details	Match Lines	Sheet Index
VDF File	2. (110)	ects\12345\[Design \In Roads \50sca	le.vdf New	Open
Clipping	Boundary Mod	e: 💿 Calcu	late 💿 Use Existin	g	Save
Sheet Inc	lav:				Save As
Sheet	Sheet Name		Host File	Sheet Rotation 🔺	Help
1	01	C:\Projects	\12345\Design\Drawir	nas 105^00'00''	Create Plot Set
2	02	-	\12345\Design\Drawir	-	
3	03	C:\Projects	12345\Design\Drawir	ngs 105^00'00''	2
4	04	C:\Projects	\12345\Design\Drawir	ngs 105^00'00''	All
5	05	C:\Projects	\12345\Design\Drawir	ngs 99^00'00'' 🗸 🔻	
٠				•	None
Sheet Vie	Delete Sh	eet	generate Sheet	Show Sheet	
Sheet	Viev				
4	Plan	entiey inkoa	ads XM Edition		
4	Profile		his sheet border and ish to continue?	its data will be delet	ed and re-created. Do you
					Yes No

15. **<D> Yes** on the message box that is displayed.

The sheet now looks like the illustration below.



16. Close the **Plan and Profile Generator** dialog box.

17. **<D> Yes** on the message box that is displayed. Navigate to *C:\Projects\12345\Design\ InRoads*\ and name it *12345DES_50Scale.vdf*.

Bentley InRoads XM Edition
Save Current VDF File?
Yes No Cancel

- 18. Save all of the data files and Close InRoads.
- 19. Close MicroStation.

Chapter Summary:

- In *Lab 18.1 Creating 100 Scale P and P Sheets* the input data for the initial 100 scale Plan and Profile Generator run was described
- In *Lab 18.2 -Creating 50 Scale P and P Sheets* the annotation scale in the seed files was changed for 50 scale sheets along with the InRoads scale factors and the Plan and Profile Generator settings. Then a new set of sheets was generated
- In *Lab 18.3 -Edit Sheet Extents* the sheet extents for the 50 scale plans were modified to center the intersection and the sheets were regenerated
- In *Lab 18.4 -Moving Reference Files Within the Sheet Border* the reference files (plan and profile) were moved within the sheet border to the right margin
- In *Lab 18.5 Adding a Model File to a Single Sheet* a traffic signal plan model file was added to sheet 4 only

LAB 19 - Tab Sheets

This lab demonstrates the functionality built into the standardized tab sheets. It highlights the ability to quickly modify the sheet's structure by adding and removing columns and dividing the sheet so that it will fit within the sheet border. The functionality is similar with all of the standardized tab sheets. This lab uses the DES Tabulation of Surfacing.xls file for the exercises.

Chapter Objectives:

- Open and review the tab sheet instructions
- Update the Pay Item File location
- Add additional columns to the table
- Delete columns from the table
- Modify fields associated with asphalt pay items
- Add additional rows to the table
- Enter data in the new rows and columns
- Divide the main sheet into sub sheets
- Link the sub sheets to a MicroStation sheet border.

The files used in this lab are:

- C:\Projects\12345\Design\Drawings\Tabs\12345DES_Tabulation of Surfacing.xls
- C:\Projects\12345\Design\Drawings\12345DES_TabMisc##.dgn

Lab 19.1 - Review the Tab Sheet Instructions

- Start Excel and *Open* the 12345DES_Tabulation of Surfacing.xls file from *C:\Projects\12345\Design\Drawings\Tabs*.
- 2. **<D>** the **Instruction**s button in the upper right corner of the spreadsheet. A warning message is displayed. **<D> OK** on the message window.

	4 😳 🗸 🔍	f_{x}		
	A	Microsoft	Office	x)
1	Instructions			
2	Update / Browse for Pay Item File	?	Opening http://www.dot.state.co.us/DesignSupport/CADD and Engineering Innovation/Manuals and	
3	Data Entry		Training/Resources/Tab_Sheet_Instructions/Surfacing Tab Sheet Instructions.pdf	
4	Divide Sheet		Some files can contain viruses or otherwise be harmful to your	
5			computer.	
6	Choose the correct Hot Mix Asphalt (HMA) Lift type for your project. Details		It is important to be certain that this file is from a trustworthy source.	
7	for making changes to this setting are found in the instructions.		Would you like to open this file?	
8	Yariable HMA Lift Vidths			
э	Change in Width per Lift:			
10	1		OK Cancel	
11			Station Course (Class of Course (Class	مبر (100)

3. Take a few minutes and review the instructions and then minimize or dismiss them.

Lab 19.2 - Update the Pay Item File Location

In order for the tab sheet to function properly, it must access the *Trnsport_Itemlist.csv* file. The location of this file is specified in cell *D1* of the worksheet. This exercise demonstrates how to load the Trnsport_Itemlist.csv file.

	A	B C D	I J K	L M N	O P Q
1	Instructions	Pay Item File: <i>CilWorkspace</i>	CDOT_XINIStandar	ds-GlobaliTinspor <u>t</u>	ltemlist.csv
2	Update / Browse for Pay Item File	Pay Item:	304-03000	304-03005	304-06007
3	Data Entry	Number of Lifts:	n/s	nta	nia
4	Divide Sheet	Application Rate (lb <i>st</i> unit Volume):	133	nla	nla
5		Application Rate (Tons/Ton):	nta	nia	nla
	Choose the correct Hot Mix Aspha	/ Application Rate (aal / Sa. Yd.):	n/a	nta	nta

Notice that the text for the Pay Item File is red. This indicates that the file is not found. Without this file, additional pay items cannot be added. To locate the Trnsport_Itemlist.csv file:

4. **<D>** the **Update / Browse for Pay Item File** button. This displays the *Update / Browse for Pay Item File* dialog box.

	A E
1	Instructions
2	Update / Browse for Pay Item File
3	Data Entry
4	Divide Sheet Applis

5. **<D>** The **Browse for Pay Item File** button. This displays the *Open* dialog box.

Updat	e / Browse for Pay Item File 🛛 🛛 🔂
	Download New Pay Item File
	Browse for Pay Item File
	Return to Excel

6. Navigate to the C:\Workspace\Workspace-CDOT_V8i\Standards-Global\ directory.

- 💽 Open × Vorkspace-CDOT_XM\Standards-Global Search 2 $\Theta \Theta$ 🔄 Organize 👻 🏭 Views 👻 New Folde ? Name Date modified Size Type Favorite Links CFG Files Documents lnRoads Desktop MicroStation 9 Recent Places Computer Trnsport_Itemlist.csv E Pictures P Music **Recently Changed** B B Searches Public Folders ~ File name: CSV Files (*.csv) --Cancel Tools -Open
- 7. Highlight the **Trnsport_Itemlist.csv** file and **<D> Open**.

8. **<D>** the **Return to Excel** button in the *Update / Browse for Pay Item File* dialog box.

Update / Browse for Pay Item File	3
Download New Pay Item File	
Browse for Pay Item File	
Return to Excel	

The text for the Pay Item File is now black, indicating that the Trnsport_Itemlist.csv file is available for use.

Lab 19.3 - Adding a Pay Item

There are times when additional pay items need to be added after work has begun on the tabulation sheet. The standardized tab sheet can add and sort the additional columns, keeping the existing data in the sheet with its proper pay item. In this exercise, a column for removal of concrete pavement is added.

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Sta	tion		ng Coi 10.5 Ind			regate se (Cli	Base ass 6)	(F	Hix As 'atchin Asphal			Hot Mix Asphalt (Grading SG) (100) (PG 64-22)							(Gr	Mix As ading 0) (PG 28)	ŚG)				
			LF			TON			\$¥			TON									TON				
From	To											Botto	•		Lift 2			Lift 3			Lift 4	Ļ		Тор	
XXX	xxx	xxx	xxx	LF	Wid (ft)	Thk (in)	TON	Wid (ft)	xxx	SY	Vid (£)	Thk (in)	TON	Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON	Vid (ft)	Thk (in)	TON	Vid (ft)	Thk (in)	TON
1+00	5+00			400	48	6	638			0	44	4	430	43	3	315	42	3	308	41	3	301	40	2.5	244
5+00	12+00			700	48	6	1117			0	44	4	753	43	3	552	42	3	539	41	3	526	40	2.5	428
12+00	19+00			700	48	6	1117			0	44	4	753	43	3	552	42	3	539	41	3	526	40	2.5	428
13+00	26+00			700	48	6	1117			0	44	4	753	43	3	552	42	3	539	41	3	526	40	2.5	428
26+00	33+00			700	48	6	1117			0	44	4	753	43	3	552	42	3	539	41	3	526	40	2.5	428

The illustration above shows the sheet before adding the column.

1. **<D>** the **Data Entry** button. This displays the *Surfacing Data Entry* dialog box.

1	A	В	С	D
1	Instructions		Pay Item Fi	le: C:\Work
2	Update / Browse for Pay Item File			Pi
3	Data Entry			Number
4	Divide Sheet	Ар	plication Rat	e (Ibs/ unit V
5			Applicat	ion Rate <mark>(</mark> To

2. Scroll down the list of pay items and highlight the **202-00210 Removal of Concrete Pavement** pay item.

	Automatic Pay Item Entry	
202-00165	Removal of Wall	LS 🔺
202-00170	Grinding And Texturing Concrete Pavement	SY
202-00175	Removal of Concrete	LS
202-00190	Removal of Concrete Median Cover Material	SY
202-00195	Removal of Median Cover	SY
202-00200	Removal of Sidewalk	SY
202-00201	Removal of Curb	LF
202-00202	Removal of Gutter	LF
202-00203	Removal of Curb and Gutter	LF
202-00204	Removal of Curb	Gutter and Si
202-00205	Removal of Wheel Stop	EACH
202-00206	Removal of Concrete Curb Ramp	SY
202-00207	Pemoval of Brick Payers	SV.
202-00210	Removal of Concrete Pavement	SY
202-00212	Removal of Concrete Pavement (Planing)	SY
202-00220	Removal of Asphalt Mat	SY
202-00220	Removal of Asphalt Mat (Special)	SY
202-00240	Removal of Asphalt Mat (Planing)	SY
202-00245	Removal of Asphalt Mat (Planing)	TON
202-00246	Removal of Asphalt Mat (Planing) (Special)	SY
202-00247	Removal of Asphalt Mat (Planing)	LS
202-00248	Removal of Rumble Strips	LF
202-00250	Removal of Pavement Marking	SF
202-00300	Removal Of Building(s)	LS
202-00400	Removal of Bridge	EACH
202-00401	Removal of Bridge (Special)	EACH
202-00410	Removal of Mat From Bridge	SY
202-00420	Rem of Ped Rail	LF
202-00425	Removal of Bridge Railing	LF
202-00450	Removal of Portions of Present Structure (Class 1)	SY
	ems Delete a Pay Item	Close

3. **<D>** the **Add Items** button.

4. **<D> Close** to dismiss the *Surfacing Data Entry* dialog box.

Notice that the Removal of Concrete Pavement is now the first pay item column on the sheet. Also note that the data in the sheet was shifted to keep it with the proper pay item.

																			()								
Sta	Station Remotal of Coarrete Parenet (10.5 Inch) Course (Cless C							11	Alix As atchin \sphal	ia) –			Hat N	lix Asj	phalt (Gradii	ng SG) (100)	I (PG 6	4-22]	1		(Gr	Mix As nding 0) (PG 28)	ŚG)			
			21			LF			IUM ST										н	JN							IUN	
From	То												Botta	•		Lift 2			Lift 3			Lift I			ταρ			
XXX	xxx	via (2)	xxx	δY	xxx	ax	ur.	₩H (P)	Thi- (in)	TON	Via (R)	xex	s٣	Wia (ft)	Thk (in)	TON	WA (f)	The (in)	TON	Via (R)	Thk (n)	TON	мы (6)	Thk (in)	TON	wid (R)	Thk (ir)	тон
1+C0	5+00			0			400	48	6	638			0	44	4	430	43	3	315	42	3	308	41	3	301	40	2.5	244
5.00	12-00			0			700	48	6	1117			0	44	4	753	43	3	552	42	3	539	41	3	526	40	2.5	42‡
12+30	19×00			0			700	48	6	1117			0	44	4	753	43	3	552	42	3	539	41	3	526	40	2.5	42#
19+00	26+00			0			700	48	6	1117			0	44	4	753	43	3	552	42	3	539	41	3	526	40	2.5	428
26+00	33+00			n			700	48	6	1117			n	44	4	753	43	3	552	42	3	539	41	3	526	۵î	23	4.72

The illustration above shows the sheet after the new column is added.

5. Next, add pay item 411-10300 Emulsified Asphalt (Prime Coat).

Lab 19.4 - Deleting a Pay Item

Sometimes pay items originally added to the sheet are not used. The standardized tab sheet can remove the specified columns and reorganize the remaining data. In this exercise, the column for patching asphalt is removed.

- 1. **<D>** the **Data Entry** button. This displays the *Surfacing Data Entry* dialog box.
- 2. **<D>** the **Delete a Pay Item already placed in sheet** button. This displays the **Delete Item** dialog box.
- 3. Highlight the 403-00721 Hot Mix Asphalt (Patching) (Asphalt) pay item.
- 4. **<D>** the **Delete Item** button.

202-00210 202-05011	Removal of Concrete Pavement Sawing Concrete (10.5 Inch)	SY
403-00721	Hot Mix Asphalt (Patching) (Asphalt)	SY
403-34871 411-10251 412-01100 420-00500	Hot Mix Asphalt (Grading SX) (100) (PG 76-28) Emulsified Asphalt (CSS-1) Concrete Pavement (11 Inch) Geotextile (Paving)	TON GAL SY SY
Delete	Item	Close

5. **<D> Close** on the *Delete Item* and the *Surfacing Data Entry* dialog boxes.

Notice that the patching asphalt column is gone and the columns to the right have shifted over. The illustration below shows the final layout.

																		0							
Sta	tion	C	noval oncre avene	te		ng Cor 10.5 Ind	icrete :b)			Base ass 6)	6) noc mix Aspearc (Grading SG) (100) (PG 04-22)							(Gr	Mix As ading 0) (PG 28)	ŚG)					
			\$¥			LF			TON		TON									TON					
From	To											Botto	•		Lift 2			Lift 3			Lift 4			Тор	
xxx	xxx	Wid (ft)	xxx	SY	xxx	xxx	LF	Vid (€)	Thk (in)	TON	Wid (ft)	Thk (in)	TON	Vid (ft)	Thk (in)	TON	Vid (ft)	Thk (in)	TON	∀id (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON
1+00	5+00			0			400	48	6	638	44	4	430	43	3	315	42	3	308	41	3	301	40	2.5	244
5+00	12+00			0			700	48	6	1117	44	4	753	43	3	552	42	3	539	41	3	526	40	2.5	428
12+00	13+00			0			700	48	6	1117	44	4	753	43	з	552	42	3	539	41	3	526	40	2.5	428
19+00	26+00			0			700	48	6	1117	44	4	753	43	3	552	42	3	539	41	3	526	40	2.5	428
26+00	33+00			0			700	48	6	1117	44	4	753	43	3	552	42	3	539	41	3	526	40	2.5	428

Lab 19.5 - Additional Fields Associated with HMA Pay Items

Unlike concrete, asphalt pavement is laid down in a series of lifts. Each lift making up the total pavement could be a different thickness, width, and/or a different grade (which uses a different pay item code). In addition, the tab sheet can account for assumed irregularities in the paving process. These items are accounted for in the tabulation sheet with three fields outside of the table and a heading row within the table.

For the exercise below, the final pavement consists of three lifts of PG 64-22 asphalt and one lift (the Top lift) of PG 76-28 asphalt. The existing tab sheet consists of four lifts of PG 64-22 asphalt which will be corrected in this exercise. An irregularity factor of 5% will be used for the Bottom lift only.

1. **<D>** in the Number of Lifts cell for the *403-32841 Hot Mix Asphalt (Grading SG) (100)* (*PG 64-22)* pay item.

P Q	R S	TU	V	W X	Y	Z AA	AB	AC	AD	AE	A
Trnsport_Itemlis	t.csv										
304-06000				403-328 <mark>4</mark>	1				4	03-3287	71
n/a				4					-	1	
133	3									110	
n/a	4 5			n/a						n/a	
n/a				n/a						n/a	
n/a	10%		10%		10%		10%				

2. Use the drop down menu and select **3** from the list.

			v		
Aggregate Base Course (Class 6)	Но	ot Mix Asphalt (Grad	ing SG) (100) (PG 64-2	(2)	Hot Mix Asphalt (Grading SG) (100) (PG 76-28)
TON		Т	NC		TON
	Bottom	Lift 2	Lift 3	Lift 4	Тор

The pay item now consists of three lifts instead of four. The original Lift 2 row was deleted (including the data). The Lift 3 and Lift 4 rows were shifted over and renamed. The illustration below shows the results.

0

								()					
	regate se (Cla			Hot N	∕lix Asp	halt (G	rading	SG) (10	0) (PG	64-22)		(Grad	Mix As ling SG PG 76-2	(100)
TON TON TON														
				Botton	n		Lift 2			Lift 3			Тор	
Wid (ft)	Thk (in)	TON	Wid (ft)	Wid Thk TON		Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON
48	6	638.4	44	4	430.2	42	3	308	41	3	300.7	40	2.5	244.4
48	6	1117	44	4	752.9	42	3	539	41	3	526.2	40	2.5	427.8

Now change the irregularity factor for the PG 64-22 pay item. The irregularity factor for the PG 76-28 does not have to be changed because it is already 0.

- <D> in cell R7. This is the% *Irreg to Apply:* cell for the Bottom lift of the 403-32841 Hot Mix Asphalt (Grading SG) (100) (PG 64-22) pay item.
- 4. Key in **5** and press the **Tab** key. The change is made in cell R7. This value is used to determine the total amount of material used for irregularities at the bottom of the sheet.
- 5. Using the *Tab* has moved the cursor to the *U*7 cell. Press the *Delete* key to clear this cell.
- 6. *Tab* again and *Delete* the contents of cell *X*7. The Irregularities quantity is shown at the bottom of the sheet in the totals area.

O P Q	R S	T U	V	W	Х	Y	Z	AA	AB	AC	
bal\Trnsport_Itemlis	st.csv										
304-06000			403-328	41				4	03-3287	71	
n/a			3						1		
133			110						110		
n/a			n/a						n/a		
n/a			n/a						n/a		
n/a	5%										

								()					
	regate rse (Cla			Hot N	/lix Asp	halt (G	rading	SG) (10	0) (PG	64-22)		(Grad	Mix As ling SG PG 76-2) (100)
	TON						TON						TON	
				Botton	n		Lift 2			Lift 3			Тор	
Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON
48	6	638.4	43	4	420.4	42	3	308	41	3	300.7	40	2.5	244.4
	v			-	100.0	74	5		71	~	JEV.E	TV	2.5	741.0
48	6	1117	43	4	735.8	42	3	539	41	3	526.2	40	2.5	427.8
		0	43		0	42		0	41		0	40		0
		0			0			0			0			0
		0			0			0			0			0
	783													
	23780			15662			11473			11200			9106	
	23780			16445			11473			11200			9106	

The width for each asphalt lift may be fixed, so that they are all the same, or they may be variable with each successive lift one foot wider than the lift above.

The width for each HMA lift is based on the width of the Top lift. The values for the Top widths were entered prior to deleting the extra lift and were entered as Variable HMA Lift Widths. Notice that the data entered in the table has not been re-calculated since deleting the extra lift. Therefore, the bottom lift is one foot too wide.

			-					()					
	regate se (Cla			Hot N	/lix Asp	halt (G	rading	SG) (10	0) (PG	64-22)		(Grad	Mix As ling SG PG 76-2) (100)
	TON						TON						TON	
				Botton	n		Lift 2			Lift 3			Тор	
Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON
48	6	638.4	44	4	430.2	42	3	308	41	3	300.7	40	2.5	244.4
48	6	1117	44	4	752.9	42	3	539	41	3	526.2	40	2.5	427.8
48	6	1117	44	4	752.9	42	3	539	41	3	526.2	40	2.5	427.8
48	6	1117	44	4	752.9	42	3	539	41	3	526.2	40	2.5	427.8
48	6	1117	44	4	752.9	42	3	539	41	3	526.2	40	2.5	427.8
48	6	1117	44	4	752.9	42	3	539	41	3	526.2	40	2.5	427.8
48	6	1117	44	4	752.9	42	3	539	41	3	526.2	40	2.5	427.8
48	6	798	44	4	537.8	42	3	385	41	3	375.8	40	2.5	305.6

To correct the Bottom width:

- 7. **<D>** in cell **AA15**.
 - **Note:** Changing the width of an HMA Top lift triggers a re-calculation of HMA lower lift widths on a row by row basis.
- 8. Key in **40** and press **Enter**.
- 9. Repeat step 8 for the remaining rows that contain data.

								()						
	regate rse (Cla			Hot I	/lix Asp	halt (G	rading	SG) (10	0) (PG	64-22)		(Grad	Mix As ling SG PG 76-2) (100)	Emuls
	TON						TON						TON		
				Botton	n		Lift 2			Lift 3			Тор		
Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON	Wid (ft)	Thk (in)	TON	Wid (ft)
48	6	638.4	43	4	420.4	42	3	308	41	3	300.7	40	2.5	244.4	43
48	6	1117	43	4	735.8	42	3	539	41	3	526.2	40	2.5	427.8	43
48	6	1117	43	4	735.8	42	3	539	41	3	526.2	40	2.5	427.8	43
48	6	1117	43	4	735.8	42	3	539	41	3	526.2	40	2.5	427.8	43
48	6	1117	43	4	735.8	42	3	539	41	3	526.2	40	2.5	427.8	43
48	6	1117	43	4	735.8	42	3	539	41	3	526.2	40	2.5	427.8	43
48	6	1117	43	4	735.8	42	3	539	41	3	526.2	40	2.5	427.8	43
48	6	798	43	4	525.6	42	3	385	41	3	375.8	40	2.5	305.6	43

Note: Values for any column can also be entered manually. However, re-entering the width in the Top column ensures that all columns of HMA items using a unit of TONs are updated correctly.

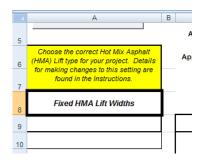
Important! Non-HMA quantities based on pavement widths (like Aggregate Base Course) are not automatically updated and must be corrected manually.

The next series of steps will illustrate the difference between fixed and variable lift width by entering additional data into rows 37 and 38.

- 10. Verify that cell *A8* is set to Variable HMA Lift Widths.
- 11. **<D>** in cell **C37** and enter **157+00** for the *From* station, then *Tab* to the next column.
- 12. In cell *D*37, key in *164+00* for the *To* station.
- 13. **<D>** in cell **AA37**. This is the cell for the Top lift of all of the HMA pay items.
- 14. Key in **40** for the width. Notice that the widths for each of the other HMA lifts on the row are automatically calculated, increasing by one foot for each lift.

C	D		J	K	L	M	N	0	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
136+00	143+00			0			700	48	6	1117	43	4	735.8	42	3	539	41	3	526.2	40	2.5	427.
143+00	150+00		Ĩ	0		Ű.	700	48	6	1117	43	4	735.8	42	3	539	41	3	526.2	40	2.5	427.
157+00	164+00			0			700			0	43		0	42		0	41		0	40		0
				0			0			0			0			0			0			0
			Î	0			0			0			0			0			0			0
Irregu	larities											783										
Sub	lotals	Ú.	0	- ji		15600			23780			15662			11473) <u>(</u>		11200	8		9106	
Project	Totals	1	0			15600			23780			16445	_	_	11473	1		11200			9106	

15. Change cell *A8* to Fixed HMA Lift Widths.



- 16. **<D>** in cell **C38** and enter *164+00* for the *From* station, then *Tab* to the next column.
- 17. In cell *D37*, key in *171+00* for the *To* station.
- 18. **<D>** in cell **AA38**. This is the cell for the Top lift of all of the HMA pay items.

С	D	1	J	К	L	М	N	0	Р	Q	R	S	T	U	V	W	Х	Y	Z	AA	AB	AC
136+00	143+00			0			700	48	6	1117	43	4	735.8	42	3	539	41	3	526.2	40	2.5	427.8
143+00	150+00			0			700	48	6	1117	43	4	735.8	42	3	539	41	3	526.2	40	2.5	427.8
157+00	164+00			0			700			0	43		0	42		0	41		0	40		0
164+00	171+00			0			700			0	40		0	40		0	40		0	40		0
				0			0			0			0			0			0			0
Irregu	larities											783										
Sub	Totals		0			16300			23780			15662			11473			11200			9106	
Projec	t Totals		0			16300			23780			16445			11473			11200			9106	

19. Key in *40* for the width. Notice that the widths for each of the other HMA lifts on the row are populated with the same value for each lift.

- **Note:** Category 411 pay items with a unit of GALs use the same value as the Bottom HMA width to calculate quantities.
- 20. Copy the Thickness value down to the two new rows for each of the HMA columns.

С	D	1	J	К	L	М	N	0	Р	Q	R	S	Т	U	V	W	Х	Y	Z	AA	AB	AC
136+00	143+00			0			700	48	6	1117	43	4	735.8	42	3	539	41	3	526.2	40	2.5	427.8
143+00	150+00			0			700	48	6	1117	43	4	735.8	42	3	539	41	3	526.2	40	2.5	427.8
157+00	164+00			0			700			0	43	4	735.8	42	3	539	41	3	526.2	40	2.5	427.8
164+00	171+00			0			700			0	40	4	684.4	40	3	513.3	40	3	513.3	40	2.5	427.8
				0			0			0			0			0			0			0
Irregu	larities											854						-				
SubT	Fotals		0			16300			23780			17082			12525			12239			9961	
Project	t Totals		0			16300			23780			17936			12525			12239			9961	

Rows 4, 5, and 6 in the spreadsheet are reserved for the application rates of various materials. Although standard default values are automatically entered when a pay item is added to the tab sheet, these values can be changed manually. In this exercise, the application rate for 411-10300 Emulsified Asphalt (Prime Coat) needs to be changed from 0.1 gallons per square yard to 0.2 gallons per square yard.

21. **<D>** in cell **AH6**.

22. Key in *0.2* and press *Enter*.

411-10251	411-10300
n/a	n/a
n/a	n/a
n/a	n/a
0.1	0.2
n/a	n/a

Emuls	sified A (CSS-1	sphalt)		sified A rime Co	
	GAL			GAL	
Wid (ft)	ххх	GAL	Wid (ft)	ххх	GAL
43		764.4	43		1529
43		1338	43		2676
43		1338	43		2676

Notice that the quantities in column *AI* automatically update to reflect the new application rate.

Lab 19.6 - Add Additional Data to the Sheet

Two additional rows are needed for this next exercise.

1. **<R>** on the row number **39** and follow the steps in *Section 2.4* of the *Tabulation of Surfacing* instructions to add two additional rows.

The next few steps will consist of entering new station extents for the last three rows, removing unwanted data values for Sawing Concrete pay item, and adding pay item quantities for Removal of Concrete Pavement, Sawing Concrete Pavement, and 11" Concrete Pavement

- 2. First, enter the station extents for the last three lines using the following data:
 - ◆ 171+00 to 178+00
 - ◆ 178+00 to 185+00
 - ♦ 185+00 to 192+00
- Next, remove the quantities for Sawing Concrete for all rows except for station 185+00 to 192+00. <D> in cell N15. This is the first quantity cell of the sawing concrete pavement pay item.
- 4. Press the *Delete* key to remove the quantity.
- 5. **<D> and hold** on the little box in the lower right corner of the *N15* cell.

	A B	С	D		J	K	L	M	N	0	P	0
2					SY			LF			TON	
3		From	То									
14	This row for worksheet only	ххх	xxx	Wid (ft)	ххх	SY	xxx	ххх	LF	Wid (ft)	Thk (in)	т
15		1+00	5+00			0				48	6	63
16		5+00	12+00			0			700	48	6	11
17		12+00	19+00			0			700	48	6	11
18		19+00	26+00			0			700	48	6	11
19		26+00	33+00			0			700	48	6	11
20		33+00	40+00			0			700	48	6	11
21		40+00	47+00			0			700	48	6	11
22		47+00	52+00			0			500	48	6	7
23		52+00	59+00			0			700	48	6	11
24		59+00	66+00			0			700	48	6	11
25		66+00	73+00			0			700	48	6	11
26		73+00	80+00			0			700	48	6	11
27		80+00	87+00			0			700	48	6	11
28		87+00	94+00			0			700	48	6	11
29		94+00	101+00			0			700	48	6	11
30		101+00	108+00			0			700	48	6	11
31		108+00	115+00			0			700	48	6	11
32		115+00	122+00			0			700	48	6	11
33		122+00	129+00			0			700	48	6	11
34		129+00	136+00			0			700	48	6	11
35		136+00	143+00			0			700	48	6	11
36		143+00	150+00			0			700	48	6	11
37		157+00	164+00			0			700			
88		164+00	171+00			0			700+			
				+				- 1	ş		<u> </u>	t

6. Drag down the *N* column to row *40* then release the mouse button. This deletes all of the unneeded quantities.

7. The illustration below shows the completed station columns.

129+00	136+00		0			48	6	1117	43
136+00	143+00		0			48	6	1117	43
143+00	150+00		0			48	6	1117	43
157+00	164+00		0					0	43
164+00	171+00		0					0	40
171+00	178+00		0					0	
178+00	185+00		0					0	
185+00	192+00		0		700			0	
Irregul	arities								
SubT	otals	0		700			23780		
Project	Totals	0		700			23780		

The project requires 36' of concrete sawing for the extents from Sta. 171+00 to Sta.178+00 and from Sta. 185+00 to Sta. 192+00.

- 8. **<D>** in cell **N39**.
- 9. Key in a value of *36* in cell *N39* and cell *N41*.

This completes the changes for Sawing Concrete.

Next, the Removal of Concrete Pavement quantities are added. This occurs from Sta. 171+00 to the end of the job. The width of the pavement being removed is 36'

- 10. **<D>** in cell **I39**.
- 11. Key in **36**.
- 12. **<D> and hold** on the little box in the lower right corner of the *I39* cell.
- 13. Drag down the *I* column to row *41* then release the mouse button. This adds the 36' width to each row.
- 14. To calculate the quantity for 11" Concrete Pavement, enter **36** in cells AJ39 through AJ41.

Below is an illustration of the completed sheet.

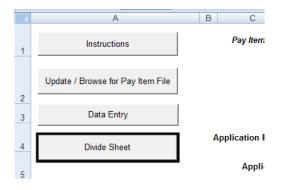
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°22 30	108-00			0				46	6	1117	43	1	756	42	3	538	41	8	526	40	25	42#	18		1336	60					٥			٠	
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15. **Save** the file.

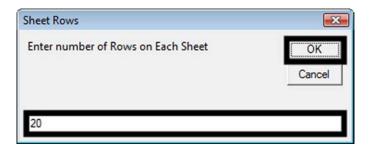
Lab 19.7 - Dividing the Surfacing Sheet into Sub Sheets

It the sheet is too long to fit inside the sheet border, there is a option to divide the master sheet into sub sheets of a specified number of data rows. When this option is selected, additional worksheets are added to the file that contain a part of the master sheet along with a sheet totals table. In this exercise, it was decided that 20 rows of data was the maximum per sheet. (this number will vary based on the tab sheet being used and additional information that may be included in the printable sheet.)

 In the top left portion of the tab sheet, <D> the Divide Sheet button. This displays the Sheet Rows dialog box.



- 2. Key in **20**. This is the number of data rows used on each sub sheet.
- 3. **<D>OK**.



Two sub sheets (Sub Sheet 1 and Sub Sheet 2) are created along with Sub Sheet Totals.

26	129+00	136+00	0		622	73
27	Irregu	arities				142
28	SubT	otals	0	0	12000	1557
29	Sheet 1	Subtotals	0	0	12000	1699
29 30 Ready	▶ Surfacing Sheet	Sub Sheet 1	Sub Sheet 2 🖌 Sub Sh	neet Totals 🖉 Surfacing	Data 🖉	

The master sheet (Surfacing Sheet) is left intact. To re-divide the master sheet by a different number of rows, delete all the Sub Sheet and Sub Sheet Totals worksheets and run through the process again.

4. **Save** but do not close the file.

Lab 19.8 - Link the Sub Sheets to a MicroStation Sheet Border

The final step in creating the tab sheet is to link the Excel file to the MicroStation sheet border. Linking allows the Excel file to be updated and reflect those updates in the MicroStation file. In this exercise, Sub Sheet 1 is linked to the sheet border file. The process is the same for the other sub sheets.

The first step in linking the spreadsheet is to prepare the MicroStation file. The miscellaneous tab sheet border is copied and renamed to be the surfacing tab sheet.

- 1. Start MicroStation and open **12345DES_TabMisc##.dgn**.
- 2. Select **File > Save As** from the MicroStation menu bar.

File	Edit	Element	Settings	Tools	Utilities	Workspace	Window	Help	CDOT Help	
1	New									Ctrl+N
3	Open									Ctrl+O
1	Close									Ctrl+W
	Save									Ctrl+S

- 3. Key in 12345DES_TabSurf01.dgn in the File name field.
- 4. **<D> Save**. This creates the new file and opens it.

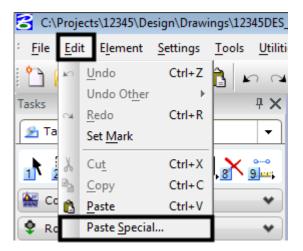
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		S_GenINote##.dgn	-		S_Plan##.dgn		
Desktop		S_Prof##.dgn			S_SAQ01.dgn		
-		S_SAQ##.dgn			S_StdPlanList.dgn		
13		S_SWMP.dgn			S_TabConc##.dgr		
hris Ferree		S_TabMisc01.dgn		and the post of the second second	S_TabMisc##.dgn	-	
		S_TabRem##.dgn			S_TitleSht.dgn	1	
		S_TyplSect##.dgn			RV_Tab.dgn		
Computer	A 1234550	RV_WUTab.dgn	8	M&S Sta	ndard Plans List Ir	ndex.dgn	
Network						_	
	File name:	12345DES_TabSurf01.d	gn		-	Save	
	Save as type:	MicroStation V8 DGN File	es (*.dgn)		•	Cancel	
						Options	

- 5. Bring Excel to the front.
- 6. Select the **Sub Sheet 1** worksheet.

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*s≥	1465	*		39	4 /		98 ⁰	~	124	0.20	Ÿ	۳	
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12-62	18-52	÷		622	N		<i>1</i> 2	12	1787	21%	*	2852	
15-69	97-97	÷		6 <u>8</u> 7	N	.3/	72	42	1202	E57%	*	2102	
97 - 97	27-99	÷		685	N	34	<i>72</i>	42	2002	86°%	\$	21722	
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2000	2845	*		6427	6	24	12	42	2000	24-8		۳	
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7. Highlight the entire table (cells **C2** through **AP29**).

- 8. Select **Edit > Copy** from the Excel menu bar.
- 9. Bring MicroStation to the front.
- 10. Select **Edit > Paste Special** from the menu bar. This displays the *Paste Special* dialog box.



11. In the *Paste Special* dialog box, highlight Linked Microsoft Office Excel 2003 Worksheet.

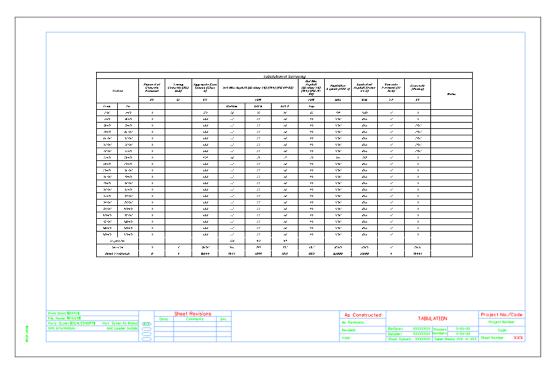
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Linked Microsoft Office Excel 200	3 Works
Picture of Microsoft Office Excel 2	UU3 WC
Embedded Microsoft Office Excel	2003 W 🗉
Text To Design File	
Rich Text to Design File	
Linked Text To Design File	-

- 12. **<D> Paste**. This displays the *Paste OLE Object* tool settings box.
- 13. In the *Paste OLE Object* tool settings box, set the *Method* to By Size.
- 14. In the *Scale* field key in *8.500*. This makes the text in the Excel file the proper size for the MicroStation file.

📕 Paste OLE Object		×
Object: Microsoft Office Exc Paste as: Link <u>M</u> ethod: By Size	el 2003 Work	
 Display as icon Transparent Backgroun Rotate With View Scale: 8.5000 Size: (145.916 x 84.38) 		

15. A box is connected to the cursor. This represents the size of the table that is being placed. Center it inside the sheet border and **<D>**. The file is now linked to the sheet border file.

16. The hatching in the table indicates that the Excel file is open. Bring Excel to the front and close it to remove the hatching. The illustration shows the final result.



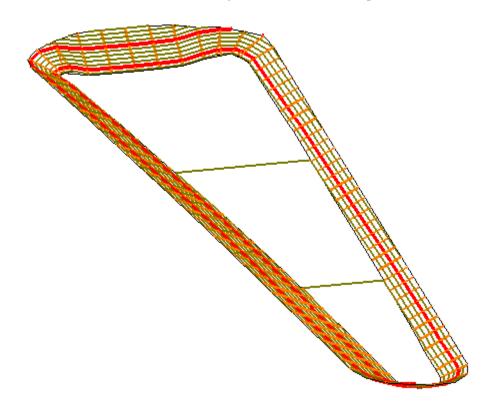
17. **Close** MicroStation.

Chapter Summary:

- The tab sheets use the Trnsport_Itemlist.csv file to set the column headings for the tab sheet.
- The Trnsport_Itemlist.csv file is updated by ServerCop at log in or it can be manually updated.
- Programming that automates the layout and revision of the column headings is accessed through various buttons placed in the worksheet.
- Rows are added or deleted using standard Excel functionality.
- Large tab sheets can be divided to fit into multiple sheet borders.
- If the tab sheet is divided, a sheet totals table is also created.
- The tab sheets are linked to a MicroStation sheet border for printing

LAB 20 - Creating a Detention Pond

In this exercise, you will create a proposed digital terrain model (DTM) without using Roadway Modeler. Instead, a combination of feature creation and editing tools is used to develop the breaklines for a pond.



Chapter Objectives:

- Use a combination of feature tools to create a proposed design
- Understand the concept of creating a surface of features solely for use as a target

The following files are used for this lab:

- C:\Projects\12345\Bridge\Working \CU12345BRDG_Model.dgn
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345_Existing_Pond-Lab.dtm
- C:\Projects\12345\Design\Drawings\Reference Files\12345DES_Pond.dgn as a reference file

Lab 20.1 - Load and Create Surfaces

- 1. Open MicroStation and InRoads using the C:\Projects\12345\Bridge\Working \CU12345BRDG_Model.dgn file.
- 2. Delete any MicroStation graphics currently in the design file.
- 3. Verify the correct *XIN* file is loaded.
- 4. Delete any MicroStation graphics currently in the design file.
- 5. Select **File > Open** from the InRoads menu.
- 6. Open C:\Projects\12345\ROW_Survey\InRoads\DTM\12345_Existing_Pond-Lab.dtm.
- 7. **Cancel** the *Open* dialog box.
- 8. Toggle Locate Features/Locate Graphics to Locate Graphics.
- 9. Select File > New.
- 10. Select the *Surface* tab.
- 11. Set the *Type* to *Design*
- 12. Key in *12345 pond* for the *Name*.
- 13. Key in *Pond training example* for the *Description*.
- 14. Set the *Preference* to *Proposed*
- 15. **<D> Apply** and **Close** the *New* dialog box.

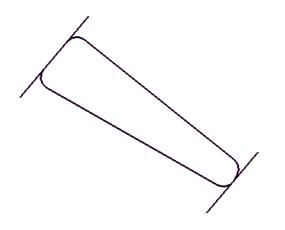
Mew New			- • •
Surface Geometry	/ Site Modeler		
Туре:	Design	-	Apply
Name:	12345 pond		Help
Description:	Pond training exa	mple	
Maximum Length:	0.00		
Preference:	Proposed	•	
Name		Description	1
Default			
12345_Existing_P	ond-Lab		
	Close		

Lab 20.2 - Display the Pond Graphics

1. Toggle on the display for the 12345DES_Pond.dgn reference file.

Model CDOT Default	Description	Logical	Presentation	•	9	Cà
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1.000000	Rotation 0	0°00'00''				
	1.000000 Y 0.0000					

2. **Fit** the view to see the pond graphics.



The pond you are going to create is beside a new roadway SH52. The toe of slope for the roadway is the boundary for the pond on the South side, with the existing ROW limiting the size on the North and other existing features dictating the basic shape of the pond. The graphic that you just toggled on shows what has previously been determined as the outer limit of the pond.

Lab 20.3 - Creating a feature for the top of pond

In this case, you are going to start with the known outside of the pond, so you must first set the elevations of this boundary. You will do this by draping the graphic element onto the existing topo.

1. Select Surface > Design Surface > Generate Longitudinal Feature.

On the *Main* tab:

- 2. Toggle off Generate Graphics Only.
- 3. Select **12345 pond** as the *Surface*.
- 4. Toggle on **Interval** and set it to **10**.
- 5. Toggle on **New** for the *Mode*.
- 6. Key in *Pond top* for the feature *Name*.
- 7. Set the *Feature Style* to H_Detention_Pond-Top.
- 8. Set the *Point Type* to Breakline.
- 9. Leave the *Point Density Interval* set to *O*.

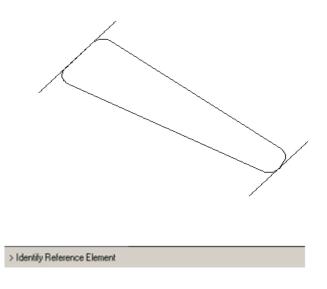
🕌 Generate Longitudina	al Feature	
Main Controls		
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Exterior Arc: 5^00'0	0"	New Style
Reference Feature	10.00	Help
Stroke Tolerance:	0.01	<u>.</u>
Thin Tolerance:	0.01	
Longitudinal Feature Mode:	New O Modify	
Name:	Pond Top 👻	¢ -
Feature Style:	H_Detention_Pond-Top	
Point Type:	Breakline 💌	
Point Density Interval:	0.00	\$ -
Duplicate Names: Append	Replace 🔘 Rename	
Exclude from Triang	Julation	
Remove Loops	Generate Graphics Only	
Triangulate Surface		
Арр	bly Preferences Close	•

On the *Controls* tab:

- 10. Set the Horizontal Method to Offset from Primary Feature.
- 11. Set both *Offsets* to *0.00*.
- 12. Set the *Vertical Method* to **Drape**.
- 13. Set the *Drape Surface* to **12345_Existing_Pond-Lab**.
- 14. **<D> Apply**, then **<D>** to Identify and **<D>** to Accept the pond outline as the *Primary Element*.

Generate Longi	tudinal Feature	- 0 2
dain Controls		
Horizontal	-	
Method:	Offset from Primary Feature 🔹	
Start Offset:	0.00 +	
Stop Offset:	0.00 +	Help
Vertical		
Method:	Drape 🔻	
Drape Surface:	12345 existing grot 💌	

> Identify Primary Element



15. **<D>** to Identify and **<D>** to Accept the same shape again as the *Reference Element*.

> Identify beginning/Reset for Entire

- 16. Reset **<R>** for the *Entire shape*.
- 17. **<D>** anywhere for the *Location*.
 - **Note:** If your *Horizontal Offsets* were not 0, you would be telling InRoads which side to offset by moving your cursor to that location before **<D>**; since they are both 0, it does not matter where you identify the location.

The shape is draped on the existing model, but placed in the new surface.

18. **<D> Close** on the *Generate Longitudinal Feature* dialog box.

Lab 20.4 - Review the feature

- 1. Select **Surface > Feature > Feature Properties** from the InRoads main menu.
- 2. Set the *Surface* to *12345 pond*.
- 3. Highlight the *Pond top* feature and choose *List Points*.

🕌 Feature Pro	operties				- 0 🔀
Surface: Feature: Name Pond top	12345 pond	Style Available: B RAIL_Ty-1(B RAIL_Ty-1(B RAIL_Ty-7) B RAIL_Ty-7 B RAIL_TY-	JR _SECT-A	From Style	Apply Close Filter List Points New Style Help
Name: Description: Parent: Refresh/Dis	Pond top Created by Generate Longitudinal Feature command	Triangulation Feature Type: Point Densit	Breakline Ity Interval: 0.00 m Triangulation	•	

Note: If you do not see the **Pond top** feature in the surface, go back and try the **Generate Longitudinal Feature** command again.

Su	Name: Pond top iption: Created M rface: 12345 pond Type: Breakline Style: H_Detentid ength: 848.73	1	gitudinal Feat	ure command	• E	Close Save As Append
Point 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 20 21	X 134921.58 134911.48 134911.52 134913.49 134913.49 134925.85 134932.30 134938.76 134945.21 134945.21 134945.28 134945.28 134945.28 134945.69 134976.85 134985.57 134976.85 134985.57 134995.37 135001.17 135008.98 135016.78 135024.58 135024.58 135024.39	Y 291319.73 291326.62 291336.06 291345.75 291353.78 291361.42 291369.06 291376.70 291384.33 291391.97 291399.46 291404.18 291404.07 291399.38 291399.38 291393.12 291386.87 291380.62 291374.36 291355.60	$\begin{array}{c} Z\\ 5150.97\\ 5150.55\\ 5150.42\\ 5151.53\\ 5153.95\\ 5154.07\\ 5154.07\\ 5154.07\\ 5154.07\\ 5154.07\\ 5153.62\\ 5153.62\\ 5150.05\\ 5149.34\\ 5150.05\\ 5149.07\\ 5149.07\\ 5148.92\\ 5148.92\\ 5148.17\\ 5148.62\\ 5148.30\\ 5148.06\\ \end{array}$	Distance Along Featur 0.00 9.90 19.80 29.75 40.01 50.01 60.01 70.01 80.02 90.26 100.29 110.25 120.16 130.10 140.10 150.10 160.10 170.10 180.10 190.10 200.11	e v	Display Print Help

- 4. You should see all different elevations for the feature. If you have a feature listed, but the elevations are not in the range shown, use **Surface > Edit Surface > Delete Feature** to delete the feature, then try again.
- 5. **<D> Close** on the *Results* dialog box and again on *Feature Properties* dialog box.

Lab 20.5 - Create a target for the pond bottom

In this series of steps, you will create features from the two lines at either end of the pond. The one on the West side represents the 5144 elevation and on the East end 5141. These features will then be triangulated to form a 'dummy' surface that can be used as a target to create the pond bottom.

- 1. Select **File > New** from the InRoads main menu.
- 2. Set the *Type* to **Design**.
- 3. Key in *12345 dummy pond bottom* for the *Name*.
- 4. Key in *Pond training example* for the *Description*.
- 5. Set the *Preference* to **Proposed**.

6. **<D> Apply** and **Close** the *New* dialog box.

Mew New		
Surface Geometry	y Site Modeler	
Туре:	Design 🔹	Apply
Name:	12345 dummy pond bottom	Help
Description:	Pond training example	
Maximum Length:	0.00	
Preference:	Proposed •	
		-
Name	Descript	ion
Default		
12345_Existing_F 12345 pond	ond-Lab	
12545 pond		
	Close	

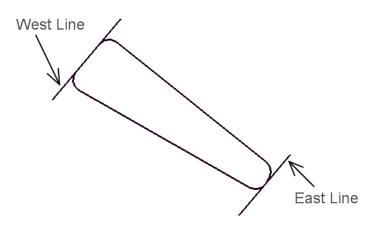
- 7. Select Surface > Design Surface > Generate Longitudinal Feature (GLF) from the InRoads main menu.
- 8. Set the *Surface* to *12345 dummy pond bottom*.

Exterior Arc: 5'0000" Reference Feature Interval: 10.00 Thin Tolerance: 0.01 Congitudinal Feature Mode: Point Trape: Point arget Point Type: Point arget Point Type: Point Breakline Point Duplicate Names: Append Replace Replace Remove Loops Generate Graphics Only Triangulate Surface Generate Longitudinal Feature Apply Preferences Close Generate Longitudinal Feature Kain Controls Horizontal Method: Diffset from Primary Feature Start Diffset: D.00 Vertical	Filter New Style + Help	00 +	12345 dummy por rc: 5^00'00" rce Feature 10.00 val: 10.00 ce Tolerance: 0.01 folerance: 0.01 dinal Feature Image: New Style: Pond tage	Surface: Exterior Arc: Reference Fea Interval: Stroke Tole Thin Tolerand Longitudinal Fe Mode: Name:
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Point Density Interval: 0.00 + Duplicate Names: Append Replace @ Rename Exclude from Triangulation Remove Loops Generate Graphics Only Triangulate Surface Apply Preferences Close Generate Longitudinal Feature Main Controls Horizontal Method: Offset from Primary Feature Start Offset: 0.00 + Stop Offset: 0.00 + Help	<u>+</u>		Pe. Breakli	Point Type:
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Generate Longitudinal Feature Main Controls Horizontal Method: Offset from Primary Feature Start Offset: 0.00 \$top Offset: 0.00				
Main Controls Horizontal Method: Offset from Primary Feature Start Offset: 0.00 Stop Offset: 0.00 Vertical	•	Preferences Close	Apply	
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Start Offset: 0.00 + Stop Offset: 0.00 +				
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Vertical			0.00	
	нер		fset: 0.00	Stop Offset:
				Vertical
Method: Elevation/Elevation 👻				
Start Elevation: 5144.00 🜩		n/Elevation	Elevation/E	Method:
Stop Elevation: 5144.00 +			LIEVAGOINE	
		44.00	evation: 5144.	Start Elevation

9. Set the other criteria as shown in the illustrations below to create a new feature.

10. **<D> Apply**.

11. Select the West linestring with a data point **<D>**.



The linestring highlights and you are prompted to Accept/Reject.

12. **<D>** to accept.

You are prompted to *Identify Reference Element*.

13. Select the same linestring again with a **<D>** and **<D>** again to *Accept* when the linestring highlights.

A tracking line appear and you are prompted to *Identify Beginning (Reset for Entire Element)*.

- 14. **<R>** Reset to copy the entire element.
- 15. **<D>** for the location.
 - **Note:** Since the horizontal offsets are 0.00, the location of the data point does not matter. If there were horizontal offsets, the data point would tell the software which way to make the copy, similar to a MicroStation copy command.

The line is made into a feature at elevation 5144 in the surface dummy pond bottom.

- 16. Repeat steps 7-14 to create a feature in the same surface for the East line, which should be set to an elevation of *5141*.
- 17. **<D> Close** to dismiss the *GLF* dialog box.

Lab 20.6 - Review the feature

- 1. Select **Surface > Feature > Feature Properties** from the InRoads main menu.
- 2. Set the *Surface* to 12345 dummy pond bottom.
- 3. Highlight the **Pond target** (5144 elevation) feature and **<D>** the **List Points** button.

You should see all 5144 elevations for the feature.

🐂 Feature Pro	perties						- • •
Surface: Feature: Name Pond target Pond target1	12345 dummy pond bottor I 2345 dummy pond bottor Style Default Default	+	Style Available: B_RAIL_Ty-10M B_RAIL_Ty-10R B_RAIL_Ty-3 B_RAIL_Ty-7 B_RAIL_Ty-7_SI Breakline Primary:			•	Apply Close Filter List Points New Style
			Default Secondary: Pay Items			•	Help
•	4 m		Name	Description DATABASE NOT OPEN	From Style Yes	*	
Name: Description: Parent:	Pond target Created by Generate Longitudinal Feature command play in 3-D/Plan View		Triangulation Feature Type: Point Density I Exclude from		•		

- 4. **<D> Close** on both the *Results* and *Feature Properties* dialog boxes.
- 5. Turn off the reference with the original pond graphics.

References (1 of 1 unique, 0 displayed)						
Tools Settings						
🗄 🗸 📴 🕺 🏷 🆃 🖆 📅 🚰 🐉 👘 🗊 🕲 🗙 Mitte Mode	Boundaries 👻					
Slot 🏱 🗋 File Name Model Description Logical Presentation 💽 🖕	2 🔪 🕒					
1 12345DES_Pon CDOT Default Global Origin align Wireframe	/ /					
Scale 1.000000 : 1.000000 Botation 00°00'00"						
Offset <u>X</u> 0.0000 <u>Y</u> 0.0000 <u>Z</u> 0.0000						
💽 🔊 💦 🖓 🕼 🎬 🏵 🖗 🕼 🧘 🕼 No Nesting 💿 🗸 Ilow Overides 🔻 Depth: 1						
New Level Display: Config Variable <u>G</u> eoreferenced: No						

6. **Triangulate** the dummy pond bottom surface.

Bentley InRoads V8i (SELECTseries 2)					E		×
<u>File Surface Geometry Drainage Eva</u>	luation <u>M</u> o	odeler	Site Mod	leler Dr <u>a</u> fting	<u>Q</u> uantiti	es <u>T</u> ools	<u>H</u> elp
<unnamed> 🗸 👔</unnamed>	💐 🚳	📏 🎽	? 📕 -	يبك 🕞	Ē		
	Dat	a Type		A	ctive	Feat	ures
□ ⇒ Surfaces	T.	Breakli	ne Fe		0		0
🔒 📲 Default	2	Contou	ur Fea		0		0
12345_Existing_Pond-Lab	0	Exterio	r Feat		0		0
12345 pond	1 🕅 🏹	Inferre	d Brea		0		0
12345 dummy pond bottom	Sav	(A)			0		0
		-			0		0
	Sav	/e As			0		0
	Set	Active			0		0
🛢 Surfaces 🖁 Geometry 🚮 F 🧃	Tria	angula	te				+
Toggles the Feature Highlight Lock	Co	ру					d
	Clo						
	Em	pty					
	Pro	perties	i				

Lab 20.7 - Define the pond side slopes

This series of steps takes you through creating sideslopes from the new top-of-pond outline down to the target DTM.

1. Set the *Locate* mode to **Features**.

Locks	
<unnamed></unnamed>	- 18 😴 🚳 🔪 🏏 🔜 🖃 👔
	Locate Features

Since the source for the slopes is the feature created for the top of the pond, you must first change the *Locate* mode.

2. Select the Surface > Design Surface > Generate Sloped Surface (GSS) from the InRoads main menu.

On the *Main* tab:

- 3. Set *Source Surface* to **12345** pond.
- 4. Set Intercept Surface to 12345 dummy pond bottom.
- 5. Set *Destination Surface* to **12345 pond**.
- 6. For *Interval* key in *10*.
- 7. For *Cut Slope* key in *50%*.
- 8. For *Fill Slope* key in -50%.

In the *Feature* area:

- 9. Toggle off Generate Graphics Only.
- 10. Toggle off **Tic Marks** and **Source**.
- 11. Toggle on **Transverse**. Key in *transverse* for the *Name* and set the *Feature Style* to **DTM_Transverse**.
- 12. Toggle on *Catch Point*. For *Catch Point* key in *Pond bottom* and set the *Feature Style* to H_Detention_Pond-Bottom.
- 13. Set the *Point Type* to Breakline.
- 14. For *Point Density Interval* key in *10.000*.

🐂 Generate Sloped Surfa	ice			- • 💌
Main Advanced				
Current Locate Mode:	Features			Filter
Source Surface:	12345 pond 🔹			New Style
Intercept				
Surface:	12345 dummy pond 🔻			Help
Elevation:	0.00			
Destination Surface:	12345 pond 🗸	Ĺ		
Interval:	10.00	+		
Cut Slope: 50.00%	To:	3	3.00%	
Fill Slope: -50.00%	To:	-3	3.00%	
Apply to Both Sides	Triangulate	Surfa	асе	
Feature				
Name			Style:	
	verse 🔻	+	DTM_Transverse	•
🔲 Tick Marks				
Source: Pond	I Top 👻	-	Breakline	-
Catch Point: Pond	l bottom 👻	ŧ	[H_Detention_Pond-B	ottom 🔻
Point Type:	Breakline 👻			
Point Density Interval:	10.00	-		
Duplicate Names:				
🔘 Append 🛛 🔘 F	Replace 🧿 Rename			
Exclude from Triang	ulation 📃 Generate G	iraphi	cs Only	
	Apply Preference	:es	Close	

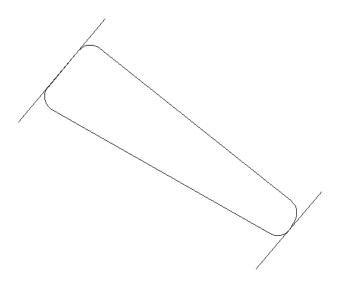
15. On the *Advanced* tab, key in *5^00'00.00"* for *Exterior Arc*.

Generate Sloped Su	urface		
Main Advanced			
Corners			
Exterior Arc:	5^00'00''		
Fillet Interior			
Berm Cut Slope:	5.00%		Help
Berm Fill Slope:	-5.00%		
Transverse Feature	\$		
🔲 Maximum Distano	ce: 100.00	-#-	
	Apply Preferences	. Close	

16. **<D> Apply** to run the **GSS** command.

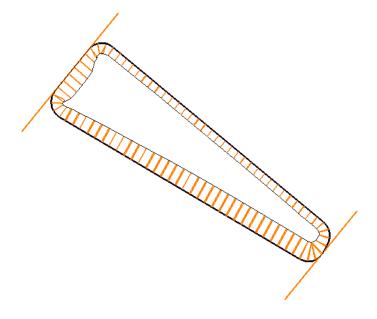
You will be prompted to *Identify Feature*.

17. **<D>** on the closed feature that represents the top of your pond.



The entire pond top will highlight and you will be prompted to <Accept/Reject>.

- 18. **<D>** in an area away from the shape to accept the pond top.
- 19. When prompted to *Identify beginning/Reset for Entire*, **<R>** to run side slopes around the entire complex shape.
- 20. When prompted for *Location*, **<D>** inside the shape, so the sideslopes will go in instead of out.



Graphics appear as shown above.

21. **<R>** and then select **Close** to dismiss the dialog box.

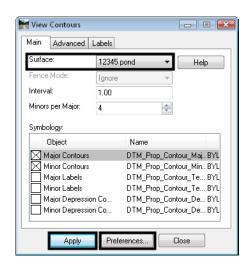
Lab 20.8 - Evaluate the pond surface

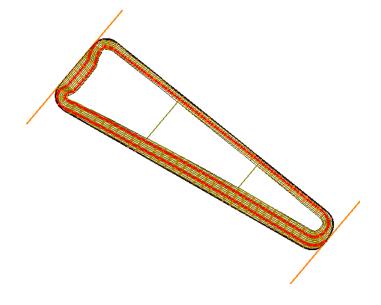
1. **<R>** on the pond surface in the Explorer portion of the InRoads menu and select **Triangu**late.

<u>File</u> <u>Surface</u> <u>Geometry</u>	Drainage Evaluation	n <u>M</u> odeler	Site Modeler	Drafting	Quantities	<u>T</u> ools	Help
		Data Typ	e	Acti	ive	Feat	ures
🖃 😂 Surfaces		小 Break	line Fe		86		1
🗄 🥌 Default		Contour Fea Ø Exterior Feat			0		0
📩 🥌 12345 Existin	g_Pond-Lab				0		0
🖶 🖘 12345 pond	Save	erre	ed Brea		0		0
⊞ <u>e</u> ∰ 12545 dumm	Save As	erio	erior Feat		0		0
	50VC A3	ndo	om Fea		0		0
	Set Active	nge	e Points		0		1
Triangulate Copy		ngles			0		0
需 Surfaces 🔠 Geon	Close		1				
oggles Pencil/Pen mode Empty							
	Properties						

- 2. Select **Surface > View Surface > Contours** from the InRoads main menu.
- 3. Select Preferences.
- 4. Highlight the **Proposed 5' Mjr 1' Minor** preference.
- 5. **<D> Load**, then **Close**.
- 6. Set the *Surface* to **12345 pond**.

7. **<D> Apply**.





Lab 20.9 - Save the pond surface to the hard disk

- 1. Select **File > Save As** from the InRoads main menu.
- 2. Set the *Save as type* to **Surfaces (*.dfm)**.
- 3. Set the *Active Surface* to **12345 pond**.
- 4. Verify the *Name* is **12345 pond.dtm**.
- 5. Verify the folder is c:\12345\Design\lnRoads.
- 6. Select Save.
- 7. **Cancel** the *Save As* dialog box.

Lab 20.10 - Calculate the pond's capacity

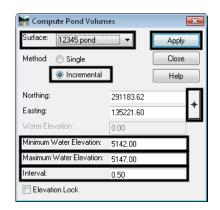
- 1. Select Tools > Application Add-ins from the InRoads main menu.
- 2. Toggle on Hydrology and Hydraulics Add-in (if it's not already on).
- 3. **<D> OK** then **<D> Close**.

H Application Add-ins	- • •
Available: GENIO Translator Add-In Global Scale Factors Add-In Graphics Translator Add-In Horizontal and Vertical Bements Add-In Horizontal and Vertical Bements Add-In Minport AMSA Add-In Import LAS Add-In Import SRV Add-In Import SRV Add-In Description The Active Project Settings Add-In provides a floating dialog that displ surface, horizontal and vertical alignments and superelevation.	OK Cancel Help
Command	
Commands placed in Tools menu	

The command for calculating the pond volume is located on this add-in.

Next, compute the volume of water your pond will hold for a range of water elevations.

- 4. Select Evaluation > Hydrology and Hydraulics > Compute Pond Volumes from the InRoads main menu.
- 5. Set the *Surface* to **12345 pond**.
- 6. Set the *Method* to **Incremental**.
- 7. For the *Minimum Water Elevation* key in 5142.
- 8. For the *Maximum Water Elevation* key in 5147.
- 9. For the *Interval* key in *0.5*.
- 10. Select the *Target* button next to the *Northing* and *Easting* fields and place a **<D>** in the middle of your pond toward the lower end.
- 11. **<D> Apply** and the volume is calculated for the range of elevations you entered. A report is shown with the incremental volumes.

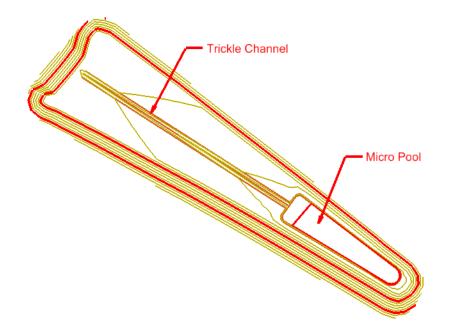


Elevation	Incremental Volume	Cumulative Volume	Acre-Feet	Surface Area	Clos
	cu ft	cu ft		sq ft	Save A
5142.00	1076.01	1076.01	0.02	2865.92	- Saver
5142.50	2071.19	3147.20	0.07	5544.57	Apper
5143.00	3605.25	6752.45	0.16	9019.63	Displ
5143.50	5558.26	12310.71	0.28	13348.39	Prin
5144.00	7826.31	20137.02	0.46	17119.15	
5144.50	8753.37	28890.39	0.66	17895.19	Help
5145.00	9142.65	38033.04	0.87	18676.26	
5145.50	9534.45	47567.49	1.09	19462.38	
5146.00	9928.77	57496.26	1.32	20253.58	
5146.50	10325.64	67821.90	1.56	21049.80	
5147.00	0.00	67821.90	0.00	0.00	

- 12. **Save** the report to your hard drive if desired.
- 13. Close the Compute Pond Volumes dialog box.

Lab 20.11 - Challenge

If you would like a challenge on this activity, complete the following steps.



- 1. Add a micro pool of your own design at the deep end of the pond.
- 2. Add a trickle channel from the upper end down to the micro pool.
- 3. Zoom in close to the upper end of the pond and look at the pond toe line. Clean up the problems in the corner using **Design Surface** and **Edit Surface** tools.

Chapter Summary:

- Design surfaces can be created using a variety of tools to create features.
- Dummy surfaces can be created just to use as intercept targets for design commands.
- The Generate Longitudinal Feature command is a very powerful tool for creating 3D features.
- Simple sideslopes can be formed with Generate Sloped Surface command.
- Staged water volumes can be computed for DTMs using the Pond Volumes command on the Hydrology and Hydraulics Add-in.

LAB 21 - 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:

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

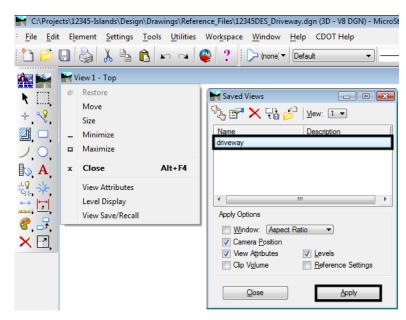
The driveway is 12' wide extending from the proposed edge of pavement to the right of way, 60' to the right of the SH 86 centerline. The driveway returns have a 15' radius. There is a 12:1 slope for 20' from the edge of pavement.

Lab 21.1 - 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.

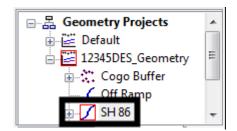
Section Objectives:

- 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.

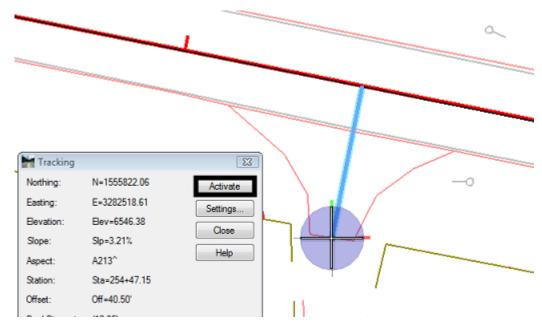


c. **<D> Apply** and then **<D> Close** to dismiss the *Saved Views* dialog box.

- 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_V8i\Standards-Global\ InRoads\Preferences\CDOT_Civil.xin file is loaded.
- 4. Verify that the **SH 86** alignment is active.

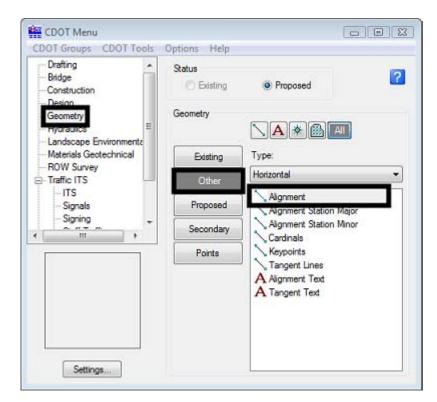


5. Select **Tools > Tracking > Tracking** from the InRoads menu bar.



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. **<D> Close** to dismiss the *Tracking* dialog box.
- 9. From the *CDOT Menu*, highlight the **Geometry** group.
- 10. **<D>** the **Other** button and select **Alignment** from the item list.



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

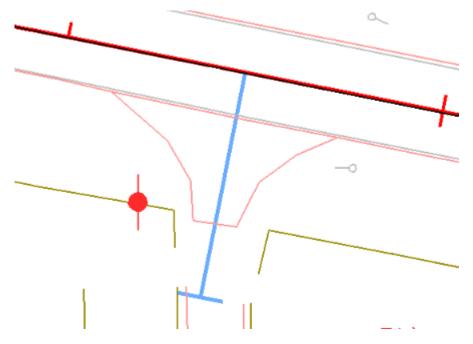


Note: Use the station that you wrote down in step 6.

12. 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.

- 13. Key in *so=254+41.15,60* and *Enter*.
- 14. 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 21.2 - Setting Elevations

In this section, the driveway end line is draped to the existing surface to acquire 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 the Drape Surface command 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**.

Type: Name: Description:	Design Driveway 254+ Driveway at sta		Apply Help
Maximum Length:	0.00		
Name		Description	n
Name Default		Description	n
	ound		n

- 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		÷	Filter
Source Level:	ALG_COG)_Points	÷	Preferences
Destination Level:	DES_SURF	ACE_1	-	Help
Delete Original Grap	hics			
Features Surface:	12345 exist	ing ground	Ŧ	
Name	Style	Descript	ion	- \$

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.

Handre Import Surface		- • •
From Graphics DEM	From Geometry	
Suface:	Driveway 254+47.15 Rt 👻	Apply
	Single Element 🔹	Fiter
Level:	ALG_COGO_Points -	Results
Elevations:	Use Element Elevations 🔹	Preferences
Intercept Surface:	Default 👻	
Drape Vertices Only		Help
Thin Surface		
Tolerance:	5.00	
Features	hics Information	
Seed Name:	Driveway_End	- +
Feature Style:	Breakline	•
Point Type:	Breakline	*
Maximum Segm	ent Length: 0.00	
Point Density In	terval: 0.00	
Duplicate Names:	Replace Rename	
Exclude from Trian	gulation	
	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**.

ĺ	Bei	ntley InRo	oads V8i (SE	LECTseries	; 2)				
	<u>F</u> ile	<u>S</u> urface	Geometry	<u>D</u> rainage	Evaluation	Modeler	Site Modeler	Drafting	Qu
	XS	Exluded f	rom Triangul	ation 👻	12 😴	6 🔨 🏷	🗶 📕 🛶	• 🗊 🚛	Ē

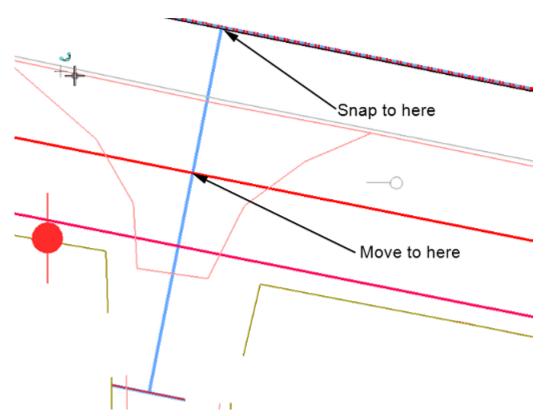
- 24. Select **Surface > View Surface > Features** from the InRoads menu bar.
- 25. Select **SH86** for the *Surface*.

- 26. Highlight all of the features in the *Features* list.
 - View Features x Surface SH86 Apply Fence Mode: Ignore Close Fiter Edit Style. Help Features: + 1 * Name Style Exterior Bounda Lift1 Centerline-Top Centerline HMA_Lift1_EOP-Top D_EOP Toe-of-Fil co-of-Cat D_Top-of-Cut HMA_Lift1_EOP-Top D_EOP
- 27. **<D> Apply** then **Close** the *View Features* dialog box.

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.

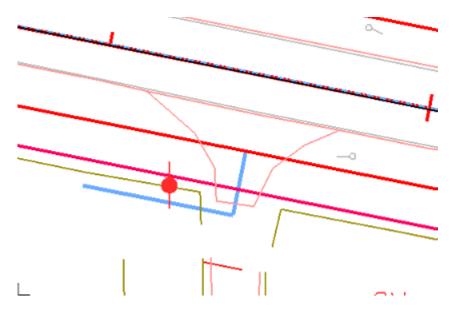
29. Snap to the intersection of the driveway centerline and the edge of pavement feature to place the line in its new location. **<D>** to complete the move then **<R>** to exit the command.



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**.

Generate Longitudina	l Feature	- • ×
Main Controls		
Surface: Drivewa	y 254+47.15 👻	Filter
Exterior Arc: 5^00'0	D''	New Style
Reference Feature	20.00	+ Help
Stroke Tolerance:	0.01	
Thin Tolerance:	0.01	
Longitudinal Feature Mode: © N	lew 🔘 Modify	
Name:	-	ф
Feature Style:	Breakline 🔹	
Point Type:	Breakline 👻	
Point Density Interval:	0.00	- ф -
Duplicate Names: Append F	Replace 🔘 Rename	
Exclude from Triang	ulation	
Remove Loops	Generate Graphics Only	
Triangulate Surface		
Арр	ly Preferences Close	e

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.

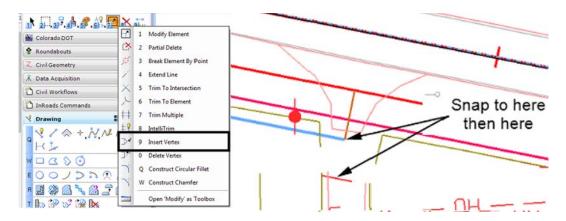
a.	Generate Longitudinal Feature
	Main. Controls
	Hotorital Offset from Panacy Feature Sat Offset: 0.00 + Stop Offset: 0.00 +
	Verical Method: Elevation/Longtudinal Stope • Stat Elevation: 6545.50 + Longtudinal Stope 8.33%
<t> then <d> here to set the elevation</d></t>	Apply Preferences. Cose

42. Key in *1/12* for the *Longitudinal Slope*. The result is 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, then **<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 line, 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 Longitudinal Feature command. Finally, the elevation at the end of the drive was set by snapping the new vertex to the driveway end line created earlier. The driveway centerline now represents the profile of the driveway.

Section Summary:

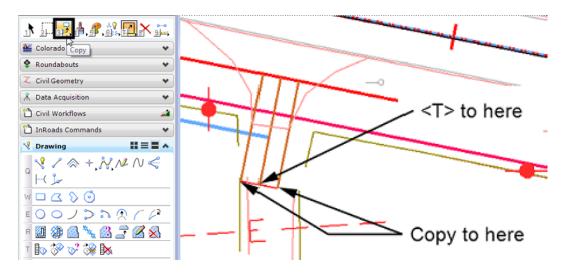
In this section, the features of the mainline road were displayed as an aid in designing the driveway. The driveway end line was draped to the existing ground and stored in the driveway surface. A 3D centerline was created with the desired slopes.

Lab 21.3 - 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.

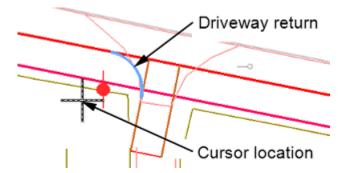
- 5. Set up the *Import Surface* dialog box as in the *Setting Elevations* section above, using *Driveway Edge* as the *Seed Name*.
- 6. **<D> Apply** then **<D>** on one of the edge lines. Repeat the process with the other edge line.
- 7. Close the *Import Surface* dialog box.

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

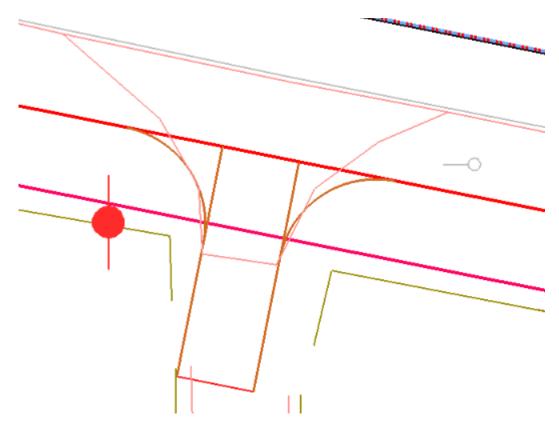
- 8. Select **Surface > Design Surface > Fillet Feature** from the InRoads menu bar.
- 9. Make the settings as shown in the illustration below.

Destination Surface:	Driveway 254+47.*	- Elevations from	Destination Surface		Apply
Radius:	15.00		Feature Points	3	Close
Filet Feature		Reference Feature	1	_	Liose
Interval:	0.50	Surface:	Driveway 254+47.15	•	Filter
Stroke Tolerand		Name:	Driveway_Edge	• +	Preferences.
Name:	Driveway_Return 💌	Offset:	0.00	+	Help
Feature Style:	Breakline 👻	Transverse Slop	e. 0.00%	+	25
Point Type:	Breakline 👻	Elevation Adjust	ment: 0.00	+	
Duplicate Names:				_	
Append	Replace (2) Renar	ne Reference Feature Surface:			
Exclude from Tr	langulation		SH86	.	
Generate Graph	ics Only	Name:	RT_HMA_Lift1_EOF	* +	
		Offset:	0.00	+	
Extension Length	0.00	+ Transverse Slop	e: 0.00%	+	
Triangulate Surfa		Elevation Adjust	ment: 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.

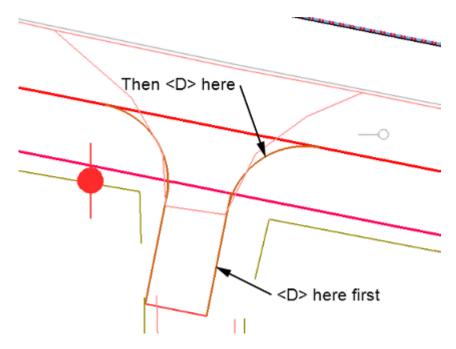
- 19. **<T>** to the end of the fillet on the drive way edge line then **<D>** to complete the partial delete.

- 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 21.4 - 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 and 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 Dynar	nic 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**.

Current Templa	ate	
Name: Description:		
New	•	Folder
Cut Copy Paste	Ctrl-X Ctrl-C Ctrl-V	Template
	Name: Description: New Cut Copy	New Cut Ctrl-X Copy Ctrl-C

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\In Road: E Point Name List 1 - Templates 2 - Sections - Pavement	Current Template Name: Description:	
3 - Sections - End Conditions Curb & Gutter Sections Z-Slope End Conditions		
Driveway End Conditions 4 - Components	New	▶ Folder
	New Cut Ctrl-X	Template
		Template
	Cut Ctrl-X	Template
	Cut Ctrl-X Copy Ctrl-C	Template

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* window.
- 12. Drag the component from the *Preview* window into the *4_to_1-Existing* section by its origin and place it on the origin of 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 section 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	e (Close
Style:	D_	Toe-of-Fil	•	12	< Previous
Parent Com	ponent:		· +		
Display Rul	es:			Edit	Next >
Exclude	from triangulatio	0			Help
	Warning and Parameter				
	ition Properties				
	ition Properties		Priority:	1	
End Cond	ition Properties pe: Sur			1	
End Cond Target Ty	ition Properties pe: Sur	face		1 0 0.00	
End Cond Target Ty	ition Properties pe: Sur	face	n Benching Count:	-	P

- 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.

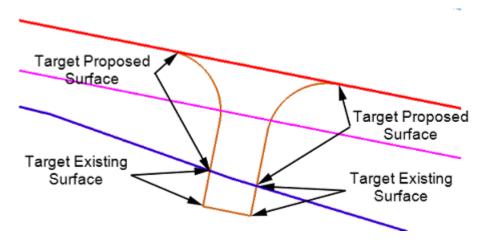
- 22. **<R>** on the **4_to_1-Existing** section and select **Copy**.
- 23. **<R>** on the *Driveway End Conditions* folder and select **Paste**.
- 24. Rename the section to 4_to_1-Proposed.
- 25. **<D> <D>** on the **4_to_1-Proposed** section to make it active.

Name:	Fil_4/1			+ Apply			
Description				Cree			
Style:	D_Toe-of-Fil	3	Component Pro				
Parent Component:	-	+	Name:	Cut_4/1		+	Apply
Display Rules:			Description:			1	Close
Exclude from trian	julation		Style:	D_Top-of-Cut			< Previous
End Condition Prop	aties		Parent Component:	·	• <u>+</u>		Next >
Target Type:	Suface	P	Display Rules:		11	Edit	11111111
Surface		E	Exclude from trian	gulation			Help
	6		End Condition Prop	erties			
Horiza	ntal Vertical		Target Type:	Surface	Priority:	2	
Offsets: 0.00	0.00	B	Surface		Benching Count:	0	
					From Datum:	0.00	
			Horizi	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.

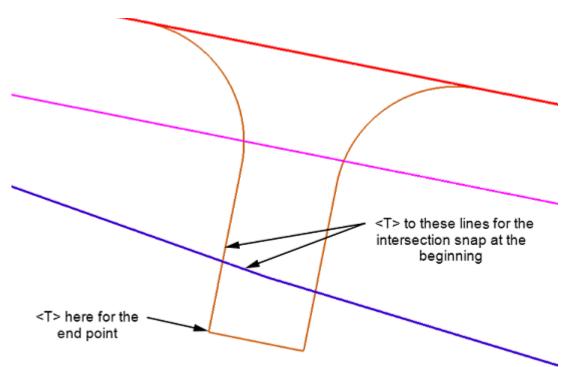


- 28. Select **Surface > Design Surface > Apply Template** from the InRoads menu bar.
- 29. In the Apply Template dialog box, set the Design Surface to Driveway 254+47.15 Rt.
- 30. Toggle on **Interval** and key in **1.00** for the value.
- 31. Toggle on **Stroke Tolerance** and key in **0.01** for the value.
- 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**.

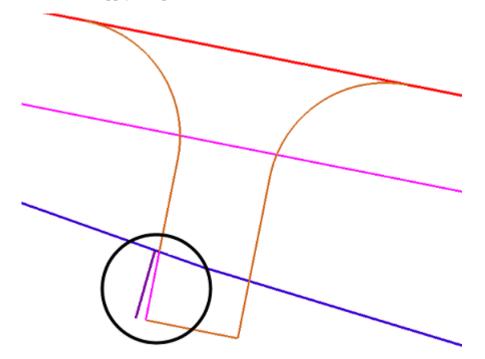
🕌 Apply Template		- • •
Design Surface:	Driveway 254+47.15 Rt 👻	Apply
Exterior Arc:	5^00'00"	Close
Mirror	Reflect	Preferences
Reference Feature		
V Interval:	1.00 .	Help
Stroke Tolerance:	0.01	
	Pavement End Conditions End Conditions	Modfy

- 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.



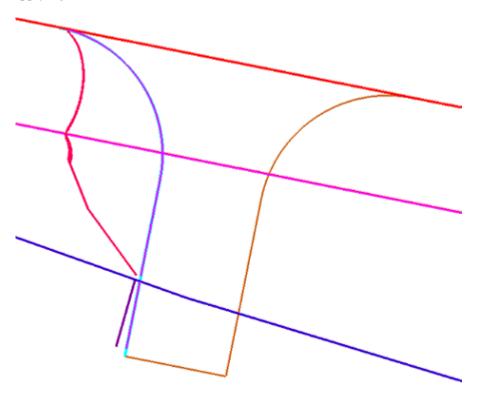
39. At the prompt, "Identify Beginning/Reset for Entire", Set the MicroStation snap mode to Intersection.

- 40. **<T>** on the mainline top of cut feature then **<T>** on the driveway edge feature then **<D>** to accept the location.
- 41. Use the keypoint snap to select the end point then $\langle D \rangle$ to accept the location.
 - 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).

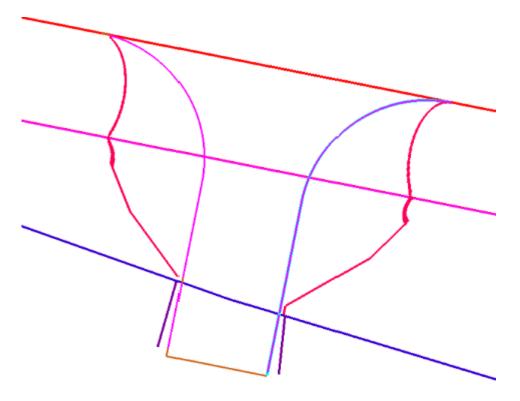
42. Repeat the Apply Template process, using the *4_to_1-Proposed* section, to model the sideslope to the (proposed) SH86 surface. The illustration below shows the results after applying both sections to the left side.



esign Surface:	Driveway 254+47.1	5 Bt 👻	Apply
oterior Arc:			Uhhā
	5^00'00*		Close
Mirror	Reflect		Preferences.
Reference Feature			
V Interval:	1.00	+	Help
Stroke Tolerance:	0.01		
1 - Templates 2 - Sections - F 3 - Sections - E Curb & Gut	ind Conditions =		
2 - Sections - F 3 - Sections - E Curb & Gut Gutb & Gut Driveway E 4_to_1 × 4_to_1	Ind Conditions = ter Sections End Conditions -Existing	<	
2 - Sections - F 3 - Sections - F Curb & Gut Gutb & Gut Driveway F 4_to_1 X - 4_to_1 Z-Slone Fr til Features	Ind Conditions ter Sections End Conditions -Existing -Proposed	<	
2 - Sections - F 3 - Sections - E Curb & Gut Driveway E 4_to_1 X - 4_to_1 X - 4_to_1 X - 5lone Fr + III Features Duplicate Names:	Ind Conditions ter Sections End Conditions -Existing -Proposed	ne ©1	Modfy

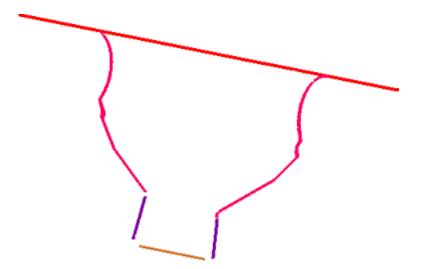
43. In the *Apply Template* dialog box, toggle on **Reflect**.

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.



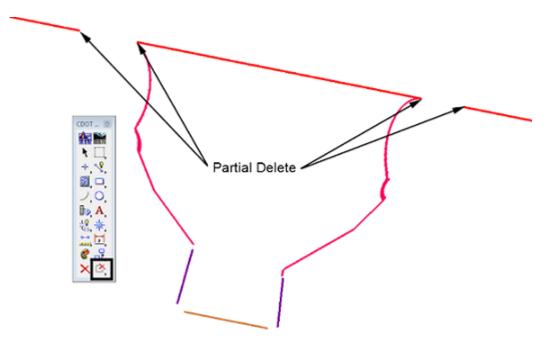
The final step for the drive is to create an exterior boundary. The boundary is defined using the graphics of the cut and fill features along with the driveway end feature and the proposed edge of pavement from Sh86.

- 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.

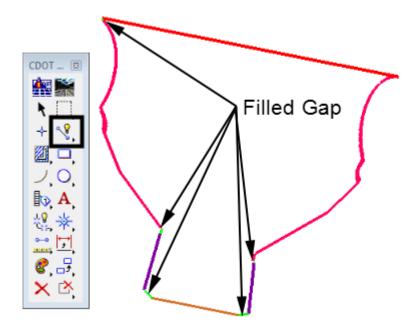


To create the boundary, the edge of pavement line needs to be trimmed and the gaps between elements need to be filled.

- 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.

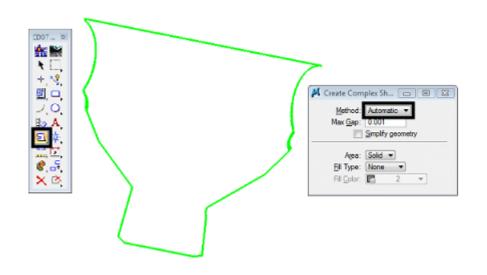


50. Select the MicroStation Place Smartline command. Use this command to fill in the gaps between elements. Be sure to <T> to the ends of the lines. This will ensure that the elements are connected properly. Not snapping to the lines could result in erroneous elevation data. The gaps filled are illustrated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

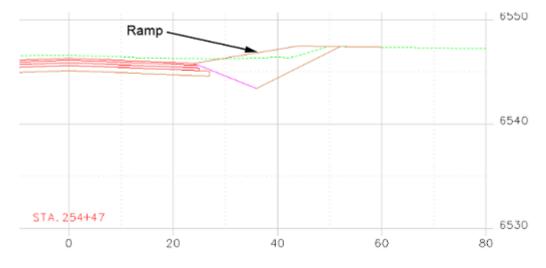


Import complex shape into the driveway surface as an exterior boundary, to complete the model.

- 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.

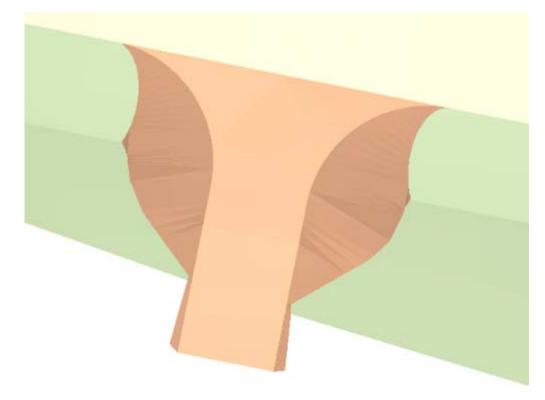
Mark Import Surface			- • •
From Graphics DEM	From Geome	stry	
Surface:	Driveway 254	+47.15 Rt 👻	Apply
Load From:	Single Element	t 🔫	Fiter
Level:	ALG_COGO_F	Points -	Results
Elevations:	Use Element E	Bevations 💌	Preferences
Intercept Surface:	Default	+	Help
Drape Vertices Or	ily		пар
Thin Surface			
Tolerance:	5.00		
Features	phics Informatio	n	
Seed Name:		Exterior Boundary	- +
Feature Style:		Exterior Boundary	-
Point Type:		Exterior	-
Maximum Seg	ment Length:	0.00	
Point Density	Interval:	0.00	
		Rename	
Exclude from Tri	angulation		
	0	lose	

- 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, create 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

LAB 22 - Creating an Island

In this lab, and island with pedestrian ramps is constructed on the southeast corner of the intersection. Surface features of the island are built using various MicroStation commands and InRoads surface design and editing tools. The island model is added to the proposed intersection model to create a triangulated model of the finished grade surface. Because the island is constructed by feature modeling techniques, there are no components included in the model.

Chapter Objectives:

- Lay out the horizontal geometry of the island.
- Identify ramp locations.
- Add elevations to the island shape.
- Create curb and ramp features.

The following files are used with this lab:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Intersec100SH86.dgn
- C:\Projects\12345\Design\InRoads\12345DES_Geometry-Islands.alg
- C:\Projects\12345\Design\InRoads\Intersection.dtm

The two roads of the intersection are 4 lane curb and gutter. Each has an additional lane through the intersection for a turn bay and acceleration lane. The island protects the right turn lane from through traffic on SH 86.

The SE Curb Return alignment (in the quadrant of the island) represents the edge of pavement for the right turn lane. The features constructed for the island represent the gutter flowline around the island and the pedestrian ramps leading on to the island.

Lab 22.1 - Layout the Island Geometry

Section Objectives:

- Use horizontal alignment graphics to create the basic outline of the island.
- Define the radii for the island corners.
- Layout the initial geometry for the pedestrian ramps.

The basic outline of the island is created by offseting the alignment graphics. This is done by displaying the alignments from InRoads then using the MicroStation Move Parallel command to copy the graphics to the desired locations. Construct Circular Fillet is used to create the rounded corners for the island. The pedestrian ramps are laid out with a variety of MicroStation tools like, Place Smartline, Construct Line at Active Angle, Extend Element to Intersect, etc.

- Open MicroStation and InRoads with the C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Intersec100SH86.dgn file.
- 2. Verify that the C:\Workspace\Workspace-CDOT_XM\Standards-Global\ InRoads\Preferences\CDOT_Civil.xin is loaded.
- 3. Open the following InRoads files (they are all in the *C:\Projects\12345\Design\InRoads* folder):

- 12345DES_Geometry-Islands.alg
- ♦ Intersection.dtm
- 4. From the InRoads menu bar, select **File > New**.
- 5. Select the **Surface** tab in the *New* dialog box.
- 6. Set the *Type* to **Design**.
- 7. Key in *SE Island* for the *Name*.
- 8. Key in Island for SE quad SH 86 and Side Road for the Description.
- 9. Set the *Preference* to **Proposed**.
- 10. **<D> Apply** then **<D> Close**.

Surface Geometr	v Site Modeler	7	
Type: Name: Description: Maximum Length:	Design SE Island Island for SE c	•	Apply Help
Preference:	Proposed	•	
Name		Description	n
Name Default 12345 existing gr Intersection	ound	Existing Gro	n ound from m roadway

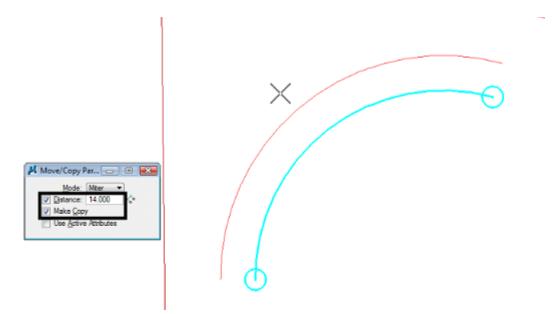
This surface is used to store the island surface data as its being created. It also protects the data in the Intersection.dtm from being accidently modified while editing the island surface features.

- 11. In the InRoads Explorer, expand the **12345DES_Geometry** geometry project.
- 12. **<R>** on the **SH 86** horizontal alignment and select **View** from the menu.
- 13. Repeat the process for the SideRoad and SE Curb Return horizontal alignment

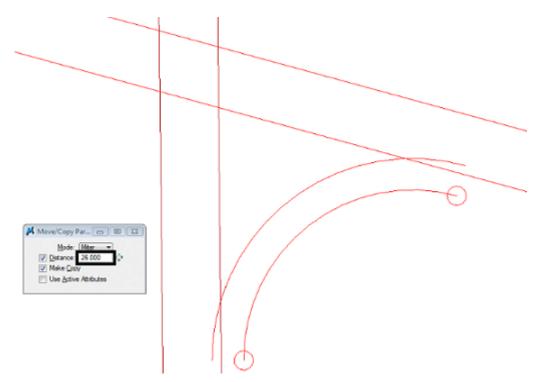
The MicroStation Move Parallel command is used to offset these lines. The SE Curb Return line is offset 14' (12' for the driving lane and 2' for the gutter) to the left to form one side of the island. The SH 86 and SideRoad lines are offset 26' (24' for the driving lane and 2' for the gutter) to the right to form the other two sides.

- 14. From the MicroStation *Main* toolbar, select **Move Parallel**.
- 15. In the *Move/Copy Parallel* tool settings box, toggle on *Distance*.
- 16. Key in **14** for the value.
- 17. Toggle on **Make Copy**.

- 18. **<D>** on the **SE Curb Return** line.
- 19. Move the cursor to the left of the line and **<D>** to make the copy. **<R>** to exit the command.

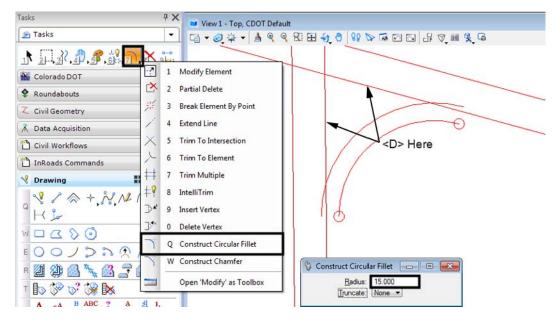


- 20. In the *Move/Copy Parallel* tool settings box, key in *26* for the value.
- 21. **<D>** on the **SH 86** line then **<D>** to the right of the line. **<R>** to exit the command.
- 22. **<D>** on the **SideRoad** line then **<D>** to the right of the line. **<R>** to exit the command. The illustration below shows the results.

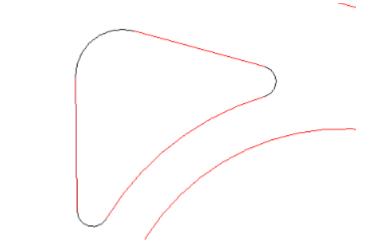


Next the radii for the island corners are added. The corner facing into the intersection has a 15' radius. The other two have a radius of 5'. These are placed using the Construct Circular Fillet command.

- 23. Select the Construct Circular Fillet command from the MicroStation Main toolbar.
- 24. In the tool settings box, key in **15** for the *Radius*.
- 25. Set *Truncate* to **Both**.
- 26. **<D>** on the lines as shown in the illustration below.

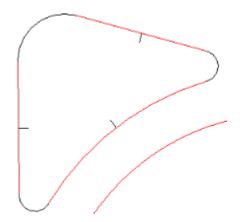


- 27. In the tool settings box, key in **5** for the **Radius**.
- 28. Place the other two fillets as done in step 25. The illustration shows the results.

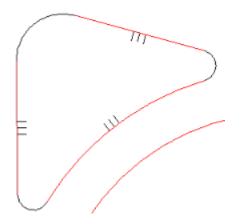


With the outline of the island in place, the pedestrian ramps can be located. These are placed in the center of each side of the island. The MicroStation Construct Line At Active Angle command is used to place the ramp centerline perpendicular to the island side.

- **Note:** The dimensions for the pedestrian ramp are taken from the M-608-1 Curb Ramps standard, page 104 of the M & S Standards July 2006 edition.
- 29. Select the **Construct Line At Active Angle** command from the MicroStation Main toolbar.
- 30. In the tool settings dialog box, set the *Method* to From Point.
- 31. Set the Active Angle to 90^00'00".
- 32. Toggle on *Length* and key in *3* for the value. This is the length of the 20:1 slope at the mouth of the ramp.
- 33. **<T>** to the center of a side of the island, move the cursor inside the island and **<D>**.
- 34. Repeat step 33 for the other two sides. The illustration shows the results.

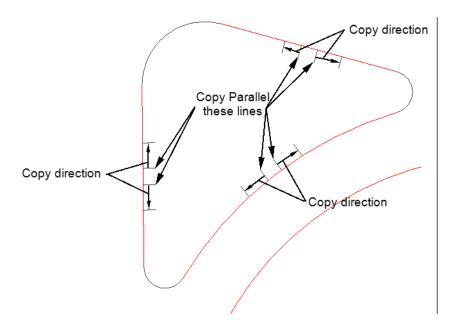


- 35. From the MicroStation *Main* toolbar, select Move Parallel.
- 36. In the *Move/Copy Parallel* tool settings box, toggle on *Distance*.
- 37. Key in $\boldsymbol{2}$ for the value.
- 38. Copy each of the ramp centerlines to either side of itself. These will make up the edges of the ramp tread. The illustration shows the results.



39. Delete the ramp centerline elements, they will not be used again.

- 40. From the MicroStation Main toolbar, select Move Parallel.
- 41. In the Move/Copy Parallel tool settings box, toggle on Distance.
- 42. Key in **6** for the value.
- 43. Copy each of the ramp edge lines to the outside of itself. These lines are used to create the ramps "wings". The illustration shows the results.



Section Summary:

InRoads was used to display the alignments that are the basis of the island. These were copied to their exact XY location using the MicroStation Move Parallel command. Rounded corners were added to the island using the Construct Circular Fillet command. The initial parts of the pedestrian ramps were added using the Construct Line At Active Angle command.

Lab 22.2 - Create Ramp and Curb Graphic Elements

The outline of the island is complete. Now this outline needs to match the elevations in the design surface. The Drape Surface and Import Surface From Graphics commands are used to create dtm features of the island at the desired elevations. The ramp elements are draped to set the initial elevation, then Generate Longitudinal Feature is used to apply the proper slope to the element.

Section Objectives:

- Create graphic elements of the island at the design surface elevation.
- Modify slope on ramp landing elements.
- Create curb elements.
- Modify the curb elements for the ramp wings.
- Add the ramp wing elements.

All of the graphic elements that make up the island and curb ramps are draped to the intersection surface. This sets the graphic elements of the island outline to the proper elevation. It also sets the initial elevations for the curb ramp features.

- 1. Highlight all of the elements that make up the island and ramp.
- 2. Select **Surface > Design Surface > Drape Surface** from the InRoads main menu. This displays the *Drape Surface* dialog box.

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		Rename Surface		<u>Apply Template</u>	
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- 3. In the *Drape Surface* dialog box, set the *Destination Surface* to **Intersection** (this is the surface whose elevations are going to be matched).
- 4. Set the *Input Mode* to Single.
- 5. Toggle on **Destination Level** and select **DES_ROADWAY_Curb-Flowline** from the drop down menu.

6. Toggle on Delete Original Graphics.

📷 Drape Surface			- • ×
Current Locate Mode:	Graphics		Apply
Destination Surface:	Intersection	*	Close
Graphics Input Mode:	Single	-	Filter
Source Level:	ROW_MONUME	_	
Destination Level:	DES_ROADWAY	Y_Curb-Fla ▼	Help
Delete Original Grap	hics		
Features			
Surface:	Intersection	~	
Name	Style	Description	
Scale:	1.0000		
Elevation Adjustment:	0.00		
Drape Vertices Only			

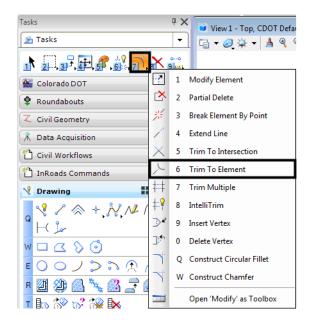
<D> Apply. This displays a message window asking, "Use elements contained in selection set?". <D> OK to complete the processing.

Bentley InRoads XM Edition	G
Use elements contained in selection set?	
OK Cancel	

8. **<D> Close** to dismiss the *Drape Surface* dialog box.

The result of the command is that the graphic elements selected are redrawn at the elevation of the intersection surface. Next, the lines representing the pedestrian ramps are given the proper slope. These elements represent the landing pad of the pedestrian ramp and have a 20:1 slope.

9. Zoom In around the ramp lines on the long arc of the island.

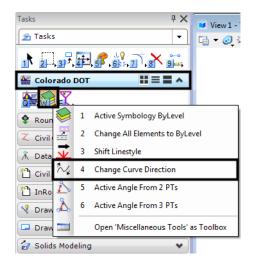


10. Select **Trim to Element** from the MicroStation main menu.

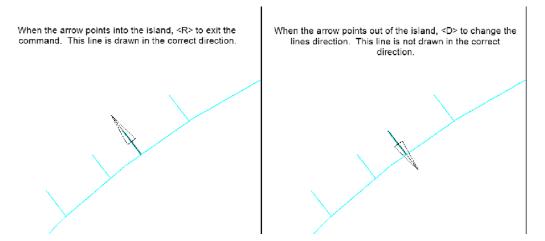
11. Extend the ramp wing lines to meet the Island line.

Next, check the direction of the lines. This will affect how the Generate Longitudinal Feature command operates.

12. **<D>** the **Change Curve Direction** tool from the *Misc. Tools* bar under the *Colorado DOT* task tab.



13. **<D>** on one of the ramp landing edge lines. An arrow appears on the line.



- 14. Repeat step 13 for each of the ramp lines
- 15. Select **Surface > Design Surface > Generate Longitudinal Feature** from the InRoads main menu. This displays the *Generate Longitudinal Feature* dialog box.

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<u>File</u> <u>Surface</u> <u>Geometry</u> <u>Drainage</u> <u>Evaluation</u>	ion <u>M</u> odeler Dr <u>a</u> fting <u>Q</u> uantities <u>T</u> ools <u>H</u> elp
 ∠U <u>V</u>iew Surface ₩ Update <u>3</u>-D/Plan Surface Display ₩ Fit Surface 	• 🔪 🌶 🗮 🔆 端 📳 🚧 🖉 vame Description File Name
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Design Surface	Place Feature Projects\12
Design Pad	 <u>III</u> Generate <u>Transverse Feature</u>
Edit Surface	Generate Longitudinal Feature
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Active Surface Copy Surface Delete Surface	 Fillet Features Generate Sloped Surface Apply Template
😤 <u>R</u> ename Surface	Z Set Elevation
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	🦄 Resurface

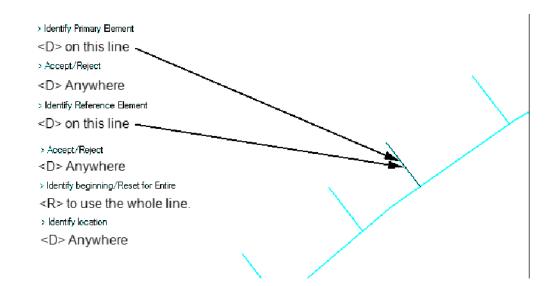
- 16. On the *Generate Longitudinal Feature* dialog box *Main* tab, Toggle on **Interval** and set the value to **1.00**.
- 17. Toggle on **Stroke Tolerance** and set the value to **0.01**.
- 18. Use the *Feature Style* drop down menu and select **D_CONC_Sw**.

Surface: SE Islan	4		
JE Isidi			Filter
5 000	0''		New Style.
Reference Feature Interval:	1.00	+	Help
Stroke Tolerance:	0.01		
Mode:	New 🔘 Modify		
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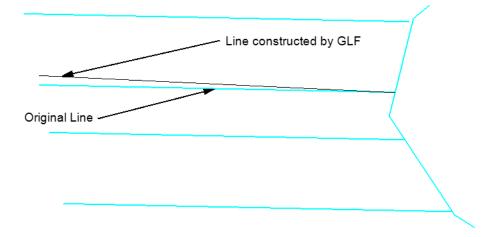
19. Toggle on Generate Graphics Only.

- 20. $\langle D \rangle$ the **Controls** tab.
- 21. Set the *Horizontal Method* to **Offset From Primary Feature**. Leave the *Start* and *Stop* values at *0.00*.
- 22. Set the *Vertical Method* to Elevation/Longitudinal Slope.
- 23. **<D>** the 'target' button for *Start Elevation*, then **<T>** to the ramp landing line where it intersects the island outline and **<D>** to accept.
- 24. Key in **5.00%** (1:20) for the *Longitudinal Slope*.

25. **<D> Apply**. Follow the prompts located in the lower left corner of the MicroStation window. Use the same line for the Primary and Secondary element. The illustration below lists the prompts and the action taken.

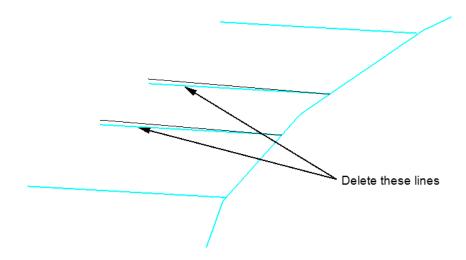


The illustration below shows the results of the *Generate Longitudinal Feature* command in a rotated view.

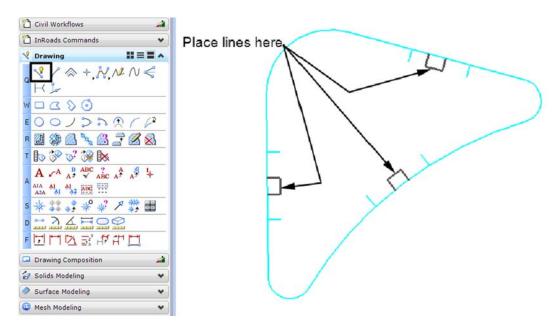


- 26. Repeat steps 23 through 25 for the remaining ramp landing lines (there are 5 more).
- 27. Rotate the view so the original ramp tread lines can be seen under the new lines.

28. Delete the original ramp tread lines from each ramp.



- 29. Rotate the view back to a *Top* view.
- 30. Select the MicroStation Place Smartline command.
- 31. Place a line connecting the back of each ramp tread line. Be sure to **<T>** to the end of each line so that the elevation of the new line will be correct.



Next, the generate longitudinal feature command is used to create the back of the pedestrian ramps.

32. From the InRoads main menu, select **Surface > Design Surface > Generate** Longitudinal Feature. The settings on the Main tab are the same as those set earlier.

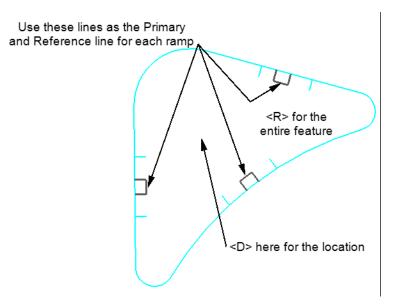
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Apt	Preferences Close	e

- 33. **<D>** the **Controls** tab.
- 34. In the *Horizontal* area, set the *Method* to Offset from Primary Feature.
- 35. Key in *4.50* for the *Start Offset* and *Stop Offset*. This is the minimum length for this section of the ramp according to the M & S Standard.
- 36. In the *Vertical* area, set the *Method* to Offset/Offset.

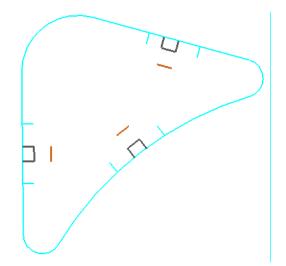
37. Key in *0.32* for the *Start Offset* and *Stop Offset*. This is the difference in height from the end of the 20 to 1 tread slope to the top of the curb.

Main Controls Horizontal Offset from Primary Feature Start Offset: 4.50 Stop Offset: 4.50	Help
Method: Offset from Primary Feature Start Offset: 4.50 Stop Offset: 4.50	Help
Method: Offset/Offset Start Offset: 0.32 Stop Offset: 0.32	
Apply Preferences Cic	

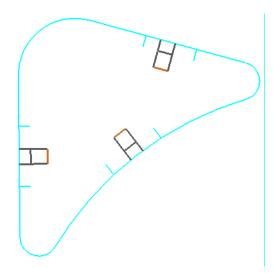
38. **<D> Apply**. Then follow the prompts. Use the ramp tread end line as the primary and reference element. **<R>** to use the entire line. **<D>** in the middle of the Island for the location.



39. Repeat step 38 for each ramp. The illustration below shows the results. Dismiss the *Generate Longitudinal Feature* dialog box when finished.



- 40. Select the MicroStation Place Smartline command.
- 41. Place a lines to complete the sides of each ramp tread. Be sure to **<T>** to the end of each line so that the elevation of the new line will be correct. The illustration below shows the results.



Next, elements defining the curb are added. The Generate Longitudinal Feature command is used for this.

- 42. From the InRoads main menu, select Surface > Design Surface > Generate Longitudinal Feature.
- 43. On the *Main* tab, key in *1.00* for the Interval.

Generate Longitu		
Surface: SE	Island 👻	Filter
Exterior Arc: 5^	00'00''	New Style
Reference Feature	1.00 +	
Stroke Tolerand	ce: 0.01	
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-Longitudinal Featu Mode:	re ⊚ New	1
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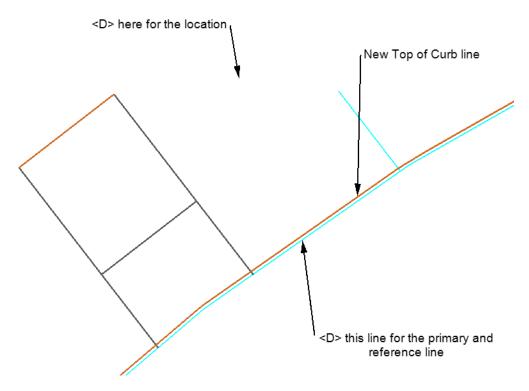
44. Set the *Feature Style* to D_C/G_Ty2_Sect II-B. The other settings remain as set.

- 45. **<D>** the **Controls** tab.
- 46. Verify that the *Horizontal Method* is set to Offset from Primary Feature.
- 47. Key in *0.125* for the *Start Offset* and *Stop Offset*. This is the horizontal distance from the gutter flowline to the top front of the curb according to the M & S Standard. Note: the entry will be rounded to 0.13 in the dialog box.
- 48. Verify that the *Vertical Method* is set to Offset/Offset.

Generate Long	itudinal Feature	
Main Controls		
Horizontal Method: Start Offset: Stop Offset:	Offset from Primary Feature	Help
Vertical Method: Start Offset: Stop Offset:	Offset /Offset • 0.50 • 0.50 •	

49. Key in **0.50** for the *Start Offset* and *Stop Offset*. This is the height of the curb.

50. **<D> Apply**. Then follow the prompts. **<D>** an island outline element for the primary feature and use the same one for the reference feature. **<D>** in the middle of the Island for the location. The illustration shows an example of the results.

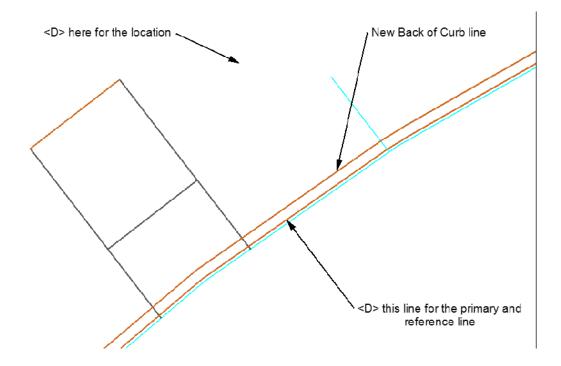


51. Repeat step 49 for each element in the island outline.

- 52. On the Generate Longitudinal Feature's *Controls* tab, key in *0.375* for the *Horizontal Start Offset* and *Stop Offset*. This is the width of the curb top. Note: the entry will be rounded to 0.38 in the dialog box.
- 53. In the Vertical area, key in **0.00** for the Start Offset and Stop Offset.

👬 Generate Lon	gitudinal Feature	
Main Controls		
Horizontal Method: Start Offset: Stop Offset:	Offset from Primary Feature	Help
Vertical Method: Start Offset: Stop Offset:	Offset/Offset ▼ 0.00 ↓ 0.00 ↓	
	Apply Preferences	Close

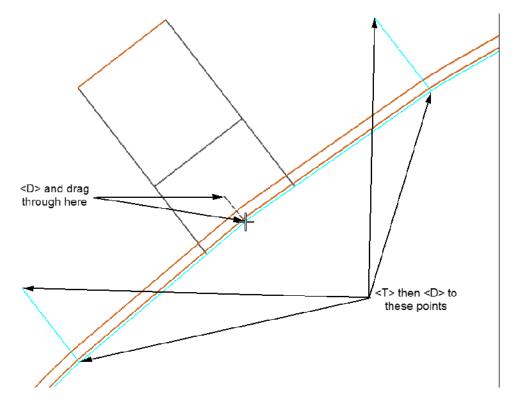
54. **<D> Apply**. Then follow the prompts. **<D>** a top of curb element for the primary feature and use the same one for the reference feature. **<D>** in the middle of the Island for the location. The illustration shows an example of the results.



55. **<D> Close** to dismiss the *Generate Longitudinal Feature* dialog box.

The final step, before importing the graphics into the surface is to modify the curbs and add the ramp wings. This includes partial deleting the top of curb lines in the area of the ramps and drawing lines for the wings.

- 56. Zoom in around one of the ramps so that the wing lines and each of the curb lines are visible.
- 57. From the MicroStation main toolbar, select the IntelliTrim command.
- 58. In the tool settings dialog box, set the *Mode* to **Quick**.
- 59. Set the *Operation* to Cut.
- 60. **<T>** then **<D>** on the ends of each of the wing lines. This cuts the curb top lines in these locations.
- <D> and drag through the curb top lines inside the ramp tread as shown in the illustration below.

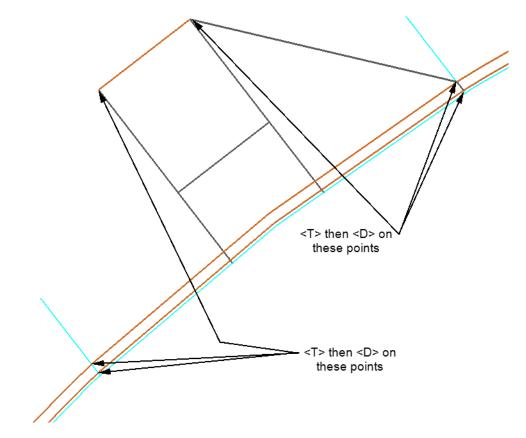


This has broken each of the curb top lines into four sections. The sections inside the ramp area will be modified after they are imported into the surface. Those outside will be left as is.

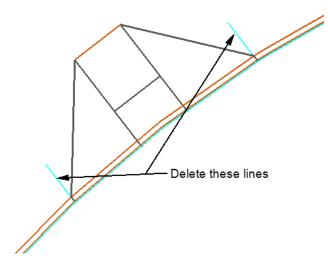
Next the lines representing the ramp wings are drawn.

62. From the MicroStation main toolbar, select the **Place SmartLine** command.

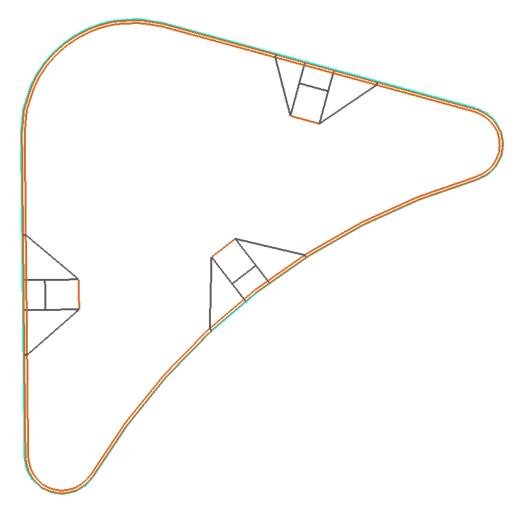
- 63. **<T>** then **<D>** to the points indicated in the illustration below.
 - *Important!* Be sure to snap to the curb top lines. Snapping to any of the line in this area will result in the wing being placed at the wrong elevation.



- 64. Select the MicroStation **Delete** command.
- 65. Delete the wing position lines.



66. Repeat steps 56 through 65 for the other two ramps. The illustration below shows the island and ramps completed to this point.



Section Summary:

- The InRoads Generate Longitudinal Feature command is used to provide elevation to graphic elements.
- When creating additional elements to be imported into a surface, snapping to elements at the proper elevation creates additional elements at the proper elevation.

Lab 22.3 - Importing Graphics to Surface and Modifying Features

With the exception of the curb top lines inside the ramp areas, the graphic elements for creating the island surface are in place. In this section, the graphic elements are imported into a surface and InRoads tools are used to modify the curb features inside the ramp areas.

Section Objectives:

- Import Graphics to create a surface.
- Use Trim Feature to modify curb top features in the ramp areas.
- Use Edit Feature Point for the final cleanup of the curb top features.

- 1. Zoom out in the MicroStation view so that the entire Island can be seen.
- 2. On the MicroStation menu bar, select **Edit > Select All**. This highlights all of the elements in the drawing.



- 3. From the InRoads menu bar, select **File > Import > Surface**.
- 4. In the *Import Surface* dialog box, verify that the **From Graphics** tab is selected.
- 5. Select **SE Island** for the *Surface*.
- 6. Verify that *Load From* is set to **Single Element**.
- 7. Verify that *Elevations* is set to Use Element Elevations.
- 8. In the *Seed Name* field, key in *SE_Island*.
- 9. Set the *Feature Style* to **D_Curb**.

10. Verify that the *Point Type* is set to **Breakline**.

🕌 Import Surface			- • •				
From Graphics DEM	From Geom	etry					
Surface:	Surface: SE Island 🗸						
Load From:	Load From: Single Element 👻						
Level:	Results						
Elevations:	Elevations: Use Element Elevations 🔻						
Intercept Surface:	Default		Preferences				
Drape Vertices Or	nly		Help				
Thin Surface							
Tolerance: 5.00							
Features							
Seed Name:		SE_Island	+ +				
Feature Style:		D_CURB	•				
Point Type:		Breakline	•				
Maximum Seg	gment Length:	0.00					
Point Density	Point Density Interval: 0.00						
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Exclude from Tri	Exclude from Triangulation						
Close							

- 11. **<D> Apply**.
- 12. **<D> OK** on the "Use elements contained in selection set?" message window.

Bentley InR	Roads XM Edition	x
<u> </u>	Use elements contained in selection set?	
	OK	

13. **<D> Close** to dismiss the *Import Surface* dialog box.

All of the graphic elements have been saved into the dtm (surface). The elements used to create the surface are deleted because they will be in the way when performing the next steps. The feature editing commands will automatically update displayed feature graphics but not the MicroStation elements originally used to create those features.

14. Select the MicroStation **Delete** command or press the **Delete** key to delete the graphic elements.

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	Surface Properties	Slope Vectors	,
品 Annot	Active Surface <u>Copy</u> Surface Delete Surface	™ Two Point Slope ☑ Vew Crossing Segments	◄ ابر

15. Select **Surface > View Surface > Features** from the InRoads menu bar.

- 16. In the *View Features* dialog box, verify that the *Surface* is set to **SE Island**.
- 17. Verify that all of the features are highlighted.
- 18. **<D> Apply** then **<D> Close** to dismiss the *View Features* dialog box.

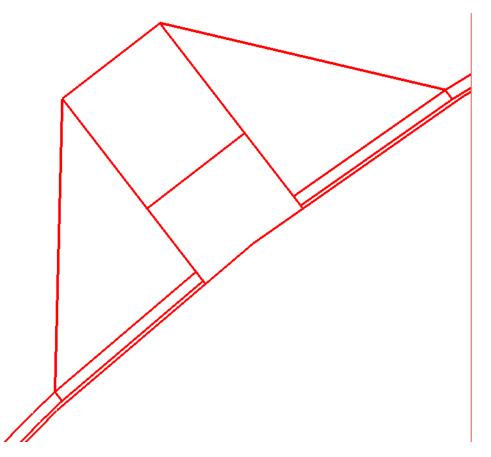
😽 View Featu	ures			×
Surface:	SE Island	•		Apply
Fence Mode:	Ignore	-		Close
				Filter
				Edit Style
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Features:				
Name			Style	<u>+</u>
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SE_Island1			D_CURB	
SE_Island10			D_CURB	
SE_Island11			D_CURB	
SE_Island12			D_CURB	
SE_Island13			D_CURB	
SE_Island14			D_CURB	
SE_Island15			D_CURB	
SE_Island16			D_CURB	
SE_Island17			D_CURB	-
SE_ISIANU 17				

- 19. In the MicroStation view, zoom in on one of the ramps.
- 20. From the InRoads menu bar select **Surface > Edit Surface > Trim Features**.

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	1.4	rim <u>F</u> eatures		
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File Surface Geometry Drainage Evaluation	Mc	ntersect Features	<u>T</u> ools	<u>H</u> elp
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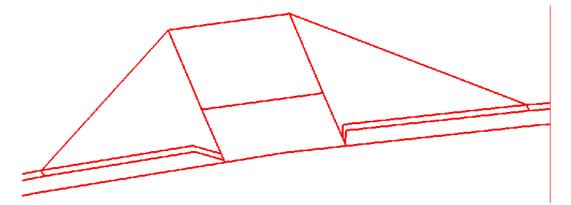
- 21. In the *Trim Features* dialog box, in the *Elevation* area, toggle on Match at Intersection.
- 22. **<D>** the target button **+** Then **<D>** the curb back line. This highlights that feature in the list.
- 23. **<D> Apply** then **<D> to Accept**.
- 24. **<D>** the ramp tread line then **<D>** again to accept it.
- 25. **<D>** inside the tread area to accept the command and trim the curb feature.

HTrim Features				3	✓ Select feature t	to trim
Current Locate Mode:	Graphics		Apply			
Surface:	SE Island	-	Close			
Features:						
Name	Style	Description	A Fiter			
SE_Island41	D_CURB		Help			
SE_Island42	D_CURB					
SE_Island43 SE_Island44	D_CURB D_CURB					
SE_Island45	D_CURB				†	
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-						<d> to accept</d>
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						∽ Then <d> here.</d>
D						
Rai	mp tread	a area 🦯				
					Ramp tread lines	
					Ramp tread intes	



26. Repeat steps 22 through 25 for the other curb top features in the ramp area. The illustration shows the results.

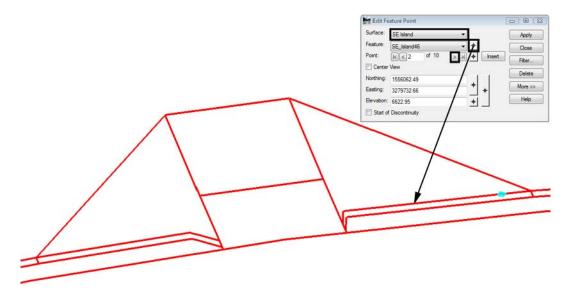
In a rotated view, notice that the curb top lines do not slope consistently from the wing to the tread. This is because the Trim Feature command matches the elevation from the intersection of the features to the next vertex in the trimmed feature.



To correct this, the feature points between the beginning and end point are deleted.

- 27. From the InRoads menu bar, select **Surface > Edit Surface > Edit Feature Point**.
- 28. Verify that the *Surface* is set to **SE Island**.

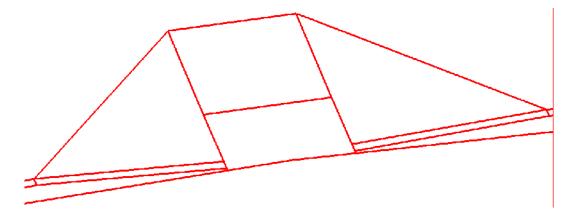
- 29. **<D>** the target button for *Feature*, then **<D>** on the curb back line.
- 30. **<D>** the advance point button \triangleright to select point **2** on the feature.



- 31. **<D>** the **Delete** button then **<D> Apply**.
- 32. Repeat step 31 until only two points are left in the feature.

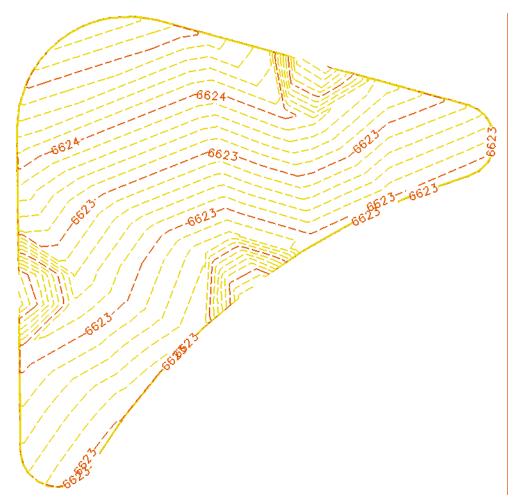
🔚 Edit Fe	ature Point				
Surface:	SE Island		•		Apply
Feature:	SE Island46		•	+	Close
Point:	K < 2	of 2	×		Filter
Center	View				Delete
Northing:	1556059.58				
Easting:	3279728.51		_	₩ +	More >>
Elevation:	6622.44			<u>+</u>	Help
Start of	Discontinuity				

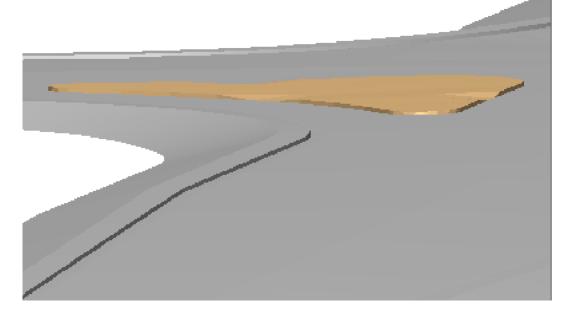
33. Repeat steps 29 through 32 to the remaining curb top features within the ramp area. The illustration below shows a completed ramp.



- 34. Repeat steps 19 through 33 for the other two ramps.
 - *Important!* Be sure to rotate to a Top view when performing the Trim Feature command. This will make it easier to identify the trim location.
- 35. In the InRoads Explorer, **<R>** on **SE Surface** and select **Triangulate** from the right click menu.
- 36. **<R>** on **SE Surface** and select **Save**.
- 37. Exit InRoads and MicroStation.

The illustration below shows the contours for the island.





Below is a rendering of the Island surface on the Intersection surface.

Section Summary:

- When importing graphic elements into a surface, if the elements are not selected ahead of time, each element can be given a unique name.
- Use the Trim Feature command in a top view. This helps when indicating which part of the feature to trim.
- Use the Edit Feature Point command to remove points from a feature. Delete Feature Point only works with Random points.

Chapter Summary:

- The island was created using MicroStation commands and InRoads surface editing commands.
- Because it was created as surface features only, there are no components in the island surface.
- The Drape Surface and Generate Longitudinal Feature commands were used to create graphic elements that were edited before they were imported into the surface.

LAB 23 - Modeling Around Bridge Abutments

Modeling the surface at the ends of a bridge can accomplished using a variety of tools. This lab illustrates a simple slope, but more complex slopes can be modeled using the same tools and methodologies. In general, you will be using InRoads tools to create breaklines that define the desired surface. For additional information on the tools used here as well as others, please see the *Surface Editing* chapter of the *Practical Guide for Using InRoads XM*.

Chapter Objectives::

- Develop an understanding of modeling surfaces without templates.
- Learn how some of InRoads' Surface tools can create breaklines necessary for modeling surfaces at the ends of a bridge.

The following files are used with this lab:

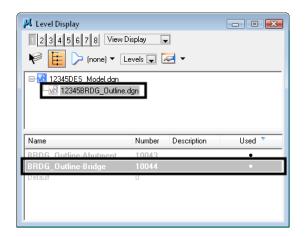
- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Projects\12345\Bridge\Drawings\Reference_Files\12345BRDG_Outline.dgn as a reference file
- C:\Projects\12345\Design\InRoads\12345 SH119 SH52 interchange.alg
- C:\Projects\12345\Design\InRoads\12345 SH52 71st intersection.dtm
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange.dtm

Lab 23.1 - Create the Surface East of the Bridge

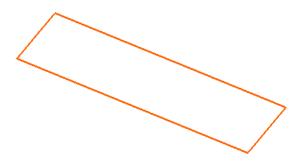
In this section, the design surface is used to create a smaller surface for the portion of the roadway East of the bridge. This surface will subsequently be used as the basis for the grading around the bridge abutment.

- 1. Open MicroStation and InRoads using the *12345DES_Model.dgn* file.
- 2. Delete in existing graphics in the file.
- 3. Select **File > Open** from the InRoads menu.
- 4. Navigate to the C:\Projects\12345\Design\InRoads folder.
- 5. Open the following files:
 - C:\Projects\12345\Design\InRoads\12345 SH52 71st intersection.dtm
 - C:\Projects\12345\Design\InRoads\12345 SH119 SH52 interchange.alg
 - C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange.dtm
- 6. Select **File > Reference** from the MicroStation menu.
- 7. Select **Tools > Attach**.
- 8. Select C:\Projects\12345\Bridge\Drawings\Reference_Files\12345BRDG_Outline.dgn.
- 9. **<D> OK** to accept the default reference settings.

10. In the *Level Display* dialog box, toggle on the reference file level *BRDG_Outline-Bridge*.



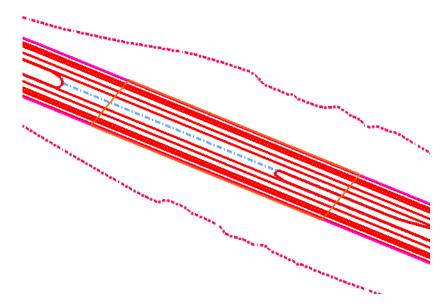
11. *Fit* the view. An outline of the proposed bridge is shown in the file.



- 12. Set the *Pen/Pencil* lock to **Pencil**.
- 13. Select Surface > Update 3D/Plan Surface Display from the InRoads main menu.
- 14. **<R>** in the *Features* list box and choose **Select All** from the menu. This displays the selected features.

15. **<D> Close**.

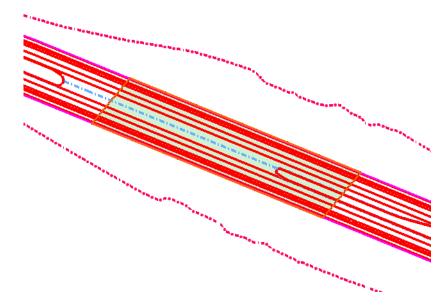
<u>S</u> ource Surface: Destination Surface:	SH52 71st intersec SH52 71st East of		
Fence <u>M</u> ode:	Inside	•	Close
Features:	L		Filter
Name	Style	Description	Besults
71 RT_Edge-of-Pave	D_CONC_Pvmt	Created By Roadway	<u>H</u> elp
71 RT_Laneline	D_CONC_Pvmt	Created By Roadway	
71 RT_POSS	D_POSS	Created By Roadway	
71 RT_Shoulder	D_SHOULDER	Created By Roadway	
71 Toe-of-Fill	D_Toe-of-Fill	Created By Roadway	
71 Top-of-Cut	D_Top-of-Cut	Created By Roadway	
71Centerline	Centerline	Created By Roadway	
741 T C 1 (D	D CONC D	C 1 10 0 1	



All of the features are shown in the file.

- 16. On the MicroStation main toolbar, select **Place Fence**.
- 17. In the *Tool Settings* dialog box, change the *Fence Type* to **Element**.

18. **<D>** on the bridge outline in the design file.

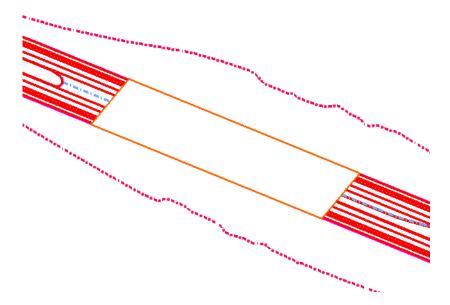


- 19. Select **Surface > Edit Surface > Delete Feature** from the InRoads main menu.
- 20. Set the *Surface* to SH5271st Intersection.
- 21. Set the *Fence Mode* to **Inside**.
- 22. **<R>** in the feature list and select **Select All**.

Surface: SH52 71st Fence Mode: Inside Features:	intersecti 💌		Apply Close
Name	Style	Desc 🔶	+ Filter
71 RT_Edge-of-Pavement	D_CONC_Pvmt	Create	<u>R</u> esults
71 RT_Laneline	D_CONC_Pvmt	Create	Help
71 RT_POSS	D_POSS	Create	
71 RT_Shoulder	D_SHOULDER	Create	
71 Toe-of-Fill	D_Toe-of-Fill	Create	
71 Top-of-Cut	D_Top-of-Cut	Create	
71 Toe-of-Fill	D_Toe-of-Fill	Create	

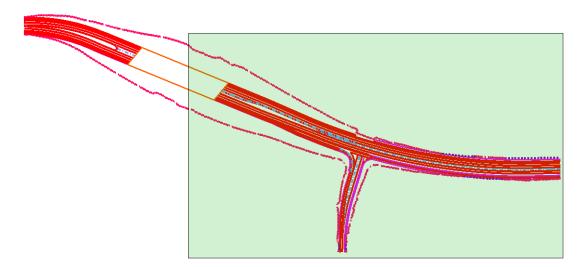
- 23. **<D> Apply**.
- 24. When prompted to *Delete selected feature(s)*, select **OK**.
- 25. **Close** the dialog box.
- 26. Clear the fence.

The features inside the bridge outline are removed from the surface. Next, the features on the East side of the bridge are copied to create a new surface.



27. Select Place Fence.

- 28. In the *Tool Settings* box, change the *Fence Type* to **Block**.
- 29. Place a fence that encompasses all features East of the bridge as shown.



- 30. Select Surface > Edit Surface > Copy Portion of Surface.
- 31. Set the *Surface* to SH52 71st intersection.
- 32. Key in SH52 71st East of Bridge for the Destination Surface.
- 33. Set the *Fence Mode* to **Inside**.

34. If all Features are not highlighted, **<R>** in the feature list and select **Select All**.

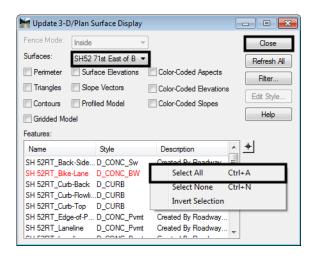
🐂 Copy Portion of	Surface		E	- • 💌
<u>S</u> ource Surface:	SH52 71st intersec	ti 💌	- [Apply
Destination Surface:	SH52 71st East of	B 🕶		Close
Fence <u>M</u> ode:	Inside			Filter
<u>F</u> eatures:				
Name	Stule	Description	+	<u>R</u> esults
71 RT_Edge-of-Pav	eD_CONC_Pvmt	Created By Roadway		<u>H</u> elp
71 RT_Laneline	D_CONC_Pvmt	Created By Roadway		
71 RT_POSS	D_POSS	Created By Roadway		
71 RT_Shoulder	D_SHOULDER	Created By Roadway		
71 Toe-of-Fill	D_Toe-of-Fill	Created By Roadway		
71 Top-of-Cut	D_Top-of-Cut	Created By Roadway		
71Centerline	Centerline	Created By Roadway		
Duplicate Names:				
Append C) Repla <u>c</u> e 🛛 🔘 R <u>e</u> r	hame		

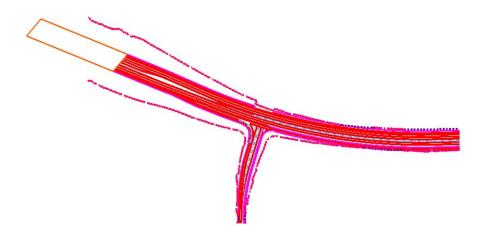
- 35. **<D> Apply**, then **Close** the dialog box.
- 36. Choose File > Save As.
- 37. Set the *Save As Type* to Surfaces (*.dtm).
- 38. Use the drop-down to set the *Active Surface* to 12345 SH52 71st East of Bridge.
 - **Note:** If the file name is not listed, use the drop-down again to select the active surface and the same name will appear in the *Name* field. You can then add the 12345 prefix to the file name on the hard drive.
- 39. **<D> Save**.
- 40. Select Surface > Update 3D/Plan Surface Display.
- 41. **<R>** in the feature list and choose **Select None**.

🐂 Update 3-D	/Plan Surface Display	- • ×
Fence Mode:	Inside 👻	Close
Surfaces:	SH52 71st intersecti 💌	Refresh All
Perimeter	Surface Elevations	Color-Coded Aspects
Triangles	Slope Vectors	Color-Coded Elevations
Contours	Profiled Model	Color-Coded Slopes
Gridded Mod	lel	Help
Features:		
Name	Style	Description
	f-PaveD_CONC_Pvmt	Select All Ctrl+A
71 RT_Laneline D_CONC_Pvm 71 RT_POSS D_POSS		Select None Ctrl+N
71 RT_Shoulder D_SHOULDE		Invert Selection
71 Toe-of-Fill	D_SI-Fill	Created by Noadway
71 Top-of-Cut 71Centerline	D_SI-Cut Centerline	Created By Roadway

- 42. Select the SH52 71st East of Bridge surface from the Surfaces drop down menu.
- 43. **<R>** in the *Features* list box and choose **Select All** from the menu. This displays the selected features

44. **<D> Close**





Note: If there are any features in the area where the bridge was clipped, these shoud be deleted. Use the Surface > Edit Surface > Delete Feature command to remove these extra features.

Section Summary:

- A fence and the Delete Feature command are used to remove the design features from the bridge area.
- The design features on the east side of the bridge are saved as a separate surface. Design surfaces for each side of the bridge are required otherwise InRoads will triangulate the across the gap made for the bridge

Lab 23.2 - Create a Feature at the Bridge

In this section, a breakline feature is created to 'cap' the end of the roadway features where the bridge starts.

1. In the *Level Display* dialog box, toggle off the reference file level **BRDG_Outline-Bridge**.

area Level Display - View 1	
🖵 🛱 (View Display 🔹	
🔃 🍃 (none) 🔻 Levels 🔹 🕶	
Light 12345DES Model.dan	
Name ^	Used
Default	
BRDG Outline-Abutment	•
BRDG_Outline-Bridge	•

This line represents the path for the path that is used to create the abutment slope.

- 2. Select Surface > Design Surface > Place Feature.
- 3. Set the *Surface* to SH52 71st East of Bridge.
- 4. Key in *abutment1* for the Feature Name.
- 5. Key in a description if desired.
- 6. Set the *Feature Style* to **D_CONC_Pvmt**.
- 7. Set the *Point Type* to **Breakline**.

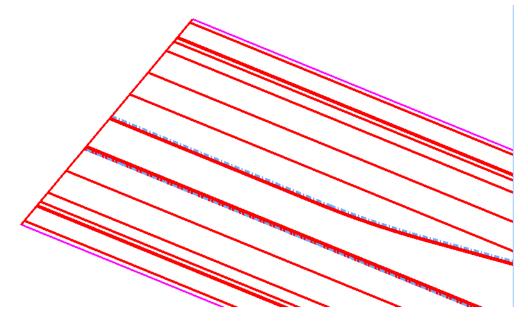
🐂 Place Feature		- • •
S <u>u</u> rface:	SH52 71 st East of Bridge 🛛 👻	Apply
Feature N <u>a</u> me: Description: Feature Style: P <u>o</u> int Type: Duplicate Names Append	abutment1	Close Ne <u>w</u> Style <u>H</u> elp
Exclude from	Triangulation	
Dynamics Setting	-	
Ele <u>v</u> ation:	0.00	
Distance:	0.00	
Direction:	0^00'00''	
Slope:	0.00%	

8. **<D> Apply**.

9. *Do not* toggle on either option on the *Set Elevation* dialog box that appears.

Ket Elevation	
Specify Elevation:	0.00
Elevation from Surface:	SH52 71st East 👻
Elevation Adjustment:	0.00

10. Snap to the end of each of the roadway features from POSS to POSS as shown.



- **Note:** If you want to use *AccuSnap*, hold down your *<Ctrl>* and *<Shift>* keys and MicroStation's AccuSnap works while using InRoads commands.
- 11. **<R>** when done.

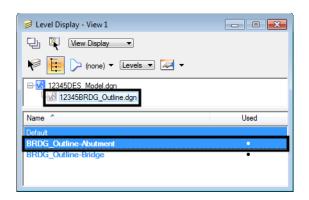
Section Summary:

• This feature defines the end of roadway/beginning of bridge in the design surface

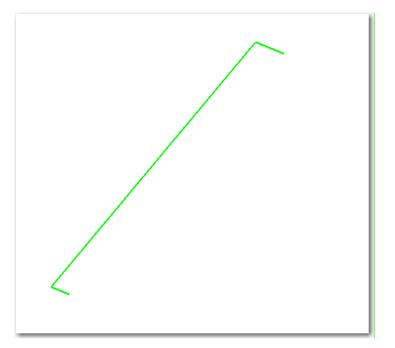
Lab 23.3 - Create the Grading Surface

In this section, the *Generate Sloped Surface* command is used to create a grading surface from the roadway down to the existing ground, effectively under the bridge.

1. In the *Level Display* dialog box, toggle on the reference file level **BRDG_Outline-Abut**ment.



A green line displays that wraps around the edge of the roadway. This is the line from which the sloped surface is generated. It was created in a similar manner as the feature built in the last section, with the addition of the segments running parallel to the road. These additional segments allow the sloped surface to wrap around the entire front of the roadway.

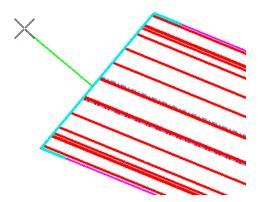


- 2. Select Surface > Design Surface > Generate Sloped Surface.
- 3. Make sure the *Locate Feature / Locate Graphics* lock is set to Locate Graphics.
- 4. Set the *Intercept Surface* to **12345** existing ground for interchange.
- 5. Set the *Destination Surface* to SH52 71st East of Bridge.
- 6. Set the other options as shown in the illustration below. Be sure to toggle on and key in the feature names for the following:
 - Transverse Abut-Transverse

- Source Abut-Top
- Catch Point Abut-Toe-of-Fill

Generate Sloped Surfa	ace			
Main Advanced				
Current Locate Mode:	Graphics			Filter
Source Surface:	SH52 71st East of B 💌]		Ne <u>w</u> Style
 Intercept Surface: 	12345 existing grour 🔻]		Help
C Elevation:	0.00			
Destination Surface:	SH52 71st East of B 👻	1		
Inter <u>v</u> al:	10.00	÷		
C <u>u</u> t Slope: 33.00%	T c	х 3	3.00%]
Fill Slope: -33.00%	E To	x 😔	33.00%]
Apply to Both Sides	Iriangulat	e Surfa	асе	
Feature				
Name	:	_	Style:	
✓ Transverse: Abut	-Transverse 🔹 🔻	+	Default	•
Tick Marks				
Source: Abut	-Тор 🔻	+	Default	•
📝 Catch Point: 🛛 Abut	-Toe-of-Fill 👻	+	D_Toe-of-Fill	•
Point Typ <u>e</u> :	Breakline 🗸	1		
Point Density Interval:	0.00	+		
Duplicate Names:				
	Repla <u>c</u> e 💿 Rena <u>m</u> e			
Exclude from Triang	ulation 📃 Generate j	<u>G</u> raphi	ics Only	
	Apply Preferen	ces	Close	

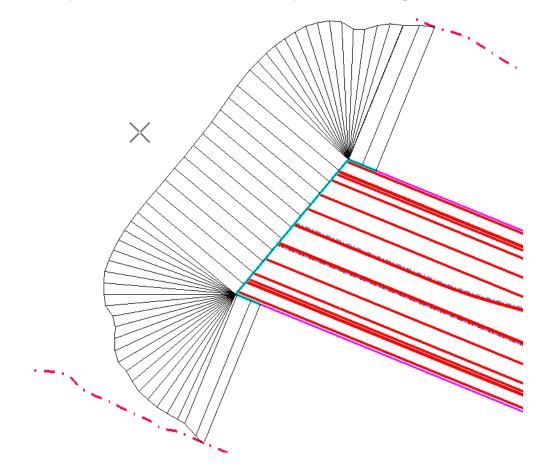
- 7. **<D> Apply**.
- 8. **<D>** to select the green line at the edge of the roadway.
- 9. **<D>** again to accept the line.



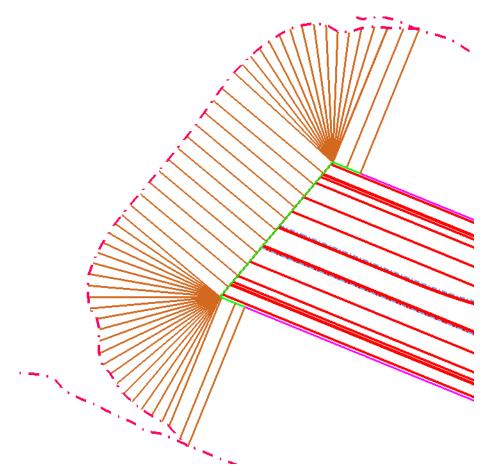
10. **<R>** to Reset for entire line.

The *Generate Sloped Surface* command can be used to create a slope from just a portion of the line, which is why the prompts allow specifying a *Start* and *End* location. Here, an **<R>** is used, since the slopes need to be created for the entire source line.

11. Move your cursor to the left of the line until you see the sideslopes form.

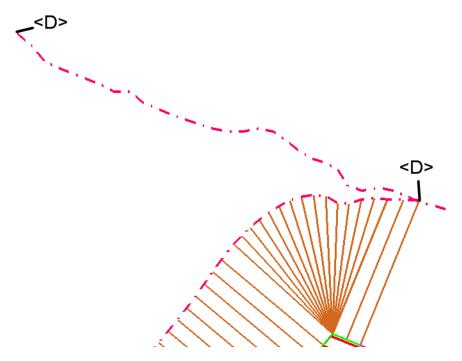


12. **<D>** to Accept the location.



- 13. **<R>** to exit the command.
- 14. **<D> Close** to dismiss the dialog box.
- 15. Save the Surface.
- 16. Select **Surface > Edit Surface > Partial Delete** from the InRoads main menu.
 - **Note:** *Partial Delete* is used just like the MicroStation *Partial Delete*, except it works on features. Here it is used to clean up the toes of slope that extend beyond the sloped surface.
- 17. **<D>** on the Toe-of-Fill on the North side of the roadway to select it as the feature to partial delete.

18. **<D>** on the left end to identify the *Start Point*, then again where the new toe and old toe come together as shown for the *End Point*.

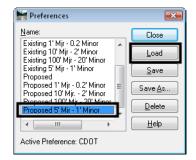


- 19. Repeat for the Toe-of-Fill on the South side of the roadway.
- **Note:** You may want to toggle off *Line Styles* under **Settings > View Attributes** to see the ends of the lines more clearly.
- 20. Save the Surface.
- 21. Select Surface > Triangulate Surface.

🕌 Triangulate Su	rface	
Surface:	SH52 71st East of Bridg 💌	Apply
Description:		Close
Maximum Length:	0.00	Help
Extended Data	Checks 🔲 Lock Triangulat	
Results		
Number of Points	:	
Number of Triang	les:	
Elapsed Time (Se	econds):	More

- 22. **<D> Apply** then **Close**.
- 23. Select Surface > View Surface > Contours.

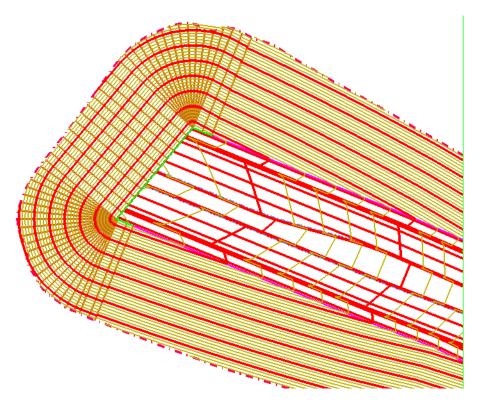
24. **<D> Preferences** and highlight *Proposed 5' Mjr – 1' Minor*.



- 25. **<D> Load**, then **Close**.
- 26. Set the *Surface* to *SH52* 71st East of Bridge.
- 27. Toggle off *Labels* if desired.

🖌 View	Contours		- 0 💌	
Main	Advanced L	abels.		
S <u>u</u> rfac	e:	SH52 7	1st East of B ▼ <u>H</u> elp	
Fence	Mode:	Inside	· ·	
Interva	l:	1.00		
Min <u>o</u> rs	per Major:	4	×	
Symbo	logy:)bject		Name	
_	ajor Contours		Name DTM_Prop_Contour_Maj BYL	
	ajor Contours		DTM_Prop_Contour_MajBTL DTM_Prop_Contour_MinBYL	
М	ajor Labels		DTM_Prop_Contour_Te BYL	
ШМ	inor Labels		DTM_Prop_Contour_Te BYL	
— М	ajor Depressior	n Co DTM_Prop_Contour_De BYL		
Шм	inor Depressior	n Co	DTM_Prop_Contour_De BYL	
Apply Preferences Close				

28. **<D> Apply** to see the contours.



- 29. **<D> Close**.
- 30. Close InRoads and MicroStation.

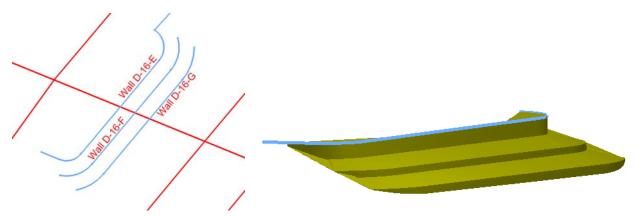
Chapter Summary:

- The *Design Surface* and *Edit Surface* tools can be used to modify existing surfaces and add to them as necessary to accomplish your design model.
- Modeling the ends of a bridge can be accomplished using a base model of the roadway, and adding features to define the desired surface.

LAB 24 - Terraced Walls

This lab covers how to use Surface Design and Editing tools to create a terraced wall under a bridge. For more information on the commands shown here, please see the *Surface Editing* chapter of *A Practical Guide for Using InRoads V8i (SELECTseries 2)*.

In this scenario, three terraced walls are to be used under the SH52 bridge over SH119. Horizontal alignments have already been defined for the three walls along with verticals for the tops of the walls. A template will be created and run along the top wall to seek the other two walls and create the slopes between them.



Chapter Objectives::

- To learn to use additional Surface Design tools.
- To expand your knowledge of templates by creating a special case terraced wall template.
- To learn how to use templates without setting up a corridor in Roadway Designer.

The following files are used for this lab:

- C:\Projects\12345\Design\Drawings\Reference Files \12345DES Model.dgn
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange.dtm
- C:\Projects\12345\Design\InRoads\12345 SH119.dtm
- C:\Projects\12345\Design\InRoads\12345 SH52.dtm
- C:\Projects\12345\Design\InRoads\12345 SH119 SH52 interchange.alg
- C:\Projects\12345\Design\InRoads\12345DES_Templates.itl

Lab 24.1 - Open Data Files

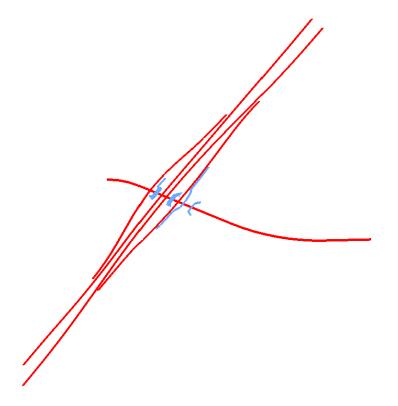
- 1. Open MicroStation and InRoads using the C:\Projects\12345\Design\Drawings\Reference Files \12345DES_Model.dgn file.
- 2. Delete any graphic elements in the file.
- 3. Verify the correct *XIN* file is loaded.
- 4. Select **File > Open** from the InRoads menu.
- 5. Open C:\Projects\12345\Design\InRoads\12345 SH119.dtm, 12345 SH52.dtm, 12345DES_Templates.itl and 12345 SH119 SH52 interchange.alg.

6. Open C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange.dtm.

Lab 24.2 - Create Components for the Wall and Slope

The three walls are very similar and therefore one set of components can be created and used multiple times in the final template. To start, components are created that will be run off of Wall D-16-E and will 'find' or 'target' Wall D-16-F. This is used in areas where there is a terrace.

- 1. **Delete** any MicroStation graphics currently in the design file.
- 2. Select Geometry > View Geometry > All Horizontals.
- 3. **Fit** the view.



4. Window around the terraced wall area to the left of SH119.

Mal Drott Wall Droc

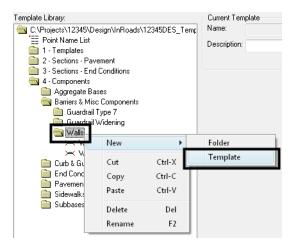
Note: The wall names in the illustration below are for information only. The walls are not labeled in your file.

Note: Walls D-16-E, D-16-F and D-16-G will be created using a terraced wall template.

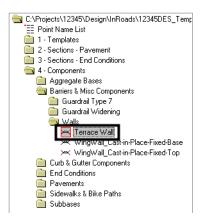
- 5. Select Modeler > Create Template.
- 6. Verify the template library is *12345DES_Templates.itl*.

Note: Since there is no similar template to the one needed, a new one is created.

- Expand the library folder structure for *Components > Barriers & Misc Components > Walls*.
- 8. Right-click on the *Walls* folder and select **New > Template**.



9. While the name is highlighted, type over it with *Terrace_Wall*.



- 10. Select Tools > Dynamic Settings.
- 11. Toggle off Apply Affixes.
- 12. For **X** and **Y** Step, key in *O.1*.

Dynamic Settings					
X: -3.70	Step: 0.10				
Y: -0.50	Step: 0.10				
Point Name:					
Point Style:	Breakline 🔹				
Apply Affixes					
hs= 🔻					
Set Dynamic Origin					

- 13. Right-click in the template view and select Add New Component > End Condition.
- 14. Under *Current Component*, key in *Finds next wall align* for the *Name*.
- 15. Set the *Style* to **D_Wall-Retaining**.
- 16. Set the *Target Type* to Alignment XYZ.
- 17. Set the Horizontal Alignment to Wall D-16-F.
- 18. Set the Vertical Alignment to Wall D-16-F.

Current Component								
Name: Fir	Name: Finds next wall align		Style:	D_Wal	l-Retaining	•		
Target Typ)e:	Alignmen	tXYZ 👻		riority:		1	
Horizontal Alignment: Wa		Wall D-16	Vall D-16-F 🛛 👻		Benching Cour		0	
Vertical Ali	gnment:	Wall D-16	6-F 🔫]	From D	atum:	0.00	
	Horizor	ital	Vertical		Step Eleva	tion:	0.00	
Offsets:	0.00	0	.00]	Rounding Len	igth	0.00	

Note: Since the template will start at *Wall D-16-E*, *Wall D-16-F* is the next wall alignment. With a target of *Alignment XYZ*, the component will use a variable slope to 'find' the horizontal and vertical alignment.

- 19. In the *Dynamic Settings* dialog box, key in *Wall_E_Top-Front* for the *Name*.
- 20. Select **D_Wall-Retaining** for the *Style*.

Dynami	c Setting	gs		E	3	
X:	-3.50	Step:	0.10			
Y:	-2.20	Step:	0.10			
Point N	ame:	√all_E_T	op-Front	•		
Point S	Point Style: D_Wall-Retaining					
Арр	Apply Affixes					
hs= •						
Set Dynamic Origin						

- 21. **<D>** on the origin point (0,0).
- 22. Back in the *Dynamic Settings* dialog box, change the name to *Wall_F_Top-Front*.
- 23. **<D>** on a point down and to the right of the first point as shown.

		1	1							
	Dynamic Settin	gs	×	111						
÷	X: 4.00	Step: 0.10								
4	Y: -1.50	Step: 0.10		Wall	E	Cop-Fr	ont			
H	🔽 Check for In	terception			1					
÷.	📝 Place Point	at Interception								
÷	📃 End Conditio	on is Infinite						 <u> </u>		
1	🔲 Do Not Con	struct						Wall_F	Top-Fr	ont
ł	Point Name:	Wall_F_Top-Fron	•	1						
ł	Point Style:	D_Wall-Retaining	•							
÷.	Apply Affixe:	s								
	hs=	•								
į.	Set D	ynamic Origin								

- 24. **<R>** and **<D> Finish** to complete the component.
- 25. Edit the second point, *Wall_F_Top-Front*. (Either double-click the point or right-click and choose Edit.)
- 26. For the *Slope Constraint*, set the *Value* to *50.00%*.
- 27. For the *Horizontal Constraint*, set the *Value* to 15.00.

Note: Because the target for this end condition is both a horizontal and a vertical alignment, these values are actually ignored when the template is run. However, it gives a more accurate picture to use realistic values.

🐂 Point Properties					×
Name:	Wall_F_T	op-Front	•	+	Apply
Feature Name Override:	Wall_F_T	op-Front			Close
Surface Feature Style:	D_Wall-F	letaining	•		< Previous
🔲 Alternate Surface:			-		Next >
End Condition Propertie Check for Intercepti Place Point at Interc End Condition is Infi Do Not Construct	on ception	Membe Finds r	r of: next wall ali	gn	Help
Constraints					
Constra Type: Slope	unt 1	-	Horizonta	raint 2 I	-
Parent 1: Wall_E_To	p-Front	- - +	Wall_E_T	-	
	/er Values.			-	
Value: -50.00%			15.00		
Label:		•			-
📃 Style Constraint:				-	
Horizontal Range: 0.00	Vertical		Both		

- 28. **<D> Apply**, then **Close**.
- 29. **Fit** the template.



In the following series of steps, another component is added to create the face of the wall, a 25% slope to the next wall and a flat top for the next wall.

30. Right-click in the template view and select Add New Component > Unconstrained.

- FinishEnterClosed ShapeCtrl-LMirrorCtrl-MUndo LastESCCancelSet Dynamic OriginCtrl-D
- 31. Right-click again and make certain all options are toggled off.

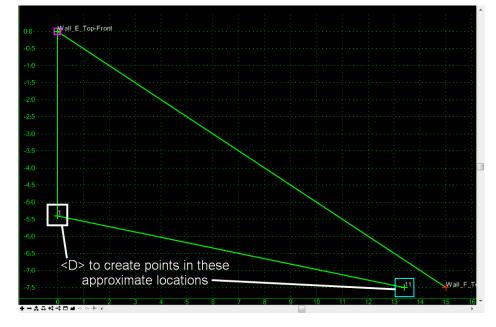
- 32. **<Esc>** to dismiss the menu if everything was already off.
- 33. Under *Current Component*, key in *Wall face and terrace* for the *Name*.
- 34. Set the *Style* to **D_Wall-Retaining**.

Component Wall face and terrace	Style:	D_Wall-Retaining

- 35. In the *Dynamic Settings* dialog box, select **D_Wall-Retaining** for the *Style*.
- 36. Key in *1* for the *Point Name*.

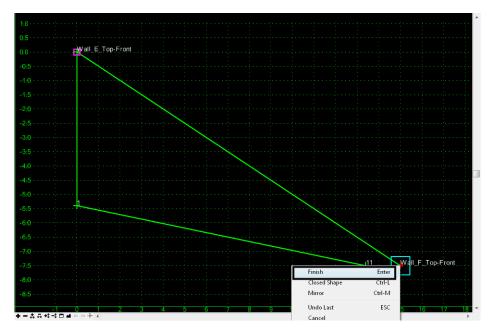
Dynami	c Settings	5			
X:	9.10	Step:	0.10		
Y:	-6.10	Step:	0.10		
Point N	ame:	1		-	
Point S	tyle:	D_Wall-	Retaining	•	
📃 Арр	Apply Affixes				
hs= •					
Set Dynamic Origin					

- **Note:** This is just a temporary seed name to place points. You will later rename the points.
- 37. **<D>** on the *Wall_E_Top-Front* point to start the component.



38. **<D>** to create two additional points similar to what is shown.

- **Note:** Do not worry about getting them exact. The slopes and distances will be set with constraints.
- 39. **<D>** on the *Wall_F_Top-Front* point for the final point in this component.
- 40. Right click and select Finish.



41. Edit the point *11* just inside the *Wall_F_Top-Front* point.

Note: This point will create the flat top on Wall F.

42. Key in *Wall_F_Top-Back* for the *Name*.

- 43. Set *Constraint 1* to Horizontal.
- 44. Set *Parent 1* to Wall_F_Top-Front.
- 45. Key in a *Value* of *1.00*.
- 46. Set *Constraint 2* to Vertical.
- 47. Set *Parent 1* to Wall_F_Top-Front.
- 48. Key in a *Value* of *0.00*.

0.0 all_E_Top-Front		
-0:5	Point Properties	n
-1:0	Name: Wall_F_Top-Back - Apply	
	Feature Name Override: 11 Close	
-1.5	Surface Feature Style: D. Surface Description	
	Volumeter of the second sec	
-2:0	Alternate Surface:	
-2:5 · · · · · · · · · · · · · · · · · · ·	Help	
	Member of:	
-3:0	Wall face and terrace	
-3:5 · · · · · · · · · · · · · · · · · · ·		••••••
-4:0	Constraints	
-4:5	Constraint 1 Constraint 2	
-4:5	Type: Horizontal	
-5:0		
-5:0	Parent 1: Wall_F_Top-Front 👻 🔶 Wall_F_Top-Front 💌 🔶	
-5:5		
	Value: -1.00 0.00	
-6:0	Labet 🗸	
-6:5	Style Constraint:	
	Horizontal Vertical Both	
	Range: 0.00	Wall F T
		11 Wall_F_T
0 1 2 2		
· · · · · · · · · · · · · · · · · · ·		1 12 13 14 15 16

- 49. **<D> Apply**, then **Close**.
- 50. Edit the point 1 below *Wall_E_Top-Front*.

Note: This point will become the location where the face of the wall is intercepted by the 25% backfill slope.

- 51. Key in *Wall_E_Backfill* for the *Name*.
- 52. Set *Constraint 1* to Horizontal.
- 53. Set *Parent 1* to Wall_E_Top-Front.
- 54. Key in a *Value* of *0.1*.

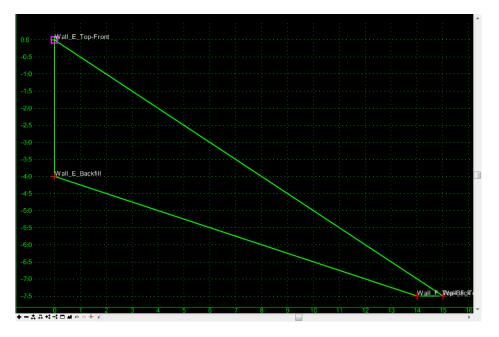
Note: This will force a small slope on the front face of the wall to allow triangulation.

- 55. Set *Constraint 2* to Slope.
- 56. Set *Parent 1* to Wall_F_Top-Back.

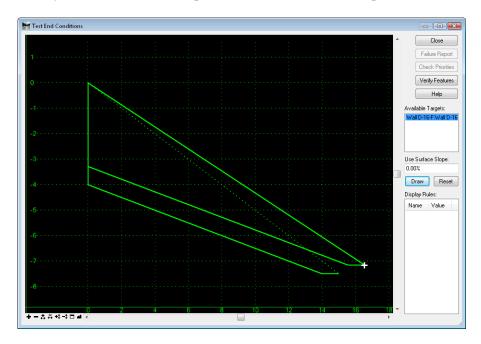
57. Key in a Value of -25.00%.

							^
0.0 Wall_E_Top-Fron	••••••						
	Maint Properties		×				
-0.5							
-1:0	Name: Wall_E_Ba	ackfill 🔻 🛉	Apply				
	Feature Name Override: 1		Close				
-1:5	Surface Feature Style: D_Wall-Re	etaining 🔻	< Previous				
	Alternate Surface:						
-2:0 · · · · · · · · · · · · · · · · · · ·		[Next >				
-2:5		[Help				
2.0		Member of: Wall face and terrace					
-3:0 · · · · · · · · · · · · · · · · · · ·		wall race and terrace					
-3:5 · · · · · · · · · · · · · · · · · · ·							
-4:0	L						
	Constraints Constraint 1	Constraint 2		1.1			
-4:5 · · · · · · · · · · · · · · · · · · ·	Type: Horizontal -	Slope	-	<			
	Parent 1: Wall_E_Top-Front -	+ Wall_F_Top-Ba	ick ▼ ₱				
-5:0 · · · · · · · · · · · · · · · · · · ·	wai_c_rop-rioni •						
-5:5	Value: 0.10		alues		<u>.</u>		
	Value: 0.10	-25.00%					
-6:0	Labei:	· 1	_				
	Style Constraint:						
-6:5	Horizontal Overtical	Both Both Solution Solut					
-7:0		O DOUI					
	Range: 0.00						
-7:5						Wall F	VopHBack
0 1 2	3 4 5	6 7	8	 a 10	11 12	13 14 1	5 16 -
÷─☆☆☆☆⊐≧♡♡☆∢		· · · · ·					Þ

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

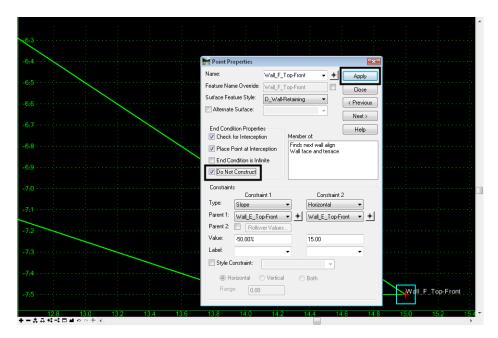


- **Note:** Since the horizontal and slope constraints have two different parent points, the location of this point varies when either of the parents moves.
- 59. **<D> Test**.
- 60. Under *Available Targets*, **<D>** on the wall alignment.
- 61. **<D> Draw**.

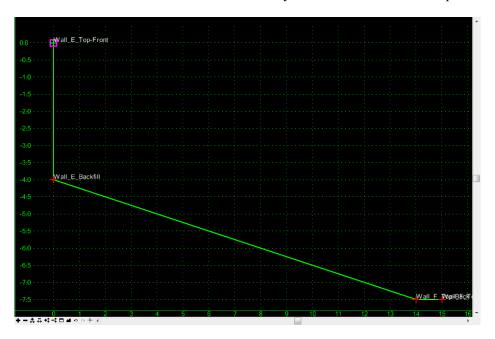


62. Move your cursor into the template view to see how the components react.

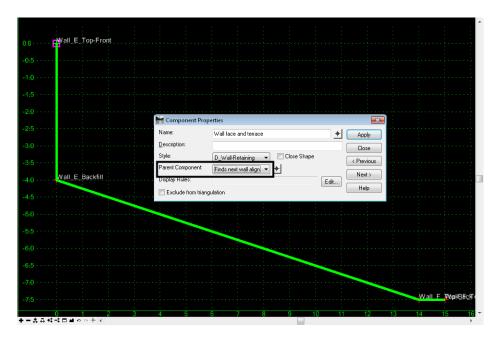
- **Note:** The original component has a variable slope, while the *Wall face and terrace* component maintains all slopes. It should also be noted that there is no need to display the original component. Also, if the original component fails the *Wall face and terrace* component should not display either. Both of these situations will be taken care of next.
- 63. **<D> Close** on the *Test End Conditions* dialog box.
- 64. Edit the Wall_F_Top-Front point.
- 65. Toggle on **Do Not Construct**.



- 66. **<D> Apply**, then **Close**.
 - **Note:** The *Finds next wall align* component disappears. However, the portion of the *Wall face and terrace* component that contains the *Wall_F_Top-Front* point remains. This is because *Do Not Construct* only affects end condition components.



- 67. Edit the Wall face and terrace component. (Double-click the component or right-click on the component and choose Edit.)
- 68. Set the Parent Component to Finds next wall align.



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

Note: Now, if the Finds next wall align end condition fails, neither component is used.

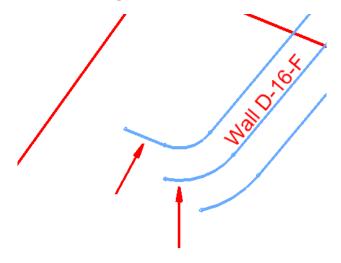
70. **Test** the template again to see the difference.



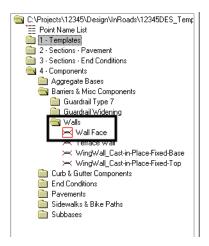
- **Note:** Now, only a dashed line is shown initially, indicating when the end condition fails, nothing is displayed. When the end condition succeeds, only the *Wall face and terrace* is displayed.
- 71. **<D> Close** on the *Test End Conditions* dialog box.
- 72. **Save** the template library.

Lab 24.3 - Create a Component for the Wall Face

In the areas where a perpendicular application of the template from the upper wall alignment would not find the next wall, the template should create a wall face. This situation will be covered in a new template and combined with the other template later.



- 1. Right-click on the *Walls* folder again in the library and select **New > Template**.
- 2. While the name is highlighted, type over it with *Wall_Face*.



- **Note:** Since the face of the wall will eventually be attached to the *Wall_Top-Front* points which are set to *Do Not Construct*, the face of the wall must be made up of a nonend condition component. However, the face of the wall must also be an end condition so it will stop when it intercepts the target surface. Therefore, the same theory is used for the face as for the terrace: an end condition that doesn't display is used along with a 'regular' component that does display.
- 3. Right-click and select Add New Component > End Condition.
- 4. Under *Current Component*, key in *Finds active surface* for the *Name*.
- 5. Set the *Style* to **D_Wall-Retaining**.
- 6. Set the *Target Type* to **Surface**.
- 7. Set the *Surface* to **<Active>**.
- 8. Set the *Priority* to *2*.
 - **Note:** Since this component is to be used only where the terraced wall doesn't work, it will need to be second in priority.

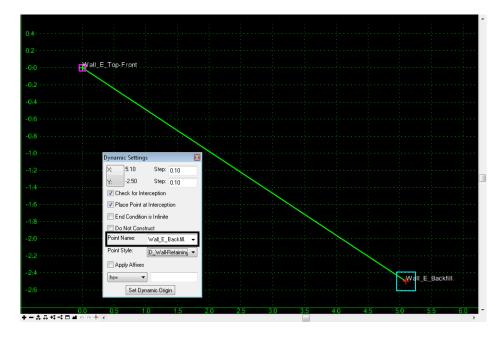
Current Component Name: Finds active s	urface	Style: D_Wall-Retaining -		
Target Type:	Surface 🔻	Priority:	2	
Surface	✓ <active></active>	Benching Count:	0	
		From Datum:	0.00	
Horizor	tal Vertical	Step Elevation:	0.00	
Offsets: 0.00	0.00	Rounding Length	0.00	

9. In the *Dynamic Settings* dialog box, key in *Wall_E_Top-Front* for the *Name*.

10. Select **D_Wall-Retaining** for the *Style*.



- 11. **<D>** on the origin point (0,0).
- 12. Back in the *Dynamic Settings* dialog box, change the name to *Wall_E_Backfill*.
- 13. **<D>** on a point down and to the right of the first point as shown.



- 14. Right click and select Finish.
- 15. Edit the second point, Wall_E_Backfill.
- 16. Change the *Slope Constraint* to Vertical and key in -5.00 for the value.
- 17. For the *Horizontal Constraint*, key in *0.1* for the *Value*.
- 18. Toggle on End Condition is Infinite.

19. Toggle on **Do No Construct**.

0.4		· · · · · · · · · · · · · · · · · · ·
0.2	Point Properties	
-0:0	Name: Wall_E_Backfill	Apply
-0.2	Feature Name Override: Wall_E_Backfill.	Close
-0.4	Alternate Surface:	Next>
-0.6	End Condition Properties Image: Check for Interception Member of:	Help
-0.8	Place Point at Interception Finds active surface Index active surface	
	Do Not Construct	
	Constraints Constraint 1 Constraint 2	
-1:6	Type: Vertical Parent 1: Wall_E_Top-Front	▼ ▼ +
-1:8	Value: -5.00 0.10	
-2.0		
-2:2	Style Constraint: Vertical Both	
	Range: 0.00	Wall_E_Backfill.
0.0 0.5 1.0 1.5	2.0 2.5 3.0 3.5 4.0	4.5 5.0 5.5 6.0
÷─⋨⋳⋪न्व≝००∲∢		4

- 20. **<D> Apply**, then **Close**.
- 21. **Fit** the template.



Note: The line forming the component disappears, but the points are still there.

22. Right-click in the template view and select **Add New Component > Unconstrained**.

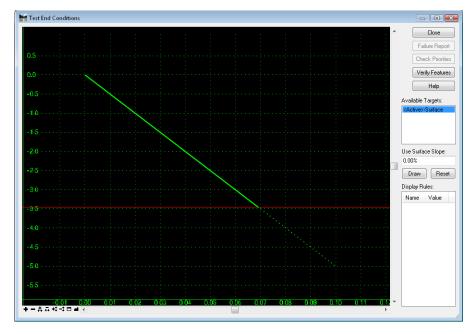
- Finish Enter Closed Shape Ctrl-L Mirror Ctrl-M Undo Last ESC Cancel Set Dynamic Origin Ctrl-D
- 23. Right-click again and make certain all options are toggled off.

- 24. **<Esc>** to dismiss the menu if everything was already off.
- 25. Under *Current Component*, key in *Wall face* for the Name.
- 26. Set the *Style* to **D_Wall-Retaining**.

	t Component	Chile	
ivame:	Wall face	Style:	D_Wall-Retaining

- 27. **<D>** on the *Wall_E_Top-Front* point to start the component.
- 28. **<D>** on the *Wall_E_Backfill* point.
- 29. Right click and select **Finish**.
- 30. Edit the Wall face component.
- 31. Set the Parent Component to Finds active surface.

0.0					Â
-0.5					
-1.0					
-1:5				_	
-2.0	Component Prop Name: Description:	Wall face	Apply Close		
-2:5	Style: Parent Component:	D_Wall-Retaining Close Shape Finds active surface	< Previous Next >]	
-3:0	Display Hules:	julation	Edit Help		
-3.5					
-4:5					
					Wall_E_B



- **Note:** Now, if the *Finds active surface* end condition fails, neither component is used.
- $32. \ \textbf{Test} \ the \ template.$

- **Note:** Only a dashed line is shown initially, indicating when the end condition fails, nothing is displayed. When the end condition succeeds, only the Wall face is displayed. The template is 'fit' to the view, so the slope seen here is not indicative of the final slope.
- 33. **<D> Close** on the *Test End Conditions* dialog box.
- 34. **Save** the template library.

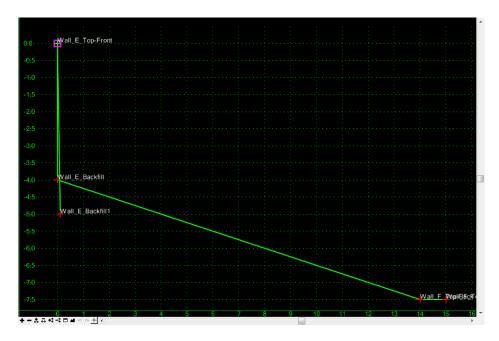
Lab 24.4 - Create the Final Wall Template

Next, these templates are combined to create the final wall template.

1. Right-click on *Walls* folder again in the library and select **New > Template**.

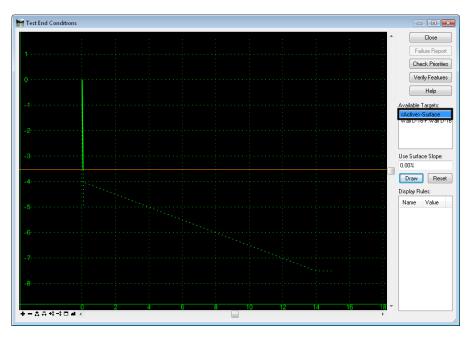
- 😋 C:\Projects\12345\Design\InRoads\12345DES_Temp E Point Name List 1 - Templates 2 - Sections - Pavement 3 - Sections - End Conditions 💼 4 - Components 🚞 Aggregate Bases 💼 Barriers & Misc Components 📋 Guardrail Type 7 Guardrail Widening 🗟 Walls 3_Terraced-walls wairrace 🛏 Terrace Wall → WingWall_Cast-in-Place-Fixed-Base → WingWall_Cast-in-Place-Fixed-Top 🚞 Curb & Gutter Components 🚞 End Conditions Pavements 🚞 Sidewalks & Bike Paths Subbases
- 2. While the name is highlighted, type over with **3_Terraced-walls**.

- 3. Highlight, but do not make active, *Terrace_Wall*.
- 4. Drag the *Terrace_Wall* template from the *Preview* window and drop it on the origin of the new template.
- 5. Highlight, but do not make active, *Wall_Face*.
- 6. Drag the *Wall_Face* template from the *Preview* window and drop it on the origin, making certain the *Wall_E_Top-Front* point turns white.

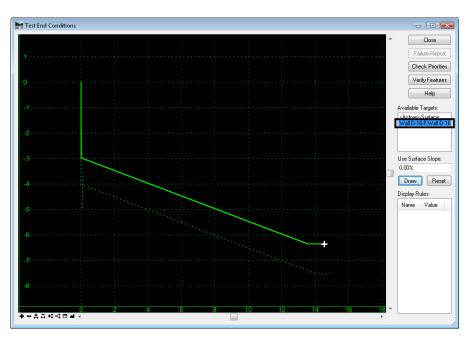


- 7. **<D> Test**.
- 8. **<D>** on the **<***Active***>**-*Surface* under *Available Targets*.
- 9. **<D>** on **Draw**.

10. Move your cursor into the template view.



- **Note:** The wall face appears, indicating that when the first option, the *Wall face and terrace*, fails, the wall face alone will be created.
- 11. **<D>** on the *Wall D-16-F* alignment under *Available Targets*.
- 12. **<D>** on **Draw**.
- 13. Move your cursor into the template view.



Note: The wall face and terrace appear.

14. **<D> Close** to dismiss the *Test End Conditions* dialog box.

There are two *Wall_E_Backfill* points in the template, so one was renamed with a suffix. In the model, only one of these points will be used at any given location and together, they should form just one breakline. This is accomplished with *Feature Name Overrides*.

- 15. Select Tools > Apply Feature Name Override.
- 16. Highlight the two *Wall_E_Backfill* points
- 17. Key in *Wall_E_Backfill* for the *Feature Name Override*.

🐂 Apply Feature Name Ove	rride to Points 🛛 💌
Feature Name Override:	Apply
Wall_E_Backfill	Close
	Help
Apply to points:	
Feature Name	Feature Override Name
Wall_E_Backfill1	
Wall E Top-Front	
Wall_E_Backfill	
Wall_F_Top-Back	
Wall_F_Top-Front	

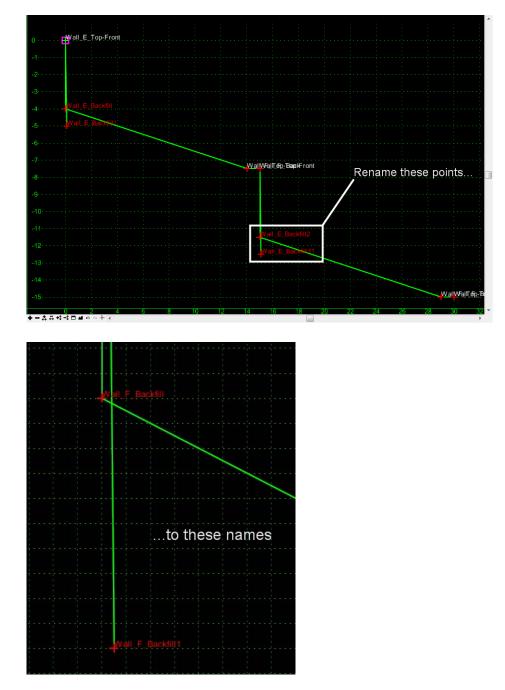
18. **<D> Apply**, then **Close**.



- **Note:** The names turn red in the template view, indicating the names have been overridden.
- 19. **Save** the template library.
- 20. Highlight the 3_Terraced-walls template in the list at left.

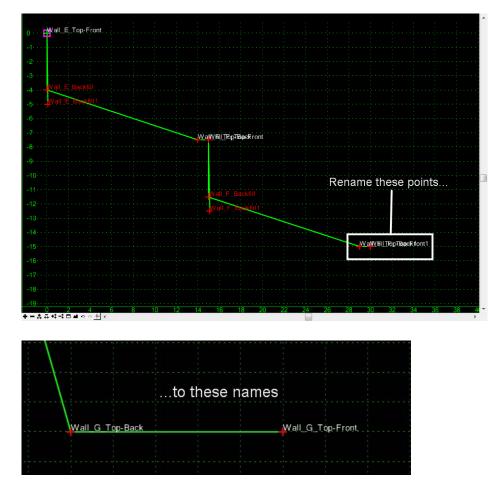
21. Drag and drop the template from the *Preview* window onto the *Wall_F_Top-Front* point, making certain the point turns white.





22. Edit the two backfill points for *Wall F* and rename the points to *Wall_F_Backfill* and *Wall_F_Backfill1*.

23. Rename the *Wall_F_Top-Front1* point to *Wall_G_Top-Front*.



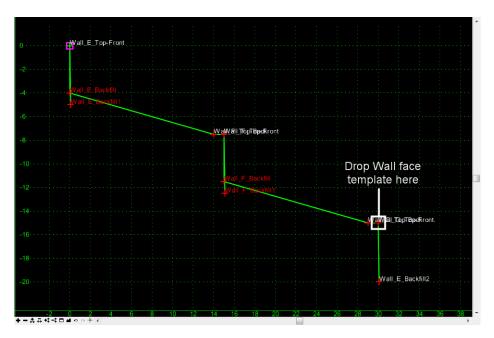
24. Rename the *Wall_F_Top-Back1* point to *Wall_G_Top-Back*.

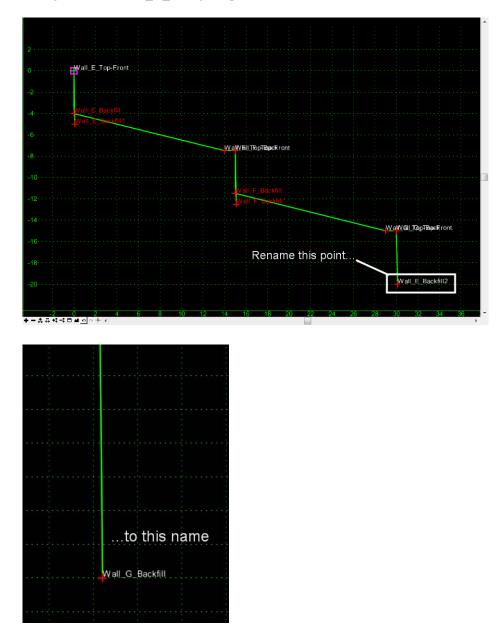
- 25. Select Tools > Apply Feature Name Override.
- 26. Highlight the two *Wall_F_Backfill* points
- 27. Key in *Wall_F_Backfill* for the *Feature Name Override*.

🐂 Apply Feature Name Ove	erride to Points	×
Feature Name Override: Wall_F_Backfill		ply
Wal_1_backin	Clo	ose
Apply to points:	H	elp
Apply to points.		
Feature Name	Feature Override Name	*
Wall_E_Backfill	Wall_E_Backfill	
Wall_F_Top-Back		
Wall_G_Top-Front.		
Wall G Top-Back		
Wall_F_Backfill	Wall_E_Backfill	
Wall_F_Backfill1	Wall_E_Backfill	
wail_r_rop-riont		-
۲ [III III III III III III III III III	1	•

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

- 29. Highlight, but do not make active, *Wall_Face*.
- 30. Drag the *Wall_Face* template from the *Preview* window and drop it on *Wall_G_Top-Front*, making certain the *Wall_G_Top-Front* point turns white.





31. Change the new *Wall_E_Backfill2* point to *Wall_G_Backfill*.

- 32. At the bottom of the Template Library list at left, select the Active Template tab.
- 33. Expand the *Components* list.

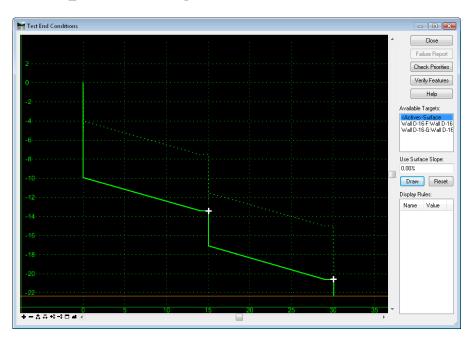
📹 Create Temp		
ile <u>E</u> dit <u>A</u> dd	<u>T</u> ools	
Components Finds act Finds act Finds act Finds act	ive surface1 ive surface2 kt wall align	
Ea Finds ne:		Edit
🖙 Wall face	e and terrace e and terrace1 e1 e2	Delete
Item	Value	
Name	Finds next wall ali	g
Description		
Style	D_Wall-Retaining	I
Parent		
Triangulated	True	
End Condition	True	
Library Active	Template	

34. Right-click on *Finds next wall align1* and select Edit.

- *Note:* Since this component was created from the original one, it is still seeking the *Wall F alignments*. Here, you'll change it to seek *Wall G*.
- 35. Change the *Horizontal* and *Vertical Alignments* to Wall-D-16-G.

🕌 Component Prope	erties			×
Name:	Finds next wall align1		+	Apply
Description:				Close
Style:	D_Wall-Retaining -	•]		< Previous
Parent Component:	_	+		
Display Rules:			Edit	Next>
Exclude from triangu	ulation			Help
- End Condition Proper	ties			
Target Type:	Alignment XYZ 🗸	Priority:	1	
Horizontal Alignment:	Wall D-16-G 🗸 🗸	Benching Count:	0	
Vertical Alignment:	Wall D-16-G 🗸	From Datum:	0.00	
Horizor	ntal Vertical	Step Elevation:	0.00	
Offsets: 0.00	0.00	Rounding Length	0.00	

- 36. **<D> Apply**, then **Close**.
- 37. **Save** the template library.
- 38. At the bottom of the Template Library list at left, select the *Library* tab.
- 39. Test the 3_Terrace-walls template.



- 40. **<D> Close** on the *Test End Conditions* dialog box.
- 41. **<D> Close** on the *Create Template* dialog box.

Lab 24.5 - Create the Terraced Wall Surface

In this section, the template is used to create a surface representing the terraced walls. The template is run along a graphic element created from the horizontal and vertical alignment for Wall E using the *Apply Template* command. As an alternative, *Roadway Designer* could be used.

- 1. **Delete** the alignment graphics in the file.
 - **Important!** If the original graphics remain in the file, you are likely to accidentally identify them when selecting the path for the template, so it is best to delete the original alignment display. The original graphics are at elevation 0. The graphic you are creating is 3D.
- 2. Select Geometry > View > 3D Alignment.
 - **Note:** This command creates a 3D linestring, taking the X and Y coordinates from the specified horizontal alignment and the Z coordinate from the specified vertical alignment.
- 3. Select the *Horizontal* and *Vertical* alignments Wall-D-16-E.

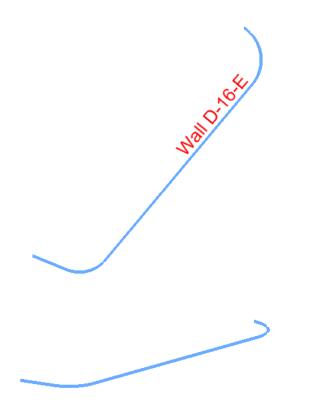
- 4. Toggle on Station Limits.
- 5. Leave the *Start Station* set to *0+00.00*.
- 6. Key in **1+98.35** for the *Stop Station*.
 - **Note:** This is the station at the end of the second curve in the wall alignment. From that point on, the wall will be created with the ramp.
- 7. Under *Include Cardinal Points*, toggle on Horizontal and Vertical.
- 8. Key in *1.00* for the *Interval*.

Note: This is how often a vertex is created on the resulting linestring.

View 3-	-D Alignm	ent				- • 💌
Horizontal	Alignment:	Wall D-16-E		-	+	Apply
Vertical Ali	gnment:	Wall D-16-E		•		Close
Apply Style						Preferences
C Activ	ve:	ALG_EXISTI	VG	-		Help
Offsets a	nd Interval Horizo	ontal		Ve	rtical	
Start:	0.00		÷	0.00		
Stop:	0.00		+	0.00		
Interval:	1.00		+			
🔲 With I	Equal Leng	th Parabolic Lin	ear Par	abolic Tra	ansition	iing
Limits						
V Statio	n			aluda His		l Cardinal Points
Start:	0+00.00	-#-	_			ardinal Points
Stop:	1+98.35	+				
-			P	ttach Tag		

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

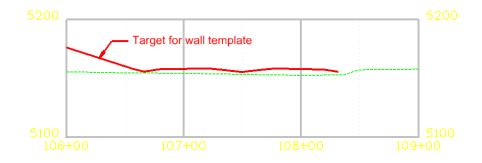
10. **Fit** the view.



- **Note:** The 3D linestring is shown here in plan and in a rotated view. It forms the origin point for the wall template.
- 11. Make 12345 SH119 the active surface.

💏 Bentley InRoads V8i (S	Set Active				×
File Surface Geometry	Triangulate	er Site	e Modeler Dr <u>a</u> fting	<u>Q</u> uantities <u>T</u> ools	<u>H</u> elp
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12345 existing gr	ound for I 🛛 🖉 Interi	or Feat	0	0	
< III		om Fea	0	0	-
Surfaces 🖁 Geometry	y + > i				. F
Toggles the Style Lock					3

- **Note:** The SH119 surface has a 3:1 slope from the bottom of the ditch that creates a 'target' for the walls.
- *Important!* Since the template was created to search for the active surface, *SH119* must be active.

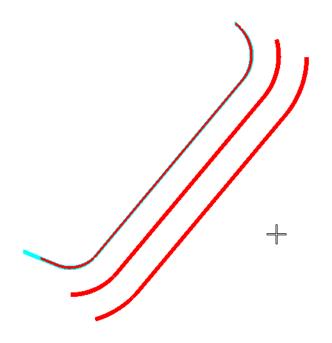


- 12. Set the *Locate Features / Locate Graphics* toggle to Locate Graphics.
- 13. Select Surface > Design Surface > Apply Template.
- 14. Key in *12345 walls E F G* for the *Design Surface*.
 - **Note:** The design surface does not have to exist. It is created when the command is applied.
- 15. Set the *Reference Feature Interval* to 10.00.
- 16. Toggle on Stroke Tolerance.
 - **Note:** The Value does not matter unless the reference graphic has an arc in it. Using *View* **3D Alignment** creates a linestring that does not contain arcs.
- 17. Highlight the 3_Terraced_Walls template in the 4 Components/Barriers & Misc Components/Walls folder.
- 18. Set *Duplicate Names* to Rename.
- 19. Toggle on **Remove Loops**.
- 20. Toggle off Generate Graphics Only.

21. Toggle on Triangulate Surface.

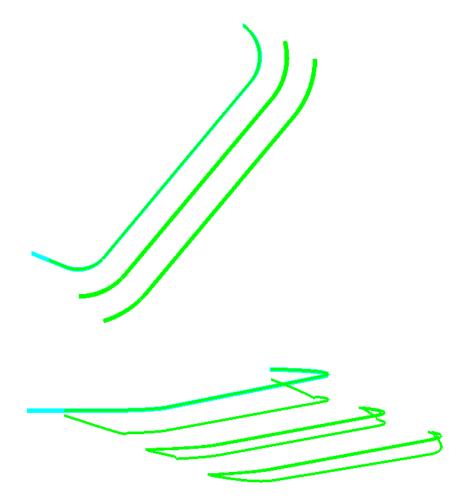
-	12345 walls E F G	•	Apply
oterior Arc:	5^00'00"		Close
Mirror	Reflect		
Reference Feature			Preferences
🔽 Interval:	10.00	+	Help
Stroke Tolerance:	1.00		
emplates:			
Barriers & Misc Guardrail T Guardrail V	ype 7		
📄 Guardrail T	ype 7 Videning aced-walls e Wall		

- 22. **<D> Apply**.
- 23. **<D>** on the 3D alignment graphic to identify the *Primary Element*.
- 24. **<D>** anywhere in the view to accept.
- 25. **<D>** on the 3D alignment graphic again to identify the *Reference Element*.
- 26. **<D>** anywhere in the view to accept.
- 27. **<R>** to apply the template to the entire element.

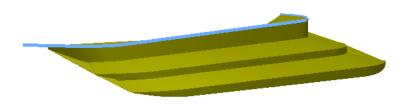


Note: Temporary graphics appear showing the resulting feature locations.

28. **<D>** anywhere in the view for the location.



- **Note:** The *Results* dialog box appears showing any end condition failures. Above, you see the plan and rotated views of the graphics. There may be failures at either end of the graphics, since the alignment actually begins slightly underground.
- 29. Save the wall surface to the c:\Projects\12345\Design\InRoads folder.
- 30. Review the surface by displaying triangles and/or contours.



Note: If the view is rotated, return to a top view when done.

31. Set the active alignment to SH52-H.

- 32. Select Evaluation > Profile > Create Profile.
- 33. In the *Surfaces* area, toggle on 12345 existing ground for interchange, 12345 SH52, 12345 SH119 and 12345 walls E F G.

🐂 Create Profile				_ • • 🔀
Create Profile General Source Include Offsets Controls Axes	Set Name: SH52-H Direction © Left to Right © Right to Left Surfaces:	Exaggeratio Vertical: Horizontal:	n 1.0000 1.0000	
ASCI	Object Default X 12345 existing groun X 12345 walls E F G X 12345 SH119	Name Default T_Existing_Ground Default D_Finished-Grade Prop	BYL BYL BYL BYL Derties	All None
	C	Apply Prefere	nces)	Close Help

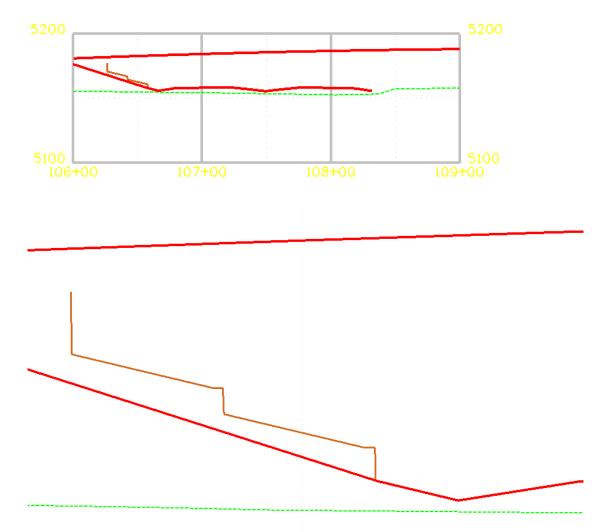
- 34. Select the *Controls* branch.
- 35. Set the *Station Limits* to *106+00* to *109+00*.

🦌 Create Profile		- • ×
Create Profile General Source Include Offsets Controls Limits Axes	Elevation Use High: 1000.00 Low: 0.00 From Cogo Points From Regression Points	Example
Grid	Station ✓ Use Start: 106+00.00 ★ Stop: 109+00.00	
	Window Clearance Image: Constraint of the state of	
	Apply	ces) Close <u>H</u> elp

36. **<D> Apply**.

37. **<D>** a clear area in the design file for the location of the profile.

38. Window in to see the wall surface.



- **Note:** Since templates can also contain non-triangulating and closed shape components, walls, footers, leveling pads, etc. can be created as part of the template if desired.
- **Note:** The features developed here can be combined with features from the other models to create an overall interchange model.

Chapter Summary:

- Templates can be used to create features for surfaces other than roadways.
- Templates can be used without *Roadway Designer* by 'running' them on a 3D elements or features.
- Using targets other than surfaces can greatly expand the capability of templates, allowing them to create features for a variety of design applications.

LAB 25 - Widening and Overlay

Widening and overlay projects are an increasingly large part of the CDOT workload. This lab illustrates the MicroStation and InRoads tools used for projects that require pavement widening, overlay, and pavement milling (stripping in InRoads terminology).

In conjunction with overlay and stripping components a slope optimization function is available to constrain transverse design slopes relative to existing conditions. This utility can be utilized for design development whether the design template contains standard components or the new overlay and stripping components introduced with the SELECTseries release of InRoads.

Chapter Objectives:

- Create a complex chains for the pavement edges from existing ground features.
- Import the chains as horizontal and vertical alignments.
- Develop a slope optimization solution.
- Develop a widening and overlay template.
- Define corridors for the project.
- Model the corridor and apply slope optimization.
- Model the corridor with overlay and stripping components.

The Following files are used in this lab:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model_Overlay.dgn
- C:\Projects\12345\Design\InRoads\12345DES_Geometry_Overlay.alg
- C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\Templates\ CDOT_Template-Library.itl
- C:\Projects\12345\Design\InRoads\12345 existing ground-Overlay.dtm

This project runs the length of the SH 86 alignment from station 205+00 to 259+00. Therefore, the display of features, etc. will be restricted to an area from station 204+00 to 260+00. This will ensure that enough data is available for the full length of the project.

Note: The first two labs in this chapter illustrate a workflow to develop horizontal and vertical alignments which represent the left and right edges of existing pavement. These alignments can be used as point controls on widening projects if the proposed design must vary width, elevation, or both, relative to the existing roadway. A slope optimization utility is also available which offers additional flexibility for vertical design development. If the design calls for it, point controls can be used to constrain the design template to the existing pavement width. Also the template can be constrained vertically based on user defined delta tolerances between the design template cross slope and the existing cross slope. Allowing the designer flexibility to match existing conditions (0% tolerance) or to define slope deviation as a user input for maximum delta tolerance.

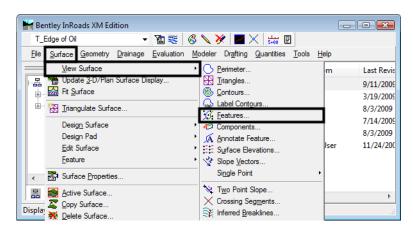
Lab 25.1 - Chain Pavement Edge Features

As single continuous lines are easier to use for point controls than a number of unconnected lines. Creating the complex chain also provides the opportunity to close gaps in the pavement edge features.

- 1. Open MicroStation and InRoads using the C:\Projects\12345\Design\Drawings\ Reference_Files\12345DES_Model_Overlay.dgn file.
- 2. Load the following files into InRoads:
 - C:\Projects\12345\Design\InRoads\12345DES_Geometry_Overlay.alg
 - C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground-Overlay.dtm
 - C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\ Templates\CDOT_Template-Library.itl
- 3. Verify that the C:\Workspace\Workspace-CDOT_V8i\Standards-Global\ InRoads\ Preferences\CDOT_Civil.xin file is loaded.

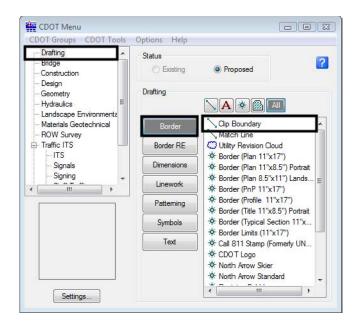
The first step is to mark out the limits of construction. Then a MicroStation fence is used to limit InRoads displays to this area.

- 4. In the InRoads explorer, **<D>** the **Geometry** tab.
- 5. **<R>** on the **SH 86** horizontal alignment and select **View** from the right click menu.



- 6. Select **Fit View** from the MicroStation view controls.
- 7. From the *CDOT Menu*, select the **Draffing** group.
- 8. **<D>** the **Border** button.

9. Highlight **Clip Boundary** from the item list. This activates the *Place SmartLine* command.



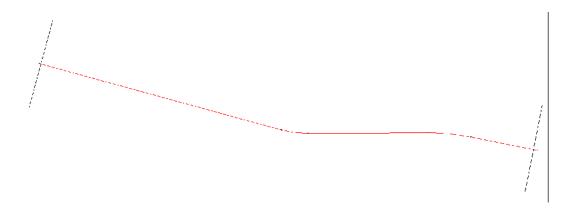
10. In the MicroStation key-in window, key in *so=204+00,500* and press *Enter*.

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Filled Placement : OFF	ا لد

11. Key in *so=204+00,-500* and press *Enter*. <**R**> to finish the line.

This places a line perpendicular to the alignment at the beginning of the project.

- 12. The Place SmartLine command is still active. Key in *so=260+00,500* and press *Enter*.
- 13. Key in *so=260+00,-500* and press *Enter*. <**R**> to finish the line.

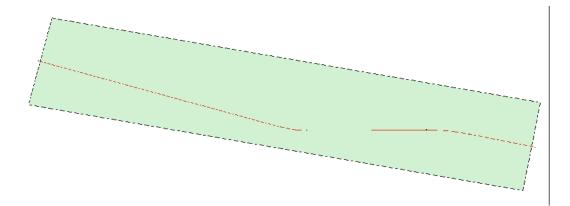


14. From the MicroStation Main toolbar, **<D> Place Fence**.

15. In the Tool Settings dialog box, set the *Fence Type* to **Shape**.

CDOT 🖾	
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+, 🔧,	Fence Type Shape
	Fence Mode: Inside
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16. **<T>** then **<D>** to the ends of the lines. The fence is shown in the illustration below.



Next, a feature filter is set up that will only display edge of pavement features. In this case these features are named T-Edge of Oil.

17. From the InRoads menu bar, select **Surface > Feature > Feature Selection Filter**.

Bentley InRoads XM Edition	 8 🔪 🏏 🔜 🖉	. • 💌
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View Surface	Modeler Drafting Quantities Tools Help Description By Whom	Last Revis
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Triangulate Surface Design Surface	SH 86 Centerline cferree , ROW LT cferree	8/3/2009 7/14/2009
Design Pad Edit Surface	, Offset cferree , oad (500 501 502) CDOT User	8/3/2009 11/24/200
▲ <u>F</u> eature	 Feature Properties 	
Ran Surface Properties	Feature Selection <u>Filter</u>	- F
Edits ti Active Surface	Component Properties	H

- 18. From the *Feature Selection Filter* dialog box, toggle on **None** for the *Start With* option.
- 19. Verify that the *Attribute* is set to **Name**.

- 20. Key in *T_Edge of Oil** for the *Value*.
- 21. Toggle on **Include** for the *Mode*.
- 22. **<D>** the **Add Rule** button.
- 23. **<D>** the **Save As** button.

Feature Selection Filter	- • 💌
Filter Name: Value of the second s	ОК
Start With: All None Build Selection Attribute: Name	Cancel Save
Value: T_Edge of Oil*	Save As
Mode: O Include O Exclude	Delete
Add Rule Replace Rule	Help
Rules: Exclude All Features Include Name = T_Edge of Oit*	Move Up Move Down Delete Rule Clear All
Current Results: T_Edge of Oil Parking Lot T_Edge of Oil Parking Lot876 T_Edge of Oil Parking Lot877 T_Edge of Oil Parking Lot893	

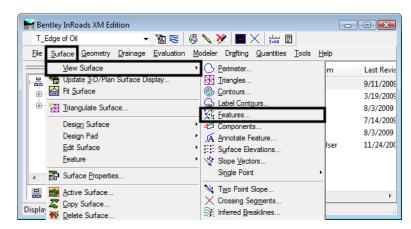
- 24. In the Save Filter As dialog box, key in *T_Edge of Oil.*
- 25. **<D>** The **OK** button. This creates the filter and dismisses the *Save Filter As* dialog box.

🚔 Save Filter As	
Name:	ОК
T_Edge of Oil	Cancel
	Help

- 26. **<D>** the **OK** button to dismiss the *Feature Selection Filter* dialog box.
- 27. On the InRoads Locks toolbar, verify that the **T_Edge of Oil filter** is selected and that the **Feature Filter Lock** is turned on.

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With the Feature Filter defined and set active, The pavement features needed can now be displayed.



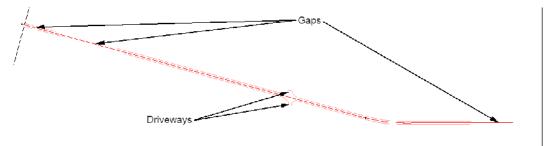
28. Select **Surface > View Surface > Features** from the InRoads menu bar.

- 29. In the *View Features* dialog box, verify that **12345 existing ground-Overlay** is set as the *Surface*.
- 30. Set the *Fence Mode* to Inside.
- 31. Hold the *Ctrl* key and **<D>** on each of the *Parking Lot* features to de-select them.
- 32. **<D>** the **Apply** button to display the features inside the fenced area.

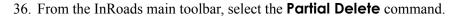
Kiew Features	
Surface: 12345 existing groun 💌	Apply
Fence Mode: Inside 🗸	Close
	Filter
	Edit Style
	Help
Features:	
Name	Style I 🔶 🕂
T_Edge of Oil Parking Lot	T_Edge of Oil Par E ≡
T_Edge of Oil Parking Lot T_Edge of Oil Parking Lot876	T_Edge of Oil Par E ≡ T_Edge of Oil Par E
T_Edge of Oil Parking Lot876	T_Edge of Oil Par E
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T_Edge of Oil Parking Lot876 T_Edge of Oil Parking Lot877 T_Edge of Oil Parking Lot893 IT_Edge of Oil106 T_Edge of Oil119 T_Edge of Oil123 T_Edge of Oil13 T_Edge of Oil15	T_Edge of Oil Par E T_Edge of Oil Par E T_Edge of Oil Par E T_Edge of Oil E

- 33. **<D> Close** to dismiss the *View Features* dialog box.
 - *Note:* If the features do not appear in the MicroStation window, **<D>** the **Fit View** from the view controls button bar.
- 34. From the MicroStation Main toolbar, **<D> Place Fence** to dismiss the fence that was placed earlier.

Notice that each of the edge of oil features displayed has three gaps and a driveway in it. The driveways must be removed and gaps filled in before the pavement edges can be chained together. In order for the corridor to function properly, the lines placed to fill in the gaps must also include elevation information.

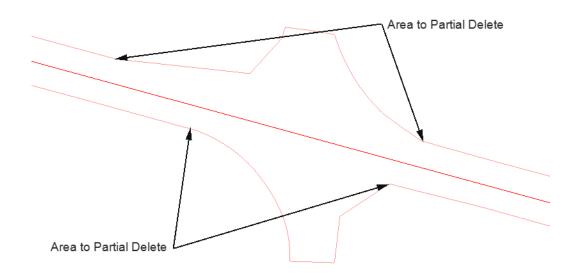


35. Use the MicroStation view controls to zoom in on the area with the driveways.



-7	<u>1</u>	Modify Element
*	<u>2</u>	Partial Delete
CDOT 🖻 🇯	<u>3</u>	Break Element
1	<u>4</u>	Extend Line
N m X	<u>5</u>	Extend Elements to Intersection
+ ~ / L	<u>6</u>	Extend Element to Intersection
	<u>7</u>	Trim Elements
	<u>8</u>	IntelliTrim
	<u>9</u>	Insert Vertex
	<u>0</u>	Delete Vertex
公 * ~	Q	Construct Circular Fillet
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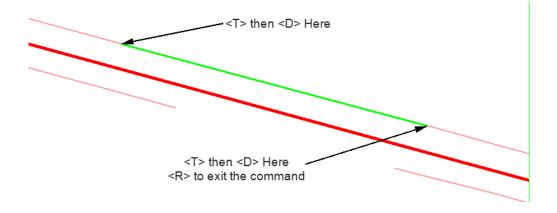
37. **<D>** on the lines as indicated in the illustration below to remove the driveways.



- 38. On the *CDOT Menu*, select the **Design** group.
- 39. Verify that the *Status* is set to **Proposed**.
- 40. **<D>** the **Surface** button.
- 41. Highlight **Surface 4** from the item list. This level was selected because of the contrast to the features displayed.

Drafting Bridge Construction Design Geometry Hydraulics	Status	Proposed
Landscape Environmental Materials Geotechnical ROW Survey	Fence	Major Contours
⊡ Traffic ITS	Guardrail	> Perimeter
Utilities	Phasing	Surface 1
	Fnasing	Surface 2
	Profile	Surface 4
	Roadway	Surface 5
	Structure	Surface 6
		Surface 8
	Surface	Surface 9
	Temporary	Surface 10
	Xsection	A Major Contours Text

42. **<T>** then **<D>** at each end of the gap created in the upper pavement edge line and then **<R>** to exit the place line command.



43. Repeat step 41 for each gap in the pavement edge lines. The illustration below shows all of the gaps closed.

The lines drawn are accurate to the surface only at the points where they were snapped to the features. To ensure that the lines represent the surface over the length of the line, the InRoads Drape Surface command is used.

44. From the InRoads menu bar, select **Surface > Design Surface > Drape Surface**.

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<u>U</u> tilities	▶ bog Project Line ♣ Generate Iso Ø Resurface	opach Surface		

- 45. In the Drape Surface dialog box, verify that the Destination Surface is set to **12345** existing ground-Overlay.
- 46. Set the *Input Mode* to Level.
- 47. Set the *Source Level* to DES_Surface_4.
- 48. Set the *Destination Level* to **DES_Surface_3**. This level was chosen because its display is different from both the lines drawn and the features displayed.

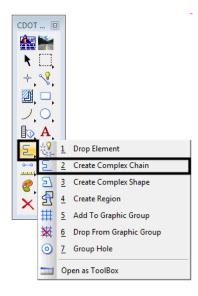
49. Toggle on Delete Original Graphics.

🐂 Drape Surface			- • •
Current Locate Mode:	Graphics		Apply
Destination Surface:	12345 existin	ng ground-Ove 💌	Close
Graphics Input Mode:	Level	-	Filter
Source Level:	DES_SURF	ACE_4 🔻	Preferences
Destination Level:	DES_SURF	ACE_3 🗸	Help
Delete Original Grap	phics		
Features Surface:	12345 existi	ng ground-Ove 🔻	
Name	Style	Description	+
Scale:	1.0000		
Elevation Adjustment:	0.00		
Drape Vertices Only			

50. **<D>** Apply. The original lines are deleted and replaced with linestrings on the destination level, DES_SURFACE_3. The new linestrings contain a vertex at each point where the original line crossed a triangle in the destination surface.

Now the edge of oil lines can be chained into a single element.

- 51. Select Fit View from the MicroStation View Controls.
- 52. From the MicroStation main toolbar, select the **Delete** command and delete the lines that mark the begin and end of the project. This is to ensure that they are not accidentally included into one of the chains.
- 53. From the MicroStation main toolbar, select the Create Complex Chain command.



54. In the tool settings box, set the *Method* to Automatic.

📕 Create Comple	x C 🗆 🔍
<u>M</u> ethod:	Automatic 💌
Max <u>G</u> ap:	0.001
Simplify g	eometry

- 55. **<D>** on the left most element in the top line then **<D>** in a blank area. All of the elements that make up the upper pavement edge highlight.
- 56. **<D>** in a blank area to accept the selection set and create a single chain from the elements.
- 57. **<D>** on the left most element in the bottom line then **<D>** in a blank area.
- 58. **<D>** in a blank area to accept the selection set and create the second chain.

Section Summary:

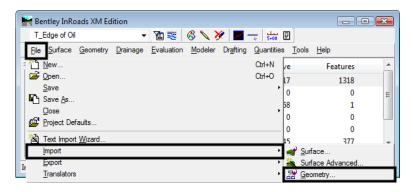
- Use Feature Selection Filters to limit the number of features to those needed.
- Use a MicroStation fence to further limit what is displayed to the area of the project.
- Once displayed, the feature graphics are like any other MicroStation element.
- Be careful if the Gap setting is increased for the Create Complex Chain command. Increasing the gap could allow the program to grab elements that are not intended to be part of the chain.

Lab 25.2 - Creating Alignments from Graphic Chains

Now that the pavement edges have been chained together, these linestrings can be imported as horizontal and vertical alignments. These alignments will be used for point controls in a later exercise.

Section Objectives:

- Import the graphic elements created in the previous exercise as horizontal and vertical alignments.
- 1. From the InRoads menu bar, select **File > Import > Geometry**.



- 2. On the *Import Geometry* dialog box, verify that the **From Graphics** tab is selected.
- 3. Set the *Type* to Horizontal and Vertical Alignment.

- 4. In the *Name* field, key in *Lt_EOP*.
- 5. In the *Description* field, key in *Left edge of pavement for point control*.
- 6. Select **ALG_OTHER** for the *Style*.
- 7. Verify that the *Geometry Project* in the *Target* area is set to **12345DES_Geometry** _**Overlay**.
- 8. **<D> Apply**.

Import Geometry		
rom Graphics ICS	Vertical from Surface	
Type: Horiz	contal and Vertical Alignment 👻	Apply
Geometry Name:	0.0	•
	OP ge of pavement for point contro	
		Help
Horizontal Curve De	_OTHER	
Vertical Curve Defin	AC •	
Target Geometry Project: Horizontal Alignmen	12345DES_Geometry_O1 •	
Geometry Project: Horizontal Alignmen		cies
Geometry Project: Horizontal Alignmen Use Fence	E SH 86	cies
Geometry Project: Horizontal Alignmen Use Fence Join Elements All Selected Eleme Attribute Tags	Resolve Gaps and Nontangen	cies
Geometry Project: Horizontal Alignmen Use Fence Join Elements All Selected Eleme Attribute Tags Use Tag Data	Resolve Gaps and Nontangen No Duplicate Cogo Points ents Added to Single Alignment	cies
Geometry Project: Horizontal Alignmen Use Fence Join Elements All Selected Eleme Attribute Tags Use Tag Data Project:	Resolve Gaps and Nontangen No Duplicate Cogo Points ants Added to Single Alignment Active	cies
Geometry Project: Horizontal Alignmen Use Fence Join Elements All Selected Eleme Attribute Tags Use Tag Data	Resolve Gaps and Nontangen No Duplicate Cogo Points ents Added to Single Alignment	cies

- <D> on the upper chain, then <D> again to accept the selection. <R> to redisplay the Import Geometry dialog box.
- 10. In the *Import Geometry* dialog box, key in *Rt_EOP* for the *Name*.
- 11. In the *Description* field, key in *Right edge of pavement for point control*.
- 12. **<D> Apply**.
- <D> on the lower chain, then <D> again to accept the selection. <R> to redisplay the *Import Geometry* dialog box.
- 14. **<D> Close** to dismiss the *Import Geometry* dialog box.
- 15. In the InRoads explorer, **<D>** the **Geometry** tab and verify that *Lt_EOP* and *Rt_EOP* are in the geometry project.
- 16. Save the 12345DES_Geometry_Overlay geometry project.

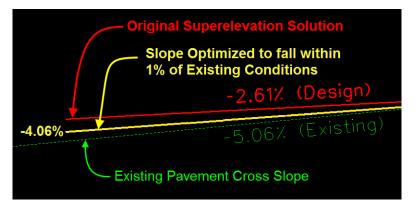
Section Summary:

- Take care when importing feature graphics as alignments, overlapping and gaps in elements are common and can cause problems in Roadway Designer.
- One way to tell if the Import Geometry command worked is to look in the Name field after the command was executed. If the last letter in the name has changed, then geometry was created.

Lab 25.3 - Cross Slope Optimization - Concept Lab

Specialized tools for overlay and stripping projects have been included in the SELECTseries release of InRoads. Included in these tools is a slope optimization utility which defines the cross slope of a template relative to existing conditions. Also new components are available for refining a template to address overlay, pavement leveling, and milling requirements.

The slope optimization utility compares design cross slopes (as created through roadway designer, including superelevation) vs. existing conditions (from the existing ground DTM) at template application locations. Based on the Slope Tolerance provided by the user, a corrected slope value is calculated for each template drop. This information is used to modify the superelevation control line and adjust the template cross slope.



Slope optimization can be utilized if the design profile is coincident or offset from existing conditions.



Section Objectives:

• Copy the standard template library into the project folder.

- Create a new template placeholder.
- Add simple components to define the template.
- Illustrate the function of the slope optimization tool.
- A subsequent lab will utilize slope optimization to model an overlay and widening project.

First, the standard template library is copied into the project directory.

- 1. In the InRoads explorer, **<D>** the **Template** tab.
- 2. **<R>** on the **CDOT_Template-Library** and select **Save As** from the right click menu.

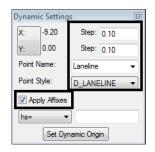
Hentley InRoads XM Edition	
T_Edge of Oil 🛛 👻 🚡 😵 💊 🏏 🌽 📰 🛶 🔛	
<u>File Surface Geometry Drainage Evaluation Modeler Drafting Quantities Tools Help</u>	
Name Number of Ent	
E Template Library 🛱 1 - Templates 6	
a CDOT_Template-Library Save	
Save As	
Close	
Templates A Corridors	
Finished saving 'C:\Projects\12345\Design\InRoads\12345 existing ground-Overlay.dtm'	

- 3. In the **Save As** dialog box, verify that the **C:\Projects\12345\Design\InRoads**\ directory is selected.
- 4. In the *File name* field, key in *DES12345_Templates-Overlay*.
- 5. **<D> Save** then **<D> Cancel**.

Nave As				.
Save in:	퉬 InRoads		- 🗿 🎓 📂 🛄 -	
ea	Name		Date modified	Туре
Recent Places	🌗 Lab - Interchan	-	10/30/2009 6:13 AM 10/30/2009 6:13 AM	File Folder File Folder
	DES12345_Tem	plates.itl	5/28/2009 4:04 PM	ITL File
Desktop				
Chris Ferree				
Computer				
	-	III		
Network	File name:	ES12345_Templates-Overlay	-	Save
	Save as type:	emplate Libraries (*.itl)	•	Cancel
				Help
				Options

Next, a new template is created in the template library. The template will be very basic to illustrate the slope optimization utility however the concept can be applied to any template created.

- 6. On the InRoads menu bar, select **Modeler > Create Template**.
- In the Create Template dialog box, expand the C:\Projects\12345\Design\ InRoads\DES12345_Templates-Overlay.itl > 1 - Templates folder.
- 8. **<R>** on the **1 Templates** folder and select **New > Template** from the right click menu.
- 9. Key in *12345_Slope-Optimization* for the *template name*.
- 10. Key in 12 FT lane with 2% Cross Slope for the description
- 11. Display the **Dynamic Settings** dialog box (Tools>Dynamic Settings)
- 12. Key in *0.10* for the *X* and *Y* Steps.
- 13. Toggle on Apply Affixes.
- 14. Select Point Name: Laneline
- 15. Select Point Style: **D_LANELINE**



16. **<R>** in the template view and select **Add New Component > Constrained** from the right click menu.

Add New Component	+	Simple
Set Dynamic Origin	Ctrl-D	Constrained
		Unconstrained
		Null Point
		End Condition
		Overlay/Stripping

- 17. In the *Current Component* area, key in *DrivingLane-12FT* for the *Name*.
- 18. Select **D_CONC_Pvmt** for the *Style*.

+-4	.류박라티베이어한 (
Current	Component		
Name:	DrivingLane-12FT	Style:	D_CONC_Pvmt

19. **<R>** in the template view and select **Mirror** from the right click menu.

	Finish	Enter
	Closed Shape	Ctrl-L
~	Mirror	Ctrl-M
	Undo Last Cancel	ESC
	Set Dynamic Origin	Ctrl-D

- 20. **<D>** on the template origin.
- 21. key in 12,-2.0% in the hs= field and <enter> to build the components

Dynamic Setting	gs 🖾	
X: 9.40	Step: 0.10	
Y: 0.00	Step: 0.10	
Point Name:	Laneline 👻	
Point Style:	D_LANELINE -	
Apply Affixes		
hs=	12,-2.0%	
Set Dynamic Origin		

- 22. **<enter>** a second time to finish the component.
- 23. This creates two components representing left and right lanes.

0:0 · ·							Lanelir	ne							
					1										
~ ~															
0:2 · ·	LT_L	anelin	é										RT_	Laneli	ne
0:4 · ·															
0.6															
0.0															
	12 -	10	-8	-6	-4 -	2	$\frac{1}{0}$ 2		4	6	8	10	12	14	16
- 4 4	; +1 -1	: 🗖 🖬	က်ဖ	4											

24. *Rename* the template origin to **Centerline by <D><D>** on the point.

Point Properties			×
Name:	Centerline -	+	Apply
Use Feature Name Override:	Centerline		Close
Surface Feature Style:	D_LANELINE -]	< Previous
Alternate Surface:	-		Next >
	Mombor of:		Help

25. Key in *Centerline* and Select Apply

-0:0							Ce	enterlir	e						
-0:2	LT	Laneli	ne										RT	_Lane	: linė · ·
-0:4 · · ·															
-0:6															
-14 ⊦ – ≛ ឝ +1	-12	-10 -10	-8	-6	-4	-2	0	2	4	6	8	10	12	14	16

- 26. *Save* the template library by selecting **File>Save**
- 27. The Create Template dialog is no longer needed, select Close.

Lab 25.4 - Creating the Slope Optimized Corridor

A corridor is constructed using the template developed and slope optimization will be applied.

Section Objectives:

- Create a corridor for the SH 86 alignment.
- Add a template drop using the developed template.
- Develop a Superelevation solution for the corridor.
- Review the superelevation solution in Roadway Designer.
- Apply slope optimization to modify the superelevation control lines
- Review the revised corridor

This corridor will contain a single template application. Superelevation is required for this corridor because of design speed criteria. However once the superelevation solution is calculated it will be modified to minimize the cross slope variation relative to existing conditions.

- 1. From the InRoads menu bar, select **Modeler > Roadway Designer**.
- 2. In the *Roadway Designer* dialog box, select **Corridor > Corridor Management** from the menu bar.
- 3. In the *Manage Corridors* dialog box, key in *Slope Optimization* for the *Name*.
- 4. Surface Symbology: D_Surface_1
- 5. Horizontal Alignment: SH 86
- 6. Vertical Alignment: SH 86_Existing-V
- 7. Toggle on **Station Limits**.
- 8. Key in *205+00.00* for the *Start* station.
- 9. Key in *259+00.00* for the *Stop* station.

Surface Symbolog Type: Horizontal Alignme	C D_SURFAC	E_1 ▼	Station Start:		Close
	Alignment	-	Start:		
Horizontal Alignme			205+00.00	+	Change
	nt: SH 86	• +	Stop:		Сору
Vertical Alignment: PI Rounding Tang	01100_010	ing-V 🔻	259+00.00	+	Copy From
Corridors:	ent: 0.00				Help
Name	Туре	Source Name	Start Station	Stop	Station
Slope Optimizatio.	Alignment	SH 86	205+00.00	259+0	00.00

10. **<D> Add** then **<D> Close** to dismiss the dialog box.

- 11. In the *Roadway Designer* dialog box, select **Corridor > Template Drops** from the menu bar.
- 12. In the *Template Drops* dialog box, key in *25.00* for the *Interval*.
- 13. Expand the C:\Projects\12345\Design\InRoads\DES12345_Templates-Overlay template library to show the contents of the 1 - Templates folder.
- 14. Highlight the **12345_Slope-Optimization** template.
- <D> the Add button then <D> the Close button to dismiss the *Template Drops* dialog box.

🐂 Temp	late Dro	ps			- • •
Corridor:	Slope	Optimization	-		Add
Station:	205+0	0.00		+	Close
Interval:	25.00			+	Change
Library Te	mplates:				
	1 - Temp				Сору
		15_Slope-Optin			Help
		IC_Divided_Ty	E		4
>	🔫 HMA	Crowned_B	10		\wedge
		_Divided_Typ			
		_Full_Depth_' \Urban 4Lan			
		Davomor	-		
Current Te		Drops:	F		_
Stati	Inter	Template	Enable Tr	Rev	Library
205+0	25.00	12345_Slop	N/A	ITL	C:\Projects\1
Supehro	nize with	Library		Edit	Delete
Synchio	THEO WILL	Lonary		Lun	Delete

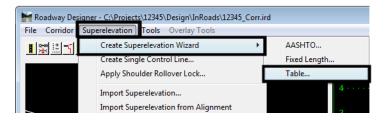
The template is now displayed in the cross section view. Next, superelevation controls are added to the corridor.

Calculating the Initial Superelevation

Superelevation is computed to develop a control line along each edge of pavement. In a subsequent command, Cross Slope Optimization, the computed design cross slopes are evaluated relative to existing conditions. When developing an optimized cross slope the superelevation control lines are copied and modified to develop a revised solution.

Use the Superelevation Wizard:

1. Select Superelevation > Create Superelevation Wizard > Table from *the Roadway Designer* menu bar.



 In the Table Wizard dialog box, select the desired super table. These are located in the C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\Superelevation Tables\AASHTO 2004\ folder.

Look jn:	🍶 AASHTO 2	004		- 🔇 🤣 🖻	? 🛄 🕶	
es	Name	Date modified	Туре	Size		-
Recent Places	06_25.sup					
Desktop	@ 06_35.sup @ 06_40.sup @ 06_45.sup					
Todd	@ 06_50.sup					=
(Normal Computer	08_20.sup					
2	File name:	06_55.sup			•	
Network	Files of type:	Superelevation 7	Table (*.sup)		•	Cancel

3. Select *06-55.sup* and **<D>** the **Open** button.

4. **<D>** the **Load Values From Table** button.

🐂 Ta	ble Wizard				
Corrid	lor: Sle	ope Optimization			Help
Tab	heral Superelevati dards-Glob % Runoff on Tan Specify Runout: Non-Linear Curve	al\InRoads\Supe gent 60%	Transiti	rpolate Table Valu on Lengths Are:	
Horiz	ontal Curve Sets:				
ID	Start Station	Stop Station	Superelevati	Table	Design
1 2	231+75.30 248+08.02	234+72.97 252+90.13	6.00% 4.40%	06_55.sup 06_55.sup	0.00 0.00
Selec	ted Curves:	Load Values From	m Table	Jpdate Geometry	from Table
	< Back	Next :	> Preference	ces Clos	e

The rate values are read from the table and updated for each horizontal curve set listed in the dialog box or highlighted.

- 5. **<D> Next**.

6. **<D>** the **ADD** button on the *Superelevation Section Definitions* pane. This displays the *Add Superelevation Section* dialog box.

🕌 Add Supereleva	tion Section		83
Name:	Section1		ОК
🔲 List all backbone	points		Cancel
Crown Point:	Centerline 🔻	+	Help
Left Range Point:	LT_Laneline 🔹	+	
Right Range Point:	RT_Laneline 🛛 🔻	+	
Pivot Direction:	From Crown Point 🛛 👻		
Number of lanes:	🖲 Two 🛛 🔘 Four		
Runoff Length Multip	blication Factor: 1.00		
Limits Station			
Start:	203+80.28	+	
Stop:	260+43.16	+	

- 7. Use the drop down menu or the target + button to select the *Crown Point:* Centerline.
- 8. Use the drop down menu or the target button to select the *Left Range Point:* LT_Laneline.
- 9. Use the drop down menu or the target button to select the *Right Range Point:* **RT_Laneline.**
- 10. **<D>** OK
- 11. **<D> Next** on the *Superelevation Section Definitions* pane. This displays the *Superelevation Controls* pane.

Section: Superelevation Cor	Section 1 htrols:		-	Help
	Point	Pivot Point	Initial Slope	Applies To
Section1 Cen Section1 Cen	-	Centerline Centerline	-2.00% -2.00%	
Round Station	n to Nearest: [[0+00.00	Edit	Delete

- **Note:** This box lists point controls that are created automatically when you step through the Superelevation Wizard. The point controls determine the vertical location (by defining a cross slope) of template points (those at and inside the range points) while rotating in superelevation.
- 12. **<D> Finish**. This completes the development of superelevation for the corridor.

The Wizard creates superelevation control lines and uses point controls to assign them to template points located within the superelevation range.

Point:	Cont	enline	• +	Statio	n Limits		Close
Mode	Cen	enine	<u> </u>	Start:	205+00.00	+	Change
Horizonta	l 🔘 Ver	tical 💿 E	Both	Stop:	259+00.00	+	Help
Control Type:	Align	nment	•	Horizo	ontal Offsets		
Horizontal Alig	nment: SH	36	+	Start:	0.00	+	
				Stop:	0.00	+	
Use as Sec	condary Align	ment		Vertic	al Offsets		
				Start:	0.00	+	
Priority:	1	_		Stop:	0.00	- \$ -	
Horizontal and		rols:					
E P	Name	Start St	Stop St	Mode	Туре	Control	Description
	-	203+80.28				Section 1 Centerline-LT_Laneline	
X 1 F	RT_Laneline	203+80.28	260+43.16	Vertica	Superelevation	Section1 Centerline-RT_Laneline	ē.
^ I I							

You will need to process your design to see the superelevation results. Each point control corresponds to a control line on the superelevation diagram.

🕌 Roadway Designer - C:\Projects\12345\Design\InRoads\Overlay.ird File Corridor Superelevation Tools Overlay Tools Close Help 6600 6580 6560 245+00 C +1 -1 -1 4 Corridor Station: Slope Optimization < < 252+25.00 ► K <</p> Process All • Active Surface: Interval 25.00 12345 existing ground-Ove 💌 Process Visible Range Display Mode: Template Normal 12345 Slope-Optimizatic Superelevation Overlay

The superelevation control lines are displayed on the superelevation diagram view in Roadway Designer. The control lines represent the percent cross slope (vertical axis) at each station (horizontal axis) for each point that is superelevated in the super range.

- 13. Toggle between *Superelevation* and *Normal* display mode to evaluate the design cross slopes vs. the existing conditions along the corridor.
- 14. In particular review station 231+50



InRoads has developed the design cross slope based on a theoretical superelevation solution. Due to the nature of this project it is necessary to minimize the amount of cross slope deviation between the design and existing conditions. The slope optimization tool lets a designer add overrides to the computed Superelevation solution.

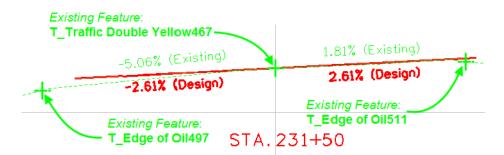
Developing a Slope Optimized Solution

For the following exercise, assume that the desired maximum delta cross slope has been determined to be a maximum of 1.0%.

- Slope optimization develops additional control lines based on modifications to the superelevation solution developed for the design. The new control line takes precedence over the original superelevation solution by automatically disabling the original solution.
- Slope optimization has to be developed independently for each lane or side of the roadway.
- Station ranges can be used to isolate curves or may be necessary based on the location of controlling features contained in the existing DTM.
- Slope optimization may be used whether the design templates contain overlay/ stripping components or not.

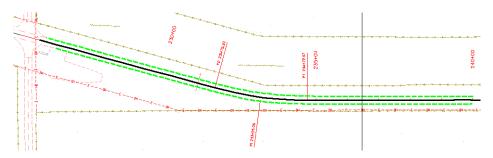
At each template application location the existing ground cross slope is determined by computing the delta elevation divided by the absolute distance between the existing pivot point and either a feature in the existing DTM or an alignment that represents the existing edge of pavement.

In the *Cross Slope Optimization* dialog, the alignments developed in labs 15.1 and 15.2 can be used as the *Existing Ground Cross Slope Definition*. However for this exercise, features that reside in the existing DTM will be used to illustrate an optional workflow.



By reviewing the physical location of features contained in the existing DTM it has been determined that a solution can be developed between station range 226+55 and 239+75 which encompasses a superelevated area of the design.

The left side of the roadway will be processed first followed by the right side.



1. In *Roadway Designer* toggle on *Display Mode:* Overlay.

Note: The display mode *must* be set to overlay to access the overlay toolset.

<u>k <</u>	236+00.00	> → + <	Process All
	25.00		Process Visible Range
	12345_Slope-Optimizatic	Display Mode:	 Normal Superelevation Overlay
			1.

2. In *Roadway Designer* Select Overlay Tools>Cross Slope Optimization.

Existing Ground Cross Slop	pe Definition	Optimizatio	n Parameters			Close
Existing Type:	Feature Name	 Slope T 	olerance :	1.00%		
Pivot Feature:	T_Traffic Double Yel		on Tolerance:			Preferences
Superelevated Feature:	T Edge of Oil497		Desirable Delta G:	0.00		Report
			Desirable Deita G:	1.00		Help
Design Cross Slope Defini	tion	Limits				
Design Type:	Control Line	▼ Station	n			
Control Line:	Section 1 Centerline-	✓ Start	t:	226+55.00	+	
		Stop):	239+95.00	+	
Calculate Correction	Reset Results					
aculte:						
lesults:	Class Desire Class	- Difference	Computed Class	- Dalka Davatia	Dalla	C
esults: Station Ground	Slope Design Slope	e Difference	Corrected Slope	e Delta Elevatio	on Delta	G
	Slope Design Slope	e Difference	Corrected Slope	e Delta Elevatio	on Delta	G
	Slope Design Slope	e Difference	Corrected Slope	e Delta Elevatio	on Delta	G
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	Slope Design Slope	e Difference	Corrected Slope	e Delta Elevatio	on Delta	G
	Slope Design Slop	e Difference	Corrected Slope	e Delta Elevatio	on Delta	G
	Slope Design Slope	e Difference	Corrected Slop	e Delta Bevatio	n Delta	G
	Slope Design Slop	e Difference	Corrected Slope	e Delta Elevatio	on Delta	G
	Slope Design Slope	e Difference	Corrected Slope	e Delta Elevatio	on Delta	G
	Slope Design Slop	e Difference	Corrected Slop	e Delta Elevatio	on Delta	G
	Slope Design Slop	e Difference	Corrected Slope	e Delta Elevatio	on Delta	G
Station Ground			Corrected Slope			G
djusted Cross Slopes:	Slope Design Slop Compared to the state of		Corrected Slope		n Detta a G Errors:	G
djusted Cross Slopes:		est	Corrected Slop			G (
djusted Cross Slopes:		est	Corrected Slop			G (

Enter the following criteria to define the Existing Ground Cross Slope Definition.

- 3. Existing Type: Feature Name
- 4. Pivot Feature: T_Traffic Double Yellow 467
- 5. Superelevated Feature: T_Edge of Oil497

For the *Design Cross Slope Definition* select the superelevation control line developed previously for the *left* edge of pavement.

- 6. Design Type: Control Line
- 7. Control Line: Section 1 Centerline-LT
- 8. Key in **1.00%** for the **Optimization Parameters Slope Tolerance**
- 9. Toggle on *Station Limits* and define limits *Start 226+55 Stop 239+50*

Existing Type: Pivot Feature:	Featur		opunizau	ion Parameters			Close
		re Name 🔻	Slope Tolerance:		1.00%		Preferences.
0 1 1 1 -	T_Trat	ffic Double Yel 👻	+ O Elevat	ion Tolerance:	0.00		Preferences.
Superelevated Feat	ature: T Ede	e of Oil497 ▼	+ Maximum	Desirable Delta G:			Report
	(1_205			Desirable Delta G:	1.00	6	Help
Design Cross Slope	e Definition		Limits			L	
Design Type:	Contro	l Line 🔹 👻	V Stati	on			
Control Line:	Castia	n1 Centerline- 🔻	Sta	art :	226+55.00	ا ه	
	Sectio	n i Centenine- •	17.0			+	
			Sto	op:	239+95.00	+	
Calculate Correctio	Reset	Results					
lesults:							
Station	Ground Slope	Design Slope	Difference	Corrected Slope	e Delta Elevation	Delta G	
	Ground Stope				Doite Lievelion	Deita G	
230+83.50 .	-4.29%	-2.00%	2.29%	-3.29%	0.13	0.26	
The second s							
231+00.00	-4.29%	-2.00%	2.29%	-3.29%	0.13	0.26	
231+00.00 231+25.00	-4.29% -4.49%	-2.00% -2.00%	2.29% 2.49%	-3.29% -3.49%	0.13 0.13	0.26 0.15	
231+00.00 · 231+25.00 · 231+34.50 ·	-4.29% -4.49% -4.81%	-2.00% -2.00% -2.00%	2.29% 2.49% 2.81%	-3.29% -3.49% -3.81%	0.13 0.13 0.13	0.26 0.15 0.15	
231+00.00 231+25.00 231+34.50 231+50.00	-4.29% -4.49% -4.81% -4.93%	-2.00% -2.00% -2.00% -2.00%	2.29% 2.49% 2.81% 2.93%	-3.29% -3.49% -3.81% -3.93%	0.13 0.13 0.13 0.13 0.13	0.26 0.15 0.15 0.14	
231+00.00 231+25.00 231+34.50 231+50.00 231+75.00	-4.29% -4.49% -4.81% -4.93% -5.06%	-2.00% -2.00% -2.00% -2.00% -2.61%	2.29% 2.49% 2.81% 2.93% 2.45%	-3.29% -3.49% -3.81% -3.93% -4.06%	0.13 0.13 0.13 0.13 0.13 0.13	0.26 0.15 0.15 0.14 0.10	
231+00.00 231+25.00 231+34.50 231+50.00 231+75.00 232+00.00	-4.29% -4.49% -4.81% -4.93% -5.06% -5.27%	-2.00% -2.00% -2.00% -2.00% -2.61% -3.59%	2.29% 2.49% 2.81% 2.93% 2.45% 1.68%	-3.29% -3.49% -3.81% -3.93% -4.06% -4.27%	0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13	0.26 0.15 0.15 0.14 0.10 0.10	
231+00.00 231+25.00 231+34.50 231+50.00 231+75.00 232+00.00 232+25.00	-4.29% -4.49% -4.81% -5.06% -5.27% -5.65%	-2.00% -2.00% -2.00% -2.00% -2.61% -3.59% -4.57%	2.29% 2.49% 2.81% 2.93% 2.45% 1.68% 1.08%	-3.29% -3.49% -3.81% -3.93% -4.06% -4.27% -4.65%	0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13	0.26 0.15 0.15 0.14 0.10 0.10 0.10	
231+00.00 - 231+25.00 - 231+34.50 - 231+50.00 - 231+75.00 - 232+00.00 - 232+25.00 - 232+36.50 -	-4.29% -4.49% -4.81% -5.06% -5.27% -5.65% -6.11%	-2.00% -2.00% -2.00% -2.00% -2.61% -3.59% -4.57% -5.55%	2.29% 2.49% 2.81% 2.93% 2.45% 1.68% 1.08% 0.56%	-3.29% -3.49% -3.81% -3.93% -4.06% -4.27% -4.65% -5.55%	0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13	0.26 0.15 0.15 0.14 0.10 0.10 0.10 0.18 0.43	

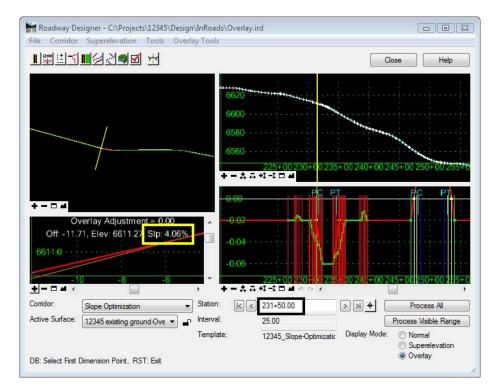
10. **<D>** *Calculate Correction* a solution is presented.

- 11. Use the navigation arrows to move between the *Adjusted Cross Slopes* or to the largest adjustment.
- 12. Navigation arrows also exist to review any *Delta G* values that exceed the desirable maximum between stations. This value is not used for computing Corrected Slopes and is used for reporting only.
- 13. Review station **231+50**. The *Corrected Slope* (-4.06%) is equal to the existing *Ground Slope* (-5.06%) less the specified *Slope Tolerance* (1.0%).
- 14. Select **Report** to generate an XML report for the solution. Dismiss the report after reviewing.
- **Note:** If it's determined the solution is not valid, selecting **Rest Results** will clear the results grid.

Note the *Corrected Slope* column. New cross slopes have been computed based on the existing conditions cross slope and the allowable *Slope Tolerance*. Edits to the corrected values can be made at this time if necessary. Once the new control line is saved edits can also be made to the new control line as with any other superelevation control line. Also note that the solutions are applied at template locations as defined in the corridor. As you navigate between station entries, the *Roadway Designer* views synchronize and both the original and the new control line are displayed in the superelevation diagram window.



- 15. Under New Control Line, select Section Name: Section 1.
- 16. For *Control Line Name*: Key in *Slope-Opt_Lt_Laneline*.
- 17. **<D>** *Create*.



- 18. Review the new control line in the superelevation view and as point controls.
- 19. The **Superelevation>Superelevation Report** command can also be used to review the results. When creating reports include *Control Line Definitions* to verify which control line is being reviewed.

20. Select **Corridor>Point Controls** to view the added control line. Note that is automatically enabled and the original superelevation control line is disabled.

Corrido	or: Slop	pe Optimization							Add
Point: Mod H Contro Horizo	le Iorizontal I Type: Intal Aligr	Centerlin	⊘ Both t •	y → Sta Sto Ho y → Sta Sto	ation Limits nt: 205+0 p: 259+0 nizontal Of nt: 0.00 p: 0.00 rtical Offse	0.00 0.00 fsets	+ + +		Close Change Help
					art: 0.00]	+		
		1 Vertical Controls:			art: 0.00 pp: 0.00	;	ф ф		
Priority Horizo En	ntal and				pp; 0.00	Type			Description
Horizo	ntal and	Vertical Controls:	Start Sta 203+80.28 203+80.28	Stop Sta 260+43.16 260+43.16	Mode Vertical	Type Superelevatio Superelevatio	Control Section 1 Center Section 1 Center	rtine-LT_Laneline:Cen. rtine-RT_Laneline Ce Laneline:Centertine	

- 21. *Repeat* steps 2 thru 15 to develop the solution for the right side of the roadway using the following input changes:
 - Existing Ground Cross Slope Definition: Superelevated Feature: **T_Edge of Oil511**
 - Design Cross Slope Definition: Control Line: Section1 Centerline-RT_Laneline

	d Cross Slope Definiti		Optimizatio	on Parameters			Close	
Existing Type:	Featur	e Name 🔹	Slope 1	olerance:	1.00%	P	references.	
Pivot Feature:		fic Double Yel 🔻	🔶 🔘 Elevatio	on Tolerance:	0.00		Report	
Superelevated	Superelevated Feature: T_Edge of Oil511 -		Haximum [Desirable Delta G:	1.00			
Design Cross S	lana Definition		Limits				Help	
Design Cross 3 Design Type:	Contro	lline 🔻	V Statio	n				
Control Line:	(anima	n1 Centerline- 🔻	Star	t:	226+55.00	+		
	00000	TT CONCOLUTE	Stop		239+95.00			
			0.01	1.	239+95.00	+		
Calculate Corre	ection Reset	Results						
Calculate Corre	Reset	Results						
Results:			Difference	Corrected Slope	Delta Flevation	Delta G		
Results: Station	Ground Slope	Design Slope	Difference	Corrected Slope	Delta Elevation	Delta G		
Results: Station 231+50.00	Ground Slope	Design Slope						
Results: Station 231+50.00 231+75.00	Ground Slope	Design Slope	0.80%	2.61%	0.10	0.47		
Results: Station 231+50.00 231+75.00 232+00.00	Ground Slope 1.81% 2.52%	Design Slope 2.61% 3.59%	0.80% 1.07%	2.61% 3.52%	0.10 0.13	0.47 0.44		
Calculate Corre Results: Station 231+50.00 231+75.00 232+00.00 232+25.00 232+36.50	Ground Slope 1.81% 2.52% 2.89%	Design Slope 2.61% 3.59% 4.57%	0.80% 1.07% 1.68%	2.61% 3.52% 3.89%	0.10 0.13 0.13	0.47 0.44 0.18		
Results: Station 231+50.00 231+75.00 232+00.00 232+25.00 232+36.50	Ground Slope 1.81% 2.52% 2.89% 3.12%	Design Slope 2.61% 3.59% 4.57% 5.55%	0.80% 1.07% 1.68% 2.43%	2.61% 3.52% 3.89% 4.12%	0.10 0.13 0.13 0.13	0.47 0.44 0.18 0.11		
Results: Station 231+50.00 231+75.00 232+00.00 232+25.00	Ground Slope 1.81% 2.52% 2.89% 3.12% 3.22%	Design Slope 2.61% 3.59% 4.57% 5.55% 6.00%	0.80% 1.07% 1.68% 2.43% 2.78%	2.61% 3.52% 3.89% 4.12% 4.22%	0.10 0.13 0.13 0.13 0.13 0.13	0.47 0.44 0.18 0.11 0.10		
Results: Station 231+50.00 231+75.00 232+00.00 232+25.00 232+25.00 232+36.50 232+50.00	Ground Slope 1.81% 2.52% 2.89% 3.12% 3.22% 3.22%	Design Slope 2.61% 3.59% 4.57% 5.55% 6.00% 6.00%	0.80% 1.07% 1.68% 2.43% 2.78% 2.78%	2.61% 3.52% 3.89% 4.12% 4.22% 4.22%	0.10 0.13 0.13 0.13 0.13 0.13 0.13 0.13	0.47 0.44 0.18 0.11 0.10 0.00		
Results: Station 231+50.00 231+75.00 232+00.00 232+25.00 232+36.50 232+50.00 232+75.00	Ground Slope 1.81% 2.52% 2.89% 3.12% 3.22% 3.22% 3.21%	Design Slope 2.61% 3.59% 4.57% 5.55% 6.00% 6.00% 6.00%	0.80% 1.07% 1.68% 2.43% 2.78% 2.78% 2.78% 2.79%	2.61% 3.52% 3.89% 4.12% 4.22% 4.22% 4.22% 4.21%	0.10 0.13 0.13 0.13 0.13 0.13 0.13 0.13	0.47 0.44 0.18 0.11 0.10 0.00 0.01		

• New Control Line: Control Line Name: Slope-Opt_RT_Laneline

- 22. Review the results as in steps 16-18.
- 23. Once the results have been reviewed and confirmed save the roadway definition.
- 24. From the Roadway Designer menu bar, select **File > Save**.
- 25. In the File name field of the Save As dialog box, key in 12345_DES_Overlay.IRD

Section Summary:

- The width of the template can be controlled by adding additional point controls or through the use of parametric constraints.
- Slope Optimization can be used to create a design surface that is vertically offset but constrained (parallel or within a delta tolerance) to existing conditions.
- A superelevation control line is not a requirement. If matching existing grade, a Design Cross Slope of any value can be input. With Slope Tolerance set to 0% the Corrected Slope will match existing conditions.
- An Elevation Tolerance can be used in place of a slope tolerance.
- Review the point controls created in Roadway Designer. Those created by the Cross Slope Optimization tool should be active and the control lines created by the superelevation control wizard should not be enabled.
- Look for and resolve any conflicting point controls (shown in orange).
- Cross Slope Optimization can be used on any template.

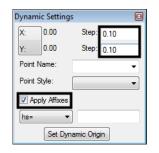
Lab 25.5 - Creating a Overlay/Stripping Template with Widening

The goal of this lab is to overlay the existing roadway and add paved shoulders outside the existing pavement. In Labs 15.1 & 15.2 alignments were created that represent the existing pavement edges. These alignments will be used as horizontal point controls to maintain the existing pavement width.

Note: Stripping and milling are interchangeable terms. They both refer to the uniform removal of some amount of pavement material from an existing roadway. InRoads menus and reference material use the term stripping.

Section Objectives:

- A 2" pavement overlay is required.
- Existing pavement cross slopes will be maintained.
- Existing pavement can be stripped to a depth of 1".
- Pavement leveling using a material that differs from the overlay course is necessary.
- 8' paved shoulders will be added to the outside of the existing pavement.
- 1. Key in *12345_Overlay* for the template name.
- 2. Key in 2" overlay with 1" milling & pavement widening for the description.
- 3. Display the **Dynamic Settings** dialog box.
- 4. Key in *0.10* for the *X* and *Y Steps*.
- 5. Toggle on Apply Affixes.



6. **<R>** in the template view and select **Add New Component > Simple** from the right click menu.

Add New Component	+	Simple
Set Dynamic Origin	Ctrl-D	Constrained Unconstrained
		Null Point
		End Condition

- 7. In the *Current Component* area, key in *HMA_Overlay* for the *Name*.
- 8. Select **D_HMA_Pvmt** for the *Style*.

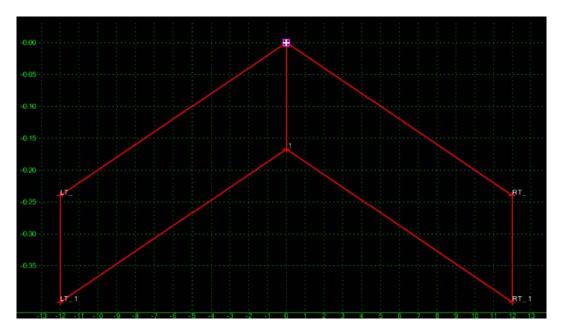
9. Key in *0.1667* for the *Thickness*. Note: this will round to 0.17 in the dialog box.

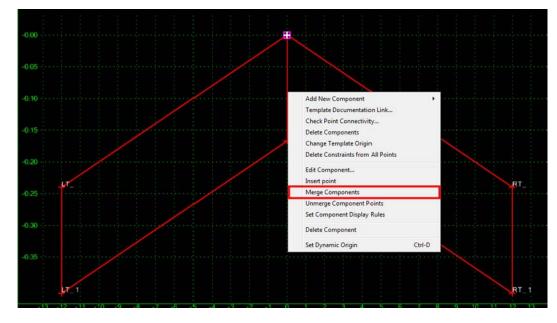
•		Style:	D_HMA_Pvmt
Slope:	-2.00%		
Thickness:	0.17		
Width:	12.00		

10. **<R>** in the template view and select **Mirror** from the right click menu.



11. **<D>** on the template origin. This creates the two components shown in the illustration below.



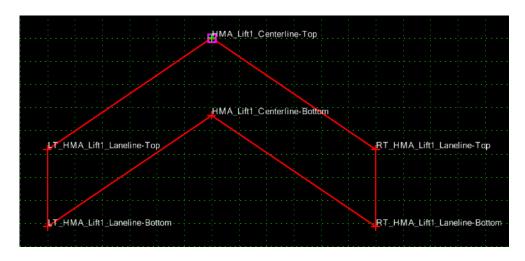


12. **<R>** on the vertical line in the center of the template and select **Merge Components** from the right click menu.

- 13. <D> <D> on the centerline point of the template to display the *Point Properties* dialog box.
- 14. In the *Point Properties* dialog box, select **HMA_Liftx_Centerline-Top** in the *Name* field. This also sets the *Surface Feature Style* to **Centerline**.
- 15. Change the *x* to a **1** in the *liftx* part of the name.
- 16. **<D> Apply** to accept the change.

Maint Properties		×
Name:	HMA_Lift1_Centerline-T 👻 🕂	Apply
Feature Name Override:		Close
Surface Feature Style:	Centerline -	< Previous
Alternate Surface:	-	Next >
	Member of:	Help
	RT_HMA_Overlay	
-		
Constraints Constra	int 1 Constraint	2
Type: None	▼ None	-
Label:		
Style Constraint:	· · · · · · · · · · · · · · · · · · ·	
Horizontal	Vertical 💿 Both	
Range: 0.00		

- 17. **<D>** the **Next** button to select the center bottom point (*1*).
- 18. Select HMA_Liftx_Centerline-Top in the Name field.
- 19. **<D> Apply** to accept the change.
- 20. **<D>** the **Next** button to select the right top point (RT_{-}).
- In the same manner as done in steps 22 and 26, change the name of the point to *RT_HMA_Lift1_Laneline-Top*.
- 22. **<D> Apply** to accept the change.
- 23. **<D>** the **Next** button to select the right bottom point (*RT_1*).
- 24. Change the name of the point to *RT_HMA_Lift1_Laneline-Bottom*.
- 25. **<D> Apply** to accept the change.
- 26. **<D>** the **Next** button to select the right top point (LT_{-}) .
- 27. In the same manner as done in steps 22 and 26, change the name of the point to *LT_HMA_Lift1_Laneline-Top*.
- 28. **<D> Apply** to accept the change.
- 29. **<D>** the **Next** button to select the right bottom point (*LT_1*).
- 30. Change the name of the point to LT_HMA_Lift1_Laneline-Bottom.
- 31. **<D> Apply** to accept the change.
- 32. **<D> Close** to dismiss the *Point Properties* dialog box. The template looks like the illustration below:



Now the shoulders and end conditions are added.

33. Expand the template library to show the contents of the 2 - Sections - Pavement > Shoulder Sections > Hot Mix Asphalt folder.

- Template Library: C:\Projects\12345\Design\InRoads\DES12345_Ter Point Name List 💼 1 - Templates CONC_Divided_TypeA_4Lane → CONC_Ramp ➤ HMA_Crowned_B10 → HMA_Divided_TypeA_4Lane HMA_Full_Depth_Widening_2Lane → HMA_Urban_4Lane 12345 Overlay 2 - Sections - Pavement Curb & Gutter Sectio Driving Lane Sections Shoulder Sections 🖥 Hot Mix Asphalt HIMA IDEID ulder_2Lifts-12z HMA_Inside_Shoulder_3Lifts-12z HMA_Inside_Shoulder_4Lifts-12z HMA Inside Shoulder 5Lifts-12z HMA Outside Shoulder 2Lifts-12 KINA_Outside_Shoulder_3Lifts-12z HMA_Outside_Shoulder_4Lifts-12z HMA_Outside_Shoulder_5Lifts-12z 3 - Sections - End Conditions 4 - Components
- 34. **<D>** on the **HMA_Outside_Shoulder_3Lifts-12z** section.

- 35. In the Preview window, **<D>** and hold on the shoulder's origin (the upper left point).
 - Create Template File Edit Add Tools Template Library: Current Template Display Close Name C:\Projects\12345\Design\InRoads\DES12345_ . Components Constraints 12345 Overlay Point Name List Help Description V Display Point Names CONC_Divided_TypeA_4Lane
 CONC_Ramp Display Al Components HMA_Crowned_B10 HMA_Divided_TypeA_4Lane HMA_Lift1_Centerline-Top 0:00 >> HMA_Full_Depth_Widening_2Lane K HMA Urban 4Lane 12345_Overlay 2 - Sections - Pavement 0.10 Curb & Gutter Sections Driving Lane Sections Median Sections 0.15 HMA_Lift1_Centerline-Botton Shoulder Sections 0.20 Concrete Hot Mix Asphalt HMA Lift1 Laneline-Top RT I >> HMA_Inside_Shoulder_2Lifts-12z -0.25 >>> HMA_Inside_Shoulder_3Lifts-12z >>> HMA_Inside_Shoulder_4Lifts-12z 0:30 HMA_Inside_Shoulder_5Lifts-12z
 HMA_Outside_Shoulder_2Lifts-1; 0.35HMA_Outside_Shoulder_3Lifts-1: HMA_Lift1_Laneline-Bottom 4 . ЗТ. Library Active Template +-++++===+++++= Test....
- 36. Drag and drop the section onto the **RT_HMA_Lift1_Laneline-Top** point.

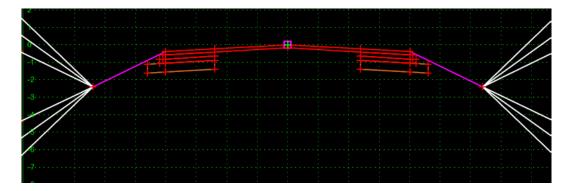
Note: Because *Mirror* was turned on when placing the overlay component, both shoulders are now placed in the template.

- 37. **<D> <D> on the RT_HMA_Lift1_EOP-Top** point to display the *Point Properties* dialog box.
- The shoulders should be 8' wide. Change the *Value* of the *Horizontal* constraint (*Constraint 1* in this example) to *8.00*.
- 39. Change the *Slope* constraint (*Constraint 2* in this example) to a **Vector-Offset** *Type*.
- 40. Set the *Parent 1* to HMA_Lift1_Centerline-Top.
- 41. Set the *Parent 2* to **RT_HMA_Lift1_Laneline-Top**.

🐂 Point Properties		×
Name:	RT_HMA_Lift1_EOP-Tc 👻 💠	Apply
Feature Name Override:	RT_HMA_Lift1_EOP-Top	Close
Surface Feature Style:	D_EOP	< Previous
Alternate Surface:	-	Next >
	Member of:	Help
	RT_HMA_Shldr_Lift1	
Constraints	int 1 Constraint	2
Type: Horizontal	✓ Vector-Offset	- -
Parent 1: RT_HMA_I	Lift1_Lan 👻 🕈 HMA_Lift1_Ce	enterlin 🔻 🕂
Parent 2:	RT_HMA_Lift	1_Lan 🔻 🕈
Value: 8.00	0.00	
Label: EOP-Top-H	loriz 👻	•
Style Constraint:	· · · ·	
(Horizontal	Vertical O Both	
Range: 0.00		
0.00		

- 42. Repeat for point LT_HMA_Lift1_EOP-Top, using the corresponding points from the left side of the template. Remember to use -8.00 for the value of the horizontal constraint.
- 43. **<D> Apply** and then **<D> Close** to dismiss the *Point Properties* dialog box.
- 44. Expand the template library to show the contents of the 3 Sections End Conditions> Z-Slope End Conditions > High Speed End Conditions folder.
- 45. **<D>** on the **Z12_6_to_1** section.
- 46. In the Preview window, **<D>** and hold on the section's origin (the upper left point).
- 47. Drag and drop the section onto the **RT_HMA_Lift1_EOP-Top** point.
- 48. This completes the template. Select **File > Save** from the *Create Template* menu bar.
- 49. **<D> Close** to dismiss the *Create Template* dialog box.

The illustration below shows the completed template:



Section Summary:

- By using the vector offset constraint the shoulders will maintain the same slope as the overlay section.
- Once the right click options of Mirror and Reflect are turned on, they remain active until they are turned off.

Lab 25.6 - Creating the Overlay Corridor

Finally, a corridor is constructed using the alignments and template developed earlier.

Section Objectives:

- Create a corridor for the SH 86 alignment.
- Add a template drop using the widening and overlay template.
- Add point controls using the edge of pavement and SH 86 alignments.
- Review the results in Roadway Designer.
- Add a superelevation solution to the corridor.
- Refine the corridor using Cross Slope Optimization.
- Add a Leveling course to the template.
- Add a stripping course to the template.
- Add vertical alignment adjustments.
- Regress the refined vertical alignment.
- Apply the regressed vertical alignment to the corridor.

This corridor will contain a single template drop along with point controls. Horizontal controls will define the width of the overlay section. Vertical controls will be generated initially through superelevation and ultimately refined by cross slope optimization. Overlay and stripping criteria will be defined to adjust and smooth the vertical alignment.

- 1. From the InRoads menu bar, select **Modeler > Roadway Designer**.
- 2. If not already set, toggle Display Mode: to Normal
- 3. In the *Roadway Designer* dialog box, select **Corridor > Corridor Management** from the menu bar.

- 4. In the *Manage Corridors* dialog box, key in *Overlay Project* for the *Name*.
- 5. Set Surface Symbology: D_ROADWAY-Asphalt
- 6. Set Horizontal Alignment: SH 86
- 7. Set *Vertical Alignment:* SH 86_Existing-V
- 8. Toggle on Station Limits.
- 9. Key in *205+00.00* for the *Start* station.
- 10. Key in *259+00.00* for the *Stop* station.
- 11. **<D>Add** then **<D> Close** to dismiss the dialog box.

🕌 Manage Corri	idors			- • •
Name: Overlay P	roject		imits V Station	Add
Туре:	Alignment	-	Start:	Close
Horizontal Alignme	ent: SH 86	+	205+00.00	+ Change
Vertical Alignment	01100_04	sting-V 👻	Stop: 259+00.00	Сору
PI Rounding Tang	gent: 0.00		259+00.00	Copy From
Corridors:				Help
Name	Туре	Source Name	Start Station	Stop Station
Overlay Project	Alignment	SH 86	205+00.00	259+00.00
				Delete

- 12. In the *Roadway Designer* dialog box, select **Corridor > Template Drops** from the menu bar.
- 13. In the *Template Drops* dialog box, key in *25.00* for the *Interval*.
- 14. Expand the C:\Projects\12345\Design\InRoads\DES12345_Templates-Overlay template library to show the contents of the 1 - Templates folder.
- 15. Highlight the **12345_Overlay** template.

<D> the Add button then <D> the Close button to dismiss the *Template Drops* dialog box.

🔚 Templa	ate Drop	05			- • •
Corridor:	Overlay	Project	•		Add
Station:	205+00	.00		+	Close
Interval:	25.00			+	Change
Library Ter	nplates:				
	Temple 1234! CONC CONC CONC CONC CONC CONC HMA HMA HMA HMA	5_Overlay Type/A C_Ramp Crowned_B10 Divided_TypeA_ Full_Depth_Wid	_4 =		Copy Help
Station	Inter	Template	Revi	Library	
204+00:		12345_Overlay	ITL	C:\Projec	belete
Coynemion	neo mur	Lordiy		Lon	/

The template is now displayed in the cross section view. Next, point controls are added to make the design template match the width of the existing roadway.

Lab 25.7 - Horizontal Point Controls

Before assigning horizontal controls to the template points, for visual reference, display the controlling elements in the roadway designer views.

1. In the *Roadway Designer* dialog box, select Corridor > Display References

Add the alignments Lt_EOP and Rt_EOP created earlier in this chapter that represent the left and right edges of existing pavement.

Surface:	: Rt_EC	5 existing gro			Change
Feature:	T_Bill	board Over 1	0f 👻 🗄	-	Help
 Filter: Display as 		amed> Way	Ŧ		
Limits					
Start:	203+8	30.28	-	þ-	
Stop:	260+4	43.16	-	Þ	
isplay Refere	nces:				
	Name	Right of	Start S	it S	top Sta
-	t_EOP t_EOP	False False			

2. Add alignments *Lt_EOP* and *Rt_EOP* as displayed references.

<D> the Add button then <D> the Close button to dismiss the *Display References* dialog box.

The alignments are displayed in Roadway Designer.

8.0	Lt_EOP	Rt_EOP —
27:5 · · · · ·		
		-
9		
.0		

- 4. In the *Point Controls* dialog box, set the Point to **RT_HMA_Lift1_Laneline-Top**.
- 5. Toggle on **Horizontal** for the *Mode*.
- 6. Select **Rt_EOP** for the *Horizontal Alignment*.
- 7. Add Control Description: Horizontal location for right lane
- 8. **<D>** the **Add** button.
- 9. In the *Point Controls* dialog box, set the Point to LT_HMA_Lift1_Laneline-Top.
- 10. Select Lt_EOP for the *Horizontal Alignment*.
- 11. Add Control Description: Horizontal location for left lane

Point Controls	
Corridor: Overlay Project Point: RT_HMA_Lift1_Lanr	Station Limits Add Stati: 205+00.00 + Stop: 259+00.00 +
Control Type: Horizontal Alignment: Rt_EOP + Vertical Alignment: Rt_EOP + Use as Secondary Alignment Priority: Horizontal and Vertical Controls:	Horizontal Offsets Help Start: 0.00 + Stop: 0.00 + Vertical Offsets
En Pri Name Start Stati Stop Sta	ati Mode Type Control
X 1 HMA_Lft1205+00.00 259+00.0 X 1 RT_HMA_L205+00.00 259+00.0	
	Delete

12. **<D>** the **Add** button the **<D> Close** to dismiss the Point Controls dialog box.

This completes the corridor definition. Now the corridor can be reviewed in Roadway Designer.

13. Scroll through the template drops using the station controls under the cross section view. Notice that the template width matches the horizontal location of the existing pavement.

6622:5 · · · ·	· · · · · · · · · · · · · · · · · · ·		
6622.0		 	
	Point		
6621:5 · · · ·	Name: LT_HMA_Lift1_Laneline-Top 		
	Offset: -12.52		
6621:0 · · · ·	Elevation: 0622.04 Constraints:		
	Slope		
6620:5 · · · ·	Horizontal		

The template has been constrained to match the width of the existing pavement. Next Cross Slope Optimization will be used to match the existing pavement cross slope. First superelevation control lines will be created. These superelevation control lines will overwritten by new control lines developed using cross slope optimization.

Use the Superelevation Wizard:

14. Select Superelevation > Create Superelevation Wizard > Table from *the Roadway Designer* menu bar.

signer - C:\Projects\12345\Design\InRoads\12345_Corr.ir Superelevation Tools Overlay Tools	rd
	AASHTO
Create Single Control Line	Fixed Length
Apply Shoulder Rollover Lock	Table
Import Superelevation Import Superelevation from Alignment	4 · · · · ·

 In the Table Wizard dialog box, select the desired super table. These are located in the C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\Superelevation Tables\AASHTO 2004\ folder.

🙀 Open Superele	evation Table							×
Look jn:	🐌 AASHTO 2	004	-	6	٢	Þ	▼	
Recent Places	Name 06_25.sup 06_30.sup 06_35.sup 06_40.sup 06_45.sup 06_50.sup	Date modified	Туре	Size				A III
Todd Todd Computer	06_55.sup 06_65.sup 08_15.sup 08_20.sup 08_25.sup							-
Network	File <u>n</u> ame: Files of <u>type</u> :	06_55.sup Superelevation	Table (*.sup)			•		<u>]pen</u> ancel <u>H</u> elp

- 16. Select *06-55.sup* and **<D>** the **Open** button.
- 17. **<D>** the **Load Values From Table** button.

	Table: dards-Global \InRoads\Superelevation Tables\AASHTO 2004\06_55 sup % Runoff on Tangent 60% % Specify Runout: 0.00 Transition Lengths Are:							
	Non-Linear Curve	0.00	0	Runoff 🔘 To	otal Transition			
ID	Start Station	Stop Station	Superelevati	Table	Design			
1 2	231+75.30 248+08.02	234+72.97 252+90.13	6.00% 4.40%	06_55.sup 06_55.sup	0.00 0.00			

The rate values are read from the table and updated for each horizontal curve set listed in the dialog box or highlighted.

18. **<D> Next**.

						Help
ections:						
Name	Start Stati	Stop Stati	Crown Po	Left Rang	Right Ra	Pivot Direc
			_			
				Add	Edit	Delete
-	ion for Selected S			5. P. M. Z		
Start Stati.	Stop Stati	Entering	Exiting R	Width fro	Superelevati	ion Hate
						Edit
	< Bac	k N	ext > P	eferences	Close	E dit

 <D> the ADD button on the Superelevation Section Definitions pane. This displays the Add Superelevation Section dialog box.

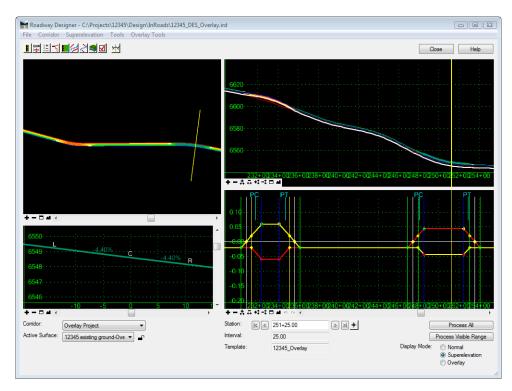
H Add Supereleve	ation Section		×
Name:	Section1		ОК
🔲 List all backbone	e points	_	Cancel
Crown Point:	HMA_Lift1_Centerlin 🔻	ŧ	Help
Left Range Point:	LT_HMA_Lift1_Lane 🔻	+	
Right Range Point:	RT_HMA_Lift1_Lan	+	
Pivot Direction:	From Crown Point -		
Number of lanes:	Two O Four		
Runoff Length Multi	plication Factor: 1.00		
Limits Station			
Start:	203+80.28	+	
Stop:	260+43.16	-	

- 20. Use the drop down menu or the target \clubsuit button to select the *Crown Point:* **HMA_Lift1_Centerline**.
- 21. Use the drop down menu or the target button to select the *Left Range Point:* LT_ HMA_Lift1_Laneline.
- 22. Use the drop down menu or the target button to select the *Right Range Point:* **RT_HMA_Lift1_Laneline.**
- 23. **<D>** OK

24. **<D> Next** on the *Superelevation Section Definitions* pane. This displays the *Superelevation Controls* pane.

H	Superelevation	n Controls		- • •
:	Section:	Section1	-	Help
1	Superelevation Co	ontrols:		
	Name	Point	Pivot Point	Initial SI
		LT_HMA_Lift1_Laneline-Top RT_HMA_Lift1_Laneline-Top	HMA_Lift1_Centerline-1 HMA_Lift1_Centerline-1	
	•			÷.
	Round Static	n to Nearest: 0+00.00	Edit	Delete
	<	Back Finish Pr	references Close	

- 25. **<D> Finish**. This completes the development of the initial superelevation control lines.
- 26. Review the computed superelevation in the Roadway Designer views and by selecting *Corridor>Point Controls*.



Lab 25.8 - Optimize the Overlay Corridor

Now Cross Slope Optimization will be used to related the template cross slopes to the existing pavement cross slopes.

1. In *Roadway Designer* toggle on *Display Mode:* Overlay.

Note: The display mode *must* be set to overlay to access the overlay tools.

2. In *Roadway Designer* Select Overlay Tools>Cross Slope Optimization.

Enter the following criteria to define the *Existing Ground Cross Slope Definition*.

- 3. Existing Type: Alignment
- 4. Pivot Alignment: Lt_EOP

For the *Design Cross Slope Definition* select the superelevation control line developed previously for the *left* edge of pavement.

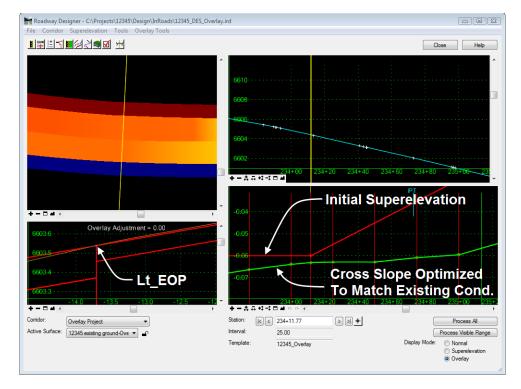
- 5. Design Type: Control Line
- 6. Control Line: Section1 HMA_Lift1_Centerline-Top-LT_HMA_Lift1_Laneline-Top
- 7. Key in **0.00%** for the **Optimization Parameters Slope Tolerance**
- 8. **<D>** *Calculate Correction* a solution is presented.

Existing Groun	d Cross Slope Definiti	on	Optimizatio	on Parameters		Clo	se
Existing Type:	Alignm	ient 🔻	Slope 1		0.00%		2.2
Pivot Alignmen	t: SH 86	•	1	L		Preferen	nces.
Superelevated			0.00		Repo	ort	
Superelevateu	Alignment:	P 🔻	- Maximum I	Desirable Delta G:	1.00	He	la.
Design Cross S	Slope Definition		Limits			Не	яр
Design Type:	Contro	l Line 🔹 🔻	C Statio	n			
Control Line:	Sectio	n 1 HMA_Lift 1 🔻	Sta	rt - F	203+80.28	+	
	Land the second	,	Sto		260+43 16	+	
19210 - 1920 - SA				E L	200443.10	<u></u>	
Calculate Com	Report	Regulte					
Calculate Com	Reset	Results					
Results:					-		
Results: Station	Ground Slope	Design Slope	Difference	Corrected Slope		Delta G	
Results: Station 205+00.00	Ground Slope -1.78%	Design Slope -2.00%	-0.22%	-1.78%	0.00		
Results: Station 205+00.00 205+25.00	Ground Slope -1.78% -1.14%	Design Slope -2.00% -2.00%	-0.22% -0.86%	-1.78% -1.14%	0.00 0.00	0.32	
Results: Station 205+00.00 205+25.00 205+50.00	Ground Slope -1.78% -1.14% -1.48%	Design Slope -2.00% -2.00% -2.00%	-0.22% -0.86% -0.52%	-1.78% -1.14% -1.48%	0.00 0.00 0.00	0.32 0.17	
Results: Station 205+00.00 205+25.00 205+50.00 205+75.00	Ground Slope -1.78% -1.14% -1.48% -1.88%	Design Slope -2.00% -2.00% -2.00% -2.00%	-0.22% -0.86% -0.52% -0.12%	-1.78% -1.14% -1.48% -1.88%	0.00 0.00 0.00 0.00	0.32 0.17 0.21	
Results: Station 205+25.00 205+50.00 205+50.00 205+75.00 206+00.00	Ground Slope -1.78% -1.14% -1.48% -1.88% -2.33%	Design Slope -2.00% -2.00% -2.00% -2.00% -2.00% -2.00%	-0.22% -0.86% -0.52% -0.12% 0.33%	-1.78% -1.14% -1.48% -1.88% -2.33%	0.00 0.00 0.00 0.00 0.00 0.00	0.32 0.17 0.21 0.23	
Results: Station 205+00.00 205+25.00 205+50.00 205+75.00 206+00.00 206+25.00	Ground Slope -1.78% -1.14% -1.48% -1.48% -2.33% -2.77%	Design Slope -2.00% -2.00% -2.00% -2.00% -2.00% -2.00% -2.00%	-0.22% -0.86% -0.52% -0.12% 0.33% 0.77%	-1.78% -1.14% -1.48% -1.88% -2.33% -2.77%	0.00 0.00 0.00 0.00 0.00 0.00 0.00	0.32 0.17 0.21 0.23 0.23	
Results: Station 205+00.00 205+25.00 205+50.00 205+75.00 206+00.00 206+25.00 206+50.00	Ground Slope -1.78% -1.14% -1.48% -2.33% -2.77% -3.20%	Design Slope -2.00% -2.00% -2.00% -2.00% -2.00% -2.00% -2.00% -2.00% -2.00%	-0.22% -0.86% -0.52% -0.12% 0.33% 0.77% 1.20%	-1.78% -1.14% -1.48% -1.88% -2.33% -2.77% -3.20%	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.32 0.17 0.21 0.23 0.23 0.23	
Results: Station 205+00.00 205+25.00 205+50.00 205+75.00 206+00.00 206+25.00 206+25.00 206+25.00 206+25.00 206+25.00 206+25.00 206+25.00 206+50.00	Ground Slope 1.78% -1.14% -1.48% -1.88% -2.33% -2.77% -3.20% -3.53%	Design Slope -2.00% -2.00% -2.00% -2.00% -2.00% -2.00% -2.00% -2.00% -2.00%	0.22% 0.86% 0.52% 0.12% 0.33% 0.77% 1.20% 1.53%	-1.78% -1.14% -1.48% -1.88% -2.33% -2.77% -3.20% -3.53%	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.32 0.17 0.21 0.23 0.23 0.23 0.17	
Results: Station 205+00.00 205+25.00 205+50.00 205+75.00 206+00.00 206+25.00 206+50.00	Ground Slope -1.78% -1.14% -1.48% -2.33% -2.77% -3.20%	Design Slope -2.00% -2.00% -2.00% -2.00% -2.00% -2.00% -2.00% -2.00% -2.00%	-0.22% -0.86% -0.52% -0.12% 0.33% 0.77% 1.20%	-1.78% -1.14% -1.48% -1.88% -2.33% -2.77% -3.20%	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.32 0.17 0.21 0.23 0.23 0.23	

Note the values in columns Ground Slope & Corrected Slope match indicating the design cross slope now matches existing conditions.

Existing Type: Pivot Feature: Superelevated Feature:		e Name 🔻		tion Parameters			Close
	T Traf			Tolerance:	1.00%	1	Preferences
Superelevated Feature:	1_11ai	fic Double Yel 🔻	+ 💮 Eleva	tion Tolerance:	0.00		
	T_Edg	e of Oil497 👻	+ Maximum	Maximum Desirable Delta G: 1.			Report
Design Cross Slope Definit	ion		Limits				Help
Design Type:	Contro	l Line 🔹 🔻	V Stat	ion			
Control Line:	Section	n1 Centerline- 🔻	St	Start: 226+		+	
			St	op:	239+95.00	+	
Calculate Correction	Reset F	Results					
Results:							
Station Ground	Slope	Design Slope	Difference	Corrected Slope	e Delta Elevation	Delta G	5
230+83.50 -4.29%		-2.00%	2.29%	-3.29%	0.13	0.26	
231+00.00 -4.49%		-2.00%	2.49%	-3.49%	0.13	0.15	
			Contraction of the second s				
231+25.00 -4.81%		-2.00%	2.81%	-3.81%	0.13	0.15	
		-2.00%	2.81%	-3.81% -3.93%	0.13 0.13	0.15	(
231+34.50 -4.93%							(
231+34.50 -4.93% 231+50.00 -5.06%		-2.00%	2.93%	-3.93%	0.13	0.14	
231+34.50 -4.93% 231+50.00 -5.06%		-2.00% -2.61%	2.93% 2.45%	-3.93% -4.06%	0.13	0.14	(
231+34.50 -4.93% 231+50.00 -5.06% 231+75.00 -5.27% 232+00.00 -5.65%		-2.00% -2.61% -3.59%	2.93% 2.45% 1.68%	-3.93% -4.06% -4.27%	0.13 0.13 0.13	0.14 0.10 0.10	
231+34.50 -4.93% 231+50.00 -5.06% 231+75.00 -5.27% 232+00.00 -5.65%		-2.00% -2.61% -3.59% -4.57%	2.93% 2.45% 1.68% 1.08%	-3.93% -4.06% -4.27% -4.65%	0.13 0.13 0.13 0.13 0.13	0.14 0.10 0.10 0.18	(
231+34.50 -4.93% 231+50.00 -5.06% 231+75.00 -5.27% 232+00.00 -5.65% 232+25.00 -6.11%		-2.00% -2.61% -3.59% -4.57% -5.55%	2.93% 2.45% 1.68% 1.08% 0.56%	-3.93% -4.06% -4.27% -4.65% -5.55%	0.13 0.13 0.13 0.13 0.13 0.07	0.14 0.10 0.10 0.18 0.43	

- 9. Select Section Name: Section 1
- 10. Key in for *Control Line*: *Slope-Opt_Lt_Laneline*
- 11. **<D>** *Create.* New point controls are created for the left lane.



12. **<D>** *Close* and review the new control line in the superelevation view and under Corridor > Point Controls.

13. *Repeat* Overlay Tools > Cross Slope Optimization to develop the solution for the right side of the roadway using the following input changes:

Enter the following criteria to define the *Existing Ground Cross Slope Definition*.

- 14. Existing Type: Alignment
- 15. Pivot Alignment: Rt_EOP

For the *Design Cross Slope Definition* select the superelevation control line developed previously for the *right* edge of pavement.

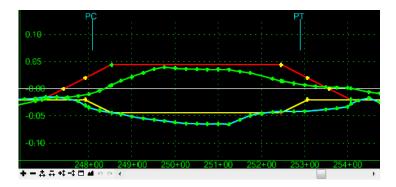
- 16. Design Type: Control Line
- 17. Design Cross Slope Definition: Control Line: Section1 HMA_Lift1_Centerline-Top-RT_HMA_Lift1_Laneline-Top
- 18. Select Section Name: Section 1
- 19. Key in for Control Line: Slope-Opt_Rt_Laneline
- 20. **<D>** Create. New point controls are created for the left lane.
- 21. **<D>** Close to dismiss the Cross Slope Optimization dialog.

22. Select Corridor > Point Controls

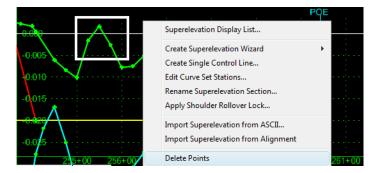
Enabled	Priority	Name	Start Station	Stop Station	Mode	Туре	Control
	1	LT_HMA_Lift1_Laneline-Top	203+80.28	260+43.16	Vertical	Superelevation	Section 1 HMA_Lift 1_Centerline-Top-LT_HMA_Lift 1_Laneline
	1	RT_HMA_Lift1_Laneline-Top	203+80.28	260+43.16	Vertical	Superelevation	Section 1 HMA_Lift 1_Centerline-Top-RT_HMA_Lift 1_Laneline.
х	1	LT_HMA_Lift1_Laneline-Top	205+00.00	259+00.00	Horizontal	Alignment	Lt_EOP
Х	1	RT_HMA_Lift1_Laneline-Top	205+00.00	259+00.00	Horizontal	Alignment	Rt_EOP
х	1	LT_HMA_Lift1_Laneline-Top	205+00.00	259+00.00	Vertical	Superelevation	Slope-Opt_Lt_Laneline:HMA_Lift1_Centerline-Top
х	1	RT_HMA_Lift1_Laneline-Top	205+00.00	259+00.00	Vertical	Superelevation	Slope-Opt_Rt_Laneline:HMA_Lift1_Centerline-Top

The original two superelevation control lines should be automatically disabled. The remaining four controls effect with and slope of the template.

23. Review the new control lines in the superelevation view.



24. **<R>** in the superelevation view and make any edits you think are necessary.



25. From the Roadway Designer menu bar, select **File > Save**.

Lab 25.9 - Corridor Review and Vertical Adjustment

Currently the corridor has horizontal and slope controls relative to existing conditions. In subsequent labs the corridor will be modified to adjust for the overlay thickness, pavement leveling and pavement stripping requirements. Prior to making those adjustments, review the current state of the corridor and related quantities.

1. In *Roadway Designer* toggle on *Display Mode:* Normal.

2. Scroll through the template drops and note the location of the template relative to existing conditions

6547:0 · · · · · ·		 	
6546.5	State of Concession, Name	 t	
546.0			
0.0.0			
EAFE			
040:0 0:040:0			
545:0			

It can be seen that the overlay falls almost entirely below the existing conditions. This will be addressed with overlay tools.

- 3. **<D>** *Process All*, in Roadway Designer
- 4. Using the scroll buttons navigate to the *last* station.
- 5. From the Roadway Designer menu bar select **Tools > Component Quantities** to take a quick look at quantities and cost.

Material	Surface Area				Total Cost/Material	Close		
D_ABC_Class 6		59400.0		0.00	0.00			
D_HMA_Pvmt		72855.7	CF	36.25	2641020.69	Report		
D_SHOULDER-Emba	131388.38		SF	0.00	0.00	Help		
D_Toe-of-Fill	31557.46		SF	0.00	0.00	Theip		
D_Top-of-Cut	57471.91		SF	0.00	0.00			
D_Top-of-Cut 57471.91 SF 0.00 0.00 Total Estimated Cost: 2641020.69								

The cost of the overlay is all we will address for this lab.

6. For the *D_HMA_Pvmt* unit cost key in \$*36.25*

The current cost for the overlay is approximately \$2,409,000. A combination of changes to the design will be made by adjusting the vertical grade, adding pavement stripping and pavement leveling components to the template to determine the optimum solution.

- 7. **<D> Close** the Component Quantities dialog.
- 8. Select Tools > Options in the *Roadway Designer dialog*, toggle on Cut and Fill Graphics.
- 9. **<D> OK** to accept the changes and dismiss the dialog box.

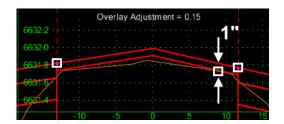
Review the limits of cut, note that the overlay is almost entirely in cut because the design profile is coincident with the existing grade. Overlay tools will be used to make adjustments to the design profile alignment.

- 10. Select Tools > Options in the *Roadway Designer dialog*, toggle off Cut and Fill Graphics.
- 11. In *Roadway Designer* toggle on *Display Mode:* Overlay.

Vertical Overlay Adjustment Settings Backbone Thickness Overlay	Preferences Reset Help
Deskhara	Parametric Label
Backbone 0.00	-
O.08	▼
🔘 Use Minimum Milling	-
Maximum Milling: 0.00	▼
Template Range	Existing Ground Range
Left Point: LT_HMA_Lift1_Lane ▼ Right Point: RT_HMA_Lift1_Lane ▼	
Limits	Solution Option Examine all Cross Section Points
Start: 203+80.28	Examine Template Points Only
Stop: 260+43.16 +	Maximum Vertical Difference: 0.00

12. Select Overlay Tools > Vertical Adjustment Settings.

- 13. Toggle on Use *Minimum Overlay* and key in **7**" which will raise the profile alignment by an amount equal to the overlay pavement thickness.
- 14. Under *Template Range* set: Left Range: LT_HMA_Lift1_Laneline-Top Right Range: RT_HMA_Lift1_Laneline-Top
- 15. **<D> OK** & **<D> Cancel** to close the Vertical Overlay Adjustments Settings dialog.



16. **<D>** Process All

Between the template range points an evaluation is performed comparing existing conditions to the design template. At template application stations the template is raised to maintain the minimum overlay thickness. The value of the vertical adjustment at the centerline is displayed.

Note: It's okay to toggle between Normal and Overlay display modes. However the overlay adjustments are only reflected while the Overlay display mode is active.

Lab 25.10 - Creating a Pavement Leveling Component

A review of the overlay adjustments shows a gap area between the bottom of the asphalt overlay component and the existing ground. This area will be addressed by adding a leveling component to the template.

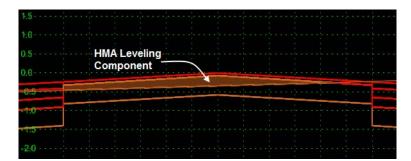
	. Overlay Adjustment = 0.15	
6632:2		- 1
6632.0		
6631.8		
6631.6 6671.4	Leveling Course Necessary	
1		
/	-10 -5 0 5 10) 15

- 1. Open the template library 12345DES_Templates-Overlay for editing.
- 2. **<D><D>** on template *12345-Overlay* to open it for editing.
- 3. **<D> Add > Overlay/Stripping** (component)

nplate Library:	Current Template			Display	Close
C.\Projects\12345\Design\InRoads	Nome: 123	45_Overlay		Components Constraints	Help
1 - Templates 12345_Overlay 12345_Slope-Optimization	Description: 210	wefay with 1° milling & pav	ement widening	Display Point Names	mp
CONC_Divided_TypeA_4Lz CONC_Ramp HMA_Crowned_B10	04				
HMA_Divided_TypeA_4Lar HMA_Ful_Depth_Widening	0.2				
HMA_Ful_Depth_Widening	.00				
2 - Sections - Pavement 3 - Sections - End Conditions	.0.2				
4 - Components HMA_StippingOnly_ZLane	-		1216-0		20
>< Hsto_seppinguny_cuane	4				
	0.0				
	-1.0				
	-1:2				
	-1:4				
	-1:0	-16 -10		0 5 10	
brary Active Template	+-****		1		
view.	Current Componer Name: HMA Let		She: D.I.F.	VELING-Arphat	Test
	Top option:	Follow Com	S_CE	ston Suface	
	Bottom option:	Follow High	PROPERTY OF	AUGO JANGLE.	
	Component Depth	0.50	Label:		
	Surface:	(Active)	· Stepping	Component	
	Surface Depth:	STRAFFU?	Label:		

- 4. Key-in or Select the following: Name: HMA_Leveling Top option: Follow Component Bottom option: Follow Highest Component Depth: 6" Style: D_LEVELING-Asphalt
- 5. Create the component by selecting the three points representing the *bottom* of the 1" overlay compliment.
- 6. **<R>***Finish*

7. **<D>** *Test* to evaluate the added component.



- **Note:** The option selected for *Top* option instructs the added component to follow or tie to the bottom of the 1" overlay asphalt component. The bottom option could have been set to follow surface (existing conditions) but by selecting follow highest a second leveling course could be added if a second leveling material is desired. Having done so the first leveling course will tie to the higher of the existing conditions or the second leveling course. In this exercise 6" should suffice for all leveling needs.
- 8. **File > Save** to save the template library.
- 9. **<D>** *Close*

In Roadway Designer synchronize the revised template with the corridor.

- 10. **<D> Corridor >Template Drops**.
- 11. **<D>** the single template drop
- 12. **<D>** Synchronize with Library
- 13. **<D>** *Close*
- 14. *Review* the overlay adjustments and the additional leveling course.

0000 4	Overlay	Adjustme	ent = <u>.</u> 0.17	
6628:4				
6628:2	·····			
6628:0				
6627:8				
6627:6				
6927.4	0	· · · · ·		 15

- 15. **<D>** *Process All*, in Roadway Designer
- 16. Using the scroll buttons navigate to the *last* station.
- 17. From the Roadway Designer menu bar select **Tools > Component Quantities** to review quantities and cost.
- 18. For the *D_LEVELING_Asphalt* unit cost key in \$*32.00*

The leveling course requires approximately 12,700 CF of material at a cost of \$406,000. The additional cost for the leveling increases the project cost to approximately \$3,047,000.

Material	Surface Area				Total Cost/Material	Close
D_ABC_Class 6		59400.0	CF	0.00	0.00	
D_HMA_Pvmt		72855.7	CF	36.25	2641020.69	Report
D_LEVELING-Asphal		12683.8	CF	32.00	405882.33	Help
D_SHOULDER-Emba	131388.38		SF	0.00	0.00	Пор
D_Toe-of-Fill	34469.60		SF	0.00	0.00	
D_Top-of-Cut	52772.45		SF	0.00	0.00	

19. **<D> Close** the Component Quantities dialog.

Lab 25.11 - Creating a Pavement Stripping Component

Adding a pavement stripping component to the template can reduce the amount of leveling material required. Two items need to be addressed. First a vertical adjustment will be made to allow for a milling depth. Secondly a component will be added to the template to quantify the amount of material milled.

1. From the Roadway Designer menu bar select **Overlay Tools > Vertical Overlay** Adjustment Settings.

🕌 Vertical Overlay Adjustmen	t Settings		23
Backbone Thickness	Minimum Overlay	Maximum Milling Parametric Label	OK Cancel Preferences Reset Help
Backbone 0.00	1	· · · · · · · · · · · · · · · · · · ·	
Use Minimum Overlay: 0.08	•	•	
O Use Minimum Milling			
Maximum Milling: 0.08		-	
Template Range Left Point: LT_HMA_Lift1_L Right Point: RT_HMA_Lift1_		Existing Ground Range Type: Match Template Ran	nge 🔻
Limits Station Start: 203+80.28 Stop: 260+43.16	+	Solution Option Examine all Cross Section Examine Template Points Maximum Vertical Differen	Only
200143.10	<u> </u>		0.00

2. Toggle on *Maximum Milling* and key-in **1**".

- 3. **<D> OK** to close the Vertical Overlay Adjustment Settings dialog.
- 4. **<D>** *Process All*, in Roadway Designer

Review the overlay/leveling results



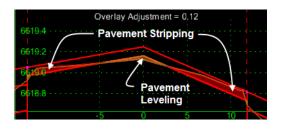
- 5. Open the template library 12345DES_Templates-Overlay for editing.
- 6. **<D><D>** on template *12345-Overlay* to open it for editing.
- 7. **<D> Add > Overlay/Stripping** (component)

Create Template					
emplate Library:	Current Template		Display		Close
C:\Projects\12345\Design\InRoadt Till Point Name Lat 1. Terroliten 1.2345_Overlay X. 12355_Stop4-Optimization	Name: 12345_0 Description: 2" overlap	verlay y with 1° milling & pavement widenin	g 🗖 Da	rponents 👘 Constraints play Point Names play All Components	Help
CORE, Divided, TypeA, Atz CORE, Rane HMA, Drawned, B10 HMA, Drawned, B10 HMA, Fall, Deph, Wolming HMA, Fall, Deph, Wolming HMA, Fall, Deph, Wolming HMA, Fall, Deph, Wolming HMA, Mathematical States HMA, States and States HMA, States and States HMA, States and States					
·	-0.5 ····				
Library Active Template	+-454404	an note a	-2 0		
	Current Component Name: D_Miling Top option: Bottom option: Component Depth: Surface Surface Depth:	Ryle: Follow Surface • Follow Component • 0.00 ¢Active> • 0.00	D_MILLING Atemate Bottom Surface Label: VI Stopping Component Label:		Test
B Place vertex of new component, ESC	Go back, ENTER: Finish				MIRROR REFLE

- Key-in or Select the following: *Name: D_Milling Top option:* Follow Surface *Bottom option:* Follow Component *Style:* D_LEVELING-Milling
- 9. Create the component by selecting the three points representing the *bottom* of the 1" overlay component.
- 10. **<R>***Finish*
 - **Note:** The component created has no depth however it's application is controlled by a combination of settings in roadway designer overlay tools and the existing surface. Testing the component may display results that appear suspect but will function correctly.
- 11. **File > Save** to save the template library.
- 12. **<D>** Close

In Roadway Designer synchronize the revised template with the corridor.

- 13. **<D> Corridor > Template Drops**.
- 14. **<D>** *the single template drop*
- **15. <D>** *Synchronize with Library*
- 16. **<D>** *Close*
- 17. *Review* the overlay adjustments which should depict both leveling and stripping components.



Make a final check on quantities and associated costs.

- 18. **<D>** Process All, in Roadway Designer
- 19. Using the scroll buttons navigate to the *last* station.
- 20. From the Roadway Designer menu bar select **Tools > Component Quantities** to review quantities and cost.
- 21. For the **D_Milling** unit cost key in \$0.30

Milling is reported in cubic feet. The cost of 2.70/S.Y. will be used as the basis. Therefore 0.30/S.F. divided by an average thickness of 1" (0.083') = 3.61/C.F.

Material	Surface Area	Volume	Units	Unit Cost	Total Cost/Materia	*	Close
D_ABC_Class 6		59400.0	CF	0.00	0.00		
D_HMA_Pvmt		72855.7	CF	36.25	2641020.69		Report
D_LEVELING-Asphal		554.74	CF	32.00	17751.61		Help
D_MILLING		5415.69	CF	3.61	19550.64		Tielp
D_SHOULDER-Emba	131388.38		SF	0.00	0.00		
D_Toe-of-Fill	33168.53		SF	0.00	0.00	Ŧ	
•					•		

The quantity for the leveling course has been reduced. This is offset by the less expensive cost of milling. The project cost has been reduced to approximately \$2,678,000.

- 22. **<D> Close** the Component Quantities dialog.
- 23. To find the precise planner area of pavement milling select **Tools > Milling Report**
- 24. For the XML report Select folder *Milling* & Style Sheet *RoadwayDesignMillingReport.xsl*
- 25. Close the XML report, Close the Component Quantities dialog.

Lab 25.12 - Creating the Regressed Vertical Alignment

The adjustments made to the vertical alignment through the use of overlay tools are temporarily stored in memory until applied to the corridor.

In Roadway Designer (in overlay display mode) the upper-right quadrant of the dialog displays two lines. These lines represent the original vertical alignment used to define the corridor. A second line, shown in red, displays the ideal vertical alignment a defined by the settings defined as part of the overlay tools. This optimized alignment can be applied to the corridor as is or it can be smoothed, or regressed, within user defined tolerances to develop a 'best fit' alignment.

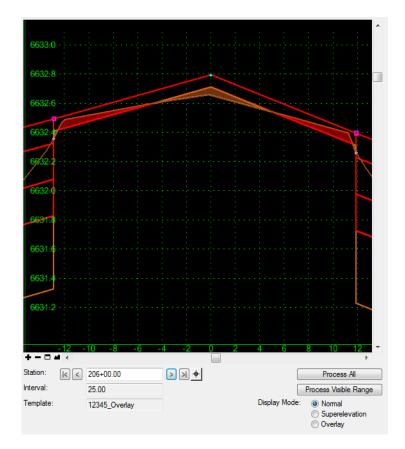
- From the Roadway Designer menu bar, select Overlay Tools > Smooth Adjusted Vertical Alignment
- 2. Key in **0.5**" as the **Tolerance**.
- 3. Key in *12345_Smoothed* for the *Vertical Alignment Name*.
- 4. $\langle D \rangle$ Apply

Tolerance Limits 6621:80 6021.75		Smoothed Vertical Alignment
🕍 Smooth Overlay Vertical Ali	gnment 🔀	
Tolerance: 0.04	Apply	1
Create Linear Elements Only	Close	
Vertical Alignment Name: 12345_Smoothed	Help	Original Vertical ————————————————————————————————————
+-+-		28 225+30 225+32 225+34 225+36

- 5. **<D>** *Close*
- 6. **<D>** Overlay Tools > Apply Adjusted Vertical Alignment
- 7. Toggle on Apply Adjusted Vertical Alignment to Corridor
- 8. Select Style: ALG_OTHER_Vert
- 9. **<D>** *Apply*

Verify the results

- 10. Select Corridor > Manage Corridors
- 11. **<D>** on corridor *Overlay Project*, note the vertical alignment associated with the alignment.
- 12. **<D>** Close the Manage Corridor dialog.
- 13. In *Roadway Designer* toggle on *Display Mode:* Normal.



14. Using the scroll buttons navigate through the template application locations to review the design.

15. **<D> Tools > Component Quantities** to see the results using the smoothed vertical alignment.

Material	Surface Area	Volume	Units	Unit Cost	Total Cost/Materia		Close
D_ABC_Class 6		59400.0	CF	0.00	0.00		
D_HMA_Pvmt		72855.7	CF	36.25	2641020.69		Report
D_LEVELING-Asphal		1126.18	CF	32.00	36037.89		Help
D_MILLING		3157.53	CF	3.61	11398.68		Theip
D_SHOULDER-Emba	131388.38		SF	0.00	0.00		
D_Toe-of-Fill	33654.00		SF	0.00	0.00	Ŧ	
•					Þ		

- 16. Select **File > Save** to write the roadway definitions to *12345_DES_Overlay.ird*
- 17. **<D> Save** then **<D> Cancel** to dismiss the dialog box.
- 18. **<D> Close** to dismiss the Roadway Designer dialog box.
- 19. Exit InRoads and MicroStation.

Chapter Summary:

- Point controls can be used to match the existing cross slope of the road.
- Slope optimization can also be used to develop a design relative to existing conditions.
- Surface features can be used to create point control alignments.
- Be aware that other features may reside inside of the edge of pavement which could cause problems when modeling the corridor.
- If the edge of pavement is to be saw cut prior to widening, a horizontal offset can be defined when point controls are created.
- Superelevation is used to develop a control line that can be overridden by cross slope optimization.
- Using cross slope optimization, the exercise can be used to rehabilitate existing pavement cross slopes.
- Vertical alignments can be adjusted to for overlay and/or milling requirements.
- There are new template components for overlay and milling (stripping).
- Component quantities can be calculated as a design progresses.

LAB 26 - Variable Median Ditch

When a divided highway has separate horizontal and vertical controls for each driving surface, the median can not have a fixed width. In this lab, an end condition section is developed for a variable width median.

Chapter Objectives:

- Build components for each median situation.
- Assemble the components into a single section.
- Add Display Rules to turn components on and off.
- Add the median ditch section to a template.
- Update a corridor to use the template and examine its behavior.

The Following files are used in this lab:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model_Median-Ditch.dgn
- C:\Projects\12345\Design\InRoads\12345DES_Median-Ditch.alg
- C:\Projects\12345\Design\InRoads\12345DES_Templates_Median-Ditch.itl
- C:\Projects\12345\Design\InRoads\12345DES_Median-Ditch.ird
- C:\Projects\12345\Design\InRoads\12345DES_Northbound.dtm
- C:\Projects\12345\DesignROW_Survey\InRoads\DTM\12345SURV_Existing_Ground_VM D.dtm

The median section attaches to the right side of the southbound template. There are four different situations that have to be accounted for on the median ditch. These are:

- ♦ 6:1 / 6:1 "V" Ditch This option is used when the inside EOP points are less than 24' apart.
- 6:1 10:1 / 6:1 10:1 Compound Ditch This option is used when the inside EOP points are greater than 24' apart.
- 6:1 10:1 / 6:1 Compound Ditch This option is used when the southbound lanes are higher than the northbound lanes and the left 10:1 slope intercepts the right 6:1 slope.
- 6:1 / 6:1 10:1 Compound Ditch This option is used when the northbound lanes are higher than the southbound lanes and the right 10:1 slope intercepts the left 6:1 slope.

A separate component will be built for each situation and tested to be sure it works.

Lab 26.1 - Create the 6:1 / 6:1 "V" Ditch Component

- 1. Open MicroStation and InRoads using the C:\Projects\12345\Design\Drawings\ Reference_Files\12345DES_Model_Median-Ditch.dgn file.
- 2. Load the following files into InRoads:
 - C:\Projects\12345\Design\InRoads\12345DES_Median-Lab.alg
 - C:\Projects\12345\ROW_Survey\InRoads\DTM\12345SURV_Existing_Ground_VMD.dtm

- C:\Projects\12345\Design\InRoads\12345DES_Templates_Median-Ditch.itl
- C:\Projects\12345\Design\InRoads\12345DES_Median-Ditch.ird
- C:\Projects\12345\Design\InRoads\12345DES_Northbound.dtm
- 3. Verify that the C:\Workspace\Workspace-CDOT_V8i\Standards-Global\ InRoads\ Preferences\CDOT_Civil.xin file is loaded.
- 4. From the InRoads menu bar, select **Modeler > Create Template**.
- 5. Expand the **4 Components** folder of the template library.
- 6. **<R>** on the **4 Components** folder and select **New > Folder** from the right click menu.

🚟 Create Template					
File Edit Add Tools					
Template Library: C\Projects\12345\Design\InRoad: " Point Name List 1 - Templates 2 - Sections - Pavement 3 - Sections - End Conditions		Current Template Name: Compound_Ditch4 Description:			
4 - Components Aggregate Ba	New	÷	Folder		
Barriers & Mis	Cut	Ctrl-X	Template		
End Condition	Сору	Ctrl-C			
Pavements					
Sidewalks & I	Paste	Ctrl-V			
	Paste Delete	Ctrl-V Del			

- 7. Key in *Variable Median Ditch* for the folder name.
- 8. **<R>** on the **Variable Median Ditch** folder and select **New > Template** from the right click menu.
- 9. Key in *6:1/6:1_V_Ditch* for the template name. The new template is automatically opened for editing.
- 10. Display the **Dynamic Settings** dialog box.
- 11. Set both the *X* Step and *Y* Step to *O. 10*.

ile Edit Add Tools		1			
emplate Library: Template Libr	rary Organizer				- Displ
	Name Override	1			C
Point Nam Options					D
1 - Templa	ings	1			
2 - Section V Dynamic Sett 3 - Sections - End Conditions	ings				V C
4 - Components					
Aggregate Bases					
Barriers & Misc Components	4				
Curb & Gutter Components					
End Conditions	3	· · · · · · · <u>} · · · ·</u>			
Pavements		Dynan	nic Settings	j .	×
Sidewalks & Bike Paths	2	X:	33.66	Step: 0.10	_
Subbases	4	<u>^.</u>		0.10	_
Compound_Ditch1		Y:	0.04	Step: 0.10	
└── Compound_Ditch2 └── Compound Ditch3	0	Point	Name:		_
Compound Ditch4					
V and Compound Median		Point	Style:		
Variable Median Ditch			oply Affixes		
6:1/6:1_V_Ditch	-2		pply Allixes		
		hs=	-		
	-3		Cet Due	amic Origin	
	1		Set Dyn	amic Orgin	
4 III >		-4			

12. Verify that **Apply Affixes** is toggled off.

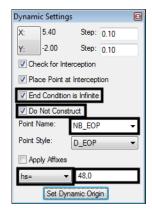
- 13. **<R>** in the template view and select **Add New Component > End Condition** from the right click menu.
- 14. In the *Current Component* area, key in *Ditch_Width* for the *Name*.
- 15. Set the *Style* to **Breakline**.
- 16. Set the *Target Type* to Feature XYZ.
- 17. Set the *Surface* to **12345DES_Northbound**.
- 18. Set the *Feature* to Northbound-Conc_EOP-Top.



19. In the *Dynamic Settings* dialog box, select **EOP** for the *Point Name*.

Dynar	nic Setting	ļs	8			
X:	0.00	Step: 0.10				
Y:	0.00	Step: 0.10				
Point	Name:	EOP	-			
Point	Style:	D_EOP	•			
A	Apply Affixes					
hs=						
Set Dynamic Origin						

- 20. Move the cursor to the template origin (0.00, 0.00) and **<D>** to place the point.
- 21. In the *Dynamic Settings* dialog box, key in *NB_EOP* for the *Point Name*.
- 22. Toggle on End Condition is Infinite and Do Not Construct.
- 23. Set the key in mode to **hs=**.
- 24. Key in *48,0* in the precision key in field and press *Enter*.



25. **<R>** and select **Finish** from the right click menu.

This end condition is used to determine the width of the median. Each of the four components used for this median ditch will contain this end condition. Next, the ditch component is added.

- 26. **<R>** in the template view and select **Add New Component > Unconstrained** from the right click menu.
- 27. In the *Current Component* area, key in *V_Ditch* for the *Name*.
- 28. Set the *Style* to **D_Median**.

╪╼┇╬╬╡╗╗╔╬╡		
Current Component	-	
Name: V_Ditch	Style:	D_MEDIAN -
	-	

29. **<D>** on the **EOP** point to start the component at the origin.

- **Note:** When the "+" symbol turns white, the cursor is snapped to the point and the points automatically merge.
- 30. In the *Dynamic Settings* dialog box, key in *Median_Ditch-Bottom* in the *Point Name* field.
- 31. Select **D_DITCH-Bottom** for the *Point Style*.

Dynai	mic Setting	js		×			
X:	35.70	Step:	0.10				
Y:	-5.40	Step:	0.10				
Poin	t Name:	Median_	Ditch-Bo	·			
Point Style:		D_DITCH-Bottom 🔻					
A	Apply Affixes						
hs=	•	•					
	Set Dynamic Origin						

- 32. **<D>** between and below the *EOP* and *NB_EOP* points.
- 33. **<D>** on the **NB_EOP** point.
- 34. **<R>** in an open area. Verify that **Closed Shape** is toggled off, then select **Finish**.



- 35. <D> <D> on the Median_Ditch-Bottom point to display the *Point Properties* dialog box.
- 36. In the *Point Properties* dialog box, set both constraints to **Slope**.
- 37. Set the *Parent 1* for *Constraint 1* to EOP.
- 38. Set the *Parent 1* for *Constraint 2* to NB_EOP.
- 39. Key in -16.67% for the Value of Constraint 1.
- 40. Key in 16.67% for the Value of Constraint 2.

Point Properties			— ×
Name:	Median_Ditch-Bottom	• +	Apply
Feature Name Override:	Median_Ditch-Bottom		Close
Surface Feature Style:	D_DITCH-Bottom	•	< Previous
Alternate Surface:		-	Next >
	Member of:		Help
	V_Ditch		
Constraints			
Constraints Constra	int 1	Constraint :	2
	int 1 (2
Constra	✓ Slop	e	2
Constra Type: Slope Parent 1: EOP	✓ Slop		▼ ▼ +
Constra Type: Slope Parent 1: EOP	▼ Slop ▼ + NB_ rer Values	e EOP Rollover ¹	▼ ▼ +
Constra Type: Slope Parent 1: EOP Parent 2: Rollov	✓ Slop ✓ + NB_	e EOP Rollover ¹	▼ ▼ +
Constrain Type: Slope Parent 1: EOP Parent 2: Rollow Value: -16.67%	▼ Slop ▼ + NB_ rer Values	e EOP Rollover ¹	▼ ▼ +
Constra Type: Slope Parent 1: EOP Parent 2: Rollow Value: -16.67% Label:	Slop Slop P	e EOP Rollover ¹	▼ ▼ +

41. **<D> Apply** then **<D> Close** to dismiss the *Point Properties* dialog box.

This component will now construct a "V" ditch with 6:1 slopes on each side. Now it must be restricted to display only when the EOP and NB_EOP points are within 24' horizontally of each other. This is accomplished using a Display Rule.

- 42. **<D> <D>** on the line forming the ditch to display the *Component Properties* for the *V_Ditch* component.
- In the *Component Properties* dialog box, <D> the Edit button. This displays the *Component Display Conditional Expression* dialog box.

K Component Prop	erties		X			
Name:	V_Ditch	+	Apply			
Description:			Close			
Style:	D_MEDIAN Close Shape		< Previous			
Parent Component:	+					
Display Rules:		Edit	Next >			
Exclude from triangulation						

- 44. In the *Component Display Conditional Expression* dialog box, **<D>** the **Add** button. This displays the *Display Rule* dialog box.
- 45. In the *Display Rule* dialog box, key in *V_DitchWidth* for the *Name*.
- 46. Key in Sets maximum width for the V ditch for the Description.
- 47. Set the *Type* to Absolute Horizontal.
- 48. Set *Between* to EOP.
- 49. Set *And* to **NB_EOP**.

50. Set the operator to < and key in **24.00** for the value. The dialog box with completed entries is illustrated below:

🕍 Display R	ule		X
Name:	V_DitchWidth		ОК
Description:	Sets maximum width for the V ditch		Cancel
Type:	Absolute Horizontal		Help
Between:	EOP 🔹	÷	
And:	NB_EOP	+	
	< ▼ 24.00		

- 51. **<D> OK**. This dismisses the *Display Rule* dialog box.
- 52. In the *Component Display Conditional Expression* dialog box, highlight **V_DitchWidth** in the *Template Display Rules* area.
- 53. **<D>** the **Selected Rule** button.
- 54. **<D> OK**. This dismisses the *Component Display Conditional Expression* dialog box and adds the rule to the component properties of *V_Ditch*.

Conditional Expr	ression for V_Ditch Componer	nt				OK
√_DitchWidth						Cance
AND OF	R NOT () Selected Rule		Ŧ		
mplate Display lame	Rules Type	Expression	Test	Value	Result	1
DitchWidth	Absolute Horizontal	EOP - NB_EOP	<	24.00	False	1
					1000	1
					10.00	
a [III				

55. In the *Component Properties* dialog box, <D> Apply then <D> Close to dismiss the dialog box.

🕌 Component Prop	erties		
Name:	V_Ditch	+	Apply
Description:			Close
Style:	D_MEDIAN Close Shape		< Previous
Parent Component:	+		Next >
Display Rules:	V_DitchWidth	Edit	
Exclude from triang	ulation		Help

If the V_Ditch does not disappear right away, it will when you click in the template view. This is because the Display Rule returned a false value (EOP and NB_EOP are more than 24 feet apart). Because an end condition controls the NB_EOP point, the template can be tested to see if it works properly.

- 56. **<D>** the **Test** button.
- 57. In the *Test End Conditions* dialog box, **<D>** the **Draw** button.
- 58. Move the cursor slowly from right to left in the dialog box. Notice that once the cursor is moved left of the 25 grid line, the template displays.
- 59. **<D> Close** to dismiss the *Test End Conditions* dialog box.
- 60. Select **File > Save** from the *Create Template* menu bar.

Lab 26.2 - Create the 6:1 - 10:1 / 6:1 - 10:1 Compound Ditch Component

The next component to build is the 6:1 - 10:1 / 6:1 - 10:1 Compound Ditch. This component has a 12 foot 6:1 slope extending from each pavement edge. The slope changes to 10:1 at this point to form the ditch bottom.

- 1. Create a new template in the *Variable Median Ditch* folder as described in steps 6 through 9 above. Name the template *Standard Compound Ditch*.
- 2. **<R>** in the template view and select **Add New Component > End Condition** from the right click menu.
- 3. In the *Current Component* area, key in *Ditch_Width* for the *Name*.
- 4. Set the *Style* to **Breakline**.
- 5. Set the *Target Type* to Feature XYZ.
- 6. Set the *Surface* to **12345DES_Northbound**.
- 7. Set the *Feature* to Northbound-Conc_EOP-Top.
- 8. In the *Dynamic Settings* dialog box, select **EOP** for the *Point Name*.
- 9. Move the cursor to the template origin (0.00, 0.00) and **<D>** to place the point.

- 10. In the *Dynamic Settings* dialog box, key in *NB_EOP* for the *Point Name*.
- 11. Toggle on End Condition is Infinite and Do Not Construct.
- 12. Set the key in mode to **hs=**.
- 13. Key in *48,0* in the precision key in field and press *Enter*.
- 14. **<R>** and select **Finish** from the right click menu.
- 15. **<R>** in the template view and select **Add New Component > Unconstrained** from the right click menu.
- 16. In the *Current Component* area, key in *Std_Compound_Ditch* for the *Name*.
- 17. Set the *Style* to **D_Top-of-Cut**. Using a different style for each ditch component will make it easier to troubleshoot the template if there is a problem
- 18. **<D>** on the **EOP** point to start the component at the origin.
- In the *Dynamic Settings* dialog box, select **POSS** for the *Point Name*. Then key in *SB_POSS* for the *Point Name*. Selecting POSS first automatically sets the Point Style, then "SB_" can be appended to the name.
- 20. In the precision key in field, type 12,-0.1667 and press Enter.

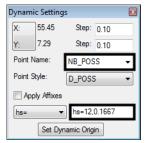
Dynami	c Setting	s		
X:	58.20	Step:	0.10	
Y:	7.30	Step:	0.10	
Point N	lame:	SB_POS	S	-
Point S	tvle:	D POSS	:	
1 0111 0		01000	·	
_	ly Affixes	0_1000		
_	-	12,-0.1		

- 21. In the *Dynamic Settings* dialog box, key in *Median_Ditch-Bottom* in the *Point Name* field.
- 22. Select **D_DITCH-Bottom** for the *Point Style*.
- 23. In the precision key in field, type 12,-0.100 and press Enter.

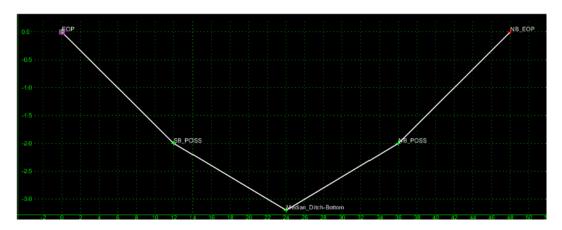
Dynami	c Setting	gs			
X:	56.50	Step:	0.10		
Y:	7.20	Step:	0.10		
Point N	lame:	Median_	Ditch-Bo' 👻		
Point S	nt Style: D_DITCH-Bottom -				
🔲 Арр	ly Affixes				
hs=					
	Set Dy	namic Orig	in		

24. In the *Dynamic Settings* dialog box, select **POSS** for the *Point Name*. Then key in *NB_POSS* for the *Point Name*.

25. In the precision key in field, type 12,0.100 and press Enter.



- 26. **<D>** on the **NB_EOP** point.
- 27. **<R>** and select **Finish** from the right click menu. The illustration below shows the component as it appears at this point.



The points on the component form the proper shape. Now they must be constrained to maintain that shape.

- 28. **<D> <D>** on the **SB_POSS** point.
- 29. In the *Point Properties* dialog box, set the *Constraint 1 Type* to Horizontal.
- 30. Set the *Constraint 2 Type* to **Slope**.
- 31. Set the *Parent 1* for both constraints to EOP.

32. **<D> Apply**.

Name:				
	SB_POSS		<u>+</u>	Apply
Feature Name Override:	SB_POSS			Close
Surface Feature Style:	D_POSS		•	< Previous
Alternate Surface:			-	Next >
				Ivext >
		Member of		Help
		Std_Compor	und_Ditch	
			-	
Constraints	int 1		Constraint	2
Constrai	int 1		Constraint	2
Constrai Type: Horizontal	int 1	Slop	e	-
Constrai	int 1)e	▼
Constrai Type: Horizontal Parent 1: EOP	int 1	Slop + EOF	e Rollover	▼
Constrai Type: Horizontal	int 1	Slop	e Rollover	▼
Constrai Type: Horizontal Parent 1: EOP	int 1	Slop + EOF	e Rollover	▼
Type: Constrai Parent 1: EOP Value: 12.00	int 1	Slop + EOF	e Rollover	▼
Type: Horizontal Parent 1: EOP Value: 12.00 Label: Style Constraint:	, , ,	y ∲ EOF	Rollover	- - +
Type: Horizontal Parent 1: EOP Value: 12.00 Label:	, , ,	Slop + EOF	Rollover	▼

- 33. **<D>** the **Next** button to select **Median_Ditch-Bottom**.
- 34. Set the *Type* of both constraints to **Slope**.
- 35. Set the *Parent 1* of *Constraint 1* to **SB_POSS**.
- 36. Set the *Parent 1* of *Constraint 2* to NB_POSS.

37. **<D> Apply**.

Point Properties		X
Name:	Median_Ditch-Bottom 👻 🔶 🗛 🗛	y -
Feature Name Override:	Median_Ditch-Bottom	e
Surface Feature Style:	D_DITCH-Bottom	ious
Alternate Surface:	▼ Next	
	Hel	
	Member of:)
	Std_Compound_Ditch	
Constraints		
Constra Type: Slope		
Jiope	▼ Slope ▼	
36_1033	ver Values	_
Value: -10.00%	10.00%	
Label:		
Style Constraint:		
	Vertical OBoth	
Range: 0.00		

- 38. **<D>** the **Next** button to select **NB_POSS**.
- 39. Set the *Constraint 1 Type* to Horizontal.
- 40. Set the *Constraint 2 Type* to Slope.
- 41. Set the *Parent 1* for both constraints to NB_EOP.
- 42. **<D> Apply** then **<D> Close** to dismiss the *Point Properties* dialog box.

There are three situations where this component will not work correctly. These are 1) when the median is less than 24 feet wide 2) when the NB_POSS drops below the 10:1 slope from the SB_POSS and 3) when the Median_Ditch-Bottom is left of the SB_POSS (this can occur when the NB_EOP is higher than the SB_EOP). Display rules are used to test for each of these situations.

- 43. <D> <D> on the line forming the ditch to display the *Component Properties* for the *Std_Compound_Ditch* component.
- 44. In the *Component Properties* dialog box, **<D>** the **Edit** button. This displays the *Component Display Conditional Expression* dialog box.
- 45. In the *Component Display Conditional Expression* dialog box, <D> the Add button. This displays the *Display Rule* dialog box.
- 46. In the *Display Rule* dialog box, key in *Std_Compound_DitchWidth* for the *Name*.
- 47. Key in *Sets minimum width for the standard compound ditch* for the *Description*.
- 48. Set the *Type* to **Horizontal**.

- 49. Set *Between* to SB_POSS.
- 50. Set *And* to **NB_POSS**.
- 51. Set the operator to < and key in *0.00* for the value. The dialog box with completed entries is illustrated below:

🕍 Display R	ule		×
Name:	Std_Compound_DitchWidth		ОК
Description:	Sets minimum width for the standard compound ditch		Cancel
Type:	Horizontal		Help
Between:	SB_POSS	+	
And:	NB_POSS	+	
	< 0.00		

- 52. **<D> OK**. This dismisses the *Display Rule* dialog box.
- 53. In the *Component Display Conditional Expression* dialog box, **<D>** the **Add** button.
- In the *Display Rule* dialog box, key in *Std_Compound_DitchVertical1* for the *Name*.
- 55. Key in **Sets minimum height for the standard compound ditch** for the **Description**.
- 56. Set the *Type* to **Vertical**.
- 57. Set *Between* to NB_POSS.
- 58. Set And to Median_Ditch-Bottom.
- 59. Set the operator to > and key in **0.00** for the value. The dialog box with completed entries is illustrated below:

🕌 Display R	ule		X
Name:	Std_Compound_DitchVertical1		ОК
Description:	Sets minimum height for the standard compound ditch		Cancel
Type:	Vertical 🗸		Help
Between:	NB_POSS	+	
And:	Median_Ditch-Bottom 💌	+	
	> • 0.00		

- 60. **<D> OK**. This dismisses the *Display Rule* dialog box.
- 61. In the *Component Display Conditional Expression* dialog box, **<D>** the **Add** button.
- In the *Display Rule* dialog box, key in *Std_Compound_DitchVertical2* for the *Name*.
- 63. Key in **Sets maximum height for the standard compound ditch** for the **Description**.
- 64. Set the *Type* to Horizontal.

65. Set *Between* to SB_POSS.

66. Set *And* to **Median_Ditch-Bottom.**

67. Set the operator to < and key in *0.00* for the value. The dialog box with completed entries is illustrated below:

ኵ Display R	ule		×
Name:	Std_Compound_DitchVertical2		ОК
Description:	Sets maximum height for the standard compound ditch		Cancel
Type:	Horizontal 🗸		Help
Between:	SB_POSS	+	
And:	Median_Ditch-Bottom 👻	+	
	< 0.00		

- 68. **<D> OK** to accept the entries and dismiss the dialog box.
- 69. In the *Component Display Conditional Expression* dialog box, highlight Std_Compound_DitchWidth in the *Template Display Rules* area.
- 70. **<D>** the **Selected Rule** button.
- 71. **<D>** the **AND** button.
- 72. Highlight Std_Compound_DitchVertical1 in the Template Display Rules area.
- 73. **<D>** the **Selected Rule** button.
- 74. **<D>** the **AND** button.
- 75. Highlight Std_Compound_DitchVertical2 in the Template Display Rules area.
- 76. **<D>** the **Selected Rule** button. The dialog box with completed entries is illustrated below:

🕌 Compon	ent Display Conditional Expres	sion				- • •
	Expression for Std_Compound_D	itch Component nd_DitchVertical1 AND Std_Compound_Ditc	hVertical2			OK Cancel Help
AND Template Dis	OR NOT () Selected Rule	Test	Value	Result	
StandardCo.		SB_POSS - NB_POSS	<	0.00	True	_
Std_Compo.	Vertical	NB_POSS - Median_Ditch-Bottom	>	0.00	True	
Std_Compo.	Horizontal	SB_POSS - Median_Ditch-Bottom	<	0.00	True	
			Add	Edit	Delete]

- 77. **<D> OK**. This dismisses the *Component Display Conditional Expression* dialog box and adds the rule to the component properties of *Std_Compound_Ditch*.
- 78. **<D>** the **Apply** button then **<D>** the **Close** button to dismiss the *Component Properties* dialog box.

Using the three display rules with the AND operator means that all of the rules must return a True result in order for the component to be displayed.

- 79. **<D>** the **Test** button.
- 80. In the *Test End Conditions* dialog box, **<D>** the **Draw** button.
- 81. Move the cursor slowly from right to left and up and down in the dialog box. Notice the different situations that cause the template to disappear.
- 82. **<D> Close** to dismiss the *Test End Conditions* dialog box.
- 83. Select File > Save from the *Create Template* menu bar.

Lab 26.3 - Create the 6:1 - 10:1 / 6:1 Compound Ditch Component

Two of the four components required for this template have been completed. The final two components define the ditch where the 10:1 slope from one side of the ditch intercepts the 6:1 slope on the other side.

- 1. Create a new template in the *Variable Median Ditch* folder as described in steps 6 through 9 above. Name the template *Compound Ditch NB_EOP High*.
- 2. **<R>** in the template view and select **Add New Component > End Condition** from the right click menu.
- 3. In the *Current Component* area, key in *Ditch_Width* for the *Name*.
- 4. Set the *Style* to **Breakline**.
- 5. Set the *Target Type* to Feature XYZ.
- 6. Set the *Surface* to **12345DES_Northbound**.
- 7. Set the *Feature* to Northbound-Conc_EOP-Top.
- 8. In the *Dynamic Settings* dialog box, select **EOP** for the *Point Name*.
- 9. Move the cursor to the template origin (0.00, 0.00) and **<D>** to place the point.
- 10. In the *Dynamic Settings* dialog box, key in *NB_EOP* for the *Point Name*.
- 11. Toggle on End Condition is Infinite and Do Not Construct.
- 12. Set the key in mode to **hs=**.
- 13. Key in *48,0* in the precision key in field and press *Enter*.
- 14. **<R>** and select **Finish** from the right click menu.

- 15. Add a new unconstrained component.
- 16. Key in *NB_EOP-High* for the *Name*.
- 17. Select **D_CONC_Sw** for the *Style*.
- 18. **<D>** on the **EOP** point to start the component at the origin.
- 19. In the *Dynamic Settings* dialog box, key in *Median_Ditch-Bottom* in the *Point Name* field.
- 20. Select **D_DITCH-Bottom** for the *Point Style*.
- 21. **<D>** between and below the *EOP* and *NB_EOP* points.
- 22. In the *Dynamic Settings* dialog box, key in *NB_POSS* in the *Point Name* field.
- 23. Select **D_POSS** for the *Point Style*.
- 24. **<D>** to the right and above *Median_Ditch-Bottom* and to the left and below *NB_EOP*.
- 25. **<D>** on the **NB_EOP** point.
- 26. **<R>** and select **Finish** from the right click menu. The illustration below shows the component as it appears at this point.



- 27. **<D> <D>** on the **Median_Ditch-Bottom** point.
- 28. In the *Point Properties* dialog box, set the *Type* to **Slope** on both constraints.
- 29. Set the *Parent 1* for *Constraint 1* to EOP.
- 30. Set the *Parent 1* for *Constraint 2* to NB_POSS.
- 31. Key in the -0.1667 for the Value of Constraint 1.
- 32. Key in the *O. 1000* for the *Value* of *Constraint 2*.
- 33. **<D> Apply**.
- 34. **<D> Next** to select the **NB_POSS** point.
- 35. Set the *Constraint 1 Type* to Horizontal.

- 36. Set the *Constraint 2 Type* to **Slope**.
- 37. Set the *Parent 1* for both constraints to NB_EOP.
- 38. Key in the *12.00* for the *Value* of *Constraint 1*.
- 39. Key in the *0.1667* for the *Value* of *Constraint 2*.
- 40. **<D> Apply** then **<D> Close** to dismiss the dialog box.

The shape of the ditch is now fixed. Now display Rules must be added to control when this component is displayed.

- 41. **<D> <D>** on the line forming the ditch to display the *Component Properties* for the *NB_EOP_HIGH* component.
- 42. In the *Component Properties* dialog box, **<D>** the **Edit** button. This displays the *Component Display Conditional Expression* dialog box.
- 43. In the *Component Display Conditional Expression* dialog box, <D> the Add button. This displays the *Display Rule* dialog box.
- 44. In the *Display Rule* dialog box, key in *NB_EOP_HIGHWidth* for the *Name*.
- 45. Key in *Sets width for ditch* for the *Description*.
- 46. Set the *Type* to Absolute Horizontal.
- 47. Set *Between* to EOP.
- 48. Set And to Median_Ditch-Bottom.
- 49. Set the operator to < and key in **12.00** for the value. The dialog box with completed entries is illustrated below:

🐂 Display R	ule		.
Name:	Compound_NB_EOP-HighWidth		ОК
Description:	Sets the width of the ditch		Cancel
Туре:	Absolute Horizontal		Help
Between:	EOP 🔹	+	
And:	Median_Ditch-Bottom	+	
	< ▼ 12.00		

- 50. **<D> OK**. This dismisses the *Display Rule* dialog box.
- 51. In the *Component Display Conditional Expression* dialog box, **<D>** the **Add** button.
- 52. In the *Display Rule* dialog box, key in *NB_EOP_HIGHVertical* for the *Name*.
- 53. Key in **Sets height for the ditch** for the **Description**.
- 54. Set the *Type* to **Vertical**.
- 55. Set *Between* to NB_POSS.
- 56. Set *And* to **Median_Ditch-Bottom.**

57. Set the operator to > and key in *0.00* for the value. The dialog box with completed entries is illustrated below:

🔚 Display R	ule		—
Name:	Compound_NB_EOP-HighVertical		ОК
Description:	Sets the minimum ditch height		Cancel
Туре:	Vertical		Help
Between:	NB_POSS	ŧ	
And:	Median_Ditch-Bottom	ŧ	
	> • 0.00		

- 58. **<D> OK**. This dismisses the *Display Rule* dialog box.
- In the *Component Display Conditional Expression* dialog box, highlight NB_EOP_HIGHWidth in the *Template Display Rules* area.
- 60. **<D>** the **Selected Rule** button.
- 61. **<D>** the **AND** button.
- 62. Highlight NB_EOP_HIGHVertical in the Template Display Rules area.
- 63. **<D>** the **Selected Rule** button. The dialog box with completed entries is illustrated below:

Compound_NB_EOP-HighWidth	AND Compound_NB_EOP-HighVertical		-		OK Cancel Help
AND OR NOT	() Selected Rule				
Name Type	Expression	Test	Value	Result	
CompoundVertical CompoundAbsolute Horizontal	NB_POSS - Median_Ditch-Bottom EOP - Median_Ditch-Bottom	> <	0.00 12.00	True False	

- 64. **<D> OK**. This dismisses the *Component Display Conditional Expression* dialog box and adds the rule to the component properties of *NB_EOP High*.
- 65. **<D>** the **Apply** button then **<D>** the **Close** button to dismiss the *Component Properties* dialog box.

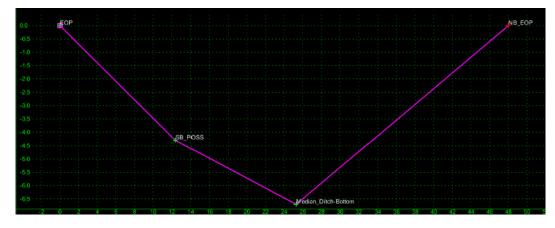
This completes the *Compound Ditch NB_EOP High* component.

Lab 26.4 - Create the 6:1 / 6:1 - 10:1 Compound Ditch Component

Next the final component is built.

- 1. Create a new template in the *Variable Median Ditch* folder as described in steps 6 through 9 above. Name the template *Compound Ditch SB_EOP High*.
- 2. **<R>** in the template view and select **Add New Component > End Condition** from the right click menu.
- 3. In the *Current Component* area, key in *Ditch_Width* for the *Name*.
- 4. Set the *Style* to **Breakline**.
- 5. Set the *Target Type* to **Feature XYZ**.
- 6. Set the *Surface* to **12345DES_Northbound**.
- 7. Set the *Feature* to Northbound-Conc_EOP-Top.
- 8. In the *Dynamic Settings* dialog box, select **EOP** for the *Point Name*.
- 9. Move the cursor to the template origin (0.00, 0.00) and **<D>** to place the point.
- 10. In the *Dynamic Settings* dialog box, key in *NB_EOP* for the *Point Name*.
- 11. Toggle on End Condition is Infinite and Do Not Construct.
- 12. Set the key in mode to **hs=**.
- 13. Key in *48,0* in the precision key in field and press *Enter*.
- 14. **<R>** and select **Finish** from the right click menu.
- 15. Add a new unconstrained component.
- 16. Key in **SB_EOP-High** for the Name.
- 17. Select **D_Shoulder** for the *Style*.
- 18. **<D>** on the **EOP** point to start the component at the origin.
- 19. In the *Dynamic Settings* dialog box, key in *SB_POSS* in the *Point Name* field.
- 20. Select **D_POSS** for the *Point Style*.
- 21. **<D>** between and below the *EOP* and *NB_EOP* points.
- 22. In the *Dynamic Settings* dialog box, key in *Median_Ditch-Bottom* in the *Point Name* field.
- 23. Select **D_DITCH-Bottom** for the *Point Style*.
- 24. **<D>** between and below the *SB_POSS* and *NB_EOP* points.
- 25. **<D>** on the **NB_EOP** point.

26. **<R>** and select **Finish** from the right click menu. The illustration below shows the component as it appears at this point.



- 27. **<D> <D>** the **SB_POSS** point.
- 28. Set the *Constraint 1 Type* to Horizontal.
- 29. Set the *Constraint 2 Type* to Slope.
- 30. Set the *Parent 1* for both constraints to EOP.
- 31. Key in the *12.00* for the *Value* of *Constraint 1*.
- 32. Key in the -*O. 1667* for the *Value* of *Constraint 2*.
- 33. **<D> Apply** to accept the changes.
- 34. **<D> Next** to select the **Median_Ditch-Bottom** point.
- 35. In the *Point Properties* dialog box, set the *Type* to **Slope** on both constraints.
- 36. Set the *Parent 1* for *Constraint 1* to **SB_POSS**.
- 37. Set the *Parent 1* for *Constraint 2* to NB_EOP.
- 38. Key in the -O. 1000 for the Value of Constraint 1.
- 39. Key in the *0.1667* for the *Value* of *Constraint 2*.
- 40. **<D> Apply**.

The shape of the ditch is now fixed. Now display Rules must be added to control when this component is displayed.

- 41. <D> <D> on the line forming the ditch to display the *Component Properties* for the *SB_EOP-High* component.
- 42. In the *Component Properties* dialog box, **<D>** the **Edit** button. This displays the *Component Display Conditional Expression* dialog box.
- 43. In the *Component Display Conditional Expression* dialog box, <D> the Add button. This displays the *Display Rule* dialog box.

- 44. In the *Display Rule* dialog box, key in *SB_EOP_HIGHWidth-Max* for the *Name*.
- 45. Key in Sets maximum width for ditch for the Description.
- 46. Set the *Type* to Absolute Horizontal.
- 47. Set *Between* to Median_Ditch-Bottom.
- 48. Set And to NB_EOP.
- 49. Set the operator to < and key in **12.00** for the value. The dialog box with completed entries is illustrated below:

🖬 Display R	ule		X
Name:	SB_EOP_HIGHWidth-Max		ОК
Description:	Sets maximum width for ditch		Cancel
Type:	Absolute Horizontal		Help
Between:	Median_Ditch-Bottom	ŧ	
And:	NB_EOP	+	
	< ▼ 12.00		

- 50. **<D> OK**. This dismisses the *Display Rule* dialog box.
- 51. In the *Component Display Conditional Expression* dialog box, **<D>** the **Add** button.
- 52. In the *Display Rule* dialog box, key in *SB_EOP_HIGHWidth-Min* for the *Name*.
- 53. Key in **Sets minimum width for ditch** for the **Description**.
- 54. Set the *Type* to Horizontal.
- 55. Set *Between* to SB_POSS.
- 56. Set And to Median_Ditch-Bottom.
- 57. Set the operator to < and key in *0.00* for the value. The dialog box with completed entries is illustrated below:

🔚 Display R	ule		—
Name:	SB_EOP_HIGHWidth-Min		ОК
Description:	Sets minimum width for ditch		Cancel
Туре:	Horizontal		Help
Between:	SB_POSS	+	
And:	Median_Ditch-Bottom	+	
	< .00		

- 58. **<D> OK**. This dismisses the *Display Rule* dialog box.
- In the *Component Display Conditional Expression* dialog box, highlight SB_EOP_HIGHWidth-Max in the *Template Display Rules* area.
- 60. **<D>** the **Selected Rule** button.
- 61. **<D>** the **AND** button.

- 62. Highlight SB_EOP_HIGHWidth-Min in the *Template Display Rules* area.
- 63. **<D>** the **Selected Rule** button. The dialog box with completed entries is illustrated below:

🕌 Component Display Conditional Exp	ression				- • •
Conditional Expression for SB_EOP-High	Component				ОК
SB_EOP_HIGHWidth-Max AND SB_EOF	P_HIGHWidth-Min		-	[]	Cancel Help
AND OR NOT () Selected Rule				
Name Type	Expression	Test	Value	Result	
SB_EOP_HAbsolute Horizontal SB_EOP_HHorizontal	Median_Ditch-Bottom - NB_EOP SB_POSS - Median_Ditch-Bottom	< <	12.00 0.00	False True	
		Add	Edit	Delete]

- 64. **<D> OK**. This dismisses the *Component Display Conditional Expression* dialog box and adds the rule to the component properties of *SB_EOP High*.
- 65. **<D>** the **Apply** button the **<D>** the **Close** button to dismiss the *Component Properties* dialog box.

This completes the *Compound Ditch SB_EOP High* component. All of the variable median ditch components can be placed into a single section.

Section Summary:

- The components use an end condition to find the edge of the northbound pavement. This is so that the component can be tested before it is added to the template. The same results can be accomplished with a null point and a point control.
- Display rules are used to define when a component will be used.
- Different Styles are used for the ditch line in each component. This is done to facilitate troubleshooting. Once the components are assembled into a section and it is working properly, the styles will be set to match for each component.

Lab 26.5 - Assemble the Components into a Section

Now that the individual components for the variable median ditch are built, they can be assembled into a section.

Section Objectives:

- Create a new folder for the variable median ditch section.
- Create a new template for the variable median ditch section.
- Add the components to the section.

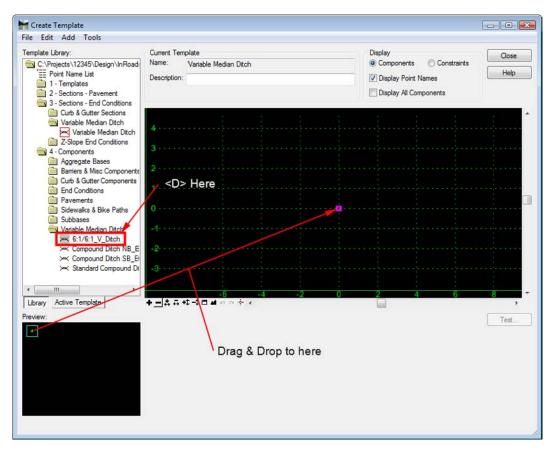
- Delete the redundant end condition components.
- Add additional display rules so that only one component is displayed at a time.

The first step is to create the folder and template for the variable median ditch section.

- 1. Expand the **3** Sections End Conditions folder of the template library.
- 2. **<R>** on the **3 Sections End Conditions** folder and select **New > Folder** from the right click menu.
- 3. Key in *Variable Median Ditch* for the folder name.
- 4. **<R>** on the **Variable Median Ditch** folder and select **New > Template** from the right click menu.
- 5. Key in *Variable Median Ditch* for the template name. The new template is automatically opened for editing.

Now the components can be placed into the new template.

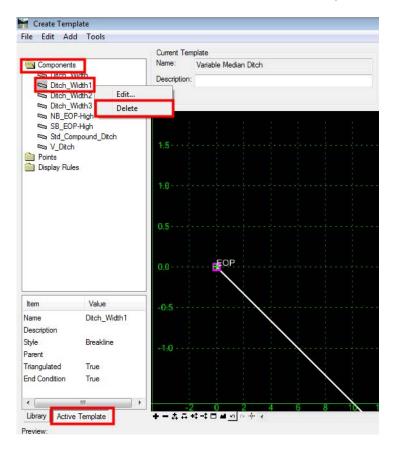
- 6. **<D>** on the **6:1/6:1_V_Ditch** component so that it is displayed in the *Preview* window.
- 7. Drag the component by its origin (the green dot in the upper left corner) and drop it on the origin in the template view.



8. Repeat steps 6 and 7 with the Compound Ditch NB_EOP High, Compound Ditch NB_EOP High, and Standard Compound Ditch.

Because each component has the same end condition in it, the Variable Median Ditch section now has four identical end conditions. Three of these end conditions are deleted to remove redundancies in the template. Because the same point names are used in each component, deleting the extra end conditions will not affect how the individual components operate.

- 9. **<D>** the **Active Template** tab at the bottom of the Template Library tree view.
- 10. Expand the **Components** folder.
- 11. **<R>** on **Ditch_Width1** and select **Delete** from the right click menu.



12. **<D> Yes** on the delete warning message box.

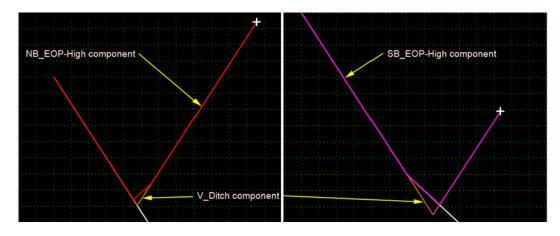


13. Repeat steps 10 through 12 for Ditch_Width2 and Ditch_Width3.

Next, test the section and see how each of the components behave.

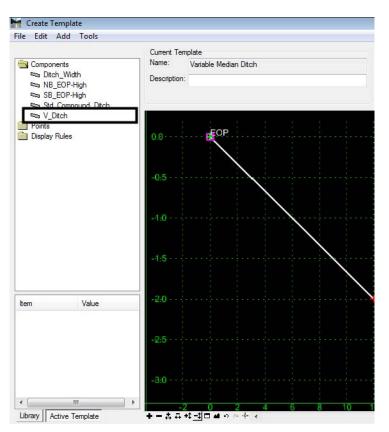
- 14. **<D>** the **Test** button.
- 15. In the *Test End Conditions* dialog box, **<D>** the **Draw** button.

16. Move the cursor around slowly in the view area. Notice that there are two instances when two components are displayed at the same time. These occur when the horizontal distance between the EOP and NB_EOP is less than 24' and there is an elevation difference between the points.



This is fixed by adding two more display rules to the V_Ditch component.

- 17. **<D> Close** to dismiss the *Test End Conditions* dialog box.
- In the *Create Templates* dialog box, <D> <D> on the V_Ditch component in the *Active Template* tree view. This opens the *Component Properties* dialog box.



- <D> the Edit button to display the *Component Display Conditional Expression* dialog box.
- In the *Component Display Conditional Expression* dialog box, <D> the Add button to display the *Display Rule* dialog box.
- 21. In the Display Rule dialog box, key in NB_EOP-High-Displayed for the Name.
- 22. Key in **NB_EOP-High is displayed** for the **Description**.
- 23. Set the *Type* to Component is Displayed.
- 24. Set the *Component* to NB_EOP-High. The dialog box with completed entries is illustrated below:

🔛 Display R	ule		×
Name:	NB_EOP-High-Displayed		ОК
Description:	NB_EOP-High is displayed		Cancel
Type:	Component is Displayed 🗸		Help
Component:	NB_EOP-High	+	<u> </u>

25. **<D>** the **OK** button. This dismisses the *Display Rule* dialog box and adds the new rule to the Template Display Rules list on the *Component Display Conditional Expression* dialog box.

Note: The Template Display Rules list contains all of the rules created thus far in the lab.

- In the *Component Display Conditional Expression* dialog box, <D> the Add button to display the *Display Rule* dialog box.
- 27. In the *Display Rule* dialog box, key in *SB_EOP-High-Displayed* for the *Name*.
- 28. Key in **SB_EOP-High is displayed** for the **Description**.
- 29. Set the *Type* to **Component is Displayed**.
- 30. Set the *Component* to **SB_EOP-High**. The dialog box with completed entries is illustrated below:

🔚 Display R	ule		×
Name:	SB_EOP-High-Displayed		ОК
Description:	SB_EOP-High is displayed		Cancel
Туре:	Component is Displayed 🗸		Help
Component:	SB_EOP-High	+	<u> </u>

31. **<D>** the **OK** button.

In the *Component Display Conditional Expression* dialog box, <D> in the *Conditional Expression for V_Ditch* area to the right of the *V_DitchWidth* entry.

Component Display Conditional Exp						
Conditional Expression for V_Ditch Compo	onent					ОК
V_DitchWidth	C> Here		* 			Cancel Help
AND OR NOT () Selected Rule					
Femplate Display Rules						
Template Display Rules Name Type	Expression	Test	Value	Result	*	
Name Type	Expression NB_POSS - Median_Ditch-Bottom1	Test	Value 0.00	Result	^	
Name Type CompoundVertical						
Name Type CompoundVertical CompoundAbsolute Horizontal	NB_POSS - Median_Ditch-Bottom1	>	0.00	True	* E	
Name Type CompoundVertical CompoundAbsolute Horizontal NB_EOP-HiComponent is Displayed	NB_POSS - Median_Ditch-Bottom1 EOP - Median_Ditch-Bottom1	>	0.00	True False	A III	
Name Type CompoundVertical CompoundAbsolute Horizontal NB_EOP-HiComponent is Displayed SB_EOP_HAbsolute Horizontal	NB_POSS - Median_Ditch-Bottom1 EOP - Median_Ditch-Bottom1 NB_EOP-High	> <	0.00	True False True	•	
Name Type CompoundVertical CompoundAbsolute Horizontal NB_EOP.H.iComponent is Displayed SE_EOP_HAbsolute Horizontal SB_EOP_HAbsolute Horizontal SB_EOP_HHorizontal	NB_POSS - Median_Ditch-Bottom1 EOP - Median_Ditch-Bottom1 NB_EOP-High Median_Ditch-Bottom2 - NB_EOP	> < <	0.00 12.00 12.00	True False True False		
Template Display Rules Name Type CompoundVertical CompoundAbsolute Horizontal NB_EOP.HiComponent is Displayed SB_EOP_HAbsolute Horizontal SB_EOP_HHorizontal SB_EOP_HHorizontal SB_EOP_HHorizontal SB_EOP_HHorizontal	NB_POSS - Median_Ditch-Bottom1 EOP - Median_Ditch-Bottom1 NB_EOP-High Median_Ditch-Bottom2 - NB_EOP SB_POSS - Median_Ditch-Bottom2	> < <	0.00 12.00 12.00	True False True False True	A III	
Name Type CompoundVertical CompoundAbsolute Horizontal NB_EOP-HiComponent is Displayed SB_EOP_HAbsolute Horizontal SB_EOP_HAbsolute Horizontal SB_EOP_HBorizontal SB_EOP-HiComponent is Displayed SB_EOP_HAbsolute Horizontal	NB_POSS - Median_Ditch-Bottom1 EOP - Median_Ditch-Bottom1 NB_EOP-High Median_Ditch-Bottom2 - NB_EOP SB_POSS - Median_Ditch-Bottom2 SB_EOP-High	> < < <	0.00 12.00 12.00 0.00	True False True False True False	4 III >	

- 33. **<D>** the **AND** button.
- 34. **<D>** the **NOT** button.
- 35. Highlight the NB_EOP-High-Displayed rule in the *Template Display Rules* list.
- 36. **<D>** the **Selected Rule** button.
- 37. **<D>** the **AND** button.
- 38. **<D>** the **NOT** button.
- 39. Highlight the SB_EOP-High-Displayed rule in the *Template Display Rules* list.

40. **<D>** the **Selected Rule** button. The dialog box with completed entries is illustrated below:

Conditional Expression for V_Ditch Comp						OK
V_DitchWidth AND NOT NB_EOP-High	-Displayed AND NOT SB_EOP-High-Displayed		_ =			Cancel Help
AND OR NOT () Selected Rule					
Name Type	Expression	Test	Value	Result	*	
Name Type	Expression NB_POSS - Median_Ditch-Bottom1	Test >	Value 0.00	Result True		
Name Type CompoundVertical						
Name Type CompoundVertical CompoundAbsolute Horizontal	NB_POSS - Median_Ditch-Bottom1	>	0.00	True	*	
Name Type CompoundVertical CompoundAbsolute Horizontal NB_EOP-HiComponent is Displayed	NB_POSS - Median_Ditch-Bottom1 EOP - Median_Ditch-Bottom1	>	0.00	True False	* Ш	
	NB_POSS - Median_Ditch-Bottom1 EOP - Median_Ditch-Bottom1 NB_EOP-High	> <	0.00	True False True	A E	
Name Type CompoundVertical CompoundAbsolute Horizontal NB_EOP.HComponent is Displayed SB_EOP_HAbsolute Horizontal SB_EOP_HHorizontal SB_EOP_HHorizontal	NB_POSS - Median_Ditch-Bottom1 EOP - Median_Ditch-Bottom1 NB_EOP-High Median_Ditch-Bottom2 - NB_EOP	> < <	0.00 12.00 12.00	True False True False	* II	
Name Type CompoundVertical CompoundAbsolute Horizontal NB_EOP.HComponent is Displayed SB_EOP_HAbsolute Horizontal SB_EOP_HAbsolute Horizontal SB_EOP_HComponent is Displayed SB_EOP_HComponent is Displayed SB_EOP_HHorizontal	NB_POSS - Median_Ditch-Bottom1 EOP - Median_Ditch-Bottom1 NB_EOP-High Median_Ditch-Bottom2 - NB_EOP SB_POSS - Median_Ditch-Bottom2	> < <	0.00 12.00 12.00	True False True False True		
Name Type CompoundVertical CompoundAbsolute Horizontal NB_EOP-HiComponent is Displayed SB_EOP_HAbsolute Horizontal	NB_POSS - Median_Ditch-Bottom1 EOP - Median_Ditch-Bottom1 NB_EOP-High Median_Ditch-Bottom2 - NB_EOP SB_POSS - Median_Ditch-Bottom2 SB_EOP-High	> < < < < <	0.00 12.00 12.00 0.00	True False True False True False	× H	

- 41. **<D>** the **OK** button to accept the changes and dismiss the dialog box.
- 42. On the *Component Properties* dialog box, **<D> Apply** then **<D> Close**.

🖌 Component Prop	erties		×
Name:	V_Ditch	+	Apply
Description:			Close
Style:	D_MEDIAN Close Shape		< Previous
Parent Component:	+		Next >
Display Rules:	V_DitchWidth AND NOT NB_EOP-High-Disp	Edit	
Exclude from triangu	ulation		Help

- 43. Test the section again. Notice that only one component at a time is displayed.
- 44. **<D> Close** on the *Test End Conditions* dialog box.
- 45. Select **File > Save** from the *Create Template* menu bar.

The Variable Median Ditch section is ready to be used on a template.

Section Summary:

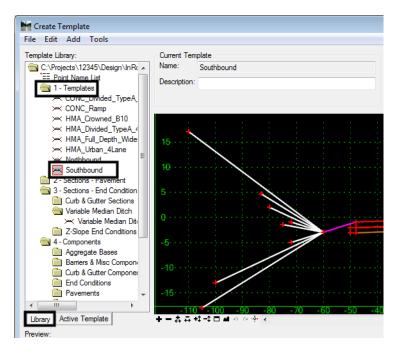
- As components were added to the section, common points were merged but common components (like the end conditions) are not.
- Use the Active Template tree view to access components that are not displayed.
- Additional display rules can be used to turn off a component when two are displayed at the same time.

Lab 26.6 - Adding the Section to a Template and Reviewing the Corridor

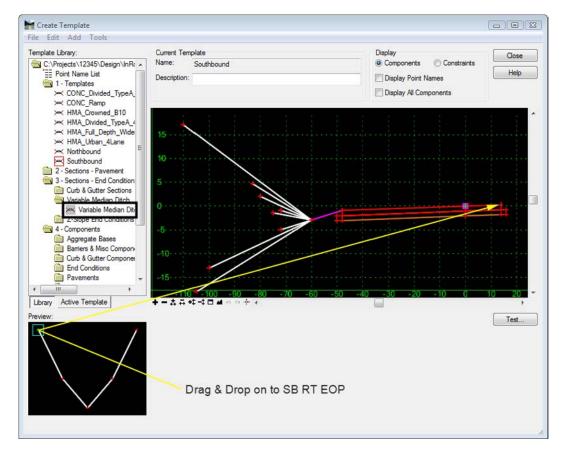
The variable median ditch section can now be added to the template and used in the design corridor.

Section Objectives:

- Add the variable median ditch to the southbound backbone template.
- Update the corridor to use the modified template.
- Examine the results in the Roadway Designer dialog box.
- 1. **<D>** the **Library** tab to show the *Template Library* tree view.
- 2. Expand the **1 Templates** folder.
- 3. **<D> <D> on the Southbound** template to make it active.



- 4. **<D>** on the **Variable Median Ditch** section (in the *3 Sections End Conditions > Variable Median Ditch*) to display it in the *Preview* window.
- 5. In the *Preview* window, **<D> and hold** on the *Variable Median Ditch* origin.



6. Drag the section into the template view and Drop it on the SB RT EOP point.

- 7. Select **File > Save** from the *Create Template* menu bar.
- 8. **<D> Close** on the *Create Template* dialog box.

The template is now ready to use in the corridor.

- From the InRoads main menu bar, select Modeler > Roadway Designer. This displays the *Roadway Designer* dialog box.
- 10. In the *Roadway Designer* dialog box, verify that the Southbound corridor is active.

+-444	-+ - -	+	
Corridor:	Southbound 🗸	Station: 🔣 < 1360+19	.10 > > +
Active Surface:	12345SURV_Existing_Ground_ V	Interval: 25.00	
		Template: SB CONC	C with LT Cut/F

- 11. Select **Corridor > Template Drops** from the Roadway Designer menu bar.
- 12. Highlight the entry in the Current Template Drops list.
- 13. **<D>** the **Synchronize with Library** button.

	ate Drop	os			
Corridor:	Southb	ound	-		Add
Station:	1397+0	00.00		+	Close
Interval:	25.00			+	Change
Library Te	mplates:				Change
	← HMA ← HMA ← HMA ← North ← South	_Crowned_B10 _Divided_TypeA _Full_Depth_Wid _Urban_4Lane bound			Help
Current Te	emplate D)rops:			
Current Te	emplate D		Revi	Library	
Current Te Station	Inter		Revi		ts\12345\D

14. **<D> Close** to dismiss the *Template Drops* dialog box.

- 15. Scroll through the stations watching the template view. Notice the changes in the median ditch (especially around stations 1407+25 and 1415+75,). The different styles used on the median ditch components make it easy to spot when the component changes.
- 16. On the Roadway Designer menu bar, select **File > Save** to save the modified ird file.
- 17. **<D> Close** on the *Roadway Designer* dialog box.
- 18. Close InRoads and MicroStation.

Section Summary:

- The variable median ditch requires no further editing to be used in the template.
- Always check the Template Drops after editing templates.
- After examining the corridor, go back and change the styles of the median ditch components so they match.

Chapter Summary:

- Build complex sections in smaller components that can be tested prior to assembling the whole thing.
- Use display rules to select a single component when more than one can be displayed.
- Use different styles to facilitate trouble shooting.

LAB 27 - Using Walls in a Corridor Run

Walls Are used to reduce the width of sideslopes in areas restricted by right of way, roads or other structures, or natural obstacles. Other labs in this series describe the design of independent walls. In this lab, walls are used as part of the template in a corridor run.

Chapter Objectives:

- Modify an existing wall component for a specific situation.
- Add the modified wall component to a template.
- Construct a new wall component that targets a surface feature.

The Following files are used in this lab:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Walls-Lab.dgn
- C:\Projects\12345\Design\InRoads\12345DES_Walls-Lab.alg
- C:\Projects\12345\Design\InRoads\12345DES_Walls-Lab.ird
- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Templates\ CDOT_Template-Library.itl
- C:\Projects\12345\DesignROW_Survey\InRoads\DTM\12345 Walls-Lab.dtm

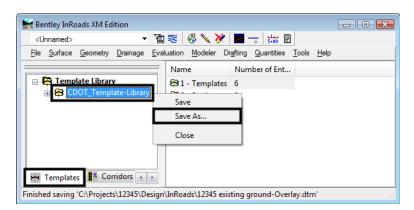
Each of these walls are applied to the same corridor. The wall component that is currently in the library is used on the right side of the template. The new wall component, that is built as part of the lab, is used on the left side.

Lab 27.1 - Add an Existing Wall Component to a Template

The existing wall component has the basic layout needed for this project. It just needs a couple of minor alterations to make it fit into the location where it is used. In this exercise, the wall component is added to the template and the minor changes are made.

- 1. Open MicroStation and InRoads using the C:\Projects\12345\Design\Drawings\ Reference_Files\12345DES_Walls-Lab.dgn file.
- 2. Load the following files into InRoads:
 - C:\Projects\12345\Design\InRoads\12345DES_Walls-Lab.alg
 - C:\Projects\12345\Design\InRoads\12345DES_Walls-Lab.ird
 - C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 Walls-Lab.dtm
 - C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\ Templates\CDOT_Template-Library.itl
- 3. Verify that the C:\Workspace\Workspace-CDOT_XM\Standards-Global\ InRoads\ Preferences\CDOT_Civil.xin file is loaded.
- 4. In the InRoads explorer, **<D>** the **Template** tab.

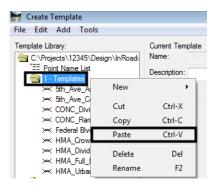
5. **<R>** on the **CDOT_Template-Library** and select **Save As** from the right click menu.



- 6. In the **Save As** dialog box, verify that the **C:\Projects\12345\Design\InRoads**\ directory is selected.
- 7. In the *File name* field, key in *DES12345_Walls-Lab*.
- 8. **<D> Save** then **<D> Cancel**.
- 9. From the InRoads menu bar, select **Modeler > Create Template**.
- 10. In the *Create Template* dialog box, expand the C:\Projects\12345\Design\ InRoads\DES12345_Walls-Lab > 1 - Templates folder.
- 11. **<R>** on the **CONC_Ramp** template and select **Copy** from the right click menu.

File Edit Add Tools Template Library:		Current Template	
\Projects\12345\Design\InRoads\DES = Point Name List ③ 1 - Templates → 5th_Ave_Asphalt → 5th_Ave_Concrete → CONC Divided_TypeA_4Lane		Name: Description:	
CONC_Ramp CONC_Ramp HMA_Crowned_B1 HMA_Divided_Typ HMA_ful_Depth HMA_Urban_4Lan 2 - Sections - Pavemen 3 - Sections - End Conc 4 - Components	Set Activ	/e	
	Cut		Ctrl-X
	Сору		Ctrl-C
	Paste		Ctrl-V
	Delete		Del
	Rename		F2
	Templat	e Documentation Link	
	Display.		

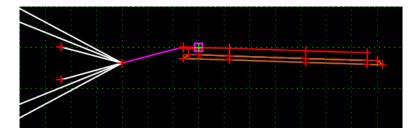
12. **<R>** on the **1** - **Templates** folder and select **Paste** from the right click menu. This creates the *CONC_Ramp1* template.



- 13. **<R>** on the **CONC_Ramp1** template and select **Rename** from the right click menu.
- 14. Key in *CONC_Ramp_with_Walls* for the name.
- <D> <D> on the CONC_Ramp_with_Walls template to make it active. Display the *Dynamic Settings* dialog box.
- 16. In the *Dynamic Settings* dialog box, set the *Steps* to *O. 10*.
- 17. Toggle on **Apply Affixes**.

Dynamic Settings	;		
X: -35.47	Step: 0.10		
Y: -22.48	Step: 0.10		
Point Name:			
Point Style:			
Apply Affixes			
hs= •			
Set Dynamic Origin			

18. Delete the POSS and end condition components from the right side of the template. The illustration below shows the template with the components deleted.



Next, the RT_SubBase_EOP-Top point is moved to line up under the RT_ABC_EOP-Top point. This is so that it will not overlap into the wall base.

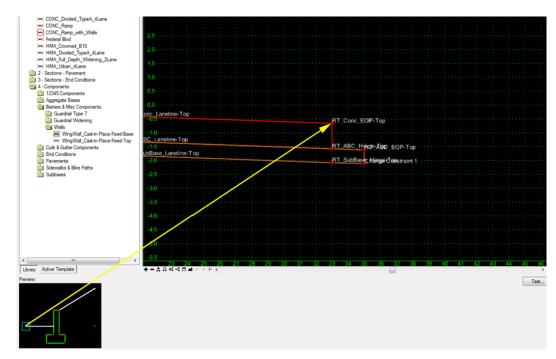
- <D> <D> on the RT_SubBase_EOP-Top point to display the *Point Properties* dialog box.
- 20. Change the *Constraint 1 Type* from *Slope* to Horizontal.

- 21. Key in **0.00** for the Value.
- 22. **<D>** the **Apply** button then **<D> Close** to dismiss the dialog box.

Point Properties			×
Name:	Change Constrain	t1 ▼ +	Apply
Feature Name Override:	RT SubBase EC		
Surface Feature Style:	D EOP		Close
Alternate Surface:	0_001		< Previous
			Next >
		,	Help
	Membe	rot: Lane-Layer	
Constraints	int 1	Constraint	2
Type: Horizontal	-	Vector-Offset	<u>►</u>
Parent 1: RT_ABC_E	OP-Top 🔻 🕈	SubBase_Lan	eline-1 🔻 🛨
Parent 2:		RT_SubBase	Hinge 👻 🕂
Value: 0.00		0.00	
Label:	-		•
Style Constraint:		-	
Horizontal	Vertical	Both	
Range: 0.00			

Now the wall component can be added to the template.

- 23. In the Template Library explorer, expand the folders to show the contents of the C:\Projects\12345\Design\InRoads\DE\$12345_Walls-Lab.itl > 4 Components > Barriers & Misc Components > Walls folder.
- 24. **<D>** on the **WingWall_Cast-in-Place-Fixed-Base** component to display it in the *Preview* window.
- 25. **<D> and hold** on the wall component's origin (the far left point).



26. Drag and drop it onto the *RT_Conc_EOP-Top* point.

Currently, the wall is set 4 feet from the pavement edge. If the wall is extended to its full height, the footer of the wall will expand into the ABC material of the ramp. To correct this problem, the wall is moved 1 foot to the right.

- 27. **<D> <D>** on the **RT_Wall_Top-Back** point to display the *Point Properties* dialog box.
- 28. In the *Point Properties* dialog box, Change the *Value* of *Constraint 2* (the Horizontal constraint) to *5.83*.

29. **<D> Apply** then **<D> Close** to dismiss the dialog box.

Point Properties		x
Name:	RT_Wall_Top-Back - + Apply	-
Feature Name Override:		_
Surface Feature Style:	D Wall-Wing	
Alternate Surface:	<pre>< Previous</pre>	;
	Next >	
	Help	
	Member of:	
	RT_HII RT_WingWall-h10 RT_WingWall-h11 RT_WingWall-h2 RT_WingWall-h3 RT_WingWall-h4	•
Constraints	sint 1 Constraint 2	
Type: Slope	Horizontal	
Parent 1: RT_Height	_Determir 🔻 🕂 RT_Conc_EOP-Top 👻 🕈	-
Parent 2: Rollov	ver Values	
Value: 50.00%	5.83	
Label:	• •	
Style Constraint:	· · · · · · · · · · · · · · · · · · ·	
Horizontal	Vertical OBoth	
Range: 0.00		

This has moved the wall 1 foot to the right. It has also left a gap between the wall and the segment that connects the wall to the rest of the template. Next this gap is closed and a shallow "V" ditch is created between the wall and pavement edge.

- 30. **<D> <D>** on the **RT_SwaleToe** point.
- 31. In the *Point Properties* dialog box, Set the *Constraint 2 Type* to Vector-Offset.
- 32. Set the *Constraint 2 Parent 1* to **RT_Wall_Top-Front**.
- 33. Set the *Constraint 2 Parent 2* to **RT_Wall_Base-Front**.
- 34. Key in **0.00** for the **Constraint 2 Value**.

10			
Maint Properties		×	
Name:	RT_SwaleToe 👻 ቀ	Apply	
Feature Name Override:	RT_SwaleToe	Close	
Surface Feature Style:	D_Top-of-Cut	< Previous	
Alternate Surface:			
		Next >	
	Marchanaf	Help	
	Member of:	<u> </u>	
	RT_Base_Elevation_	Control	
Constraints			
Constra	int 1 Constrain	t 2	
Type: Slope	▼ Vector-Offset	•	
Parent 1: RT_Conc_	EOP-Top 🔻 🕂 RT_Wall_To	p-Front 🔻 🕂	
Parent 2: Rollover Values RT_Wall_Base-Front - +			
Value: 0.00% 0.00			
Label:			
Style Constraint:			
	· · · · · · · · · · · · · · · · · · ·		
O Horizontal	🔿 Vertical 💿 Both		
Range: 0.00			
0.00			

35. **<D> Apply** then **<D> Close** to dismiss the dialog box.

36. **<R>** on the **RT_Base_Elevation_Control** component (the line that connects the Wall with the pavement edge) and select **Insert Point** from the right click menu.

RT Conc EOP-T	op RT SwaleToe RT
RT_ABC_Him RT_SubBase	Add New Component Template Documentation Link Check Point Connectivity Delete Components Change Template Origin Delete Constraints from All Points
·····	Edit Component Insert point
	Add Point Unmerge Component Points Set Component Display Rules Delete Component
0 32 34	Set Dynamic Origin Ctrl-D

- RT_PailUVopEropaBack Place the new point here RT_Conc_EOP-Top RT_SwaleToe RT_ABC_HaruseAB0P_EQP-WRat_Real WoodsWeateMaamtkTop RT_ABC_HaruseAB0P_EQP-Wrat_Real WoodsWeateMaamtkTop RT_SubBatehHitgaeComBtraint 1 RT_Wall Toe-BottoW all_Heel_Bottom
- 37. Place the point between and below the *RT_Conc_EOP-Top* and *RT_SwaleToe* points.

- 38. **<D> <D>** on the new point to display the *Point Properties* dialog box.
- 39. In the *Point Properties* dialog box *Name* field, key in **RT_Ditch-Bottom**.
- 40. Set the *Surface Feature Style* to **D_Ditch-Bottom**.
- 41. Set the *Type* for both constraints to **Slope**.
- 42. Set the *Parent 1* for *Constraint 1* to **RT_Conc_EOP-Top**.
- 43. Set the *Parent 1* for *Constraint 2* to **RT_SwaleToe**.
- 44. Key in -8.33% for the Value of Constraint 1.
- 45. Key in **8.33%** for the *Value* of *Constraint 2*.

46. **<D> Apply** then **<D> Close** to dismiss the dialog box. The illustration below shows the dialog box as completed

Point Properties			×
Name:	RT_Ditch-Bottom	- +	Apply
Feature Name Override:			Close
Surface Feature Style:	D_DITCH-Botton	n 🔻	< Previous
Alternate Surface:		-	Next >
	Membe	er of:	Help
	RT_B	ase_Elevation_C	Control
Constraints			
Constra	aint 1	Constraint	2
Type: Slope	•	Slope	-
Parent 1: RT_Conc_	EOP-Top 🔻 🕂	RT_SwaleToe	▼ +
Parent 2: Rollov	ver Values	Rollover	Values
Value: -8.33%		8.33%	
Value: -8.33% Label:		8.33%	•
-0.00%		8.33%	•
Label:	Vertical	8.33%	•
Label:	Vertical		•

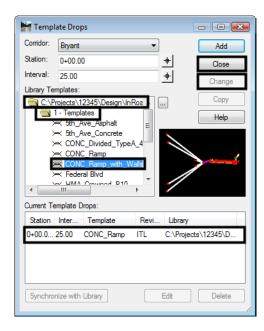
This completes the edits to the template.

47. Select **File > Save** from the *Create Template* menu bar.

48. **<D>** the **Close** button on the *Create Template* dialog box to dismiss it.

Now, examine how the template behaves in Roadway Designer.

- 49. Select **Modeler > Roadway Designer** from the InRoads menu bar.
- 50. From the *Roadway Designer* menu bar, select Corridor > Template Drops.
- 51. In the *Template Drops* dialog box, highlight the entry in the *Current Template Drops* area.
- 52. Expand the Template library folder to show the contents of the *1 Templates* folder.
- 53. Highlight the CONC_Ramp_with_Walls template from the Library Templates list.



54. **<D> Change** then **<D> Close** to dismiss the dialog box.

- 55. Scroll through the template drops in the Cross Section view of the Roadway Designer dialog box.
- 56. Verify that the wall is expanding and contracting to meet the existing ground.
- 57. Select File > Save from the *Roadway Designer* dialog box.
- 58. **<D> Close** to dismiss the dialog box.

Section Summary:

- The Wall_Top-Back point is the controlling point for the wall component's shape. Change its horizontal constraint to move the wall away from or closer to the template origin.
- Adjust the horizontal constraint on the Height Control Point to change the width of the Fill component that extends from the back of the wall to the existing ground.
- Aside from the Wall_Top-Back, SwaleToe, and Height _Control_Point try not to edit other points on the wall component as these can change the shape of the visible component but not the hidden components.

Lab 27.2 - Creating a Custom Wall

There are cases where the wall components in the template library are not suited for the situation under design. In the exercise below, a wall is required on the left side of the template from station 1+50 to the end of the project. The height of the wall is determined by running a 10 to 1 slope from a target feature in the existing ground dtm up to the base of the wall.

Section Objectives:

- Make a copy of the CONC_Ramp_with_Walls template.
- Add an end condition that seeks a surface feature.
- Build the slope component from the targeted feature to the base of the wall.
- Build the wall components.
- Update the corridor to use the templates.

First, a copy of the CONC_Ramp_with_Walls template is made. This template is used for the first 150' of the project.

- 1. From the InRoads menu bar, select **Modeler > Create Template**.
- In the Create Template dialog box, expand the C:\Projects\12345\Design\ InRoads\DE\$12345_Templates-Overlay.itl > 1 - Templates folder.
- 3. **<R>** on the **CONC_Ramp_with_Walls** template and select **Copy** from the right click menu.
- 4. **<R>** on the **1 Templates** folder and select **Paste** from the right click menu. This creates the *CONC_Ramp_with_Walls1* template.
- 5. **<R>** on the **CONC_Ramp_with_Walls1** template and select **Rename** from the right click menu.
- 6. Key in *CONC_Ramp_with_Wall-Rt* for the name.

The CONC_Ramp_with_Wall-Rt template is used for the first 150' of the project. The CONC_Ramp_with_Walls template will be modified with a wall on the left side and is used on the remainder of the project.

7. Verify that the **CONC_Ramp_with_Walls** template is active.

8. Delete the POSS and end condition components from the left side of the template. The illustration below shows the template with the left end conditions deleted:



- 9. Display the *Dynamic Settings* dialog box.
- 10. In the *Dynamic Settings* dialog box, verify that the *Steps* are set to *0.10*.
- 11. Verify that **Apply Affixes** is toggled on.
- 12. **<R>** in a blank area of the template view and select **Add New Component > End Condition** from the right click menu.
- 13. In the *Current Component* area, key in *10:1 Fill* for the *Name*.
- 14. Set the *Style* to **D_Toe-of-Fill**.
- 15. Set the *Target Type* to Feature XYZ.
- 16. Set the *Surface* to **12345_Walls-Lab**.
- 17. Select **03101311** for the *Feature*.

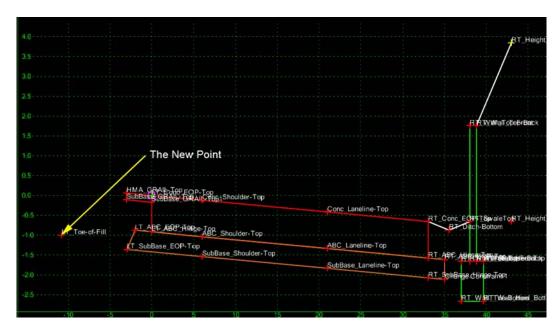
← ← ← Current Cor Name: 10;	mponent	4 A A	** *	Style:	D_Toe	-of-Fill 🔻
Target Typ	e:	Featur	re XYZ 🔹	Priority:		1
Surface			345_Walls-Lab	Benching	Count:	0
Feature: • 03101311		From D	latum:	0.00		
	Horizon	tal	Vertical	Step Elev	ation:	0.00
Offsets:	0.00		0.00	Rounding Ler	ngth	0.00

- 18. **<D>** on the **HMA_GRAIL-Top** point.
- 19. In the *Dynamic Settings* dialog box, toggle on **End Condition is Infinite** and **Do Not Construct**.

20. Select **Toe-of-Fill** for the **Point Name**.

Dynamic Settir	gs 🛛 🖻					
X: 0.90	Step: 0.10					
Y: 1.10	Step: 0.10					
Check for I	Check for Interception					
V Place Point	at Interception					
End Condition	End Condition is Infinite					
Do Not Cor	struct					
Point Name: Toe-of-Fill 👻						
Point Style:						
Apply Affixes						
hs=	•					
Set D	ynamic Origin					

- 21. **<D>** below and to the left of the **HMA_GRAIL-Top** point.
- 22. **<R>** and select **Finish** from the right click menu. The only thing that is displayed is a single point (LT_Toe-of-Fill).



This component is only used to locate the feature. The slope and wall will be built back from this point to the rest of the template.

Next, the ABC component is modified on the left side and the Wall component is added.

- 23. **<D> <D> the LT_SubBase_EOP-Top** point to display the *Point Properties* dialog box.
- 24. In the *Point Properties* dialog box, change the *Slope* constraint to a **Horizontal** constraint (Constraint 1 in this example).

25. Key in *0.00* for the *Value* of the *Horizontal* constraint. This moves the point out of the way of the wall.

Point Properties			×
Name:	LT_SubBase_EO	P-Top ▼ +	Apply
Feature Name Override:	LT_SubBase_EO	P-Top	Close
Surface Feature Style:	D_EOP	•	< Previous
Alternate Surface:		-	Next >
	Member	r of:	Help
	ABC_L	ane-Layer	
Constraints			
Constra	int 1	Constraint	2
Type: Horizontal	•	Vector-Offset	•
Parent 1: [LT_ABC_E	OP-Top 🔻 🕂	SubBase_Lane	
Parent 2:		SubBase_Shou	ulder- 👻 🕂
Value: 0.00		-0.00	
Label:	-		•
Style Constraint:		-	
Horizontal	Vertical 💿	Both	
Range: 0.00			

- 26. **<D> Apply** then **<D> Close** to dismiss the dialog box.
- 27. **<R>** in a blank area of the template view and select **Add New Component > Unconstrained** from the right click menu.
- 28. In the *Current Component* area, key in *Fill Slope* for the *Name*.
- 29. **<D>** on the **LT_Toe-of-Fill** point.
- 30. In the *Dynamic Settings* dialog box, key in *Toe-at-Wall* for the *Point Name*.
- 31. Verify that the *Style* is set to **D_Toe-of-Fill**.

32. **<D>** just to the left and below the guardrail asphalt component as shown in the illustration below:

0.4 Second point 0.2 for Fill Slope	HMA_GRAIL_Tep Conc_EOP-Top		
-0.0	SubBase_GRAIL-Top SubBase_GRAIL-Top1	Conc_Shoulder-Top	
	T_Toe-at-Wall		
-0.6			
-1:0 -1:0 -1:0 -1:0	LT ABC EORECPHinge-Top	ABC_Shoulder-Top	
-1.2	LT_SubBase_EOP-Top		
-1.6		SubBase_Shoulder-Top	
-1:8			

- 33. **<R>** and select **Finish** from the right click menu. Constraints will be added to the *LT_Toe-at-Wall* point after the wall component is added.
- 34. **<R>** in a blank area of the template view and select **Add New Component > Unconstrained** from the right click menu.
- 35. In the *Current Component* area, key in *Wall* for the *Name*.
- 36. Select **D_Wall-Retaining** for the *Style*.
- 37. **<D>** on the **HMA_GRAIL-Top** point.
- 38. In the *Dynamic Settings* dialog box, key in *Wall_Base-Back* for the *Point Name*.
- 39. Set the *Style* set to **D_Wall-Retaining**.
- 40. **<D>** directly below the **HMA_GRAIL-Top** point about half way through the ABC component.
- 41. In the *Dynamic Settings* dialog box, key in *Wall_Base-Front* for the *Point Name*.
- 42. Move the cursor to the left until the *X* coordinate reads *-3.90* in the *Dynamic Settings* dialog box then *<D>*.
- 43. In the *Dynamic Settings* dialog box, key in *Wall_Top-Front* for the *Point Name*.
- 44. Move the Cursor straight up and **<D>** near the level of the *HMA_GRAIL-Top* point.

45. **<R>** and verify that *Closed Shape* is toggled on, then select **Finish** to complete the component. The illustration below shows the new wall component.

).2 · · ·	Finish	Enter						
✓	Closed Shape	Ctrl-L	LT_	TIPRIA CHRIA				
0:0 · ·	Mirror	Ctrl-M		Publishe C	L T ^{op} Conc EO	-lop		
0:2 · ·	Undo Last	ESC		SubBase_G	RAIL-Top SubBase_GR/	AIL-Top1	Conc_Sh	oulder-Top
	Cancel							
0:4	Set Dynamic Origin	Ctrl-D	TTOP	at-Wall				
0:6 • • • •								
0:8 • • • •								
0:0								
				LT_AB(e-Top		
1.0	Toe-of-Fill					је-Тор	ABC Sho	ulder-Top
1.0 . 4 7.	Toe-of-Fill		LT	LT_AB(W∑allWBalseBl		je-Top	ABC_Sho	ulder-Top
1:0 4 7	Toe-of-Fill		LT	WTāllWBaisteBi	āsenBack		ABC_Sho	ulder-Top
1:0 - 1 :2	Toe-of-Fill		LT	WTāllWBaisteBi				
-1:0 -	Toe-of-Fill		<u>I</u> T	WTāllWBaisteBi	āsenBack			oulder-Top Shoulder-To
41:0 - 47 41:2 41:4 41:6	Toe-of-Fill		LT.	WTāllWBaisteBi	āsenBack			

- 46. **<D> <D> the LT_Wall_Base-Back** point to display the *Point Properties* dialog box.
- 47. In the *Point Properties* dialog box, set the *Constraint 1 Type* to Horizontal.
- 48. Set the *Constraint 2 Type* to Vertical.
- 49. Set the *Parent 1* for *Constraint 1* to HMA_GRAIL-Top.
- 50. Set the *Parent 1* for *Constraint 2* to LT_Wall_Base-Front.
- 51. Key in **0.00** for the *Value* of both constraints. The illustration below shows the completed dialog box.

Point Properties		×
Name:	LT_Wall_Base-Back 🔻 🛨 🛛 Apply	
Feature Name Override:	LT_Wall_Base-Back Close	
Surface Feature Style:	D_Wall-Retaining	us
Alternate Surface:	Next :	
	Member of:	
	LT_Wall	
Constraints		
Constra	aint 1 Constraint 2	
Type: Horizontal	✓ Vertical ✓	
Parent 1: HMA_GRA	NL-Top 🔹 🛨 LT_Wall_Base-Front 💌	+
Value: 0.00	0.00	
Label:	•	
Style Constraint:	· · · · · · · · · · · · · · · · · · ·	
Horizontal	Vertical 🔘 Both	
Range: 0.00		

- 52. **<D> Apply** then **<D> Close** to dismiss the dialog box.
- 53. **<D> <D>** the **LT_Wall_Base-Front** point.

- 54. Set the *Constraint 1 Type* to **Slope**.
- 55. Set the *Constraint 2 Type* to Vertical.
- 56. Set the *Parent 1* for both constraints to LT_Toe-at-Wall.
- 57. Key in 10000% for the Value of Constraint 1.
- 58. Key in **1.50** for the *Value* of *Constraint 2*. The illustration below shows the completed dialog box.

Maint Properties			×
Name:	LT_Wall_Base-Fro	ont 👻 🕂	Apply
Feature Name Override:	LT_Wall_Base-Fro	ont 📃	Close
Surface Feature Style:	D_Wall-Retaining	•	< Previous
Alternate Surface:		-	Next >
	Membe	r of:	Help
	LT W		
	L1_W		
_			
Constraints			-
Constra	int 1	Constraint	2
Type: Slope	-	Vertical	-
Parent 1: LT_Toe-at-	Wall 👻 🕂	LT_Toe-at-Wa	• •
Parent 2: Rollov	er Values		
Value: 10000.00%		-1.50	
Label:	•		•
Style Constraint:		-	
Horizontal	Vertical	Both	
Range: 0.00			
0.00			

- 59. **<D> Apply** then **<D> Close** to dismiss the dialog box.
- 60. **<D> <D>** the **LT_Toe-at-Wall** point.
- 61. Set the *Type* of both constraints to **Slope**.
- 62. Set the *Parent 1* for *Constraint 1* to LT_Toe-of-Fill.
- 63. Set the *Parent 1* for *Constraint 2* to LT_Wall_Top-Front.
- 64. Key in *10.00%* for the *Value* of *Constraint 1*.

65. Key in **-10000%** for the *Value* of *Constraint 2*. The illustration below shows the completed dialog box.

Point Properties			×
Name:	LT_Toe-at-Wall	+ Apply	
Feature Name Override:	LT_Toe-at-Wall	Close	
Surface Feature Style:	D_Toe-of-Fill	Previo	
Alternate Surface:		Next >	
	Member	of: Help	
	LT_D_1	Foe-of-Fill	
Constraints			
Constra	aint 1	Constraint 2	
Type: Slope		Slope 👻	
Parent 1: LT_Toe-of-	-Fill 🔻 🕂	LT_Toe-at-Wall3 👻	†
Parent 2: Rollos			
	ver Values	Rollover Values	
Value: 10.00%		-10000.00%	
Value: 10.00%			
Value: 10.00% Label:	• • •		
Value: 10.00% Label:	• • •	-10000.00%	

- 66. **<D> Apply** then **<D> Close** to dismiss the dialog box.
- 67. **<D> <D>** the **LT_Wall_Top-Front** point.
- 68. Set the *Constraint 1 Type* to Horizontal.
- 69. Set the *Constraint 2 Type* to Vertical.
- 70. Set the *Parent 1* for both constraints to HMA_GRAIL-Top.
- 71. Key in 1.00 for the Value of Constraint 1.

72. Key in **0.00** for the *Value* of *Constraint 2*. The illustration below shows the completed dialog box.

🐂 Point Properties			×
Name:	LT_Toe-at-Wall3	+	Apply
Feature Name Override:	LT_Toe-at-Wall3		Close
Surface Feature Style:	D_Wall-Retaining	•	< Previous
Alternate Surface:		~	Next >
	Membe		Help
	LT_W	all	
Constraints Constra	int 1	Constraint 2	2
Type: Horizontal	•	Vertical	•
Parent 1: HMA_GRA	IL-Top 🔻 🕂	HMA_GRAIL-T	op ▼ <u>+</u>
Value: -1.00		0.00	
Label:	•		•
Style Constraint:		-	
Horizontal	Vertical 🔘	Both	
Range: 0.00			

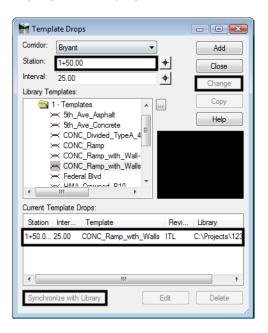
- 73. **<D> Apply** then **<D> Close** to dismiss the dialog box.
- 74. In the Template Library explorer, expand the folders to show the contents of the C:\Projects\12345\Design\InRoads\DE\$12345_Walls-Lab.itl > 4 Components > Barriers & Misc Components > Guardrail Type 7 folder.
- 75. **<D>** on the **Guardrail_Type 7-CD** component.
- 76. Drag the component by the origin (lower left corner) and drop it on to the LT_Wall_Top-Front point. The illustration below shows the completed template.



- 77. Select **File > Save** from the *Create Template* menu bar.
- 78. **<D>** the **Close** button on the *Create Template* dialog box to dismiss it.

The template is now ready to use in the corridor.

- 79. Select **Modeler > Roadway Designer** from the InRoads menu bar.
- 80. From the *Roadway Designer* menu bar, select Corridor > Template Drops.
- 81. In the *Template Drops* dialog box, highlight the entry in the *Current Template Drops* area.
- 82. In the *Station* field, key in *1+50.00*.
- 83. **<D>** the **Change** button.
- 84. Highlight the entry again and **<D>** the **Synchronize with Library** button.



- 85. In the *Station* field, key in *0+00.00*.
- 86. Expand the Template library folder to show the contents of the *1 Templates* folder.
- 87. Highlight the CONC_Ramp_with_Wall-Rt template from the Library Templates list.
- 88. **<D>** the **Add** button.
- 89. In the *Station* field, key in *1+49.99*.

🔚 Templa	ite Drops	- • ×			
Corridor:	Bryant 🔹	Add			
Station:	1+49.99 +	Close			
Interval:	25.00 +	Change			
Library Ten	nplates:				
	- Templates	Сору			
	≺ 5th_Ave_Asphalt ≺ 5th_Ave_Concrete	Help			
Current Template Drops:					
Station	Inter Template Rev	vi Library			
0+00.0 2	5.00 CONC_Ramp_with_Wall ITL	C:\Projects\123			
1+49.9 2	5.00 CONC_Ramp_with_Wall ITL	C:\Projects\123			
1+50.0 2	5.00 CONC_Ramp_with_Walls ITL	C:\Projects\123			
•	III	4			
Synchron	ize with Library Edit	Delete			

90. **<D>** the **Add** button then **<D> Close** to dismiss the dialog box. The completed dialog box is shown below.

- 91. Scroll through the template drops in the Cross Section view of the Roadway Designer dialog box.
 - Verify that the wall is expanding and contracting to meet the existing ground.
- 92. Select **File > Save** from the *Roadway Designer* dialog box.
- 93. **<D> Close** to dismiss the dialog box.
- 94. Close InRoads and MicroStation.

Section Summary:

- An end condition was used to locate the feature to tie to. This can also be done with a Null point and a point control.
- A true vertical segment can not be used to create a triangulated surface, that is why the wall face has a 10000% slope.

Chapter Summary:

- Add walls to a corridor using dedicated templates and template drops. Using walls as part of an end condition solution may result in walls occurring in areas where they are not wanted or not occurring in areas where they are needed.
- Wall sections will contain either an end condition or point control to determine the height of the wall.
- Changes from the non-wall to the wall template should occur within 0.01 feet. This ensures a clean change from one template to the other.

LAB 28 - Create Raised Median

This lab demonstrates a procedure for modeling a roadway which includes a raised median and a median opening. The exercise below uses a single template which utilizes point controls and display rules to achieve the two different roadway sections. Additionally a second template is used to model the median openings.

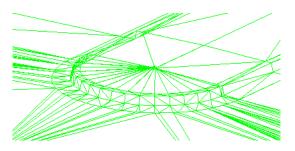
Chapter Objectives:

- Use a single template to model the mainline with and without a median
- Create display rules which determine when the raised median excluded
- Use point controls to define the location of the median nose
- Model multiple corridors
- Combine corridors in a single final surface

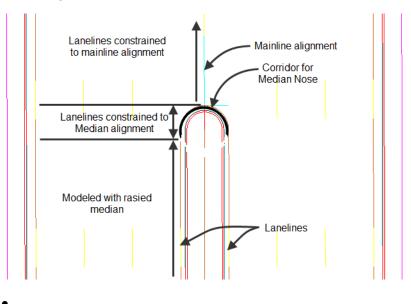
Lab 28.1 - Workflow

A summary of the overall process

- 1. In addition to the mainline horizontal and vertical alignments, create horizontal alignment(s) for the median nose.
- 2. Create a template for the crowned roadway without the raised median.
- 3. Model the mainline using the crowned template.
- 4. Create the vertical alignments for the median noses by extracting their elevations from the surface created in the previous step.
- 5. Create a template for the median noses
- 6. Model the median noses
- 7. Create a template for the raised median
- 8. Add Display Rules to the components of the raised median.
- 9. Create a corridor definition for the raised median
- 10. Add point controls to constrain the raised median template to run as defined, constrained to the medians or to the mainline alignment.
- 11. Define key stations for template drops.
- 12. Create the final design surface by modeling the mainline and median openings simultaneously.



Modeling Schematic



Lab 28.2 - Open Lab Files

An initial model of the roadway is crated using the roadway typical section without the median. This is done for the purposed of extracting the profile gradeline for the median noses.

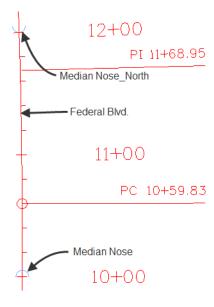
- 1. Open MicroStation and InRoads using the *12345DES_Model-Create Raised Median.dgn* file.
- 2. Verify that the file C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\ Preferences\CDOT_Civil.xin
- 3. Select **File> Open** from the InRoads menu bar.
- 4. Open the following files from C:\Projects\12345\Design\InRoads\ folder:
 - ♦ 12345DES_Existing-Create Raised Median.dtm
 - ◆ 12345DES_Geometry-Create Raised Median.alg
 - ◆ 12345DES_Templates-Create Raised Median.itl
 - ◆ 12345DES_Roadweay-Create Raised Median.ird
- 5. **<D> Cancel** the *Open* dialog box to close.

Lab 28.3 - Review The Alignments

In this exercise three alignments are used. *Federal CL* for the main corridor, *Median Nose* and *Median Nose_North* which define the median opening and termination.

- 1. Select the Geometry tab in the InRoads Explorer
- 2. View the horizontal alignments Federal CL, Median Nose and Median Nose_North

3. View stationing for horizontal alignment Federal CL



Lab 28.4 - Review Data

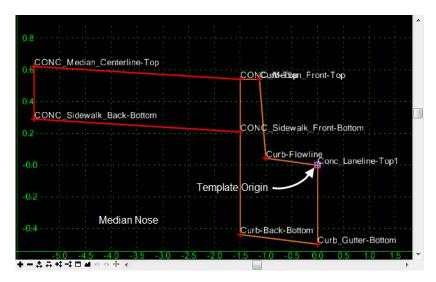
An initial model of the roadway was created using a crowned roadway section (without the raised median). This was done for the purpose of extracting the vertical profile of the median noses. This was accomplished by using the command **File > Import > Geometry [Vertical From Surface]**.

🕈 Import Geom	etry		
From Graphics	ICS	Vertical from Surface	
Surface:	12345	DES_Existing-Create Raise 🔻	Apply
Vertical Alignm	nent		
Name:	Mediar	Nose V	
Description:	Vertica	I from crowned DTM	
Style:	ALG_C)THER_Vert	Help
Target			
Horizontal Alig	nment:	Median Nose 🔹	
Station Lim	its		
Start:		0+00.00 +	
Stop:		0+17.28 +	-
Horizontal	Offset:	0.00	
Vertical Off	set:	0.00	
Points of Verti	ool lete	montion	
Interval:	car Inte	0.00	
Tolerance:		0.00	
		L	
		Close	

Next, the templates used for the project are reviewed.

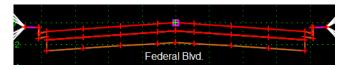
1. Select **Modeler > Create Template** from the InRoads menu bar.

2. In the *Create Template* dialog box review the template for *Median Nose* in the *1-Templates* folder.

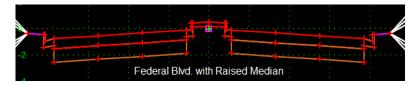


3. Also in the *Create Template* dialog box, review the templates for Federal Blvd. in the *1-Templates* folder.

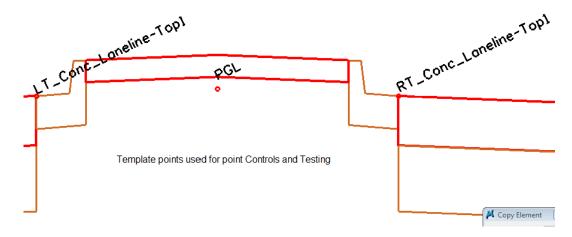
The *Federal Blvd* template was use to create a preliminary model. This model was used to extract vertical alignments for the median alignments.



The template *Federal Blvd with Raised Median*. uses display rules control to determine when the median is modeled.



The illustration below shows an expanded view of the median. The 'Laneline' points will be controlled by both the Federal Blvd. and median alignments. Additionally the median components will be assigned display rules which will test the distance between the lanelines and the PGL.



Lab 28.5 - Add Display Rules

Display rules are associated with components to test if the component should be displayed or not. The display rules turn off the median components if the distance between either lanelines and the PGL is less than 5.50'. This is the distance from the mainline alignment to the PC or PT of either median nose alignment.

- 1. Copy the template *Federal Blvd with Raised Median* to *Federal Blvd with Raised Median_DR*.
- 2. Open the *Federal Blvd with Raised Median_DR* template for editing.
- 3. Select the median curb and gutter component named *LT_C/G_Type2-1B* for editing. In the Component Properties dialog box, select the **Edit** button.

🔀 Component Prope	erties		8
Name:	LT_C/G_Type2-IB	+	Apply
Description:	Curb and Gutter 6" Barrier Curb and 1' Gutter		Close
Style:	D_C/G_Ty-2_Sect I Close Shape		< Previous
Parent Component:	· · · · · · · · · · · · · · · · · · ·		
Display Rules:		Edit	Next >
Exclude from triangu	lation		Help

					Cancel Help
AND (OR NOT	() Select	ed Rule		
Name	Туре	Expression	Test	Value Res	

4. In the *Component Display Conditional Expression* dialog box, select the **Add** button.

- 5. **Create** a Display Rule that tests the distance between the Left Laneline and the PGL using the following data:
 - ♦ Name: LeftC/G
 - Description: test distance between LT laneline and PGL
 - *Type:* Absolute Horizontal
 - *Between:* LT_Conc_Laneline-Top1
 - ♦ And: PGL
 - ◆ Test (button): >=
 - ◆ Value (field): *5.50*

🧱 Display R	ule		X
Name:	LeftC/G		OK
Description:	test distance between LT laneline and PGL		Cancel
Туре:	Absolute Horizontal		Help
Between:	LT_Conc_Laneline-Top1	+	
And:	PGL 🗸	+	
	>= • 5.50		

	oonent Display Conditi anal Expression for LT C	onal Expression /G_Type2-IB Component				OK
LeftC/G			*	=		Cancel Help
AND Template	OR NOT Display Rules	() Selected Ru	Je			
Name	Туре	Expression	Test	Value	Result	
LeftC/G	Absolute Horizontal	LT_Conc_Laneline-Top1 - PGL	>=	5.50	True	

6. Highlight the rule and **<D>** the **Selected Rule** button.

- 7. **<D> OK** to use the rule and dismiss the dialog box.
- 8. In the *Component Properties* dialog box, **<D> Apply** then **Close**.
- 9. Select the component *RT_C/G_Type2-1B* for editing.
- 10. Build and apply a similar rule for the RT Laneline using the following data:
 - ♦ Name: RightC/G
 - Between: RT_Conc_Laneline-Top1
 - ♦ And: PGL
 - All other fields are the same
- 11. Edit the component CONC_Sidewalk-4"
- 12. *Build* and **Apply** a Display Rule to test for a minimum distance of 11.00 feet between the RT and LT Lanelines for the Median Cover (Conc_Sidewalk-4") using the following data:
 - ♦ Name: MedianPavt
 - Description: Test width between lanelines
 - *Type:* Absolute Horizontal
 - Between: LT_Conc_Laneline-Top1
 - ♦ And: RT_Conc_Laneline-Top1
 - ◆ Test (button): >=

♦ Value: 11.00

🔣 Display R	ıle		23
Name:	MedianPavt		ОК
Description:	Test width between lanelines		Cancel
Type:	Absolute Horizontal		Help
Between:	LT_Conc_Laneline-Top1	+	
And:	RT_Conc_Laneline-Top1	+	
	>= • 11.00		

13. Save and Close the Create Template dialog box.

Lab 28.6 - Create Corridors

Corridors contain definitions for which alignments, templates, point controls, etc. are used to model the roadway. In this exercise, three corridors are defined, one for each median nose and a new one for the mainline.

- 1. Select Modeler > Roadway Designer
- 2. Select Corridor > Corridor Management from the Roadway Designer menu bar.
- 3. In the *Manage Corridors* dialog box, key in *Median Nose* for the *Name*.
- 4. Set the *Type* to Alignment.
- 5. Set the *Horizontal Alignment* to Median Nose.
- 6. Set the *Vertical Alignment* to Median NoseV.
- 7. **<D>** the **Add** button to create the corridor.

Name: Median No	se		Limits Station		Add
Туре:	Alignment	-	Start:		Close
Horizontal Alignmen	t: Median No	ose 🔻 🛨	0+00.00	+ a	nange
Vertical Alignment:	Median No	oseV 👻	Stop:		Сору
PI Rounding Tange	nt: 0.00		0+17.28		y From
Corridors: Name	Туре	Source Name	Start Station	Stop Station	Help
Federal	Alignment	Federal CL	8+00.00	19+00.00	
Median Nose	Alignment	Median Nose	0+00.00	0+17.28	

- 8. Repeat the steps above to add a corridor for the *Median Nose_North* alignment using the following data:
 - Name: Median Nose_North
 - Type: Alignment

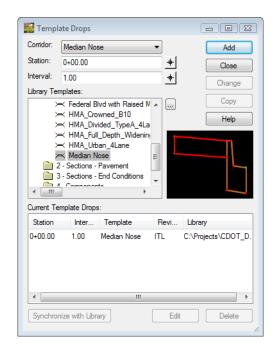
- Horizontal Alignment: Median Nose_North
- Vertical Alignment: Median Nose_NorthV
- 9. Create a corridor for the Mainline using the following data:
 - ♦ Name: Federal_Display_Rule
 - *Type:* Alignment
 - ♦ Horizontal Alignment: Federal CL
 - Vertical Alignment: Federal CL_V
 - ♦ Start Station: 8+00
 - ◆ *Stop Station:* 19+00

10. **<D> Close** to dismiss the *Manage Corridors* dialog box.

Lab 28.7 - Add Template Drops

Templates define the cross section of the design model. They are assigned to the corridor through the Template Drops dialog box. The starting station defaults to the beginning of the corridor, so setting the interval and selecting the desired template is all of the input that is required.

- 1. Select **Corridor > Template Drops** from the Roadway Designer menu bar.
- 2. Highlight the Median Nose template from the Library Templates list.
- 3. Key in **1** for the *Interval*.



4. **<D> Add** to create the template drop.

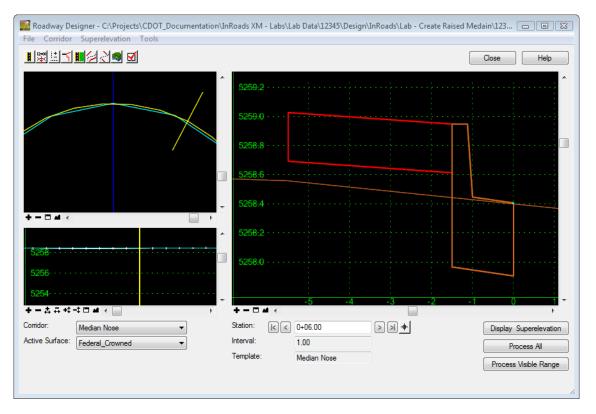
Next, add a template drop to the Median Nose_North corridor.

- 5. Set the *Corridor* to Median Nose_North.
- 6. Highlight the **Median Nose** template from the *Library Templates* list.
- 7. Key in **1** for the *Interval*.

🐂 Templa	ate Drops				- • •
Corridor:	Median N	ose_North	-		Add
Station:	0+00.00		-	₽	Close
Interval:	1.00		-	₽	Change
Library Ten	nplates:				
		Blvd with No Me]	Сору
		Blvd with Raise Blvd with Raise	-		Help
× ×	≺ HMA_D ≺ HMA_Fu ≺ HMA_U ≺ Median	Doucomont	ni 🗌		
Station	Interval	Template	Revised	d In Li	ibrary
0+00.00	1.00	Median Nose	ITL	C:	\Projects\12345
•		III			4
Synchron	nize with Lib	orary	E	dit	Delete

- 8. **<D> Add**.
- 9. Set the *Corridor* to Federal_Display_Rule.
- 10. Key in *8+00* for the *Station*.
- 11. Key in *10* for the *Interval*.
- 12. Highlight the Federal Blvd with Raised Median_DR template from the *Library Templates* list.
- 13. **<D> Add** then **Close** to dismiss the *Template Drops* dialog box.

Use Roadway Designer to evaluate the corridors. The template data is displayed in the cross section view of the Roadway Designer dialog box. There are two options for scrolling through the corridor; using the station arrows below the cross section view and using the station line in the plan view.

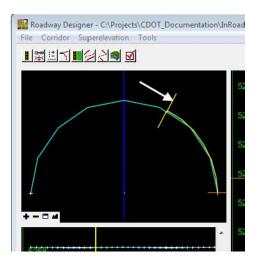


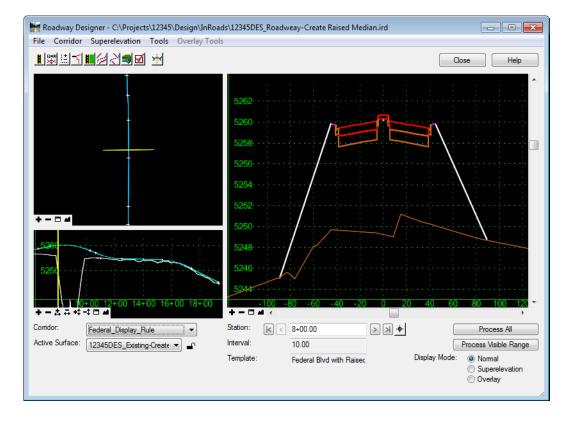
14. In the *Roadway Designer* dialog box, set the *Corridor* to Median Nose.

15. **<D>** on the station arrows to scroll through the design. Notice how the data in the cross section view is updated for each station.

+-□/	1		
Station:	K < 04	+00.00	+ K <
Interval:	1.	00	
Template:	M	edian Nose	

16. **<D> and Hold** on the yellow station line. Move the pointer back and forth to scroll through the design. The data is now updated based upon the location of the station bar.





17. Evaluate the *Federal_Display_Rule* corridor.

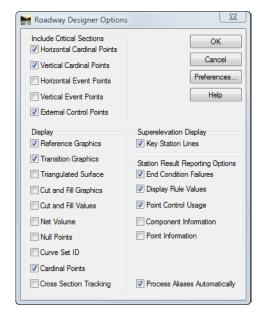
Lab 28.8 - Change Roadway Designer Settings

The Roadway Designer settings determine if additional stations are processed, what information is displayed in the views, and what information is included in the processing report. In this exercise, cardinal points are processed and component and point information is added to the processing report.

The first series of steps set Roadway Designer to process the horizontal cardinal and event points.

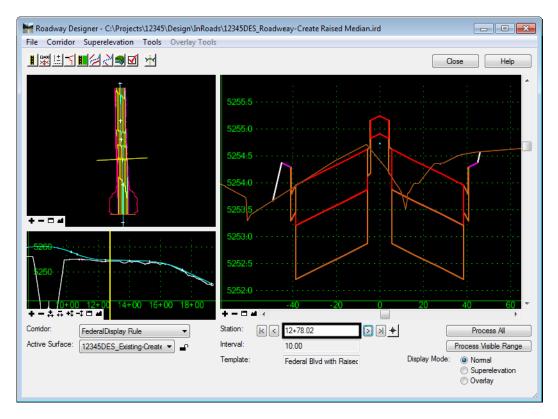
- 1. From the Roadway Designer menu bar, select **Tools > Options**.
- 2. In the *Roadway Designer Options* dialog box, toggle on the following options:
 - + Horizontal Cardinal Points
 - Vertical Cardinal Points
 - External Control Points
 - Reference Graphics

• Transition Graphics.



3. **<D>OK**.

4. Scroll through the stations and notice that some stations do not fall on even intervals. These are the cardinal and event points.



Lab 28.9 - Point Controls

This series of steps adds Point Controls (overrides) to the Federal_Display_Rule corridor. The roadway is modeled as defined until it encounters a point control. For this design, three point controls are required for each side of the roadway (Left laneline and Right laneline) for 6 total point controls. The first control instructs the laneline to follow a feature created by the *Median Nose* corridor. The second control instructs the laneline to follow the *mainline alignment*. The third control instructs the laneline to follow a feature created by the *Median Nose_North* corridor.

- 1. Verify the corridor Federal_Display_Rule is the active corridor.
- 2. Select **Corridor > Point Controls** from the Roadway Designer menu bar.

X	Point	Control	s	_	
Co	omidor:	Federa	I_Display_Rule		
Po	pint:		RT_Conc_	_ Laneline-	+
	Mode) Horiz	ontal	Vertical	Ø Both	

Next, create the following Point Control entries to instruct the RT_Conc_Laneline-Top1 template point to follow a feature (by the same name) created by the Median Nose corridor.

- 3. Select **RT_Conc_Laneline-Top1** from the *Point* drop-down menu.
- 4. Set the *Mode* to **Both**.
- 5. Set the *Control Type* to Corridor Point.
- 6. Select **Median Nose** for the *Corridor*.
- 7. Select Conc_Laneline-Top 1 for the *Reference Point*.
- 8. Key in *10+00.00* (begin of median radius) for the *Start* station.
- 9. Key in *10+05.50* (end of median radius/nose) for the *Stop* station.
- 10. **<D> ADD** to create the point control.

Horizontal	rizontal and Vertical Controls:									
Enab	Priority	Name	Start Station	Stop Station	Mode	Туре	Control			
х	1	RT_Conc_Laneline-Top1	10+00.00	10+05.50	Both	Corridor Point	Median Nose:Conc_Laneline-Top1			

- 11. Repeat the steps above to add the other two point controls for this corridor, using the following data:
 - Second point control
 - *Point:* RT_Conc_Laneline-Top1
 - Mode: Both
 - Control Type: Alignment
 - Horizontal Alignment: Federal CL
 - Vertical Alignment: Federal CL_V

- *Start Station: 10+05.51* (end of median radius/nose beginning of median opening)
- *Stop Station*: **12+00.00** (beginning of north median/radius nose)

Horizontal and Vertical Controls

Enab	Priority	Name	Start Station	Stop Station	Mode	Туре	Control
x	1	RT_Conc_Laneline-Top1	10+00.00	10+05.50	Both	Corridor Point	Median Nose:Conc_Laneline-Top1
X	1	RT_Conc_Laneline-Top1	10+05.51	12+00.00	Both	Alignment	Federal CL:Federal CL_V

- Third point control
 - Point: RT_Conc_Laneline-Top1
 - Mode: Both
 - Control Type: Corridor Point
 - Corridor: Median Nose North
 - Reference Point: Conc_Laneline-Top 1
 - Start Station: 12+00.00 (begin of median radius/nose)
 - *Stop Station:* use the default station.

Horizontal	and Verti	cal Controls:					
Enab	Priority	Name	Start Station	Stop Station	Mode	Туре	Control
x	1	RT_Conc_Laneline-Top1	10+00.00	10+05.50	Both	Corridor Point	Median Nose:Conc_Laneline-Top1
х	1	RT_Conc_Laneline-Top1	10+05.51	12+00.00	Both	Alignment	Federal CL:Federal CL_V
Х	1	RT_Conc_Laneline-Top1	12+00.00	12+05.00	Both	Corridor Point	Median Nose_North:Conc_Laneline-Top1

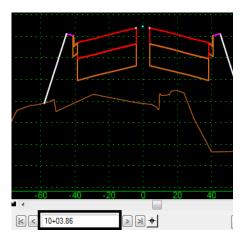
The fourth, fith, and sixth entry for the *LT_Conc_Laneline-Top1* point. The definitions mimic the definitions use for the RT_Conc_Laneline-Top1 point.

- Fourth point control
 - *Point*: LT_Conc_Laneline-Top1
 - Mode: Both.
 - Control Type: Corridor Point
 - *Corridor:* Median Nose for the *Corridor*.
 - *Reference Point:* Conc_Laneline-Top 1 for the *Reference Point*.
 - *Start Station: 10+00.00* (begin of median radius)
 - *Stop Station: 10+05.50* (end of median radius/nose)
- Fifth point control
 - *Point:* LT_Conc_Laneline-Top1
 - *Mode:* Both
 - Control Type: Alignment
 - Horizontal Alignment: Federal CL
 - Vertical Alignment: Federal CL_V
 - *Start Station: 10+05.51* (end of median radius/nose beginning of median opening)
 - Stop Station: 12+00.00 (beginning of north median/radius nose)

- Sixth point control
 - *Point:* LT_Conc_Laneline-Top1
 - *Mode:* Both
 - Control Type: Corridor Point
 - Corridor: Median Nose_North
 - Reference Point: Conc_Laneline-Top 1
 - Start Station: 12+00.00 (begin of median radius/nose)
 - *Stop Station:* use the default station.

Enabled	Priority	Name	Start Sta	Stop Station	Mode	Туре	Control
X	1	RT_Conc_Laneline-Top1	10+00.00	10+05.50	Both	Corridor Point	Median Nose:Conc_Laneline-Top1
x	1	RT_Conc_Laneline-Top1	10+05.51	12+00.00	Both	Alignment	Federal CL:Federal CL_V
х	1	RT_Conc_Laneline-Top1	12+00.00	12+05.00	Both	Corridor Point	Median Nose_North:Conc_Laneline-Top1
Х	1	LT_Conc_Laneline-Top1	10+00.00	10+05.50	Both	Corridor Point	Median Nose:Conc_Laneline-Top1
х	1	LT_Conc_Laneline-Top1	10+05.51	12+00.00	Both	Alignment	Federal CL:Federal CL_V
х	1	LT_Conc_Laneline-Top1	12+00.00	12+05.00	Both	Corridor Point	Median Nose_North:Conc_Laneline-Top1

- 12. **<D> Close** to dismiss the *Point Controls* dialog box.
- 13. Review the results graphically in Roadway Designer. Notice that the raised median disappears between stations 10+00.00 and 10+05.00 and again between 12+00.00 and 12+05.00. Between these station extents, the corridors for the medians will complete the model.



Also notice that the left and right pavement edges run together between stations 10+05.51 and 12+00.00. This represents the median opening.

Lab 28.10 - Adding Key Stations

Key Stations are specific locations you define relative to your design. At these locations an additional template is processed. You can also elect to create a cross section a locations defined by key stations. Examples of Key Stations may be at driveways, side roads, drainage structures or in the case of this exercise, just prior to and after the application of point controls. This ensures that the roadway is modeled as designed and eliminates transitions between point controls and the next corridor defined interval.

1. Select **Corridor > Key Stations** from the Roadway Designer menu bar or **<D>** the Key

Station button $\stackrel{\boxed{}}{\sim}$.

- 2. Key-in the station values as shown in the list below. Select Add after each entry.
 - ♦ 9+99.99
 - ♦ 10+05.51
 - ♦ 11+99.99
 - ♦ 12+05.51

Key Stations		23
Corridor: Federal_Display_Rule		Add
Station: 8+00.00	+	Close
Selected:		Help
9+99.99		пер
10+05.51		
11+99.99		
12+05.51		
Delet	е	

- 3. <D> Close
- 4. Select **File > Save** from the Roadway Designer menu.

Lab 28.11 - Creating the Model

With all the corridors, template drops point controls and key stations defined, the model is ready to be created.

1. Select **Corridor > Create Surface** from the Roadway Designer menu bar or **<D>** the

Create Surface button

- 2. Select the following corridors for modeling:
 - Federal_Display_Rule
 - ♦ Median Nose
 - ♦ Median Nose_North

3. **<D>** on the *Clipping Options* button.

Comidor	Clipping Comidor	Clipping Option	ОК
Median Nose	Federal_Display_Rule	Clip None	Cancel
Median Nose_North	Federal_Display_Rule	Clip None	
			Help

4. Under the *Clipping Option* column, **<D>** to cycle through the options and set both the *Median Nose* and *Median Nose_North* corridors to **Clip None**.

Also set:

- Name: **Design Model**
- Default Preference: **Proposed**

And toggle on:

- Densify Horizontal Curves using Chord Height Tolerance
- Densify Vertical Curves using Chord Height Tolerance
- Triangulate
- Remove Loops
- Display Features in Plan View

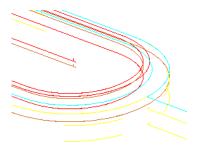
And toggle off:

Add Exterior Boundary - Style:

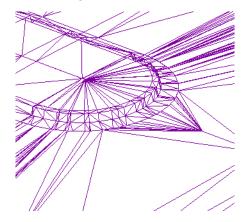
Name: Design Model Apply Default Preference: Proposed Close Create Surface(s) from: Preferences Preferences Federal Preferences Help Federal Display_Rule Help Median Nose None Image: North Clipping Options All None Clipping Options Create Atemate Surfaces Empty Design Surface Empty Design Surface Process Visible Range Only Include Null Points Include Null Points Ø Remove Loops Triangulate Features Duplicate Names: Modify Add Transverse Features Style: Default Image: Preference Style: Default Image: Preference Display in Plan View Velation Boundary Style: Exterior Boundary Image: Preference Densify using Chord Height Tolerance Display in Plan View Verticateres	🚔 Create Surface			X
Create Surface(s) from: Federal Federal Median Nose Median Nose Mone Median Nose Median Nose Mone Median Nose Median Nose Median Nose Mone Median Nose Median Median Median Nose Median Median Median Median Median Median Median Median Median Median Median Median Med				
New Surface for Each Corridor Create Atternate Surfaces Empty Design Surface Process Visible Range Only Include Null Points Remove Loops Triangulate Features Duplicate Names: Append Replace Rename Modify Add Transverse Features Style: Default Style: Exterior Boundary Style: Exterior Boundary Densify using Chord Height Tolerance Display in Plan View	Federal Federal_Display_Ru Median Nose Median Nose_North	•	All	Preferences
Duplicate Names: Append Peplace Pename Modify Add Transverse Features Style: Add Exterior Boundary Style: Exterior Boundary Densify using Chord Height Tolerance Display in Plan View	New Surface for Empty Design So Include Null Poir	uface 🔲 F	Process Visib	le Range Only
Add Exterior Boundary Style: Exterior Boundary Densify using Chord Height Tolerance Display in Plan View	Duplicate Names:		name 🔘) Modify
Densfy using Chord Height Tolerance Display in Plan View	Add Exterior Bo	Dordon	v	
			Display	in Plan View
Vertical Curves Components	Horizontal Curve	-	V Fea	tures

Lab 28.12 - Review the Design

Use your knowledge of InRoads to review your model. Some methods may include: • A 3D isometric view of DTM features



• DTM triangles



Contours, profiles and cross sections are additional options.

Chapter Summary:

- Display Rules are used to turn on or off components based on the relationship between two points
- Point Controls are used to modify a template during processing. In this lab, the point controls were used to modify the relationship between points used in display rules to affect the display co the median components
- Key Stations and the settings under Options force the template to be processed at specific stations in addition to the processing that occurs at the normal template drop interval
- Clipping Options determine how template components are affected in areas where corridors overlap. The None option was used here, so that all of the components from each corridor would be retained.

LAB 29 - Create Ramp Model

This lab demonstrates the InRoads design process for creating a single lane freeway entrance ramp (tapered type) model and the infield, gore and taper area segment of the mainline model. The Vertical Gore Tool is used to create a guide for revise and tie the ramp vertical alignment into the edge of lane of the mainline taper. The corridors are created for both the ramp and mainline models. Display rules, Point controls, and end condition exceptions are used to tie the inside of the ramp model into the mainline corridor model in the gore and infield area. The outside lane of the mainline corridor is widened with a point control to create the ramp taper. After the ramp and mainline surfaces are created from the Roadway Designer, cross sections are displayed and examined to view the results.

Chapter Objectives:

- Revise the ramp vertical alignment to tie into the edge of lane of the mainline taper using the Vertical Gore Tool
- Create the freeway entrance ramp (tapered type) model
- Create the infield, gore and taper area segment of the mainline model
- Create a ramp and mainline surfaces from Roadway Designer, display cross sections and examine the results

The following files are used for this lab:

- C:\Projects\12345\Design\InRoads\12345DES_Geometry-Create Ramp Model.alg
- C:\Projects\12345\Design\InRoads\12345DES_Template-Create Ramp Model.itl
- C:\Projects\12345\Design\InRoads\12345DES_Roadway-Create Ramp Model.ird
- C:\Projects\12345\Design\InRoads\12345DES_Existing-Create Ramp Model.dtm
- C:\Projects\12345\Design\InRoads\CDOT_Civil-Create Ramp Model.xin

Lab 29.1 - Open InRoads Data Files

- 1. Open MicroStation and InRoads using the *12345DES_Model-Create Ramp Model.dgn* file.
- 2. Load CDOT_Civil-Create Ramp Model.xin.

In the MicroStation drawing, notice the entrance ramp and mainline proposed linework displayed as a reference and the profile views for each alignment.

- 3. Open the following files from the *C:\Projects\12345\Design\InRoads* directory in InRoads:
 - 12345DES_Geometry-Create Ramp Model.alg
 - ◆ 12345DES_Template-Create Ramp Model.itl
 - ◆ 12345DES_Roadway-Create Ramp Model.ird
 - ♦ 12345DES_Existing-Create Ramp Model.dtm

Lab 29.2 - Set the Global Scale Factors

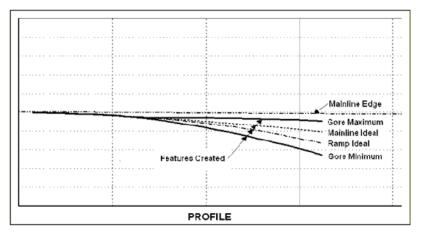
1. Select **Tools> Options** from the InRoads menu bar.

- 2. In the *Options* dialog box, Select *Factors* tab.
- 3. Key in *200* for the *Text* and *Cell Scale Factor* fields.
- 4. **<D> Apply** and **<D> Close.**

Lab 29.3 - Create Ramp Vertical Alignment Guide with Vertical Gore Tool

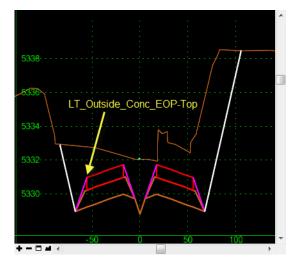
The Vertical Gore Tool is used to create a guide for revising the ramp vertical alignment. The output from this command is a surface with four linear features which are then displayed in the profile of the ramp alignment. These features specify the allowable maximum and minimum elevations of the ramp vertical alignment, as well as the ideal locations to make the gore cross slope match the mainline and ramp cross slopes.

The exercise will use the Mainline Ideal cross slope to set the ramp's vertical alignment. This is used because the mainline's cross slope extends out at a constant 2% from the crown in the 50:1 taper section. Note the Ramp Ideal cross slope feature is at the same location.

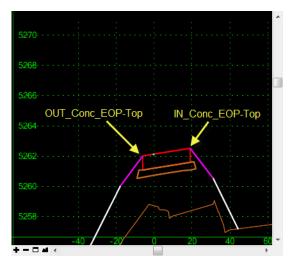


- 1. Select **Modeler> Roadway Designer** from the InRoads menu bar.
- 2. Select Tools> Vertical Gore Tool from the Roadway Designer menu bar.
- 3. In the Vertical Gore Design Tool dialog box, select IH 39 in the Mainline Corridor field.

4. Select LT_Outside_Conc_EOP-Top for the *Mainlined Edge* field, using the drop-down list or the selector button.



- 5. Select **NW Ramp** in the *Ramp Corridor* field.
- 6. Select IN_Conc_EOP-Top for the *Ramp Inside Edge* field.
- 7. Select **OUT_Conc_EOP-Top** for the *Ramp Outside Edge* field.



- 8. Key in **8%** in the *Maximum Difference* field.
- 9. Key in **30+50** in the *Mainline Start* field.
- 10. Key in **32+00** in the *Mainline Stop* field.
- 11. Key in *Gore Design* in the *Surface Name* field.
- 12. Select **D_GORE_Max_Vertical** for the *Maximum Style*.
- 13. Select **D_GORE_Mainline_Ideal** for the *Mainline Ideal Style*.
- 14. Select **D_GORE_Ramp_Ideal** for the *Ramp Ideal Style*.

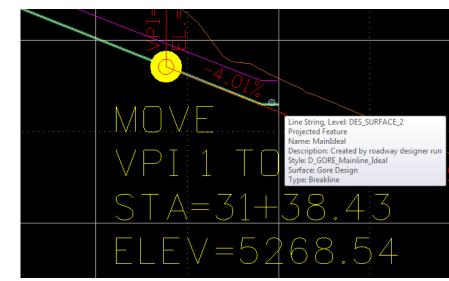
Vertical Gore De	sign Tool		Σ
Mainline Corridor:	IH 39 🔻	Plan View	Apply
Mainline Edge:	LT_Outside_Conc_E - +		Close
Ramp Corridor:	NW Ramp	Start Gore Stop Gore Station	Preferences
Ramp Inside Edge:	IN_Conc_EOP-Top V +	Station	
Ramp Outside Edge:	OUT_Conc_EOP-To - +	Mainline Edge	Help
Maximum Difference:			
Limits			
Mainline Start:	30+50.00 +	Ramp Outside Edg	ge
Mainline Stop:	32+00.00 +	Ramp Inside Edge	
		Cross Section View	
		Maximum Vertical —	Ramp
Output			iline Ideal
Surface Name:	Gore Design	Ram	p Ideal
Maximum Style:	D_GORE_Max_Vert -		
Mainline Ideal Style:	D_GORE_Mainline_	Minimum Vertical	
Ramp Ideal Style:	D_GORE_Ramp_Ide -		
Minimum Style:	D_GORE_Min_Vertir		

15. Select D_GORE_Min_Vertical for the *Minimum Style*.

- 16. **<D> Apply** and **<D> Close** to dismiss the *Vertical Gore Design Tool* dialog box.
- 17. In the *Roadway Designer* dialog box, **<D> Close** and select **No** to save changes.

Lab 29.4 - Update NW Ramp profile and Modify the Vertical Alignment

- 1. Select Evaluation> Profile> Update Profile from the InRoads menu bar.
- 2. In the *Update Profile* dialog box, verify that **NW Ramp** is selected for the *Profile Set*.
- 3. Select Projected Features from the Update Profile tree.
- 4. Select **Display On** for the *Mode*.
- 5. Select Gore Design in the *Surfaces* area.
- 6. Select All features in the *Projected Features* area.



<D> Apply and <D> Close.

The NW Ramp vertical alignment needs to be revised to tie to the edge of lane of the mainline taper and to better tie into the mainline ditch in the infield area.

- 7. Set alignment NW Ramp as the Active alignment
- 8. Select Geometry> Vertical Curve Set> Move PI from the InRoads menu bar.
- 9. **<D> Apply** on the *Move Vertical PI* dialog box then **<D>** on the first vertical PI.
- 10. In the MicroStation key in window, type *se=31+38.43,5268.54* and press *Enter*.
- 11. **<D>** to accept the location then **<R>** to exit the command.
- 12. **<D> Apply** on the *Move Vertical PI* dialog box then **<D>** on the second vertical PI.
- 13. In the MicroStation key in window, type *se=35+75.00,5251.04* and press *Enter*.
- 14. **<D>** to accept the location then **<R>** to exit the command.
- 15. **<D> Close** to dismiss the *Move Vertical PI* dialog box.
- 16. Select Geometry> View Geometry> Vertical Annotation from the InRoads menu bar.
- 17. **<D> Apply** and **<D> Close.**
- 18. Examine the changes in the vertical alignment.

Next, revise NW Ramp corridor to start at the beginning of the ramp's revised vertical alignment.

- 19. Select Modeler> Roadway Designer from the InRoads menu bar.
- 20. In the *Roadway Designer* dialog box, select **NW Ramp** from the *Corridor* drop down menu.

- 21. Select **Corridor > Corridor** Management from the Roadway Designer menu bar.
- 22. Highlight NW Ramp in the Corridors area.
- 23. Key in *31+38.43* in the *Start* field.
- 24. **<D> Change**.
- 25. **<D> Close** to dismiss the *Manage Corridors* dialog box.

Lab 29.5 - Define End Condition Exceptions

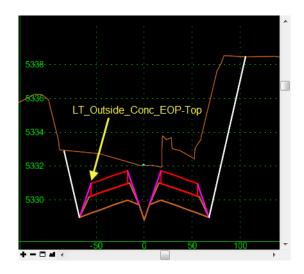
Next, end condition exceptions are added to right side of NW Ramp along the gore and infield area.

- 1. In the *Roadway Designer* dialog box, select *NW Ramp* from the *Corridor* drop down menu.
- 2. Select Corridor> End Condition Exceptions in the Roadway designer menu bar.
- 3. Key in *31+38.43* in the *Start* field.
- 4. Key in *40+50* in the *Stop* field.
- 5. Toggle on *Right Override* in the *Apply To* area.
- 6. Toggle on *Backbone* Only.
- 7. **<D> Add** and **<D> Close** to dismiss the *End Condition Exceptions* dialog box.

Lab 29.6 - Define Point Controls

Define Point Controls for the IH 39 corridor. Stretch westbound roadway's left edge of pavement to create the ramp taper.

- 1. In the *Roadway Designer* dialog box, select *IH* 39 from the Corridor drop down menu.
- 2. Select Corridor> Point Controls in the Roadway Designer menu bar.

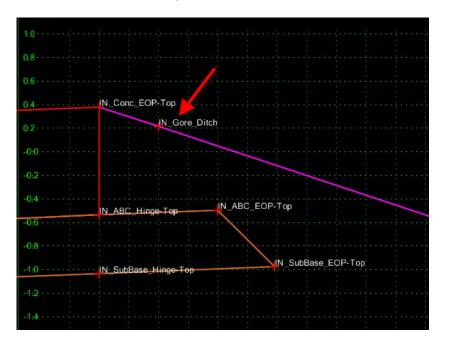


3. In the *Point Controls* dialog box, select LT_Outside_Conc_EOP-Top for the *Point*.

- 4. Toggle on **Horizontal** for the *Mode*.
- 5. Select Alignment in the *Control Type* field.
- 6. Select Outside Edge of Pavement in the *Horizontal Alignment* field.
- 7. Toggle on Use as a Secondary Alignment.
- 8. Key in *31+38.43* in the *Stop Station* field.
- 9. **<D> Add** and **<D> Close** to dismiss the *Point Controls* dialog box.

Create a special ditch between the ramp and mainline shoulder pavements from the gore nose to a station where the mainline ditch starts (when the ramp fore slope is flatter than the 3:1 maximum).

- 10. In the *Roadway Designer* dialog box, select *NW Ramp* from the Corridor field.
- 11. Select Corridor> Point Controls in the Roadway designer menu bar.



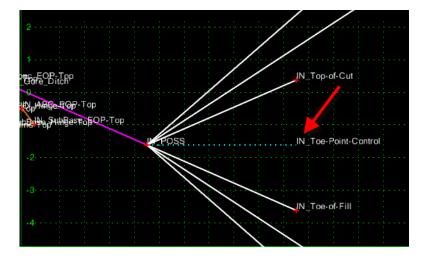
12. In the *Point Controls* dialog box, select **IN_Gore_Ditch** from the *Point* menu.

- 13. Toggle on **Both** for the *Mode*.
- 14. Select **Alignment** in the *Control Type* field.
- 15. Select Special_Ditch_NW_Ramp in the Horizontal Alignment field.
- 16. Toggle off Use as a Secondary Alignment.
- 17. Key in *31+38.43* in the *Start Station* field.
- 18. Key in **35+99.90** in the *Stop Station* field.
- 19. **<D> Add**
- 20. Select **IN_POSS** from the *Point* menu.



- 21. Toggle on **Both** for the *Mode*.
- 22. Select Corridor Point in the Control Type field.
- 23. Select IH 39 in the *Corridor* field.
- 24. Select LT_Outside_Conc_EOP-Top in the *Reference Point* field.
- 25. Key in *31+38.43* in the *Start Station* field.
- 26. Key in *35+99.90* in the *Stop Station* field.
- 27. **<D> Add**
- 28. Select *IN_Toe-Point-Control* from the *Point* menu.

Note: This component has a display rule.



- 29. Toggle on **Both** for the *Mode*.
- 30. Select Corridor Point in the Control Type field.
- 31. Select **IH 39** in the *Corridor* field.
- 32. Select LT_POSS in the *Reference Point* field.
- 33. Key in *36+00* in the *Start Station* field.
- 34. Key in *40+50* in the *Stop Station* field.
- 35. **<D> Add** and **<D> Close** to dismiss the *Point Controls* dialog box.

Lab 29.7 - Define Key station for IH 39 corridor

- 1. Select *IH 39* from the *Corridor* drop down menu.
- 2. Select **Corridor> Key Stations** in the Roadway designer menu bar.
- 3. Key in *31+38.42* in the *Station* field.

4. **<D> Add** and **<D> Close**

Next, define Key station for NW Ramp corridor.

- 5. In the *Roadway Designer* dialog box, select **NW Romp** from the *Corridor* drop down menu.
- 6. Select **Corridor> Key Stations** in the Roadway Designer menu bar.
- 7. Key in *3599.90* in the *Station* field.
- 8. **<D> Add** and **<D> Close.**

Lab 29.8 - Create Surfaces to display in cross sections to examine design models

- 1. In the *Roadway Designer* dialog box, select *Existing_Ground* from the Active Surface drop down menu.
- 2. Select **Corridor> Create Surface** in the Roadway designer menu bar.
- 3. Select the following options as shown in the illustration below:

			×
		Ap	ply
Default		- Co	ISE
n.			
		Prefere	nces
		He	elp
	All		
	None		
ning Options			
ping Options			
Fach Caridae	Carata	Alternate Confe	
urface	Proces	s Visible Rang	e Only
its	Remov	e Loops	
its	Remov	e Loops	
its	✓ Remov	e Loops	
its	Remov	e Loops	
Replace			
Replace			
Replace			
Replace Features Default Indary	Rename		
Replace Features	Rename		
Replace Features Default Indary	Rename		View
Replace Features Default indary Exterior Boun	Rename dary	Modify ▼	View
	ping Options	n: All None ping Options	Default Cic n: Prefere All ping Options Each Comidor Create Alternate Suffer

- 4. **<D> Apply** to create the surface.
- 5. Review and then close the *Results* dialog box.
- 6. **<D> Close** to dismiss the Create Surface dialog box.

- 7. In the *Roadway Designer* dialog box, select **File> Save** from the Roadway designer menu bar.
- 8. **<D> Close** to dismiss the *Roadway Designer* dialog box.

Lab 29.9 - Display and Review Cross Sections

- 9. Make **IH 39** the active alignment.
- 10. Select Evaluation> Cross Section> Create Cross Sections from the InRoads menu bar.
- 11. In the *Create Cross Section* dialog box, **<D> Preferences.**
- 12. Highlight 40H 20V 320' Wide.
- 13. **<D> Load** then **Close**.
- 14. Toggle off **Gore Design** surface.

Cross Section Set Mode: @ Refresh Display On Display Off Start: Stop: Create Cross Section Set Name: Special_Ditch_NW_Rar Create Window and Data Interval Include Controls Interval 50.00 Custom Layout Herval 160.00 Axes Grid Show Data Outside Elevation Range Suffaces: Object Name Update Cross Section Object Name Default BYL All MVR Ramp Default BYL MVR Ramp Default BYL MVR Ramp Default BYL MV Ramp Default BYL MV Ramp Default BYL MV Ramp Default BYL More Properties Properties	Cross Sections				
IH 39 Default BYL None	File Cross Section Set: Cross Section Cross Section Cross Section Cross Section Controls Controls Custom Cu	Start: Set Name: Create: Interval: Left Offset: Netical Exaggeration: Show Data Outside Surfaces: Object Default Existing_Ground	Stop: Special_Ditch_NW_Ran Window and Data ▼ 50.00 -160.00 160.00 2.0000 Elevation Range Name Default Default	+ + BYL	
		🖂 IH 39	Default	BYL BYL	

- 15. **<D> Apply** and **<D>** in the drawing view to display the cross section set.
- 16. **<D> Close** to dismiss the *Create Cross Section* dialog box.
- 17. Select **Evaluation> Cross Section> Cross section Viewer** from the InRoads menu bar.
- 18. Select **24+00.00** in the *Cross Sections* area and **<D> Run**.
- 19. Examine the ramp and westbound mainline sections as the viewer moves along the taper, gore, and infield areas.

Chapter Summary:

- The Vertical Gore Tool is used to create design guides for laying out vertical alignments on merging corridors
- End Condition Exceptions are used to modify or remove the sideslope within a defined station range
- A single design surface can be created from two or more corridors

LAB 30 - Forcing Toes Inside of the Right Of Way

There are numerous reasons why it may not be possible to acquire additional right of way on a project. In these situations, the end conditions must adjust to the location of the right of way where it is restrictive and follow the proper design criteria where it is not.

In this lab, an end condition section is constructed that determines the proper sideslope based on the criteria from the 2005 Roadway Design Guide and the location of the right of way. This end condition section is then attached to a template and used in a corridor to demonstrate its functionality.

Chapter Objectives:

- Modify an existing end condition section to account for the right of way.
- Add the modified section to a "backbone" template.
- Create a corridor that uses the modified template.
- Add point controls so that the template can locate the right if way line.

The following files are used with this lab:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Projects\12345\Design\InRoads\12345DES_Geometry-Toes.alg
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\12345DES_Templates_Toes-Lab.itl

Lab 30.1 - Modifying the End Condition Section and Adding it to a Template

In this exercise, a standard end condition section is copied and modified to account for the right of way. This end condition is then added to a template.

Section Objectives:

- Copy the end condition section.
- Add NULL points to control the maximum length of sideslopes and locate the right of way.
- Modify point constraints to place the toes in the proper location.
- Add the modified end condition section to a template.

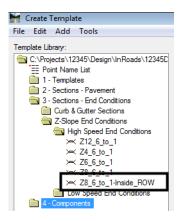
Three NULL points are used to modify the end condition. Two are used to locate the maximum length of the 6 to 1 and 4 to 1 slopes. The third locates the right of way. The constraints are changed on the toe of slope points to extend to the NULL point closest to the centerline.

- 1. Open MicroStation and InRoads using the C:\Projects\12345\Design\Drawings\ Reference_Files\12345DES_Model.dgn file.
- 2. Load the following files into InRoads:
 - C:\Projects\12345\Design\InRoads\12345DES_Geometry-Toes.alg

- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\12345DES_Templates_Toes-Lab.itl
- 3. Verify that the C:\Workspace\Workspace-CDOT_XM\Standards-Global\ InRoads\ Preferences\CDOT_Civil.xin file is loaded.
- 4. From the InRoads menu bar, select **Modeler > Create Template**.
- 5. Expand the template library to show the 3 Sections End Conditions > Z-Slope End Condition - High Speed End Conditions.
- 6. **<R>** on the **Z8_6_to_1** and select **Copy** from the right click menu.

🐂 Create Template		
File Edit Add Tools		
Template Library: C:Projects\12345\Design\InRoat Templates C:Projects\12345\Design\InRoat C:Projects\12345\Design\12345\De	Description: LT_Top-of-Cut2	Ane
	10 Set Active	
	Cut	Ctrl-X
	Сору	Ctrl-C
	Paste	Ctrl-V
	Delete	Del
	Rename	F2
	Template Documentation Link	
	Display	

- 7. Paste the copy into the same folder.
- 8. Rename the copy **Z8_6_to_1-Inside_ROW.**



- 9. **<D> <D> on the Z8_6_to_1-Inside_ROW** to open it for editing.
- 10. Open the **Dynamic Settings** dialog box.

- 11. Key in *0.10* for the *X* and *Y Step*.
- 12. Verify that **Apply Affixes** is toggled off.

-20	Dynamic Settings
	X: -1.70 Step: 0.10
-25	Y: -0.30 Step: 0.10
-30	Point Name:
-35	Point Style: ▼
-40	Apply Affixes
-45	hs= 🔻
	Set Dynamic Origin
-40 -30 ╋╼┇╦┿╪═ᆲゃ╡┊	۰ <u>ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ</u>

13. **<R>** in the template view and select **Add New Component > Null Point** from the right click menu.

Add New Component	×	Simple
Template Documentation Link		Constrained
Check Point Connectivity		Unconstrained
Delete Components		Null Point
Change Template Origin		End Condition
Delete Constraints from All Points		
Set Dynamic Origin	Ctrl-D	

- 14. In the *Dynamic Settings* dialog box, key in *Max_6_to_1* in the *Point Name* field.
- 15. Set the *Point Style* to *Default*.
- 16. Set the precision key in type to **xy=**.
- 17. In the precision key in field, key in **24,35** and press the **Enter** key. The 24 equals the maximum horizontal distance that a 6 to 1 toe can be from the pavement edge. The 35 represents the height above the pavement edge. The height for this point is irrelevant and can be set to any value. 35 is used here to place the point out of the way of other data while having the fit view at a reasonable scale.

Dynami	ic Setting	s	
X:	68.80	Step: 0.	10
Y:	-48.50	Step: 0.	10
Point N	lame:	Max_6_to_1	-
Point S	ityle:	Default	
TOIL		Derault	
_	ly Affixes	Derault	
_	-	24,35	

The *Max_6_to_1* point is placed in the correct location, but it is not constrained. It should be constrained to the pavement edge sot that the proper distance is maintained if the pavement width is changed.

 Mex 6 to 1

 Add New Component

 Template Documentation Link...

 Check Point Connectivity...

 Delete Components

 Change Template Origin

 Delete Constraints from All Points

 Move Point

 Edit Point...

 Add Constraint

 Full Constraint

 Horizontal

Toe-of-Fill1

Toe of Fill2

<R> on the Max_6_to_1 point and select Add Constraint > Full Constraint from the right click menu.

19. **<D>** on the **EOP** point. This displays the *Add Full Constraint* dialog box.

The data in the dialog box is correct because the precision key in was used to place the point.

Ctrl-D

Vertical

Slope Vector Offset

Angle Distance Horizontal Maximum

Horizontal Minimum Vertical Maximum Vertical Minimum

20. **<D> OK** to accept the constraints and dismiss the dialog box.

Set Dynamic Origin



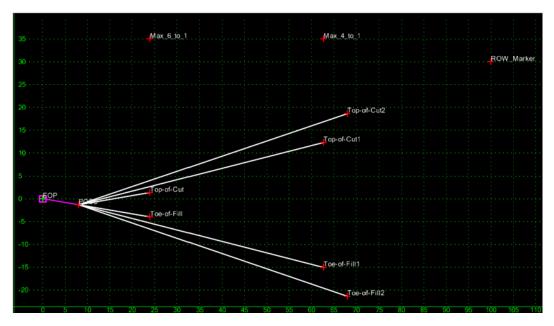
- 21. **<R>** in the template view and select **Add New Component > Null Point** from the right click menu.
- 22. In the *Dynamic Settings* dialog box, key in *Max_4_to_1* in the *Point Name* field.
- 23. In the precision key in field, key in *62.67,35* and press the *Enter* key.
- 24. **<R>** on the *Max_4_to_1* point and select **Add Constraint > Full Constraint** from the right click menu.
- 25. **<D>** on the **EOP** point. This displays the *Add Full Constraint* dialog box.
- 26. **<D> OK** to accept the constraints and dismiss the dialog box.

Next, a point to follow the right of way is added.

- 27. **<R>** in the template view and select **Add New Component > Null Point** from the right click menu.
- 28. In the *Dynamic Settings* dialog box, key in *ROW_Marker* in the *Point Name* field.

- 29. In the precision key in field, key in *100,30* and press the *Enter* key.
- 30. **<R>** on the *ROW_Marker* point and select **Add Constraint > Full Constraint** from the right click menu.
- 31. **<D>** on the **EOP** point. This displays the *Add Full Constraint* dialog box.
- 32. **<D> OK** to accept the constraints and dismiss the dialog box.
- 33. Select **File > Save** from the *Create Template* menu bar.

The illustration below shows the template completed to this point.



Next, the constraints on the toe points are changed to use the three Null points just added.

- 34. **<D> <D>** on the **Toe-of-Fill** point. This displays the *Point Properties* dialog box.
- 35. In the *Point Properties* dialog box, set the *Constraint 1 Type* to Horizontal Minimum.
- 36. Set the *Parent 1* to Max_6_to_1.
- 37. Set the *Parent 2* to **ROW_Marker**.
- 38. Verify that the *Value* is set to *0.00*.

Point Properties		×
Name:	Toe-of-Fill	+ Apply
Feature Name Override:	Toe-of-Fill	Close
Surface Feature Style:	D_Toe-of-Fill	
Alternate Surface:		<pre> < Previous</pre>
End Condition Propertie Check for Interceptiv Place Point at Interce End Condition is Inflit Do Not Construct	on Memb ception Fill-6.	Next > Help
Constraints Constra	aint 1	Constraint 2
Type: Horizontal	Minimum 🔻	Slope 👻
Parent 1: Max_6_to_	1 +	POSS 👻 🕈
Parent 2: ROW_Mark	ker 🔻 🕂	Rollover Values
Value: 0.00		-16.67%
Label: Toe-of-Fill-H	loriz 👻	Toe-of-Fill-Slope 👻
Style Constraint:		~
Horizontal	Vertical (🖱 Both
Range; 0.00		

39. **<D> Apply** to accept the changes. **<D> Close** to dismiss the dialog box.

40. Repeat steps 34 through 39 for the **Top-of-Cut** point.

The Horizontal Minimum constraint uses the left most of the two Parent points as a Horizontal constraint. When the right of way is to the right of the two Max null points, the Max null point distance is used for the sideslope. When the right of way is to the left of a Max null point, the ROW Marker sets the length of the sideslope.

- 41. $\langle D \rangle \langle D \rangle$ on the **Toe-of-Fill1** point.
- 42. Set the *Constraint 1 Type* to Horizontal Minimum.
- 43. Set the *Parent 1* to Max_4_to_1.
- 44. Set the *Parent 2* to **ROW_Marker**.
- 45. Verify that the *Value* is set to *0.00*.

Name:	Toe-of-Fi	II1		→ +	Арр	v
Feature Name Override:	Toe-of-Fi	II 1			Clos	
Surface Feature Style:	D_Toe-o	f-Fill		•	< Previ	
Alternate Surface:				-	Next	
End Condition Propertie Check for Intercepti Place Point at Interce End Condition is Infi	on ception	Member Fill-4/1			Helj)
Constraints			0	onstraint	2	
Type: Horizontal		Ţ	Slope		<u>~</u>	
Parent 1: Max_4_to_	1	→ +	POSS	3	•	+
Parent 2: ROW_Mar	ker	• +		Rollover	Values	
Value: -0.00			-25.00)%		
Label: Toe-of-Fill-h	Horiz	•	Toe-o	f-Fill-Slop	e 🔻	
Style Constraint:				Ŧ		
(a) Horizontal	Vertical		Both			

46. **<D> Apply** to accept the changes. **<D> Close** to dismiss the dialog box.

- 47. Repeat steps 41 through 46 for the **Top-of-Cut1** point.
- 48. **<D> <D>** on the **Toe-of-Fill2** point.
- 49. Toggle off End Condition is Infinite.
- 50. Set the *Parent 1* for the *Horizontal* constraint to **ROW_Marker**.
- 51. Key in *0.00* for the Value of the *Horizontal* constraint.

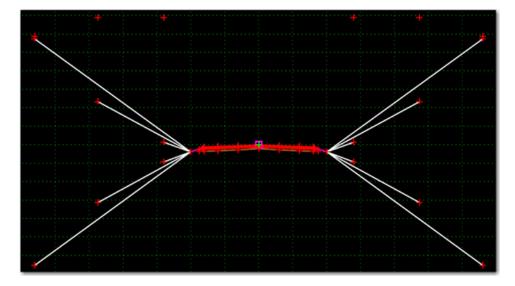
Point Properties			×
Name:	Toe-of-Fill2	→ +	Apply
Feature Name Override:	Toe-of-Fill2		
Surface Feature Style:	D_Toe-of-Fill		Close
Alternate Surface:			< Previous
			Next >
End Condition Propertie		. (Help
Check for Interception			
Place Point at Interc	eption Fill-3/	1	
End Condition is Infir	nite		
Do Not Construct			
Constraints			
Constrai	int 1	Constraint 2	
Type: Horizontal	-	Slope	-
Parent 1: ROW_Mark	ter 🔻 🕈	POSS	+
		Rollover Va	alues
Value: 0.00		-33.33%	
Label: Toe-of-Fill-H	oriz 👻	Toe-of-Fill-Slope	•
Style Constraint:			
Horizontal	Vertical	Both	
Range: 0.00			

52. **<D> Apply** to accept the changes. **<D> Close** to dismiss the dialog box.

- 53. Repeat steps 48 through 52 for the **Top-of-Cut2** point.
- 54. Select **File > Save** from the *Create Template* menu bar.

This completes the section. It is now ready to be added to the template backbone.

- 55. Expand the **1 Templates** folder in the Template Library area.
- 56. **<D> <D>** on the **HMA_B10-4 Lane** template to make it active.
- 57. In the *Dynamic Settings* dialog box, toggle on Apply Affixes.
- 58. **<D>** on the **Z8_6_to_1-Inside_ROW** section to display it in the *Preview* window.
- 59. **<D> an hold** on the section's origin and drag it into the template view.
- 60. **<R>** and select **Mirror** from the right click menu.



61. **Drop** the section on the *HMA_Lift1_EOP-Top* point. Below is an illustration of the finished template.

62. <D> <D> on the LT_TOe-of-Fill. Notice that the *Constraint 1* has changed from *Horizontal Minimum* to *Horizontal Maximum*. Horizontal Maximum uses the right most point of the two parents as a horizontal constraint.

Point Propertie	5			×
Name:	LT Toe	of-Fill	+ +	Apply
Feature Name Over	_			
Surface Feature Styl				Close
Alternate Surface	0_1000	0T-FIII		< Previous
Alternate Surrace			T	Next >
End Condition Pro Check for Inter Place Point at I End Condition i Do Not Constru	ception nterception s Infinite	Member		Help
	nstraint 1	_	Constrain	t 2
Thomas a	ntal Maximum		Slope LT POSS	
	x_6_to_1	<u> </u>		▼ +
Value: -0.00)W_Marker	• •	16 67%	values
-0.00		_		
100-01	Fill-Horiz-Mirra	•	Toe-of-Fill-Slo	pe-Mim ▼
Style Constraint	:		-	
Horizontal	Vertical		Both	
Range:	0.00]		

- 63. Select **File > Save** from the *Create Template* menu bar.
- 64. Close the *Create Template* dialog box.

This completes the work done in the template library. Next, the template is used in a corridor.

Section Summary:

- The end condition sections in the standard template library can be easily modified to stop at the right of way.
- Null points are used to determine the maximum length of the sideslope.
- Horizontal Minimum constraints change to Horizontal Maximum constraints when the template is reflected (or on the reflected side when mirrored).

Lab 30.2 - Corridor Set up and Run

As designed, the template requires two point controls to follow the right of way lines. For this exercise, the right of way lines have already been chained together and imported as horizontal alignments.

Section Objectives:

- Create a corridor and template drop.
- Create point controls for the right of way.
- Add the right of way alignments as reference displays in the Roadway Designer views.
- 1. Select **Modeler > Roadway Designer** from the InRoads menu bar.
- 2. From the Roadway Designer menu bar, select **File > New**.
- 3. Verify the directory is C:\\12345\Design\InRoads\.
- 4. Key in *12345DES_Toes-Lab.ird* for the file name.
- 5. **<D> Save** to create the Roadway Designer file and dismiss the *Save Roadway Design As* dialog box.
- 6. Select **Corridor > Corridor Management** from the Roadway Designer menu bar.
- 7. Key in *SH 86* for the corridor *Name*.
- 8. Verify that **SH 86** and **SH 86 V** are set as the *Horizontal Alignment* and *Vertical Alignment*.

9. **<D> Add** to create the corridor then **<D> Close** to dismiss the *Manage Corridors* dialog box.

Гуре:	Alignment	-	Station		Close
Horizontal Alignment:	SH 86	- +	203+80.28	-	Change
/ertical Alignment:	SH 86 V	•	Stop:		Сору
91 Rounding Tangen	t: 0.00		260+43.16	+	Copy From
Name	Туре	Source Name	Start Station	Stop	Station
Name	Туре	Source Name	Start Station	Stop	Station

- 10. Select **Corridor > Template Drops** from the Roadway Designer menu bar.
- 11. Key in *25* for the *Interval*.
- In the *Library Templates* area, expand the C:\Projects\12345\Design\InRoads\ 12345DES_Templates_Toes-Lab.itl > 1 - Templates folder.
- 13. Highlight the HMA_Crowned_B10-4 Lane template.
- 14. **<D> Add** then **<D> Close** to dismiss the *Template Drops* dialog box.

🕌 Templa	ate Drops		×
Corridor:	SH 86 -	Add	
Station:	203+80.28	+ Close	1
Interval:	25.00	+ Change	
		Copy Help	
Current Te	mplate Drops:		
Station	Inter Template Revi	Library	
203+802	25.00 HMA_CrownedITL	C:\Projects\12345\D	
Synchron	ize with Library	Edit Delete	

- 15. Select **Corridor > Point Controls** from the Roadway Designer menu bar.
- 16. In the *Point Controls* dialog box, set the *Point* to RT_ROW_Marker.

- 17. Toggle on **Horizontal** for the *Mode*.
- 18. Verify that the *Control Type* is set to **Alignment**.
- 19. Select **RT_ROW** for the *Horizontal Alignment*.
- 20. **<D> Add** to create the point control.

Point Controls		- • 🔀
Point Controls Corridor: SH 86 Point: RT_ROW_Marker Mode Mode Mode Netrical Both Control Type: Alignment Horizontal Alignment: RT_ROW Use as Secondary Alignment	Station Limits Static: 203+80.28 + Stop: 260+43.16 + Horizontal Offsets + Statt: 0.00 + Stop: 0.00 +	Add Close Change Help
Priority: 1 Horizontal and Vertical Controls:	Vertical Offsets Start: 0.00 Stop: 0.00	
En Pri Name Start Stati Stop Sta	ti Mode Type Co	ntrol
X 1 RT_HMA_Li203+80.28 260+43.1	6 Horizontal Alignment RT_	ROW

- 21. Set the *Point* to LT_ROW_Marker.
- 22. Select LT_ROW for the *Horizontal Alignment*.
- <D> Add to create the point control. <D> Close to dismiss the *Point Controls* dialog box.

The toes will now remain inside the right of way. However, it is not apparent. To show the relationship between the toes and the right of way, The right of way alignments are displayed in the Roadway Designer window as references.

- 24. Select **Corridor > Display References** from the Roadway Designer menu bar.
- 25. Verify that **Alignment** is toggled on.
- 26. Select **RT_ROW** for the *Alignment*.
- 27. Toggle on **Displays as Right of Way**.

- Maisplay References - • • Corridor: SH 86 Add isplav Refe Close Alianment: RT_ROW Change 12345 existing gr 6650 Help Feature: Centerline Profile Filter <Unnar Display as Right of Way 6645 RT ROW line Limits Station 6640 203+80.28 + 260+43.16 Display References Right of. Name Start St ... Stop Sta. Alignment RT ROW True 6625 Delete 620
- 28. **<D> Add**. Notice the line displayed on the right side of the template view. That line represents the offset distance to the right of way from the corridor alignment.

- 29. Repeat steps 26 through 28 using **LT_ROW** for the alignment.
- 30. **<D> Close** to dismiss the *Display References* dialog box.
- 31. Scroll through the stations. Notice two things, 1) the toes never go outside the right of way, and 2) If the toe can not tie before the right of way, it is omitted.
 - **Note:** This end condition will not solve every template drop. Those template drops that do not solve will have to be examined to determine the best solution for those areas. The solutions for those areas are not a part of this lab.

Section Summary:

- The ROW_Marker points are attached to the right of way horizontal alignments using point controls.
- Using Display References helps to show that the template is working properly.
- Design decisions have to be made in areas where the toes can not tie inside the right of way.

Chapter Summary:

• The right of way controls can be easily added to an existing template.

- This example uses a point control, however the same results can be achieved by making the ROW markers into end conditions.
- Developing these kinds of templates is an iterative process. Parts will be developed that show areas which need further consideration.

LAB 31 - End Conditions that Require Multiple Solutions

This lab demonstrates the construction of end conditions that require multiple solutions. The section will place a minimum 2-foot deep ditch, with a berm if necessary, when in cut. The section will also place a 4 to 1 fill slope when the embankment height is 10-feet or less and a 3 to 1 fill slope when over 10-feet in height. This section is constructed using the drag and drop method. Then, the end condition priorities are reset so that the section operates properly.

Chapter Objectives:

- Build an end condition section that tests for solutions based on priority
- Build an end condition section using existing components with the drag and drop method

Lab 31.1 - End Conditions that Require Multiple Solutions

- 1. Open MicroStation and InRoads using the *12345DES_Model-End Cond Mult Sol.dgn* file.
- 2. Select **File> Open** from the InRoads menu bar.
- Select the C:\Projects\12345\Design\InRoads\ 12345DES_Template-End Cond Mult Sol.itl from the available files.
- 4. **<D> Open** then **<D> Cancel** to dismiss the *Open* dialog box.
- 5. Select **Modeler> Create Template** from the InRoads menu bar.
- 6. Select *Tools> Options* from the *Create Template* menu bar.
- 7. Make sure that **Apply Affixes** is toggled off and the **X** and **Y Step Options** are set to *O.10*.

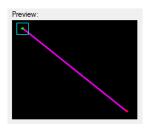
Naming Options Component Seed Name:	OK Cancel
Specify:	Preferences
Point Seed Name:	▼ Help
Apply Affixes Prefix Su Left: Right	
Step Options X: 0.10 Y: 0.10	Slope: 0.00%

- 8. **<D>** the **OK** button.
- 9. **<D> <D>** on the root folder in the Template Library pane to expand the folder structure.

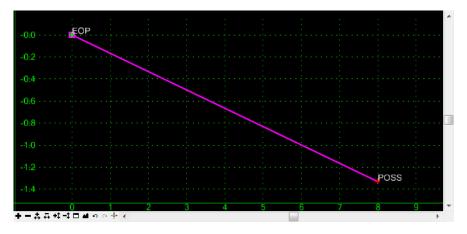
- 10. Expand the *3* Sections End Conditions> Z-Slope End Conditions> High Speed End Conditions folder.
- 11. Create a new template in the *High Speed End Conditions* folder. Name it *Z8_6_to_1_Ditch*.



- 12. Expand 4 Components> End Conditions> Z-Slope Components > High Speed End Conditions folder.
- 13. **<D>** on the *Z-Slope_8_6_to_1* component. The component is displayed in the Preview window.
- 14. **<D> and hold** on component's origin (the green dot).



15. **Drag** the component into the Template View and **drop** (release the data button) it on the new section's origin.

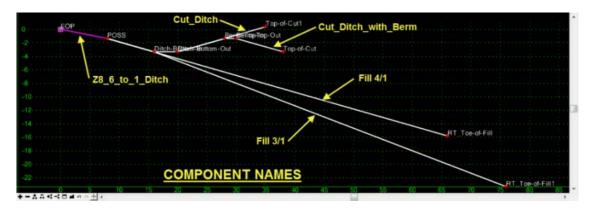


- 16. Expand 4 Components> End Conditions> Cut Slope Components folder.
- 17. **<D>** on the *Cut_Ditch_with_Berm* component.

- 18. **<D> and hold** on component's origin (the green dot).
- 19. **Drag** the component into the Template View and move the pointer on to the component point named *POSS* and **drop**. The "+" on the component point turns white when the pointer is on it.



- 20. Repeat steps 16, 17 & 18 for the *Cut_Ditch* component.
- Expand 4 Components> End Conditions> Fill Slope Components folder.Repeat steps 16, 17 & 18 for the Fill_4_to_1 and Fill_3_to_1 components.

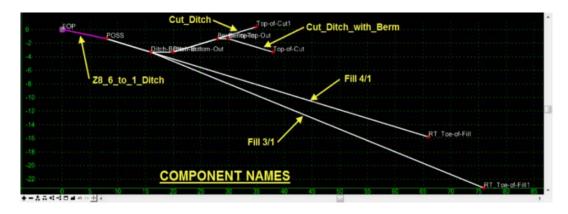


22. **<D> <D>** on the *Cut_Ditch_with_Berm* component.

23. Verify that the **Priority** is set to **1**.

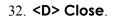
Name:		Cut_Ditc	h_with_Ber	m		+	Apply
Description:						⋪	Close
Style:		D_Top-o	of-Cut	•	Locate	/	< Previous
Parent Compo	nent:			• +	Button	•	
Display Rules:	:						Next >
						Edit	
Exclude fro	om trianqu	lation				Edit	Help
Exclude fro	-					Edit	Help
Exclude fro End Conditio Target Type	on Propert			▼ Prior	ity:	Edit	Help
End Conditio	on Propert	ties			ity: Benching Count	1	Help
End Condition	on Propert	ties Surface			-	1	Help
End Condition	on Propert	ties Surface <act< td=""><td></td><td></td><td>Senching Count</td><td>1</td><td>Help</td></act<>			Senching Count	1	Help

- 24. **<D>** on the *Locate Button* next to *Name* in the *Component Properties* dialog box.
- 25. **<D>** on the *Cut_Ditch* component in the Template View.



- 26. Verify that the **Priority** is set to *2* in the *Component Properties* dialog box.
- 27. Set the remaining End Condition Component priorities as follows:
 - ♦ Fill 4/1 = 3
 - ♦ Fill 3/1 = 4
- 28. Be sure to **<D>** the **Apply** button if any Priority values were modified.
- 29. **<D>** the **Close** button in the Component Properties dialog box.
- 30. **<D>** the **Test** Button.

- 4 2 0 -2 -4 -6
- 31. In the *Test End Conditions* dialog box, **<D> Draw** and notice how end conditions behave.



Chapter Summary:

- When multiple end conditions are chained together, if one part of the chain fails then the whole chain fails.
- End condition components that share a common starting point are considered a single end condition.

LAB 32 - Create End Conditions to Search a Surface

This lab demonstrates the ability of an end condition to target multiple surfaces, using target aliasing. In this exercise, a template is edited and new corridor is defined to target multiple surfaces. The existing ground surface was divided into three separate segments along the length of the project. There is also a rock layer surface 10-feet below the existing ground, for the second and third segments, where there is a deep cut section in the profile. The template end conditions target the rock and active surfaces, so target aliasing is required to target all the existing ground and rock surfaces as the corridor extends along the three segments of the project.

Chapter Objectives:

- Modify a template end condition to target a rock layer when that surface is present.
- Build a corridor and use target aliasing to target multiple existing ground and rock layer surfaces along three segments of the project.
- View the corridor to examine the end condition's behavior and determine if templates and target aliasing are working properly

The following files are used in this lab:

- C:\Projects\12345\Design\InRoads\12345DES_Geometry-Create End Condit Search Surf.alg
- C:\Projects\12345\Design\InRoads\12345DES_Template-Create End Condit Search Surf.itl
- C:\Projects\12345\Design\InRoads\12345DES_Roadway-Create End Condit Search Surf.ird
- C:\Projects\12345\Design\InRoads\Exist_Ground_1-Create End Condit Search Surf.dtm
- C:\Projects\12345\Design\InRoads\Exist_Ground_2-Create End Condit Search Surf.dtm
- C:\Projects\12345\Design\InRoads\Exist_Ground_3-Create End Condit Search Surf.dtm
- C:\Projects\12345\Design\InRoads\Rock_Layer_2-Create End Condit Search Surf.dtm
- C:\Projects\12345\Design\InRoads\Rock_Layer_3-Create End Condit Search Surf.dtm

Lab 32.1 - Create End Conditions to Search a Surface

1. Open MicroStation and InRoads using the *12345DES_Create End Cond Search Surf.dgn* file.

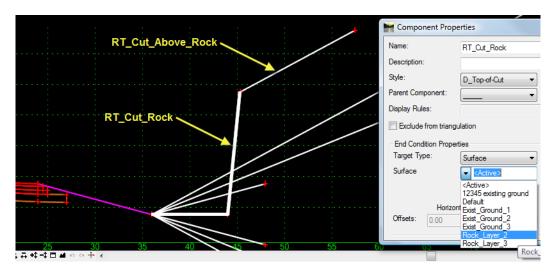
In the MicroStation drawing, notice the three perimeters displayed for each existing ground surface

- 2. Select **File> Open** from the InRoads menu bar.
- 3. Open the following files from C:\Projects\12345\Design\InRoads\ directory.
 - CDOT_Civil.xin
 - 12345DES_Geometry-Create End Condit Search Surf.alg
 - 12345DES_Template-Create End Condit Search Surf.itl

- 12345DES_Roadway-Create End Condit Search Surf.ird
- Exist_Ground_1-Create End Condit Search Surf.dtm
- Exist_Ground_2-Create End Condit Search Surf.dtm
- Exist_Ground_3-Create End Condit Search Surf.dtm
- Rock_Layer_2-Create End Condit Search Surf.dtm
- Rock_Layer_3-Create End Condit Search Surf.dtm
- 4. **<D> Cancel** the to dismiss the *Open* dialog box.

Lab 32.2 - Edit template end condition components to target rock layer.

- 1. Select **Modeler> Create Template** from the InRoads menu bar.
- 2. **<D> <D>** on the root folder in the Template Library pane to expand the folder structure.
- 3. Expand the *1 Templates* folder.
- 4. **<D> <D>** on the *12345_HMA_2Lane_Rock* template to open it for editing.
- 5. **<D> <D>** on the RT_Cut_Rock component.
- 6. In the *Component Properties* dialog box, change the Surface to *Rock_Layer_2* and <D> Apply



- **Note:** This end condition has two components and is only placed when there is a rock surface above the ditch bottom. The first component, *RT_Cut_Rock*, extends to intersect the rock layer surface. The second, *RT_Cut_Above_Rock*, is a child of the first and extends to intersect the active surface (existing ground). All other end condition components in this template target the active surface (existing ground).
- 7. **<D>** on the *Locate Button* next to *Name* in the *Component Properties* dialog box

LT_Cut_Above_Rock	🖌 Component Prop	erties		X	a ^
	Name:	LT_Cut_Rock		+ Apply	1
8 LT_Cut_Rock	Description:			Close	1
6	Style:	D_Top-of-Cut		< Previous	í.
4	Parent Component: Display Rules:	-	<u>+</u>	Next >	j
2	Exclude from triang	ulation		Edit Help	
0	End Condition Proper				1
-2	Target Type:	Surface 💌	Priority:	1	
-4	Surface	▼ Rock_Layer_2	Benching Count:	0	
-6			From Datum:	0.00	
	Horizor	ntal Vertical	Step Elevation:	0.00	
	Offsets: 0.00	0.00	Rounding Length	0.00	
-50 -45 -40 -	45 - 30	-25 -20	- 15 - 10	-5 U	
╪╼╧╧┿┿⊒╕╗╓╺┊┥					•

8. On the left side of the template, **<D>** on the *LT_Cut_Rock* component.

In the *Component Properties* dialog box, Change the Surface to *Rock_Layer_2*, then
 Apply and <D> Close.

Lab 32.3 - Create a Corridor and Template Drop

Build a corridor that follows the centerline alignment and extends along all three segments of the project.

- 10. Select **Modeler> Roadway Designer** from the InRoads menu bar.
- 11. Select **Corridor > Corridor Management** from the Roadway Designer menu bar.
- 12. In the *Manage Corridors* dialog box:
 - Key in *Centerline* in the *Name* field.
 - Select **Centerline** for the *Horizontal Alignment*.
 - Select **Centerline V** for the *Vertical Alignment*.
- 13. **<D> Add** then **<D> Close**.

Name: Cente	dine		Limits Station		Add
Туре:	Align	ment 👻	Start:		Close
Horizontal Alig	nment: Cente	erline 🔹 🕈	4+00.00	+	Change
Vertical Alignm	nent: Cente	erline V 🔻	Stop:		Сору
	_		700.00.00	-	
PI Rounding 1	Tangent: 0.00		706+00.00	-	Copy From.
PI Rounding T Corridors:	Tangent: 0.00		706+00.00	<u>+</u>	Copy From
-	Tangent: 0.00	Source Name	706+00.00 Start Station		
Corridors:	0.00	Source Name Centerline		Stop	Help
Corridors: Name	Туре		Start Station	Stop	Help

- 1. Select Corridor> Template Drops from the Roadway Designer menu bar.
- 2. In the *Template Drops* dialog box, select **Centerline** for the *Corridor* name.
- 3. Key in *50* for the *Interval*.
- 4. Expand 1 Templates folder in *Library Templates* area.
- 5. **<D>** on the **12345_HMA_2Lane_Rock** template.
- 6. **<D> Add** then **Close**.

	Centerline 4+00.00 50.00 nplates: ojects\1234 - Templates ↓ 12345_H ★ 12345_H ★ 12345_H ★ 12345_H ★ 12345_H	MA_2Lane_Rock MA_2Lane_Rock MA_4Lane Lane_Right-Side_Only vided_TypeA_4Lane amp	_Template-Libr	any.tl
Current Ter Station	Interval	Template	Revised In	Library
4+00.00	50.00	12345_HMA_2Lane_Rock	ITL	C:\Projects\12345\Design\InRoads\1
Synchror	nize with Libra	III ary		Edit Delete

Lab 32.4 - Define target aliasing

Target aliasing allows multiple targets to be specified for a single end condition. In this example, the existing ground for the project was contained in three separate dtms.

- 7. Select Tools> Target Aliasing from the Roadway Designer menu bar.
- 8. In the *Target Aliasing* dialog box, select **<Active Surface>** for the *Target*.
- 9. Highlight Surface Exist_Ground_1, Surface Exist_Ground_2 and Surface Exist_Ground_3 in the *Surface or Corridor* area.

10. **<D> Add**.

Marget Aliasing	3	ζ
Target: Surface or Comidor Surface - Default Surface - Rock_Layer_2 Surface - Rock_Layer_3 Move Up Move Down		

- 11. Select **Rock_Layer_2** for the *Target*.
- 12. Highlight Surface Rock_Layer_2 and Surface Rock_Layer_3 in the *Surface or Corridor* area.
- 13. **<D> Add**.

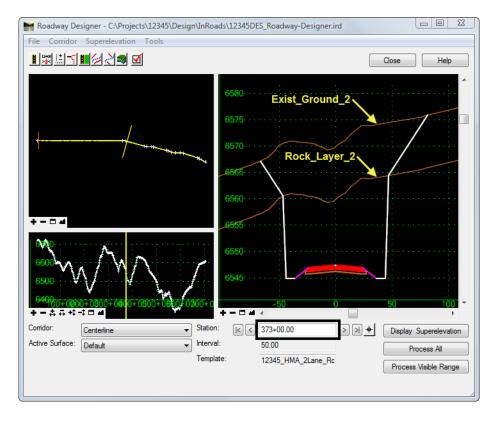
Target: Rock_Layer_2 Surface or Comidor OK Surface - Default Surface - Default Surface - Default Add -> Surface - Exist_Ground_1 Surface - Rock_Layer_2 Surface - Exist_Ground_2 Move Up Move Down Move Down Image: Use Closest Image: Use Closest

14. **<D> OK.**

Lab 32.5 - Review Design Model

View the corridor to examine the end condition's behavior and determine if templates and target aliasing are working properly.

1. In the *Roadway Designer* dialog box, key in *373+00* for the *Station*. Notice the end conditions target the existing ground and rock layer surfaces in Roadway Designer dialog's cross- section viewer.



2. Key in *600+00* for the *Station*. Notice in the illustration below, that even though the surfaces are different, the end condition still solves. This is because the Target Aliasing allows multiple surfaces to be specified for the end condition.



Chapter Summary:

- When end conditions are chained together (like the rock layer components used above), all parts of the chain must solve or the whole end condition fails.
- Use target aliasing to target multiple existing ground and rock layer surfaces.

Chapter 2 - Intersection Project

This intersection lab is based on the Federal Blvd. and 6th Ave. interchange reconstruction project. The lab focuses on the reconstruction of the intersection at Federal Blvd. and 5th Avenue. It describes the tools and techniques for modeling an intersection.

Chapter Objectives:

- Describe the procedures and techniques used to create an at-grade intersection
- Improve proficiency in creating corridors
- Practice creating design surfaces
- Introduce the student to the multi-centered curve tool used to develop geometry for curb returns
- Learn how to use point controls in typical sections to model curb returns
- Reinforce techniques for combining surfaces to create a final surface

Project Overview

The scope of work for the Federal Blvd. and 5^{th} Ave. intersection project is a complete reconstruction. Key features of the reconstruction are:

- Federal Blvd. (the mainline) is being widened from 4 to 6 lanes
- 5^{th} Ave. (the crossing street) is being realigned to accommodate the on ramp to 6^{th} Ave.
- Federal Blvd. uses a concrete pavement design
- 5th Ave. uses an asphalt pavement design
- 5th Ave. switches to a concrete pavement prior to the intersection.
- 5th Ave has a taper on the south side to facilitate right turns.

Project Data

The following data is provided for this project:

- **Federal @ 5thAve.alg** This file contains predefined horizontal and vertical alignments for Federal Blvd. and the horizontal alignment 5th Ave. The student will create a vertical alignment for 5th Ave. in addition to geometry for each of the curb returns.
- **16628_Existing.dtm** This file represents the surveyed surface data of the existing intersection.
- Federal_and_5th.itl This file contains predefined templates for Federal Blvd. and 5th Ave.

InRoads Design Process

Below is an outline of the InRoads procedures used to create the intersection design model:

- 1. Create the initial mainline design surface
- 2. Create the vertical alignment for crossing street and match the mainline design surface through the intersection
- 3. Create the initial crossing street design surface
- 4. Add geometry for each curb return
- 5. Update the crossing street corridor to include curb returns
- 6. Update mainline corridor to include curb returns and features from the crossing street.
- 7. Create the final intersection Surface

Initial Modeling

Section Objectives:

Federal Blvd. is considered the mainline and should be modeled first. Use this initial Federal Blvd. design surface to assist in defining the vertical alignment for 5th Ave., the intersecting street. Using the new vertical alignment and the predefined template for 5th Ave., create the initial design surface for the crossing street. At this point there will be two separate design surfaces, one for the mainline and one for the crossing street.

Create the Initial Federal Blvd. Design Surface

Use the following procedure to create the initial design surface for Federal Blvd.:

- ♦ Load project data
- Create the Federal Blvd. corridor
- Add template drops
- Generate the initial mainline design surface

Load Project Data

- 1. Open the Federal @ 5thAve.alg geometry file.
- 2. Open the Federal_and_5th.itl template library.
- 3. Open the **16628_Existing.dtm** surface.

Create the Federal Blvd. Corridor

The Federal Blvd. alignment runs from south of 5th Ave to north of the ramps for eastbound 6th Ave. Because this lab is concerned with the intersection at 5th Ave., the first 300 feet of the Federal Blvd. alignment is used.

- 1. Select **Modeler > Roadway Designer** from the InRoads menu bar. This displays the *Roadway Designer* dialog box.
- 2. In the *Roadway Designer* dialog box, select Corridor > Corridor Management or

<D> the **button**. This displays the **Manage Corridors** dialog box.

- 3. In the *Manage Corridors* dialog box, key in *Federal Blvd* for the *Name*.
- 4. Set the *Surface Symbology* to **D_Finished-Grade.**
- 5. Set the *Type* to Alignment.
- 6. Select Federal CL as the Horizontal Alignment.
- 7. Select Federal CL_V as the *Vertical Alignment*.
- 8. Toggle on **Station** in the *Limits* area.
- 9. Key in *O+OO.OO* for the *Start* station.
- 10. Key in *3+00.00* for the *Stop* station.
- 11. **<D> Add** to complete the corridor.
- 12. **<D> Close** to dismiss the *Manage Corridors* dialog box.

🕌 Manage Corrido	ors			
Name: Federal Blvc			Limits	Add
Surface Symbology:	D_Finished-Gra	de 🔻	Station Start:	Close
Туре:	Alignment	-	0+00.00	+ Change
Horizontal Alignment	Federal CL	+	Stop:	Сору
Vertical Alignment:	Federal CL_V	•	3+00.00	+
PI Rounding Tanger	it: 0.00			Copy From
Corridors:				Help
Name	Туре	Source Name	Start Station	Stop Station
Federal Blvd	Alignment	Federal CL	0+00.00	3+00.00
L				Delete
				Delete

Add Federal Blvd. Template Drops

- 1. In the *Roadway Designer* dialog box, select **Corridor > Template Drops** or **<D>** the button. This displays the *Template Drops* dialog box.
- 2. In the *Template Drops* dialog box, Key in *O+OO.OO* for the *Station*.
- 3. Key in *25* for the *Interval*.
- 4. In the *Library Templates* area, expand the **1 Templates** folder.

5. Highlight the **Federal Blvd** template.

🕌 Temp	late Drops	- • •
Corridor:	Federal Blvd 🔻	Add
Station:	0+00.00 +	Close
Interval:	25.00 +	Change
	mplates: 1 - Templates \Leftrightarrow Sth_Ave_Asphalt \Leftrightarrow Sth_Ave_Concrete \leftarrow CONC_Divided_TypeA_4L \leftarrow Federal Blvd \leftarrow HMA_Divided_TypeA_4La \leftarrow HMA_Divided_TypeA_4La \leftarrow HMA_Divided_TypeA_4La \leftarrow HMA_Divided_TypeA_4La \leftarrow HMA_Divided_TypeA_4La \leftarrow HMA_Divided_TypeA_4La \leftarrow HMA_Divided_TypeA_4La	Copy Help
	Inter Template Enable Tr F	Rev Library
0+00.0;	25.00 Federal Blv N/A IT	L C:\Projects\1
Synchro	nize with Library Ec	it Delete

6. **<D> Add** and **<D> Close**.

Create the Initial Federal Blvd. Design Surface

The surface created here will be used in conjunction with the existing ground to lay out the vertical alignment for 5th Ave. Having the Federal Blvd. surface makes it easier to match it's cross slope with the 5th Ave vertical alignment.

- In the *Roadway Designer* dialog box, select Corridor > Create Surface or <D> the sutton. This displays the *Create Surface* dialog box.
- 2. Key in *Federal Blvd* for the *Name*.
- 3. Select **Proposed** for the *Default Preference*.
 - **Note:** If Proposed is not found in the list, make sure the standard CDOT_Civil.xin file is loaded.

4. Verify the remaining settings match the illustration below.

Create Surface		×
Name:	Federal Blvd	- Apply
Default Preference:	Proposed	
		Close
Create Surface(s) from Federal Blvd	1:	Preferences
		Help
		All
Clip	ping Options	
General Options		
New Surface for	Each Corridor 📃 Cre	ate Alternate Surfaces
Empty Design Su	irface 📃 Pro	cess Visible Range Only
Include Null Poin	ts 📝 Rer	nove Loops
📝 Triangulate		
Features Duplicate Names: Append) Replace 🛛 Rena	ime 🔘 Modify
Style:		
Add Exterior Bou	Default	_
Style:		
Style:	Exterior Boundary	•
Densify using Chord	-	Display in Plan View
Horizontal Curves	3	Features
Vertical Curves		Components

- 5. **<D> Apply** and **<D> Close**.
 - **Note:** If the *Report Lock* is *On*, the *Results* dialog box will appear with information about the creation of the surface. This can be dismissed.

Roadway Designer is exited at this point. Save the ird file so that it can be used in later steps.

- 6. Select **File > Save** from the *Roadway Designer* menu bar.
- 7. Key in *Federal_and_5th.ird* for the file name.
- 8. **<D> Save** then **<D> Cancel** in the *Save As* dialog box.
- 9. Close the *Roadway Designer* dialog box.

Changing the symbology for the cross sections and profiles makes it easier to differentiate between surfaces. To change the symbology:

 From the InRoads menu bar, select Surface > Surface Properties. This displays the Surface Properties dialog box.

Main Advance	d						
Surface:	Federal Blv	d 🔻					Report
Name:	Federal Blv	d					Help
Description:	Created from	m roadway de					
Maximum Length	: 0.00						
Preference:	Default	-					
Туре:	Design	•	-Data Totals-	Active	Features	Deleted	Total
Use Extended	Data Checks		Random:	0	0	2	2
🔲 Lock Triangul	ation		Breakline:	343	49	0	343
Data Range			Contour:	0	0	0	0
Point Type:	Total	•	Inferred:	0		0	0
Northing:	Minimum 686569.27	Maximum 686871.44	Interior:	0	0	0	0
Easting:	952622.69	952755.52	Exterior:	53	1	0	53
Elevation:	5258.15	5263.46	All Points:	396	52	2	398
20101011	0200.10	0200.10	Triangles:	240		56	296
			oply C	lose			

11. In the *Surface Properties* dialog box on the *Main* tab, select the **Federal Blvd** surface.

- 12. Select the *Advanced* tab.
- 13. Select **D_Finished-Grade** for *Cross Sections Symbology*.

Surfac	e: Feder	al Blvd 👻					
	Sections						Help
Symbo	ology: D_Fin	ished-Grade		•	🔲 Use F	eatures Only	Tiop
Profile	s						
Symbo	logy: D_Fin	ished-Grade		-	Lock	Symbologies	
Offset	Distance	Symbology	Colo	or Offset	Distance	Symbology	Col
1:	0.00	Default	-	9:	0.00	Default	-
2:	0.00	Default	•	10:	0.00	Default	•
3:	0.00	Default	•] 11:	0.00	Default	•
4:	0.00	Default	•	12:	0.00	Default	▼
5:	0.00	Default	•] 13:	0.00	Default	•
6:	0.00	Default	•] 14:	0.00	Default	•
7:	0.00	Default	•	15:	0.00	Default	•
8:	0.00	Default	•	16:	0.00	Default	•
		·		-			

14. Select **D_Finished-Grade** for *Profile Symbology*.

- 15. **<D> Apply**.
- 16. **<D> Close**.

This completes the initial design of Federal Blvd.

Create the 5th Ave Vertical Alignment

The vertical alignment for 5th Ave. is created at this point. Using the initial Federal Blvd surface and the existing ground surface, the vertical alignment for 5th Ave. can be tied into Federal Blvd. properly.

- Create the crossing street profile
- Define the crossing street vertical alignment

Create a Profile for 5th Ave.

In order to define a vertical alignment, a profile window is required. The existing surface along with the initial Federal Blvd. surface is displayed in this profile.

- 1. In MicroStation, move to an area to the right of the alignments.
- 2. Verify the *5th_Ave* horizontal alignment is active.
- 3. On the InRoads main menu, select **Evaluation > Profile > Create Profile**. This displays the *Create Profile* dialog box.

The 5x Vertical preference is used here so that the slopes are easier to see.

- 4. **<D> Preferences** and highlight the preference **5x Vertical** from the list.
 - **Note:** Because there are so many settings that control the look and feel of a profile, several CDOT preferences have been created that can save the end user a significant amount of time setting up and creating a profile. Be sure to use a standard preference as much as possible.
- 5. **<D> Load** to load the preference and then **<D> Close**.

Preferences		- ×-
Name:		Close
10x Vertical 10xVert_Drain 1x Vertical		Load
1xVert_Drain 2x Vertical	=	Save
2x/vert_Drain 5x Vertical		Save As
CDOT		Delete
Default SS Drain	Ψ.	Help
Preference '5x Vertical' loaded		

- 6. On the *General* leaf, enter **5th_Ave** for the *Set Name*.
- 7. Toggle on **Right to Left** in the *Direction* area.
- 8. Toggle on the 16628_Existing and Federal Blvd surfaces.
- 9. **<D>** on the **Controls** leaf.

Create Profile Create Profile General Source Include Create Referent Referent Referent Referent Re	Set Name: Eth_Ave Direction © Left to Right © Right to Left	Exaggerati Vertical: Horizontal:	1.0000	
	Surfaces: Object	Name	_	
	Default 16628_Existing Federal Blvd	Default T_Existing_Ground D_Finished-Grade	BYL BYL	Al
	1	Pro	peties	None
		10	general.	
		Apply Prefere	inces	Close Help

10. Toggle on **Use** in the *Station* area.

Because this lab is concerned with just the intersection, the vertical alignment (and the profile) is constructed to cover just the area of the intersection.

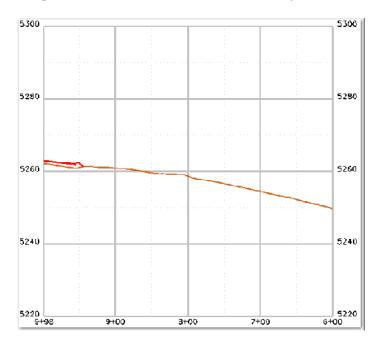
11. Key in *6+00.00* for the *Start* station.

- 12. Key in *9+98.50* for the *Stop* station.
- 13. Toggle on **Apply** in the *Window Clearance* area.
- 14. Key in *25* for both the Top: and Bottom.

🔄 Create Profile	Elevation	Example
General	Use Use	T
Source	High: 980.00	TOP
Include		
Offsets	Low: 910.00	The second secon
Controls	From Cogo Points From Regressio	on Points BOTTOM
····· Iimits ····· → Limits		
Grid	Station	
Details	V Use	
ASCII		
	Start: 6+00.00 -+	
	Stop: 9+98.50 +	
	_Window Clearance	
	Top: 25.00 +	
	Bottom 25.00 +	
	23.00	

15. **<D> Apply**.

- 16. **<D>** in the MicroStation view window to identify the profile's location. Because the *Direction* was set to *Right to Left*, the profile will be place to the right of the data point.
- 17. The profile should look similar to the following:



18. **<D> Close** on the *Create Profile* dialog box to dismiss it.

Define the 5th Ave Vertical Alignment

- 1. Select the **Geometry** bottom tab from the InRoads Explorer.
- 2. Expand the *Federal@5thAve* geometry project to show the **5th_Ave** horizontal alignment.
- 3. **<R>** on the **5th_Ave** horizontal alignment and select **New** from the menu.

🙀 Bentley InRoads XM Edition	
<unnamed></unnamed>	- 🚡 📚 🚳 📏 🎽 📘
<u>File S</u> urface <u>G</u> eometry <u>D</u> rain	age <u>E</u> valuation <u>M</u> odeler Dr <u>a</u> ft
🖂 🗠 😬 🔚 🖓 🖾 🗠	
	Name T
🖃 📇 Geometry Projects	
🗄 📴 Default	
Federal@5thAve	
Cogo Buffer	
···· <mark>∕</mark> 5th_Ave ⊕··· ∕ Federal CL	New
	Set Active
	Copy
몶 Geometry 🖻 Prefer	Delete
Creates a cross section surface	Empty ^{is}

- 4. In the *New* dialog Box, set the *Type* to Vertical Alignment.
- 5. In the *Name* field, key in *5th_Ave-V*.
- 6. In the Description field, key in 5th Ave Vertical Alignment.
- 7. Set the *Style* to ALG_PRO_Vert. (This stands for Alignment Proposed Vertical)

- New New - • • Surface Geometry Type: Vertical Alignment Apply Name: 5th_Ave-V Help Description: 5th Ave Vertical Alignment Style: ALG_PRO_Vert Curve Definition: Parabolic Name Description Style Close
- 8. The dialog box should look like the following:

- 9. **<D> Apply** and **<D> Close**.
- 10. Select **Geometry > Vertical Curve Set > Add PI** from the InRoads main menu. There is no dialog box with this command.
- 11. In the MicroStation **Key in** window, key in *se=6+00.00, 5249.77* and press *Enter*.



- 12. Key in *se=7+87.03, 5258.98* and press *Enter*.
- 13. Key in *se=9+57.46, 5261.99* and press *Enter*.
 - **Note:** This is the station where the alignment of 5th Ave. ties into the cross slope of Federal Blvd. Make sure that this is a smooth transition by comparing the cross slope of Federal Blvd. to the slope of this tangent.
- 14. Key in *se=9+98.49, 5262.82* and press *Enter*.
- 15. **<R>** to stop placing PI's.
- 16. In the Add Vertical PI dialog box, **<D> Close** to dismiss the dialog box.
- 17. Select Geometry > Vertical Curve Set > Define Curve from the InRoads main menu.

- 18. In the *Define Vertical Curve Set* dialog box, verify that the *Station* is **7+87.03**.
- 19. Verify that the *Elevation* is *5258.98*.
- 20. In the Vertical Curve area, key in 200.00 in the Length field.

🕍 Define Vertical	Curve Set	- 0 X
Vertical PI Define PVI By:	Station and Elevation	Apply
Station:	7+87.03	Close
Elevation:	5258.98	Undo
Entrance Grade:	4.92%	Design Calc
Exit Grade:	1.77% _+	Report
- Vertical Curve		Help
Calculate By:	Length of Curve 👻	
Length:	200.00 4	ŀ
Adjacent Curves		
Update By:	Length of Curve 🔻	
Distance:	0.00	⊦]
First < Pr	evious Next > Last	Select

21. **<D> Apply** and **<D> Close**.

Create the Initial 5th Ave. Design Surface

- Define the corridor for the crossing street
- Add template drops
- Add point controls
- Create the initial crossing street design surface

Build the 5th Ave. Corridor

- 1. Select **Modeler > Roadway Designer** from the InRoads menu bar. This displays the *Roadway Designer* dialog box.
- In the *Roadway Designer* dialog box, select Corridor > Corridor Management or
 <D> the button. This displays the *Manage Corridors* dialog box.
- 3. In the *Manage Corridors* dialog box, key in *5th Ave* for the *Name*.
- 4. Set the *Type* to Alignment.

- 5. Select **5th_Ave** as the *Horizontal Alignment*.
- 6. Select **5th_Ave -V** as the *Vertical Alignment*.
- 7. Toggle off **Station** in the *Limits* area.
- 8. **<D> Add** to complete the corridor.

🐂 Manage Corri	dors			- • •
Name: 5th Ave			Limits Station	Add
Type: Horizontal Alignme Vertical Alignment: PI Rounding Tang	5th_Ave-V	▼ ▼ +	Station Start: 6+00.00 Stop: 9+98.50	Close Change Copy Copy Copy From
Corridors:				Help
Name	Туре	Source Name	Start Station	Stop Station
				Delete

9. **<D> Close** to dismiss the *Manage Corridors* dialog box.

Add 5th Ave. Template Drops

The pavement for 5^{th} Ave. needs to change from an asphalt pavement to a concrete pavement as it approaches Federal Blvd. This takes place at Sta. 8+30.00. Therefore, the asphalt template is used from the beginning of the 5^{th} Ave. corridor to station 8+29.99. The concrete template is used from station 8+30.00 to the end of the project. Switching templates in 1/100 of a foot gives a clean change between templates.

- 1. In the *Roadway Designer* dialog box, select **Corridor > Template Drops** or **<D>** the button. This displays the **Template Drops** dialog box.
- 2. Verify the *Corridor* is set to **5th Ave.**
- 3. In the **Template Drops** dialog box, Key in *6+00.00* for the *Station*.

- 4. Key in *25* for the *Interval*.
- 5. In the *Library Templates* area, expand the **1 Templates** folder.
- 6. Highlight the **5th_Ave_Asphalt** template.
- 7. **<D> Add**.

🔚 Temp	late Drops	- • •
Corridor:	5th Ave 🔹	Add
Station:	6+00.00 +	Close
Interval:	25.00 +	Change
Library Te		Сору
	1 - Templates	Help
	 CONC_Divided_TypeA_4L CONC_Ramp Federal Blvd HMA_Crowned_B10 HMA_Divided_TypeA_4La HMA_Divided_TypeA_4La 	
Current T	emplate Drops:	· · · ·
Station	Inter Template Revi Li	ibrary
6+00.0	. 25.00 5th_Ave_Asph ITL C:*	\Projects\InRoads
Synchro	onize with Library Edi	t Delete

- 8. Key in *8+29.99* for the *Station*.
- 9. Highlight the **5th_Ave_Asphalt** template.
- 10. **<D> Add**.
- 11. Key in *8+30.00* for the *Station*.
- 12. Highlight the **5th_Ave_Concrete** template.
- 13. **<D> Add**.

🚔 Templa	te Drops							
Corridor:	5th Ave	-		Add				
Station:	6+00.00		+	Close				
Interval: 25.00								
Library Templates:								
Current Template Drops:								
Station	Inter	Template	Revi	Library				
6+00.00	25.00	5th_Ave_Asphalt	ITL	C:\Projects\InRc				
8+29.99	25.00	5th_Ave_Asphalt	ITL	C:\Projects\InRc				
8+30.00	25.00	5th_Ave_Concrete	ITL	C:\Projects\InRo				
•		III		•				
Synchron	ize with Lib	rary	Edit	Delete				

14. The template drops appear in the dialog box as shown below:

15. **<D> Close**.

Add 5th Ave. Point Controls

The templates are defined to be used "as is" at the beginning of the alignment and are to widen out as Federal Blvd. is approached. The point controls used here reflect the area of widening where 5th Ave. approaches Federal Blvd.

Because the asphalt template and the concrete template use different point names, point controls have to be defined for each template. This first set of point controls define the widening on the right side of 5th Ave. This widening is constant through the corridor.

- 1. In the *Roadway Designer* dialog box, select **Corridor > Point Controls** or **<D>** the **button**. This displays the *Point Controls* dialog box.
- 2. In the *Control Description* field, key in *5th Ave Rt Asph EOP Control*.
- In the *Point Controls* dialog box, set the *Point* to RT_HMA_Lift1_Laneline-Top using the drop down menu or the *Button*.
- 4. Toggle on **Horizontal** in the *Mode* area.
- 5. Set the *Control Type* to Alignment.

6. Set the *Horizontal Alignment* to **5th_Ave**.

Note: The settings made in steps 3 through 5 are used for setting up all of the point controls that follow.

- 7. In the *Station Limits* area, key in *6+00.00* for the *Start* station.
- 8. Key in *8+29.99* for the *Stop* station.
- 9. In the *Horizontal Offsets* area, key in *23.89* for the *Start* and *Stop* offsets.
- 10. **<D> Add**.

Roint Controls				- • •
Comidor: 5th Ave				Add
Control Description: 5th Ave Rt Asph E	OP Control			Close
Point: Mode Mode Porizontal Vertical Back	Start:	n Limits 6+00.00 8+29.99	+ +	Change Help
Control Type: Alignment Horizontal Alignment: Bth_Ave	▼ Horizo ▼ -+ Start: Stop:	20.00	+ +	
Priority: 1	Vertic Start: Stop:		+	
Horizontal and Vertical Controls:				
E P Name Start St St	top St Mode	Туре	Control	Description
X 1 RT_HMA6+00.00 8+3	29.99 Horizontal	Alignment	5th_Ave	5th Ave Rt Asph
<				•
				,
				Delete

- 11. Advance the *Station* to **8+30.00** in the Roadway Designer plan view window.
- 12. In the Control Description field, key in 5th Ave Rt Conc EOP Control.
- 13. In the *Point Controls* dialog box, set the *Point* to RT_Conc_Laneline-Top using the drop down menu or the button.
- 14. In the *Station Limits* area, key in *8+30.00* for the *Start* station.
- 15. Key in *9+98.50* for the *Stop* station.
- 16. In the *Horizontal Offsets* area, key in *23.89* for the *Start* and *Stop* offsets.
- 17. **<D> Add**.

This set of point controls define the widening on the left side of 5th Ave. It is constant from the beginning of the corridor to station 8+30.00 (where the templates change). From here it transitions out to provide the additional width for right turns. The additional width is maintained to the end of the corridor.

- 18. In the Control Description field, key in 5th Ave Lt Asph EOP Control.
- 19. Set the Point to LT_HMA_Lift1_Laneline-Top.
- 20. In the *Station Limits* area, key in *6+00.00* for the *Start* station.
- 21. Key in **8+29.99** for the **Stop** station.
- 22. In the Horizontal Offsets area, key in -12.45 for the Start and Stop offsets.
- 23. **<D> Add**.

The next series of steps define the tapered area of the widening.

- 24. In the Control Description field, key in 5th Ave Lt Conc EOP Transition Control.
- 25. Set the Point to **LT_Conc_Laneline-Top**.
- 26. In the *Station Limits* area, key in *8+30.00* for the *Start* station.
- 27. Key in *9+00.48* for the *Stop* station.
- 28. In the Horizontal Offsets area, key in -12.45 for the Start offset.
- 29. Key in -15.87 for the Stop offset.
- 30. **<D> Add**.

For the final point control use the following steps:

- 31. In the Control Description field, key in 5th Ave Lt Conc EOP Full Width Control.
- 32. In the *Station Limits* area, key in *9+00.48* for the *Start* station.
- 33. Key in *9+98.50* for the *Stop* station.
- 34. In the Horizontal Offsets area, key in -15.87 for the Start and Stop offsets.
- 35. **<D> Add**.

36. At this point there should be 5 point controls setup, 3 for the left side of 5th Ave. and 2 for the right side, as shown in the following image.

Point Controls		- • •
Corridor: 5th Ave		Add
Control Description: 5th Ave Lt Conc EOP Transitio	n Control	Close
Point: ABC_Centerline-Top	Station Limits Start: 6+00.00	thange
Horizontal Overtical Obth	Stop: 9+98.50	+ Help
Control Type: Alignment	Horizontal Offsets	
Horizontal Alignment: 5th_Ave	Start: 0.00	<u>+</u>
_	Stop: 0.00	<u>+</u>
Use as Secondary Alignment	Vertical Offsets	
	Start: 0.00	-#-
	Stop: 0.00	
Priority: 1		
Horizontal and Vertical Controls:		
E P Name Start St Stop St N	Node Type (Control Description
	-	th_Ave 5th Ave Rt Asph
	-	th_Ave 5th Ave Rt Conc
	-	th_Ave 5th Ave Lt Asph
	-	th_Ave 5th Ave Lt Conc
X 1 LT_Conc9+00.48 9+98.50 He	orizontal Alignment 5t	th_Ave 5th Ave Lt Conc
•		4
		Delete

37. **<D> Close**.

Create the Initial 5th Ave. Design Surface

This surface, along with the initial Federal Blvd. surface, will be used to determine the vertical alignments for the curb returns.

- 1. In the *Roadway Designer* dialog box, on the InRoads *Surfaces* tab, verify that **16628_Existing** is the active surface.
- 2. Select Corridor > Create Surface or <D> the sutton. This displays the Create Surface dialog box.
- 3. Key in *5th Ave* for the *Name*.
- 4. Select **Proposed** for the *Default Preference*.
- 5. Highlight only **5th Ave** in the *Create Surface(s) From* list.

- Create Surface X Name: 5th Ave Apph Default Preference: Close ate Surface(s) from Preferences Help All None Clipping Options... General Options New Surface for Each Corridor Create Alternate Surfaces Process Visible Range Only Empty Design Surface Remove Loops Include Null Points **V** Triangulate Features Duplicate Names Append Replace Rename Modify Add Transverse Features Style: Default $\overline{\mathbf{w}}$ Add Exterior Boundary Style: Exterior Boundary 💌 Densify using Chord Height Tolerance Display in Plan View Horizontal Curves Features Vertical Curves Components
- 6. The remaining settings should be correct. If not, set them to match the illustration below.

- 7. **<D> Apply**.
- 8. **<D> Close**.
- 9. Select File > Save from the *Roadway Designer* menu bar.
- 10. Close the *Roadway Designer* dialog box.
- From the InRoads menu bar, select Surface > Surface Properties. This displays the Surface Properties dialog box.
- 12. In the *Surface Properties* dialog box on the *Main* tab, select the **5th Ave** surface.
- 13. Select the *Advanced* tab.
- 14. Select **D_Finished-Grade** for *Cross Sections Symbology*.
- 15. Select D_Finished-Grade for Profile Symbology.
- 16. **<D> Apply** and **<D> Close**.

Section Summary:

At this point there are two initial design surfaces created; a mainline and the crossing street. In order for these surfaces to match up through the intersection additional, geometry will need to be created.

Additional Geometry

Section Objectives:

• Create horizontal and vertical geometry for curb returns

In this section the two initial design surfaces are used to create smooth vertical alignment transitions around the corners of the intersection. Horizontal and vertical geometry for each curb return is defined with the InRoads *Create Multicenter Curves* tool. The new geometry will be used to create the final design surface.

Curb Returns

Because this example is a T-intersection there are only two curb returns to model. In a typical intersection there are four returns to model. The steps shown below can also be used to develop curb returns for an intersection with more than one crossing street.

Create Northeast Curb Return

- 1. From the InRoads menu bar, select **Geometry > Utilities > Multicenter Curve...** This displays the *Multicenter Curve* dialog box.
- 2. On the *Main* tab of the *Multicenter Curve* dialog box, set the *Curve Type* to **One Center**.
- 3. In the *Radii* area, key in *75* for *Radius* 1.
- 4. In the *Widths* area, key in *23.89* for *Width* **1**. This is the width of 5th Ave. from its centerline to the right edge of pavement.

Multicente	r Curve			
Main Adva	inced			
Curve Type:	One Center	•		Help
Radii				
Radius 1:	75.00	+	Widths	
Radius 2:	40.00	+	Width 1: 23.89	+
Radius 3:	120.00	- -	Width 2: 41.00	+
Define By-				
Offsets a	at Shifted PC/PT	Offse	ets at PCC/PCC) Length
Use Sec	cond Set of Values			
Offset 1:	2.00	+	Length 1: 0.00	+
Offset 2:	2.00	+	Length 2: 0.00	- -
	Width	Alignment	1 Vidth 2	
L	Apply	Preferer	nces Close	

5. Key in **41** for **Width 2**. This is the width of Federal Blvd. from its centerline to the right edge of pavement.

Important! Use the graphic in the Example area to determine how to enter your curb data. This graphic changes according to the Curve Type:. As an example, when prompted by the software to choose the first alignment, choose the alignment that is associated with Width 1.

6. **<D>** the **Advanced** tab.

The steps below define the properties of the horizontal alignment representing the northeast curb return.

- 7. In the *Name* field of the *Alignment* area, key in *5th_Ave_NE-Quadrant*.
- 8. In the Description field, key in NE Return for Federal & 5th.
- 9. Set the *Style* to ALG_OTHER.

The following steps define the vertical alignment for the curb return. Because the 5th Ave. width was entered in Width 1 previously, 5th Ave. data must be used in the First Selected Alignment fields here. The Federal Blvd. data is used in the Second Selected Alignment fields.

- 10. Toggle on Create Vertical Alignment.
- 11. In the *First Selected Alignment* area, toggle on **Surface**.
- 12. Select **5th Ave** for the surface.
- 13. In the *Second Selected Alignment* area, toggle on **Surface**.
- 14. Select **Federal Blvd** for the surface.

The dialog box should now look like the image below.

Main Advanced Alignment Help Name: 5th_Ave_NE-Quadrant Description: NE Return for Federal & 5th Style: ALG_OTHER Image: Create Vertical Alignment Image: Create Vertical Distance: 0.00 Image: Organized Transmission State Image: Surface: 5th Ave Image: Surface: 5th Ave Image: Surface: 0.00 Image: Surface: 0.00 Image: Surface: Federal Blvd Image: Surface: Federal Blvd Image: Surface: Federal Blvd Image: Surface: The strend Ends: 10.00 10.00	Multicenter Curve		- • •
Name: 5th_Ave_NE-Quadrant Description: NE Return for Federal & 5th Style: ALG_OTHER Image: Create Vertical Alignment Image: Create Vertical Alignment Image: Vertical Distance: Image: Output Image: Style: Image:	Main Advanced		
First Selected Alignment Vertical Distance: 0.00 Gradient: -2.00% Surface: 5th Ave Second Selected Alignment Vertical Distance: 0.00 Gradient: -2.00% Gradient: -2.00% Gradient: -2.00% Sufface: Federal Blvd	Name: 5th_Ave_ Description: NE Return	n for Federal & 5th	Help
○ Gradient: -2.00% ③ Surface: 5th Ave Second Selected Alignment ▼ ○ Vertical Distance: 0.00 ○ Gradient: -2.00% ③ Surface: Federal Blvd	First Selected Alignmer	nt	
Second Selected Alignment ○ Vertical Distance: ○ Gradient: -2.00% Surface: Federal Blvd	Gradient:	-2.00%	
	 Vertical Distance: Gradient: 	[0.00	
	Аррһ	Preferences	ose

15. **<D> Apply**.

Important! Now you must select the alignments in the same order that they were defined in the dialog box.

The following message is displayed in the lower left corner of the MicroStation window:

> Identify first alignment/Reset

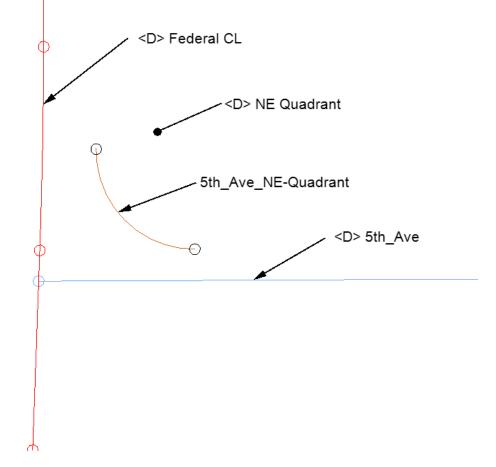
16. **<D>** on the **5th_Ave** alignment in the MicroStation view window. The following message is displayed:

> Identify second alignment/Reset for new first alignment

17. **<D>** on the **Federal CL** alignment. The following message is displayed:

> Identify quadrant for retum/Reset for new second alignment

- 18. **<D>** above the **5th_Ave** alignment and to the right of the **Federal CL** alignment. The curb return alignment is displayed.
- 19. **<D>** one more time to **Accept** the creation of the new alignment.

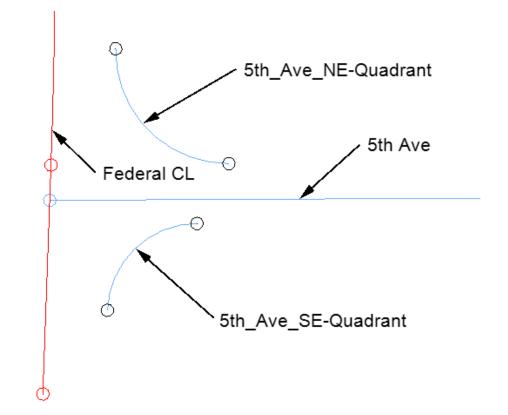


Create Southeast Curb Return

Again, the 5th Ave. data is used first to create the southeast curb return.

- 1. From the InRoads menu bar, select **Geometry > Utilities > Multicenter Curve...**
- 2. On the *Main* tab, in the *Radii* area, key in *60* for *Radius* 1.
- 3. In the *Widths* area, key in *15.87* for *Width 1*.

- 4. Key in **41** for **Width 2**.
- 5. **<D>** the **Advanced** tab.
- 6. In the *Name* field of the *Alignment* area, key in *5th_Ave_SE-Quadrant*.
- 7. In the *Description* field, key in *SE Return for Federal & 5th*. The remaining data is the same as used on the northeast quadrant.
- 8. **<D> Apply**.
- 9. Follow the prompts, identifying **5th_Ave** first then **Federal CL**. Identify the quadrant below the **5th_Ave** alignment and to the right of the **Federal CL** alignment. The curb return alignment is displayed.



日 品 Geometry Projects
🖻 🛗 Default
Cogo Buffer
🖻 🗹 🖉 Default
Default
E Federal@5thAve
Cogo Buffer
5th_Ave
5th_Ave-V.
🗄 🖌 Federal CL
⊡
5th_Ave_NE-Quadrant.
🖻 🖌 5th_Ave_SE-Quadrant
5th_Ave_SE-Quadrant
Surfaces 🖁 Geometry 🖻 Pri 📢 🕨

10. Verify that the new alignments show up in the *Geometry* tab of InRoads Explorer as shown below.

Section Summary:

The *Multicenter Curve* tool created smooth horizontal and vertical alignments from the surface of the cross street to the surface of the mainline. You may need to modify these alignments depending on the actual design needs for the flowline.

Final Design Modeling

Section Objectives:

- Revise the point controls and template drops for 5th Ave using new curb return alignments.
- Use Target Aliasing to match the surface of Federal Blvd to the surface of 5th Ave.
- Update the 5th Ave surface
- Update Federal Blvd. template drops and add point controls
- Create a complete final combined surface

Create the Final 5th Ave. Corridor Surface

The 5th Ave. design surface is created first so that a feature in that surface can be used to control the edge of Federal Blvd. through the intersection. The 5th Ave. corridor is used to clip the Federal Blvd. corridor, removing the curb and gutter through the intersection that would normally be placed by the Federal Blvd. template.

Edit 5th Ave. Corridor Definition

The 5th Ave corridor is going to clip out portions of the Federal Blvd. corridor when the final surface is created. If the 5th Ave. corridor clips any of the driving lane components in the Federal Blvd. template, those components will be lost for calculating volumes. In order to prevent this from occurring, The corridor for 5th Ave. is stopped before it reaches the edge of the Federal Blvd. template.

- 1. Select **Modeler > Roadway Designer** from the InROads main menu.
- 2. In the *Roadway Designer* dialog box, select **Corridor > Corridor Management** or

<D> the **I** button. This displays the *Manage Corridors* dialog box.

- 3. Highlight **5th Ave** in the *Corridors* list.
- 4. Toggle on **Station** in the *Limits* area.
- 5. Key in **9+40.00** for the **Stop** station. This station was selected because it is about halfway through the curb returns and before the edge of Federal Blvd.
- 6. **<D> Change**.
- 7. **<D> Close**.

🕌 Manage Co	rridors						- • •
Name: 5th Ave					Limits V Station		Add
Туре:		Alignment	•		Start:		Close
Horizontal Alignm	nent:	5th_Ave	•	+	6+00.00	+	Change
Vertical Alignmer	nt:	5th_Ave-V	•		Stop:	.	Сору
PI Rounding Tar	ngent:	0.00			9+40.00	+	Copy From
Corridors:							Help
Name	Ту	/pe	Source	Name	Start Station	Stop	Station
5th Ave	Alig	nment	5th_Ave		6+00.00	9+40.0	00
Federal Blvd	Ali <u>c</u>	inment	Federal	CL	0+00.00	3+00.0	00
							Delete

Edit 5th Ave. Template Drops

- 1. In the *Roadway Designer* dialog box, select **Corridor > Template Drops** or **<D>** the button. This displays the **Template Drops** dialog box.
- 2. Verify that the *Corridor* is set to *5th Ave*.
- 3. In the **Template Drops** dialog box, Key in *8+80.00* for the *Station*.

4. Key in **1** for the *Interval*

Note: An interval of 1 is used here in order to sufficiently model the surface around the curb returns.

- 5. In the *Library Templates* area, expand the **1 Templates** folder.
- 6. Highlight the **5th_Ave_Concrete** template.
- 7. **<D> Add**.
- 8. **<D> Close**.

and i cimpion	e Drops	5			- • 💌
Corridor: 5	ith Ave		•		Add
Station: 8	+80.00			+ (Close
Interval: 1	.00			+	Change
Library Temp	lates:				
	Templat	tes ve Asphalt	^		Сору
		/e_Asphalt /e_Concrete		l	Help
		Divided_TypeA	4L ≡	`	/
	CONC. Federa				
		Crowned_B10			-<
		Divided_TypeA_			
		Cull Dooth Midd	unine l	· //	
 ■ 		Eull Dooth Mida	*	1	
			Þ	1	N
Current Temp			Revi	Library	N
Current Temp	olate Dro nter	ops:	Revi		NnRoads
Current Temp	olate Dr nter	ops: Template	► Revi		
Image: Current Temp Station In 6+00.0 25 8+29.9 25 8+30.0 25	olate Dr nter 5.00 5.00 5.00	ops: Template 5th_Ave_Asph 5th_Ave_Asph 5th_Ave_Concr.	Revi ITL ITL .ITL	C:\Projects C:\Projects C:\Projects	\InRoads \InRoads
Image: Current Temp Station 6+00.0 25 8+29.9	olate Dr nter 5.00 5.00 5.00	ops: Template 5th_Ave_Asph 5th_Ave_Asph	Revi ITL ITL .ITL	C:\Projects C:\Projects	\InRoads \InRoads
Image: Current Temp Station In 6+00.0 25 8+29.9 25 8+30.0 25	olate Dr nter 5.00 5.00 5.00	ops: Template 5th_Ave_Asph 5th_Ave_Asph 5th_Ave_Concr.	Revi ITL ITL .ITL	C:\Projects C:\Projects C:\Projects	\InRoads \InRoads
Image: Current Temp Station In 6+00.0 25 8+29.9 25 8+30.0 25	olate Dr nter 5.00 5.00 5.00	ops: Template 5th_Ave_Asph 5th_Ave_Asph 5th_Ave_Concr.	Revi ITL ITL .ITL	C:\Projects C:\Projects C:\Projects	\InRoads \InRoads
Current Temp Station In 6+00.0 25 8+29.9 25 8+30.0 25	blate Dri nter 5.00 5.00 5.00 00	ops: Template 5th_Ave_Asph 5th_Ave_Asph 5th_Ave_Concr. 5th_Ave_Concr.	Revi ITL ITL .ITL	C:\Projects C:\Projects C:\Projects	\InRoads \InRoads

5th Ave. Point Controls for Curb Returns

Additional point controls are added to the 5th Ave. corridor to use the curb return alignments. The existing point controls for the concrete pavement must also be modified so that they do not overlap the curb returns.

- 1. In the *Roadway Designer* dialog box, select **Corridor > Point Controls** or **<D>** the <u>button</u>.
- 2. In the Control Description field, key in 5th Ave Rt Conc EOP Return Control.
- 3. Set the *Point* to **RT_Conc_Laneline-Top** using the drop down menu or the + button.

- 4. Toggle on **Both** in the *Mode* area.
- 5. Set the *Control Type* to Alignment.
- 6. Set the Horizontal Alignment to 5th_Ave_NE-Quadrant.

Note: Selecting the 5th_Ave_NE-Quadrant alignment automatically sets the *Station Limits* to cover that alignment.

- 7. Toggle on Use as Secondary Alignment.
- 8. **<D> Add**.

Point Controls		
Corridor: 5th Ave		Add
Control Description: 5th Ave Rt Conc EOP Return C	Control	Close
Point: RT_Conc_Laneline - +	Station Limits	
Mode	Start: 8+79.07 +	Change
○ Horizontal ○ Vertical	Stop: 9+40.00	Help
Control Type: Alignment -	Horizontal Offsets	
Horizontal Alignment: 5th Ave NE-Quadra -	Start: 0.00 +	
Vertical Alignment: 5th_Ave_NE-Quadra	Stop: 0.00 +	
✓ Use as Secondary Alignment		
	Vertical Offsets	
	Start: 0.00 +	
	Stop: 0.00 +	
Priority: 1		
Horizontal and Vertical Controls:		
	lode Type Control	Description
	rizontal Alignment 5th_Ave	5th Ave Rt Asph EOP Control
	rizontal Alignment 5th_Ave	5th Ave Rt Conc EOP Control
X 1 RT_Conc 8+79.07 9+40.00 Bo		5th Ave Rt Conc EOP Return Control
	rizontal Alignment 5th_Ave	5th Ave Lt Asph EOP Control
	rizontal Alignment 5th_Ave	5th Ave Lt Conc EOP Transition Control
X 1 LT_Conc9+00.48 9+98.50 Ho	rizontal Alignment 5th_Ave	5th Ave Lt Conc EOP Transition Control
·	1	1
		Delete

- *Important!* The entry is displayed in orange, indicating that there is a conflict with another point control. The point control entered during the initial modeling is now too long, so its end station must be adjusted.
- 9. Highlight the **RT_Conc_Laneline-Top** control that runs from *8+30.00* to *9+98.50*.
- 10. In the *Station Limits* area, key in *8+79.06* for the *Stop* station. This stops the point control where the curb return control starts.

11. **<D> Change**.

Point Controls							
Corridor: 5th Ave						Ac	bb
Control Description:	5th Ave Rt Co	nc EOP Cont	rol			Co	
Point:	RT_Conc_Lar	eline	⊾ Station	Limits			
Mode			Start:	8+30.00	+	Cha	nge
O Horizontal	O Vertical (可 Both	Stop:	8+79.06	+	He	elp
Control Type:	Alignment	•	Horizor	ntal Offsets			
Horizontal Alignment:	5th_Ave	-	■ Start:	23.89	+		
			Stop:	23.89	+		
Use as Secondar	/ Alianment						
			Vertica	l Offsets			
			Start:	0.00	- 		
			Stop:	0.00	- ф -		
Priority:	1						
Horizontal and Vertica	al Controls:					1	
E P Name	Start St	Stop St	Mode	Туре	Control	Description	
	A6+00.00	8+29.99	Horizontal	Alignment	5th_Ave	5th Ave Rt Asph EOP Control	_
	nc 8+30.00	9+98.50	Horizontal	Alignment	5th_Ave	5th Ave Rt Conc EOP Control	
	nc 8+79.07	9+40.00	Both	Alignment	5th_Ave		
-	A6+00.00	8+29.99	Horizontal	Alignment	5th_Ave	5th Ave Lt Asph EOP Control	
_	c8+30.00	9+00.48	Horizontal	Alignment	5th_Ave	5th Ave Lt Conc EOP Transition Control	
X 1 LT_Con	c9+00.48	9+98.50	Horizontal	Alignment	5th_Ave	5th Ave Lt Conc EOP Transition Control	
•			III				F.
						Del	ete
							- /

12. In the Control Description field, key in 5th Ave Rt Conc EOP Return Control.

- 13. Set the *Point* to LT_Conc_Laneline-Top using the drop down menu or the + button.
- 14. Toggle on **Both** in the *Mode* area.
- 15. Set the *Control Type* to Alignment.
- 16. Set the *Horizontal Alignment* to 5th_Ave_SE-Quadrant.
- 17. Toggle on **Use as Secondary Alignment.** This is so that the curb component is placed perpendicular to the curb return alignment.
- 18. In the *Horizontal Offsets* area, key in *O* for the *Start* and *Stop* offsets.

19. **<D> Add**.

Point Controls		
Comidor: 5th Ave		Add
Control Description: 5th Ave Lt Conc EOP Return C	Control	Close
Point: LT Conc_Laneline-] - +	Station Limits	
Mode	Start: 9+00.48 +	Change
○ Horizontal ○ Vertical	Stop: 9+40.00 +	Help
Control Type: Alignment	Horizontal Offsets	
Horizontal Alignment: 5th_Ave_SE-Quadra - +	Start: 0.00 +	
Vertical Alignment: 5th Ave SE-Quadra -	Stop: 0.00 +	
Use as Secondary Alignment		
	Vertical Offsets	
	Start: 0.00 +	
Priority: 1	Stop: 0.00 +	
Priority: 1 Horizontal and Vertical Controls:		
	lode Type Control	Description
		5th Ave Rt Asph EOP Control
X 1 RT_Conc 8+79.07 9+40.00 Bo		5th Ave Rt Conc EOP Return Control
_		5th Ave Rt Conc EOP Control
X 1 LT_HMA6+00.00 8+29.99 Ho	prizontal Alignment 5th_Ave	5th Ave Lt Asph EOP Control
	prizontal Alignment 5th_Ave	5th Ave Lt Conc EOP Transition Control
X 1 LT_Conc9+00.48 9+40.00 Bo	th Alignment 5th_Ave	5th Ave Lt Conc EOP Return Control
•	11	4
•		Delete

20. Highlight the **LT_Conc_Laneline-Top** control that runs from *9+00.48* to *9+98.50*. This entry is completely covered by the curb return, so it is deleted.

21. **<D> Delete**.

Point Controls			
Comidor: 5th Ave			Add
Control Description: 5th Ave Lt Conc EOP Return C	ontrol		Close
Point: LT_Conc_Laneline- +	Station Limits		
Mode	Start: 9+00.48	+	Change
Horizontal O Vertical O Both	Stop: 9+98.50	<u>+</u>	Help
Control Type: Alignment	Horizontal Offsets		
Horizontal Alignment: 5th_Ave +	Start: -15.87	+	
	Stop: -15.87	+	
Use as Secondary Alignment			
	Vertical Offsets		
	Start: 0.00	-#-	
	Stop: 0.00		
Priority: 1			
Horizontal and Vertical Controls:			
E P Name Start St Stop St M	ode Type	Control Description	
	-	5th_Ave 5th Ave Rt Asph	
	-	5th_Ave 5th Ave Rt Conc	
X 1 RT_Conc 8+79.07 9+40.00 Bo			EOP Return Control
	-	5th_Ave 5th Ave Lt Asph B	
X 1 LT_Conc8+30.00 9+00.48 Ho X 1 LT_Conc9+00.48 9+40.00 Bo	-	5th_Ave 5th Ave Lt Conc I 5th_Ave 5th Ave Lt Conc I	EOP Transition Control
	_		EOP Return Control
	and a sign from the		
	1		
			Delete

The illustration below shows the list of point controls used on the Final 5th Ave. corridor.

Foint Controls	
Comidor: 5th Ave	Add
Control Description: 5th Ave Lt Conc EOP Return Co	Close
Point: LT_Conc_Laneline-1 Mode	Station Limits Start: 9+00.48
e Horizontal Vertical Both	Stop: 9+98.50 +
Control Type: Alignment	Horizontal Offsets
Horizontal Alignment: 5th_Ave	Start: -15.87
	Stop: -15.87
Use as Secondary Alignment	Vertical Offsets
	Start: 0.00 +
	Stop: 0.00 +
Priority: 1	
Horizontal and Vertical Controls:	
	Mode Type Control Description
	Horizontal Alignment 5th_Ave 5th Ave Rt Asph EOP Control Horizontal Alignment 5th Ave 5th Ave Rt Conc EOP Control
	Both Alignment 5th Ave 5th Ave Rt Conc EOP Return Control
	Horizontal Alignment 5th Ave 5th Ave Lt Asph EOP Control
	Horizontal Alignment 5th_Ave 5th Ave Lt Conc EOP Transition Control
X 1 LT_Conc9+00.48 9+40.00 Bo	Both Alignment 5th_Ave 5th Ave Lt Conc EOP Return Control
< II	III
	Delete

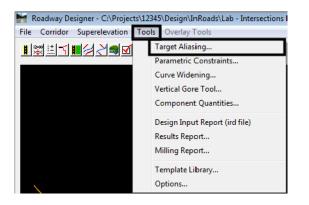
- 22. Close the Point Control dialog box.
- 23. Select File > Save from the *Roadway Designer* menu bar.998

Create the Final 5th Ave. Design Surface

The 5th Ave. surface is remodeled to incorporate the corridor changes made above and to generate the feature that will control the edge of pavement for Federal Blvd.

The target aliasing is set up so that the 5th Ave corridor will clip the Federal Blvd. corridor when the final surface is created.

1. In the *Roadway Designer* dialog box, select **Tools > Target Aliasing**.



- In the *Target Aliasing* dialog box, highlight both the Corridor Federal Blvd and Surface – 16628_Existing from the *Surface or Corridor* list.
- 3. **<D> Add**.

🕌 Target Aliasing		
Target: Corridor - Federal-Blvd Surface on Corridor Corridor - Federal-Blvd Surface - 16628_Existing Surface - On Ave Surface - Default Surface - Federal-Blvd	Aliases: Add -> Aliases: Add -> <- Remove	OK Cancel Help
L	Use Closes	st

- 4. **<D> OK** to dismiss the *Target Aliasing* dialog box.
- 5. In the *Roadway Designer* dialog box, select **Corridor > Create Surface** or **<D>** the sutton. This displays the **Create Surface** dialog box.
- 6. Key in *5th Ave* for the *Name*.

- 7. Select **Proposed** for the *Default Preference*.
- 8. Highlight only 5th Ave in the Create Surface(s) From list.

Transverse features run perpendicular to the corridor alignment and are placed at each template drop. The last transverse feature created on the 5th Ave. corridor will be used to control the edge of Federal Blvd. through the intersection.

- 9. Toggle on Add Transverse Features.
- 10. Set the transverse feature *Style* to **DTM_Transverse**.
- 11. Toggle on **Display Features in Plan View**. (These features will be used to identify important stationing for Federal Blvd. template drops.

🖌 Create Surface 🛛 💌
Name: 5th Ave - Apply
Default Preference: Proposed Close
Create Surface(s) from: Preferences
Sth Ave Help
All
Clipping Options
General Options One of the second
Empty Design Surface Process Visible Range Only
Include Null Points
☑ Triangulate
Features Duplicate Names:
Style: DTM_Transverse
Style: Exterior Boundary
Densify using Chord Height Tolerance Display in Plan View Horizontal Curves Features Vertical Curves Components

12. **<D> Apply** and **<D> Close**.

13. If necessary, click **Fit View** to see the new graphics.

Final Federal Blvd. Corridor Surface

Additional template drops and point controls are required on Federal Blvd. as well. The template drops change the interval to model smoothly around the curb returns. The point controls are used to model the remaining parts of the curb returns and the intersection driving surface.

Section Objectives:

- Add template drops to tie into 5th Ave corridor
- Add point controls

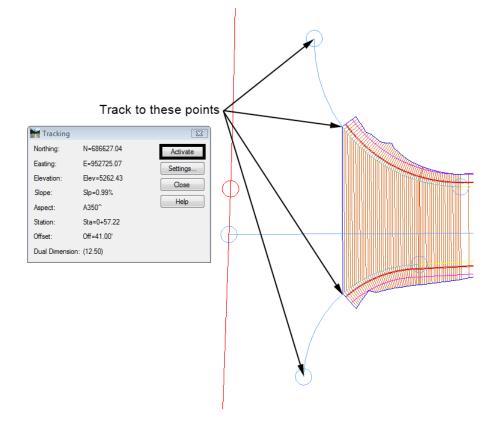
Collect Station Information for Template Drops

The locations for the template drops and point controls are determined using tracking.

- 1. In the InRoads main dialog box, set the InRoads Explorer to the **Geometry** tab.
- 2. Set the **Federal CL** as the active alignment.
- 3. <R> on the Federal@5thAve geometry project and select View All Horizontals from the menu.

Bentley InRoads V8i (SELECTse				×
		deler Drafting Quantities Tools	<u>H</u> elp	
<unnamed></unnamed>	- 🚡 🚳 🔪 🎽 🗖	5+00 E E		
	Name	Description	By Whom	La
Geometry Projects	🖌 5th_Ave	SH88 and 5th inetersection	cferree	5/
	📝 5th_Ave_NE-Qu	NE Return for Federal & 5th	cferree	1/
🗐 📲 Federal@5thAve —	New	St 5th	cferree	1/
	TNCVV		chengh	11
Federal CL	Save	tion test:	cferree	4/
5th_Ave_NE-	Save As			
5th_Ave_SE-Q	Set Active			
🛭 Surfaces 😤 Geometry	Copy			•
oggles the Feature Highlight	Close			
oggies the reature righlight	Empty			- i
	View All Horizontals			
	View All Turnouts			
	View All Rails, Joints and Dist	ance Keepers		
	Fit			
	Details			

- 4. In the MicroStation view window, zoom in around the intersection.
- 5. Select **Tools > Tracking > Tracking** from the InRoads menu bar.
- 6. In the *Tracking* dialog box, **<D>** the **Activate** button.
- 7. **<T>** to each of the points indicated in the illustration below and write down the Station for each.



These stations are (from bottom to top):

- ♦ 0+57.22
- ♦ 1+00.73
- ♦ 1+86.15
- ♦ 2+30.80

Template drops are required at the first an last stations. The first station starts the one foot intervals around the SE curb return. The last station is at the end of the intersection and goes back to a 25 foot interval.

- 8. In the *Roadway Designer* dialog box, select **Corridor > Template Drops** or **<D>** the button. This displays the **Template Drops** dialog box.
- 9. Verify the *Corridor* is set to *Federal Blvd*.
- 10. In the Template Drops dialog box, key in *0+57.22* for the Station.
- 11. Key in **1** for the *Interval*.
- 12. Highlight Federal Blvd in the Library Templates list.
- 13. **<D> Add**.
- 14. Key in *2+30.80* for the *Station*.
- 15. Key in *25* for the *Interval*.

Corridor: Federal Blvd Add Station: 0+00.00 Close Interval: 50.00 therval: t	🕌 Templa	te Drops			- • •			
Interval: 50.00 + Close Library Templates: Copy ⁽¹⁾ 1 - Templates Copy ⁽²⁾ 1 - Templates: Copy ⁽²⁾ Sth_Ave_Asphalt Help ⁽²⁾ CONC_Divided_TypeA_4L Help ⁽²⁾ CONC_Ramp Federal Blvd ⁽²⁾ HMA_Crowned_B10 HMA_Divided_TypeA_4La ⁽²⁾ UMA_E cill Deeth Widening Videning Current Template Drops: ⁽²⁾ Current Template Drops: Station Inter Template Revi Library O+00.00 25.00 Federal Blvd ITL C:\Projects\lnRoads . O+00.00 25.00 Federal Blvd ITL C:\Projects\lnRoads . C:\Projects\lnRoads . D+30.80 25.00 Federal Blvd ITL C:\Projects\lnRoads . C:\Projects\lnRoads .	Corridor:	Federal Blv	d	•	Add			
Library Templates: Copy Copy Sth_Ave_Asphalt Sth_Ave_Concrete StoONC_Divided_TypeA_4L StoONC_Ramp StoONC_RAMP StoO	Station:	0+00.00		+	Close			
Library Templates: Templates: Sth_Ave_Asphalt Sth_Ave_Concrete Stopy Help Help Help Help Help Help Help Copy Help Help Copy Copy Help Copy	Interval:	50.00		+	Change			
Image: Sth_Ave_Asphalt Image: Sth_Ave_Concrete Image: Station Inter Template Image: Station Inter Template Revi Library 0+00.00 25.00 Federal Blvd ITL C:\Projects\InRoads . 2+30.80 25.00 Federal Blvd ITL C:\Projects\InRoads .	Library Terr	nplates:						
Sth_Ave_Concrete CONC_Divided_TypeA_4L CONC_Ramp Federal Blvd HMA_Crowned_B10 HMA_Divided_TypeA_4La Library 0+00.00 25.00 Federal Blvd ITL C:\Projects\InRoads . 2+30.80 25.00 Federal Blvd ITL C:\Projects		-		·	Сору			
Image: Conc_Divided_TypeA_4L Image: Conc_Ramp Image: Federal Blvd Image: Fede					Help			
Image: Station Inter Template Revi Library 0+00.00 25.00 Federal Blvd ITL C:\Projects\InRoads . 0+57.22 1.00 Federal Blvd ITL C:\Projects\InRoads . 2+30.80 25.00 Federal Blvd ITL C:\Projects\InRoads .	>	< CONC_D	ivided_TypeA_4					
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Current Template Drops: Station Inter Template Revi Library 0+00.00 25.00 Federal Blvd ITL C:\Projects\InRoads . 0+57.22 1.00 Federal Blvd ITL C:\Projects\InRoads . 2+30.80 25.00 Federal Blvd ITL C:\Projects\InRoads .								
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0+57.22 1.00 Federal Blvd ITL C:\Projects\InRoads . 2+30.80 25.00 Federal Blvd ITL C:\Projects\InRoads .	Station	Inter	Template	Revi	Library			
2+30.80 25.00 Federal Blvd ITL C:\Projects\InRoads .	0+00.00	25.00	Federal Blvd	ITL	C:\Projects\InRoads .			
	0+57.22	1.00	Federal Blvd	ITL	C:\Projects\InRoads .			
4 III	2+30.80	25.00	Federal Blvd	ITL	C:\Projects\InRoads .			
۰ III ا								
	· · · · · · · · · · · · · · · · · · ·							
Synchronize with Library Edit Delete	Synchron	ize with Libr	ary	Edit	Delete			

16. **<D> Add**. The list of template drops is illustrated below.

17. **<D> Close**.

Federal Blvd. Point Controls for Curb Returns

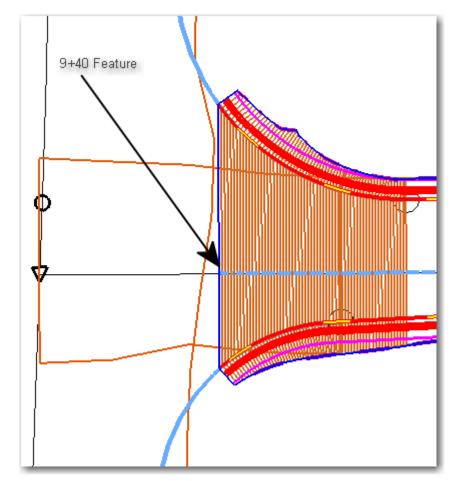
All four of the stations located above are used for point controls. The first and second stations create a control for the SE curb return. The second and third stations create a point control that follows the last transverse feature in the 5th Ave. surface. The third and fourth stations create a control for the NE curb return.

- 1. In the *Roadway Designer* dialog box, select **Corridor > Point Controls** or **<D>** the <u>t</u> button.
- 2. In the Control Description field, key in Federal EOP SE Quad Return Control.
- 3. Set the *Point* to **RT_Conc_Laneline-Top6** using the drop down menu or the + button.
- 4. Toggle on **Both** in the *Mode* area.
- 5. Set the *Control Type* to Alignment.
- 6. Set the Horizontal Alignment to 5th_Ave_SE-Quadrant.
- 7. Toggle on Use as Secondary Alignment.

- 8. In the *Station Limits* area, the *Start* station is set by the specified alignment. Key in *1+00.73* for the *Stop* station.
- 9. **<D> Add**.

Head Point Controls	
Comidor: Federal Blvd	Add
Control Description: Federal EOP SE Quad Return (Control
Point: RT_Conc_Laneline- ▼ ♥ Mode	Station Limits Change Stati: 0+57.22 + Stop: 1+00.73 +
Control Type: Alignment ▼ Horizontal Alignment: 5th_Ave_SE-Quadra ▼ Vertical Alignment: 5th_Ave_SE-Quadra ▼ ⑦ Use as Secondary Alignment	Horizontal Offsets Start: 0.00 \$top: 0.00 Vertical Offsets Start: 0.00 \$tart: 0.00 \$top: 0.00
Priority: 1 Horizontal and Vertical Controls:	
E P Name Start St Stop St N	Node Type Control Description
·	th Alignment 5th_Ave Federal EOP SE
<	- F
	Delete

- 10. In the Control Description field, key in Federal EOP Feature Control.
- 11. Set the *Control Type* to **Feature**.
- 12. Select **5th Ave** for the *Surface*.



13. Select **9+40.00** for the *Feature*.

- 14. In the *Station Limits* area, key in *1+00.73* for the *Start* station.
- 15. Key in **1+86.15** for the **Stop** station.

16. **<D> Add**.

🚔 Point C	ontrols						- • ×
Corridor:	Federal Blvd						Add
Control Des	cription: Fe	deral EOP	Feature Contro	ol			Close
Point: Mode Mode		T_Conc_L 'ertical	aneline- ▼ -	Start:	n Limits 1+00.73 1+86.15	+	Change Help
Priority:	5tł		v v	Start: + Stop:	0.00 al Offsets 0.00	+ + +	
E P	Name	Start St.	Stop St	Mode	Туре	Control	Description
X 1 X 1 X 1 X 1	RT_Conc RT_Conc RT_Conc	1+86.15		Both Both Both	Alignment Alignment Feature	5th_Ave	Federal EOP SE Federal EOP SE Federal EOP Fea
•		m					► Delete

- 17. In the Control Description field, key in Federal EOP NE Quad Control.
- 18. Set the *Control Type* to Alignment.
- 19. Set the *Horizontal Alignment* to **5th_Ave_NE-Quadrant**.18In the *Station Limits* area, key in *1+86.15* for the *Start* station. The *Stop* station is set by the selected alignment.

Point Controls	
Comidor: Federal Blvd	Add
Control Description: Federal EOP NE Quad Control	Close
Point: RT_Conc_Laneline: ▼ Mode → Horizontal → Vertical ● Both	Station Limits Change Stati: 1+86.15 + Stop: 2+30.80 + Help
Control Type: Alignment Horizontal Alignment: Sth_Ave_NE-Quadra Vertical Alignment: Sth_Ave_NE-Quadra Vortical Alignment	Horizontal Offsets Start: 0.00 + Stop: 0.00 +
	Vertical Offsets
	Start: 0.00 +
Priority: 1	Stop: 0.00
Horizontal and Vertical Controls:	
E P Name Start St Stop St N	Node Type Control Description
X 1 RT_Conc 0+57.22 1+00.73 Bo	th Alignment 5th_Ave Federal EOP SE
X 1 RT_Conc 1+86.15 2+30.80 Bo	
X 1 RT_Conc 1+00.73 1+86.15 Bo	th Feature 5th Ave:9 Federal EOP Fea
< III	•
	Delete

20. **<D> Add**. and **<D> Close**.

Create the Final Intersection Design Surface

After creating the point controls for Federal Blvd. (using features from the 5th Ave. design surface), both corridors are used to create the design surface of the entire intersection.

1. Verify that *16628_Existing* is the active surface.

Note: If the Existing surface is not the active surface several template drop errors will be listed in the Results dialog box indicating problems with the final surface.

- 2. In the *Roadway Designer* dialog box, select **Corridor > Create Surface** or **<D>** the sutton. This displays the **Create Surface** dialog box.
- 3. Key in *Federal and 5th Intersection* for the *Name*.
- 4. Select **Proposed** for the *Default Preference*.
- 5. Highlight both 5th Ave and Federal Blvd in the Create Surface(s) From: list.
- 6. **<D>** the **Clipping Options** button.
- 7. Verify that the *Clipping Option* is set to **Clip All**.
- 8. **<D> OK** on the *Clipping Options* dialog box.

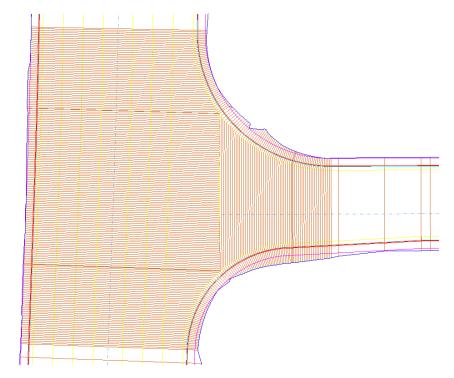
— ×
ОК
Cancel
Help
F

- 9. Toggle on Add Transverse Features.
- 10. Set the transverse feature *Style* to **DTM_Transverse**.

11. Toggle on **Display Features in Plan View**. This displays the surface features in the dgn file for review.

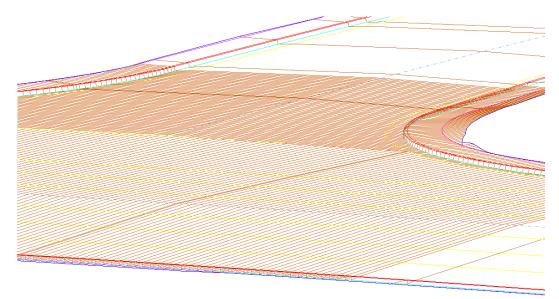
🚔 Create Surface		×
Name:	Federal and 5th Interse	cti 🔻 Apply
Default Preference:	Proposed	✓ Close
Create Surface(s) from:		Preferences
5th Ave Federal Blvd		Help
		ll ne
Clipp	ing Options	
General Options		
New Surface for E	Each Corridor 🔲 Crea	te Alternate Surfaces
Empty Design Sur	face Proc	ess Visible Range Only
Include Null Points	s 🔽 Rem	ove Loops
Triangulate		
0.111.000	Replace 🔘 Renar	ne 🔘 Modify
Add Transverse F	eatures	
Style:	DTM_Transverse	•
Add Exterior Bour	ndary	
Style:	Exterior Boundary	•
Densify using Chord Horizontal Curves	Height Tolerance	Display in Plan View Features Components

- 12. **<D> Apply** and **<D> Close**.
- 13. Select **File > Save** from the *Roadway Designer* menu bar.
- 14. **<D> Close** to dismiss the *Roadway Designer* dialog box.



15. Examine the features displayed in the MicroStation view window. The illustrations below show the finished intersection.

16. Use the rotate view command to see the features in 3D



Chapter 3 - Interchange Project

As part of the Federal Blvd. and 6th Ave. interchange reconstruction project, access from Federal Blvd. to 6th Ave. and Bryant Street is being added. The ramp from Federal Blvd. to 6th Ave (called the SE Ramp) splits to provide access to Bryant Street. This lab illustrates the InRoads design process for creating this interchange. This lab is concerned with the mergers of the SE Ramp with the 6th Ave. edge of pavement and the mergers of the Bryant Street ramp with the SE Ramp. Therefore, the intersections of the ramps at Bryant Street and Federal Blvd. will not be modeled.

Chapter Objectives:

- Give a project overview
- Create a corridor for the SE Ramp.
- Define Point Controls to tie to the existing 6th Ave. edge of pavement.
- Create a corridor for Bryant Ramp.
- Create initial design surfaces for SE Ramp and Bryant Ramp.
- Determine key stations for ramp mergers.
- Define Point Controls for street returns in both corridors
- Modify Bryant Ramp template for the area in the intersection.
- Create a combined surface of SE Ramp and Bryant Ramp.

Project Overview

Project Description

This project creates accesses to 6th Ave. and Bryant Street from Federal Blvd. The Ramp from Federal Blvd. merges into the existing edge of pavement of 6th Ave. The ramp from Bryant Street merges into the SE Ramp (from Federal to 6th).

Project Data

- **Existing_Ground.dtm** This contains the survey data for the existing terrain.
- Interchange.alg This contains all of the horizontal and vertical alignments used for this project.
- Interchange.itl The initial templates are stored in this file.

InRoads Design Process

- 1. Open Data files.
- 2. Initial Modeling for SE Ramp and Bryant Ramp.
- 3. Determine Key Stations for ramp mergers.
- 4. Modify templates for merger areas.

- 5. Make changes to corridor data.
- 6. Create the combined design surface.
- 7. Review the results

Getting Started

- 1. Open the **Interchange.alg**.
- 2. Open the Interchange.itl template library.
- 3. Open the **Existing Ground.dtm**.

Initial Modeling

There are two areas of special importance on this project, where the SE Ramps merges with the existing 6^{th} Ave. edge of pavement and where the Bryant Ramp merges with the SE Ramp. In these areas, the templates change to accommodate the narrowing pavement width. To determine the stations where template changes occur, initial design surfaces are created for the SE Ramp and the Bryant Ramp.

Initial SE Ramp Corridor Model

The initial run of the SE Ramp is primarily concerned with locating stations for template changes. Do not be concerned that the template crosses into the 6th Ave. driving lanes, as this will be corrected in the final modeling.

Section Objectives:

- Create a corridor for the SE Ramp alignment
- Add template drops to the corridor
- Create the initial SE Ramp surface

Build the SE Ramp Corridor

- 1. Select **Modeler > Roadway Designer** from the InRoads menu bar. This displays the *Roadway Designer* dialog box.
- 2. In the *Roadway Designer* dialog box, select **Corridor > Corridor Management** or

<D> the **button**. This displays the **Manage Corridors** dialog box.

- 3. In the *Manage Corridors* dialog box, key in *SE Ramp* for the *Name*.
- 4. In the *Surface Symbology* field, select **D_Finished-Grade**.
- 5. Set the *Type* to Alignment.
- 6. Select **SE Ramp** as the *Horizontal Alignment*.
- 7. Select **SE Ramp_V** as the *Vertical Alignment*.
- 8. **<D> Add** to complete the corridor.

Name: SE Rar Surface Symbol Type: Horizontal Align Vertical Alignme PI Rounding Ta	logy: D_Finished- Alignment SE Ramp ent: SE Ramp_V		Limits Station Start: 00+-0.00 Stop: 16+52.23	Add Close Change Copy Copy From Help
Corridors: Name	Туре	Source Name	Start Station	Stop Station
SE Ramp	Alignment	SE Ramp	00+-0.00	16+52.23

9. **<D> Close** to dismiss the *Manage Corridors* dialog box.

Add the SE Ramp Template Drops

- 1. In the *Roadway Designer* dialog box, select **Corridor > Template Drops** or **<D>** the button. This displays the *Template Drops* dialog box.
- 2. In the **Template Drops** dialog box, Key in *O+OO.OO* for the *Station*.
- 3. Key in *25* for the *Interval*.
- 4. In the *Library Templates* area, expand the **1 Templates** folder.
- 5. Highlight the **SE Ramp** template.
- 6. **<D> Add**.

7. **<D> Close**.

🕌 Templa	ate Drops	5			- • •
Corridor:	SE Ram	p	•		Add
Station:	0+00.00			+	Close
Interval:	25.00			+	Change
	✓ CONC, ✓ CONC, ✓ CONC, ✓ HMA_0 ✓ HMA_1 ✓ HMA_1	Crowned_B1(Divided_Type Full_Depth_V <u>Urban_</u> 4Lane) ≡ A_4La		Copy Help
Current Te Station	mplate Dr	ops: Template	Revi	. Library	
0+00.0		SE_Ramp	ITL		ts∖InRoads
Synchron	nize with L	ibrary		Edit	Delete

Create the Initial SE Ramp Design Surface

- 1. In the *Roadway Designer* dialog box, select **Corridor > Create Surface** or **<D>** the sutton. This displays the *Create Surface* dialog box.
- 2. Key in *SE Ramp* for the *Name*.
- 3. Select **Proposed** for the *Default Preference*.

- Create Surface X Name: SE Ramp Apply Default Preference: Proposed Close Create Surface(s) from: Preferences. Help Al None Clipping Options... General Options New Surface for Each Corridor Create Alternate Surfaces Process Visible Range Only Empty Design Surface Remove Loops Include Null Points **V** Triangulate Features Duplicate Names: Append Replace Rename Modify Add Transverse Features Style: Default -Add Exterior Boundary Style: Exterior Boundary 💌 Densify using Chord Height Tolerance Display in Plan View Horizontal Curves Features Vertical Curves Components
- 4. The remaining settings should be correct. If not, set them to match the illustration below.

- 5. **<D> Apply**.
- 6. **<D> Close**.

Initial Bryant Ramp Corridor Model

As with the SE Ramp, do not worry about the Bryant Ramp crossing into the SE Ramp. In fact, this has to occur in order to determine the stations required for new template drops.

Section Objectives:

- Create a corridor for the Bryant Ramp alignment
- Add template drops to the corridor
- Create the initial Bryant Ramp surface

Build the Bryant Ramp Corridor

- In the *Roadway Designer* dialog box, select Corridor > Corridor Management or
 the limit button.
- 2. In the *Manage Corridors* dialog box, key in *Bryant Ramp* for the *Name*.
- 3. In the *Surface Symbology* field, select **D_Surface_2**.
- 4. Set the *Type* to Alignment.

- 5. Select Bryant Ramp as the Horizontal Alignment.
- 6. Select Bryant Ramp_V as the *Vertical Alignment*.
- 7. **<D> Add** to complete the corridor.
- 8. **<D> Close** to dismiss the *Manage Corridors* dialog box.

Add the Bryant Ramp Template Drops

- 1. In the *Roadway Designer* dialog box, select **Corridor > Template Drops** or **<D>** the button.
- 2. In the *Template Drops* dialog box, Key in *O+OO.OO* for the *Station*.
- 3. Key in *25* for the *Interval*.
- 4. In the *Library Templates* area, expand the **1 Templates** folder.
- 5. Highlight the **Bryant Ramp** template.
- 6. **<D> Add**.
- 7. **<D> Close**.

Create the Initial Bryant Ramp Design Surface

- 1. In the *Roadway Designer* dialog box, select **Corridor > Create Surface** or **<D>** the sutton.
- 2. Key in *Bryant Ramp* for the *Name*.
- 3. In the *Create Surface(s)* from area, highlight **Bryant Ramp** only.
- 4. The remaining settings should be correct. If not, set them to match the illustration below.
- 5. **<D> Apply**.

6. **<D> Close**.

Create Surface		×
Name:	Bryant Ramp	- Apply
Default Preference:	Proposed	
	<u> </u>	Close
Create Surface(s) fro Bryant Ramp	m:	Preferences
SE Ramp		Help
		All
		None
	pping Options	
	pping options	
General Options New Surface for	r Each Comidor 🔲 C	Create Alternate Surfaces
Empty Design S	Surface 🔄 F	Process Visible Range Only
Empty Design S		Process Visible Range Only Remove Loops
		2 .
☐ Include Null Poi ✓ Triangulate		2 ,
Include Null Poi		2 ,
Include Null Pol Triangulate Features Duplicate Names:		lemove Loops
Include Null Pol Triangulate Features Duplicate Names:	ints IV F	lemove Loops
Include Null Poi Triangulate Features Duplicate Names: Append	ints IV F	lemove Loops
 ☐ Include Null Poi ☑ Triangulate Features Duplicate Names: ⑥ Append ☑ Add Transverse 	ints I Faatures	lemove Loops
 ☐ Include Null Poi ☑ Triangulate Features Duplicate Names: ⓐ Append ☑ Add Transverse Style: 	ints I Faatures	lemove Loops
 Include Null Pol Triangulate Features Duplicate Names: Ø Append Add Transverse Style: Ø Add Exterior Bo Style: 	ints ♥ F Replace Re Features Default	lemove Loops
 Include Null Pol Triangulate Features Duplicate Names: Ø Append Add Transverse Style: Ø Add Exterior Bo Style: 	ints I Factoria Provide America Provide America Provide America Provided A	Remove Loops

- 7. **<D> File > Save** from the Roadway Designer menu bar.
- 8. In the Save As dialog box, navigate to the InRoads folder.
- 9. Key in *SE Ramp and Bryant Ramp* for the *File Name*.
- 10. **<D> Save**.
- 11. **<D> Cancel** to dismiss the *Save As* dialog box.
- 12. **<D> Close** to dismiss the *Roadway Designer* dialog box.

Determine Key Stations for Ramp Mergers

It was determined that the gore between the merger of SE Ramp and 6th Ave would end at the intersection of the RT_POSS and the existing edge of pavement of 6th Ave. the gore between the merger of SE Ramp and Bryant St ends at the intersection of SE Ramp's LT_POSS and Bryant Ramp's RT_POSS. The stations of these intersections, along with the intersection of the SE Ramp's LT_POSS and Bryant Ramp's LT_POSS, must be determined for the additional template drops needed in the final surface.

Display Design Data

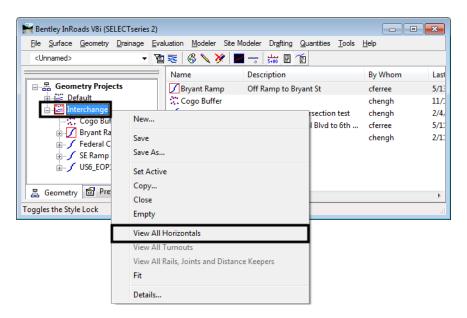
The relevant horizontal alignments are displayed in the dgn file to give a reference location when determining the key stations.

Section Objectives:

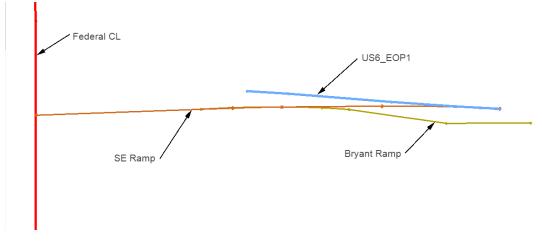
• Display the horizontal alignments

Display Horizontal Alignment Data

- 1. **<D>** the **Geometry** tab in the InRoads Explorer.
- 2. **<R>** on the **Interchange** geometry project.
- 3. Select View All Horizontals from the menu.



The illustration below identifies each of the alignments displayed



Key Station Locations

To determine the key stations, the POSS and EOP features of both initial design surfaces are displayed. Then tracking is used on both the SE Ramp alignment and the Bryant Ramp alignment. The stations are needed on each alignment so that template drops can be entered correctly.

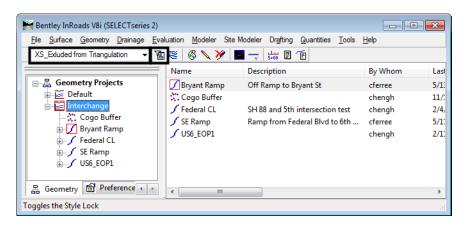
Section Objectives:

- Display the required surface features from the initial design surfaces
- Use Tracking to identify the key stations

Locate Key Stations for SE Ramp at 6th Ave.

Each point on a template creates a feature in the design surface which can make it difficult to find the desired features for display. To reduce the number of features that have to be combed through, feature filters are used. There is a predefined filter that excludes untriangulated features. This is used reduce the number of features in the dialog box to a manageable number.

1. On the InRoads Locks toolbar, set the *Feature Filter* to XS_Excluded from Triangulation.



2. Toggle on the Feature Filter Lock.

- 3. On the InRoads menu bar, select Surface > Update 3d/Plan Surface Display.
- 4. In the Update 3d/Plan Surface Display select the SE Ramp surface.
- 5. In the *Features* list, select the features with **EOP** or **POSS** in the name. Hold the *Ctrl* key to highlight each of the features. Highlighted features are automatically displayed.
- 6. **<D> Close**.

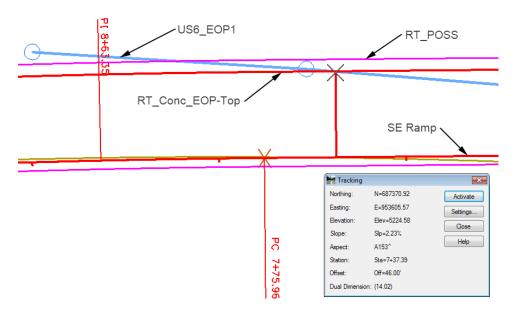
🐂 Update 3-D)/Plan S	Surface Display		
Fence Mode:	Ignore	-		Close
Surfaces:	SE Ra	mp 🔹		Refresh All
Perimeter	Surf	ace Elevations	Color-Coded Aspects	Filter
Triangles	Slop	e Vectors	Color-Coded Elevations	Edit Style
Contours	Prof	iled Model	Color-Coded Slopes	
Gridded Mo	del			Help
Features:				
Name		Style	Description	<u>+</u>
Exterior Bound	ary	Exterior Boundary	Created by roadway	-
LT_Conc_EOF	P-Top	D_EOP	Created by roadway	=
LT_Curb-Back	-Тор	D_CONC_Sw	Created by roadway	
LT_Curb-Flowl	ine	D_CURB_FL_Rt	Created by roadway	
LT Curb-Top		D CURB Top	Created by roadway	
LT_POSS		D_POSS	Created by roadway	
LT_Toe-of-Fill		D_Toe-of-Fill	Created by roadway	-
LTT (C)		DT (C)	<u> </u>	

After the features are displayed, tracking is used to determine the key stations for the SE Ramp along the 6th Ave. edge of pavement.

- 7. Using the MicroStation view controls, zoom in on the left end of the 6th Ave alignment.
- 8. Set the **SE Ramp** alignment active.
- 9. From the InRoads menu bar, select **Tools > Tracking > Tracking**.
- 10. **<T>** where the feature **RT_Conc_EOP-Top** crosses the **US6_EOP1** alignment and note the station.

Note: Use the *Intersection* snap to locate the station

11. **<T>** where the feature **RT_POSS** crosses the **US6_EOP1** alignment and note the station.



The stations for the two points above are:

- RT_Conc_EOP-Top and US6_EOP1 7+37.39
- ♦ RT_POSS and US6_EOP1 8+23.46

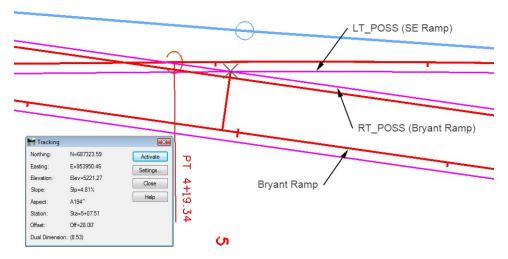
12. **<D> Close** on the *Tracking* dialog box.

Locate Key Stations for Bryant Ramp at SE Ramp

The same procedure is used for locating the key stations at the merger of the SE Ramp and the Bryant Ramp.

- 1. On the InRoads menu bar, select **Surface > Update 3d/Plan Surface Display**.
- 2. In the Update 3d/Plan Surface Display select the Bryant Ramp surface.
- 3. Toggle on the **Features** check box.
- 4. In the Features list, select the features with **EOP** or **POSS** in the name.

- 5. **<D> Apply** and **<D> Close**.
- 6. Using the MicroStation view controls, zoom in to the area where SE Ramp and Bryant Ramp intersect.
- 7. Set the **Bryant Ramp** alignment active.
- 8. From the InRoads menu bar, select **Tools > Tracking > Tracking**.
- 9. **<T>** where the feature **RT_POSS** from the *Bryant Ramp* crosses the **LT_POSS** from the *SE Ramp* and note the station.



- ♦ Intersection of **RT_POSS** and **LT_POSS** *5+07.51*
- 10. **<T>** where the feature **LT_POSS** from the *Bryant Ramp* crosses the **LT_POSS** from the *SE Ramp* and note the station.
 - ♦ Intersection of LT_POSS and LT_POSS *8+39.60*
- 11. Set the **SE Ramp** alignment active and determine the stations for the locations in 9 and 10 above for this alignment also.
 - ◆ Intersection of **RT_POSS** and **LT_POSS** *3*+92.92
 - Intersection of LT_POSS and LT_POSS 7+27.40
- 12. **<D> Close** on the *Tracking* dialog box.

Template Modifications

As designed, the SE Ramp and Bryant Ramp templates have curb and end conditions on both sides. Templates must be created for the merger areas that do not have the restrictive components.

SE Ramp Template at 6th Ave.

• Copy the SE Ramp template

• Modify the copy for the 6th Ave merger area

Copy the SE Ramp Template

The basic SE Ramp template is used once all of the merger areas are cleared. A copy of this template is made so that one can be modified and the other left intact.

- 1. On the InRoads menu bar, select **Modeler > Create Template**.
- 2. In the *Create Template* dialog box, expand the template library to show the contents of the *1-Templates* folder.
- 3. **<R>** on the **SE Ramp** template and select **Copy** from the menu.

Template Library: C:\Projects\InRoads XM Templates Point Name List 1 - Templates Set Bryant Ramp CONC_Divided_ CONC_Ramp CONC_Ramp HMA_Crowned_ HMA_Divided_T HMA_Libran_4L SE_Ramp 2 - Sections - Pa	TypeA_4L; B10 TypeA_4Lar D_Widening	Current Template Name: Description:	
3 - Sections - Er	3 - Sections - Er		Ctrl-X
Copy Paste			Ctrl-C
			Ctrl-V
	Delete		Del
	Rename	:	F2
	Templa	te Documentation Link	
	Display.		

4. **<R>** on the **1 – Template** folder and select **Paste**.

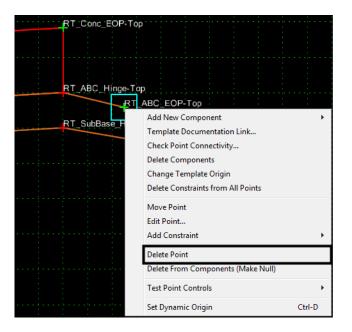
Template Library: C:\Projects\InRoads XM E Point Name List 1 - Templates	Current Templi Name: Description:	
→ Bryant Rar → CONC Div	New	•
CONC_Ra	Cut	Ctrl-X
HMA_Crov	- Copy	
HMA_Divid	Paste	Ctrl-V
⊯ НМА_Urba ⊯ SE_Ramp	Delete	Del
2 - Sections - F Rename		F2

5. <**R**> on the **SE Ramp1** template and select **Rename**. Key in *SE Ramp at 6th Ave* for the name.

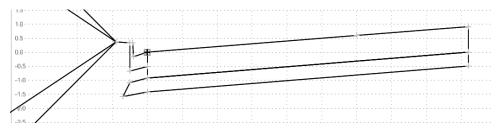
Modify the SE Ramp at 6th Template

This template needs to be modified on the right (6th Ave.) side only.

- 1. **<D> <D> SE Ramp at 6th** template to make it active.
- 2. Zoom in on the right side of the template.
- 3. **<R>** in the Template view and select **Delete Components** from the menu.
- 4. Drag a line through the **RT_C/G_Type2-IIB** and the **RT_Benching** components.
 - **Note:** The end conditions are also deleted because of the parent/child relationship they have with RT_Benching.
- 5. **<R>** on the **RT_ABC_EOP-Top** and select **Delete Point** from the menu.



6. Delete the **RT_SubBase_EOP-Top** point also. The illustration below shows the template completed to this point.



Add an End condition to the SE Ramp at 6th Ave template

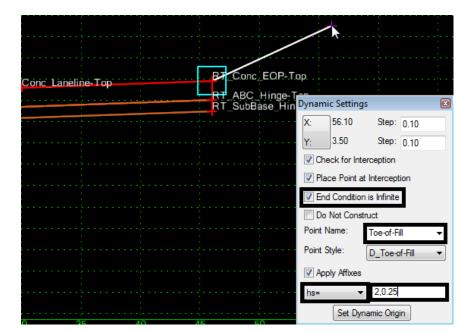
This end condition is used to create the gore after the SE Ramp edge of pavement separates from the 6th Ave. pavement edge.

- Select Tools > Dynamic Settings from the Create Template menu bar or <D> the Dynamic Settings in button.
- 2. Select **Tools > Options** from the *Create Template* menu bar.
- 3. Toggle on Apply Affixes.
- 4. Set the *X* and *Y* Step Options to *O. 1*.
- 5. <D> OK.
- 6. **<R>** in the Template view and select **Add New Component > End Condition**.
- 7. In the *Component Properties* area, key in *Tie_6th_EOP* for the *Name*.
- 8. Set the *Target Type* to Alignment XYZ.
- 9. Select **US6_EOP1** for the *Horizontal Alignment*. This automatically sets the vertical alignment.
- 10. Set the *Style* to **D_Toe-of-Fill**.

Current Component			
Name: Tie_6th_EOP		Style: D_T	oe-of-Fill 🔻
Target Type:	Alignment XYZ 🛛 👻	Priority:	1
Horizontal Alignment: US6_EOP1 -		Benching Count	: 0
Vertical Alignment:	US6_EOP1 -	From Datum:	0.00
Horizor	ital Vertical	Step Elevation:	0.00
Offsets: 0.00	0.00	Rounding Length	0.00

- 11. **<D>** on the **RT_Conc_EOP-Top** point to place the first point.
- 12. In the Dynamic Settings dialog box, toggle on End Condition Is Infinite.
- 13. Select **Toe-of-Fill** for the *Point Name*. This automatically sets the *Point Style*.
- 14. Select **hs=** for the key in type.

15. Key in *2,0.25* and press *Enter*.



16. **<R>** and select **Finish**.

SE Ramp Template at Bryant St.

The merger areas for the SE Ramp at 6th Ave. and the SE Ramp at the Bryant ramp overlap. A copy of the SE Ramp at 6th Ave template is modified for use in this merger area. A separate template is used here because using target aliasing and clipping options would result in the loss of the ABC component in the clipped template.

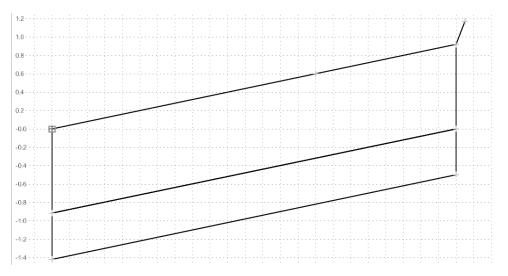
Section Objectives:

- Copy the SE Ramp at 6^{th} Ave template
- Modify the copy for the Bryant Ramp merger area

Copy and Modify the SE Ramp at 6th Ave Template

1. Make a copy of the SE Ramp at 6th Ave and key in SE Ramp at Bryant for the name.

2. Modify the *SE Ramp at Bryant* template as described above deleting the curb and end condition components and sub base points on the left side of the template. The illustration below shows the completed template.



Bryant Ramp at the SE Ramp

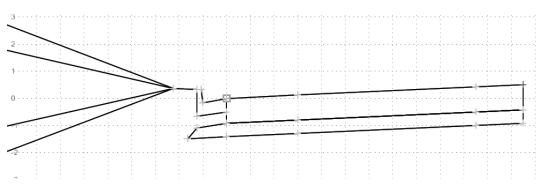
A copy of the Bryant Ramp template is also modified to work in the merger area.

Section Objectives:

- Copy the Bryant Ramp template
- Modify the copy for the SE Ramp merger area

Copy and Modify the Bryant Ramp Template

- 1. Make copy of the **Bryant Ramp** template as described above. Name it **Bryant Ramp** *at SE Ramp*.
- 2. Modify the *Bryant Ramp at SE Ramp* template as described above making the changes on the right side of the template. The illustration below shows the completed template.



Set Up For Final Modeling

With the key stations determined and the new templates created, the corridors are modified to use this data. Changes in corridor stations, additional template drops, point controls, and target aliasing are used to incorporate this data. Also, after reviewing the initial design surface data, some sideslopes require modification

Set Up for the SE Ramp

Section Objectives:

- Add template drops for the new SE Ramp templates
- Add point controls to match the template to the 6th Ave edge of pavement
- Modify sideslopes in the template view

Adding Template Drops

These are added to include the new templates into the corridor.

- 1. Open Roadway Designer.
- 2. Set the *Corridor* to **SE Ramp** and the *Active Surface* to **Existing_Ground**.

Corridor:	SE Ramp 🗸	
Active Surface:	Existing_Ground 🔹	

3. Open the Template Drops dialog box.

Because this alignment runs west to east, the first template drop is at the edge of 6th Ave. Therefore, the template for this drop is changed to use the SE Ramp at 6th Ave template.

- 4. Highlight the template drop in the *Current Template Drops* list.
- 5. In the *Library Templates* area, expand the **1 Templates** folder and select the **SE Ramp** at 6th Ave template.

6. **<D> Change**.

🕌 Templa	ate Drops	Template Drops						
Comidor:	SE Ramp -	•	Add					
Station:	0+00.00	+	Close					
Interval:	25.00	+	Change					
	Library Templates:							
	W HMA Crowned B10							
	≺ HMA_Divided_TypeA_4La		Help					
	≍ HMA_Full_Depth_Widenin; <u>≍ HMA_Urban_4Lane</u> ≡							
	🔀 SE Ramp at 6th Ave							
→ SE Ramp at Bryant → SE_Ramp								
Continue Drugment								
Current Template Drops:								
Station	Inter Template	Revi	Library					
0+00.00	25.00 SE_Ramp	ITL	C:\Projects\InRoads					
•	III		4					
Synchron	nize with Library	Edit	Delete					
			h					

The next two template drops define the change from the SE Ramp at 6th Ave to the SE Ramp at Bryant Ramp template. This change occurs in 0.01 feet so that there is an abrupt change from a template with a curb to a template without one.

- 7. Key in *3+88.03* for the *Station*.
- 8. Key in *25* for the *Interval*.

Note: The interval for this template drop could be anything greater than 0.01.

- 9. In the *Library Templates* area, highlight the SE Ramp at 6th Ave template.
- 10. **<D> Add**.
- 11. Key in *3+88.04* for the *Station*.
- 12. Key in *25* for the *Interval*.
- 13. In the *Library Templates* area, highlight the SE Ramp at Bryant Ramp template.
- 14. **<D> Add**.

The next transitions define the end of the Bryant ramp merger. Again, an abrupt change between templates is needed so the transition occurs in 0.01 feet.

- 15. Key in **7+72.78** for the **Station**.
- 16. Key in *25* for the *Interval*.
- 17. In the *Library Templates* area, highlight the SE Ramp at Bryant Ramp template.
- 18. **<D> Add**.
- 19. Key in **7+72.79** for the **Station**.
- 20. Key in *25* for the *Interval*.
- 21. In the *Library Templates* area, highlight the SE Ramp at 6th Ave template.
- 22. **<D> Add**.

Finally the transition to an independent SE Ramp is defined.

- 23. Key in *8+23.46* for the *Station*.
- 24. Key in *25* for the *Interval*.
- 25. In the *Library Templates* area, highlight the SE Ramp at 6th Ave template.
- 26. **<D> Add**.
- 27. Key in *8+23.47* for the *Station*.
- 28. Key in *25* for the *Interval*.
- 29. In the *Library Templates* area, highlight the **SE Ramp** template.

Template Drops							
Corridor:	SE Ram	p 🔻		Add			
Station:	8+23.47		+	Close			
Interval:	25.00		+				
Library Ter	Library Templates:						
	Image: Conc_Off-Ramp Copy Image: Conc_Ramp HMA_Crowned_B10 Image: HMA_Divided_TypeA_4La HMA_Divided_TypeA_4La Image: HMA_Full_Depth_Widening Image: Conc_Mark Image: HMA_Urban_4Lane Image: Conc_Mark Image: SE_Ramp Image: Conc_Mark Image: SE_Ramp Image: Conc_Mark Image: Conc_Mark Image: Conc_Mark <td< td=""></td<>						
Station	Inter	Template	Revi	Library			
0+00.00	25.00	SE_Ramp at 6th Ave	ITL	C:\Projects\InRoa			
3+88.03	25.00	SE_Ramp at 6th Ave	ITL	C:\Projects\InRoa			
3+88.04	25.00	SE Ramp at Bryant	ITL	C:\Projects\InRoa			
7+72.78	25.00	SE Ramp at Bryant	ITL	C:\Projects\InRoa			
7+72.79	25.00	SE_Ramp at 6th Ave	ITL	C:\Projects\InRoa			
8+23.46	25.00	SE_Ramp at 6th Ave	ITL	C:\Projects\InRoa			
8+23.47	25.00	SE_Ramp	ITL	C:\Projects\InRoa			
•				•			
Synchror	nize with l	ibrary	Edit	Delete			

30. **<D> Add**. The completed Template Drops dialog box is shown below.

31. **<D> Close**.

Add Point Controls for the SE Ramp

A point control is used to match the right edge of pavement of the SE Ramp templates to the existing pavement edge of 6th Ave. (defined by the US6_EOP1 alignment).

- 1. Select **Corridor > Point Controls** from the InRoads menu bar. This displays the *Point Controls* dialog box.
- 2. In the Control Description field, key in SE Ramp EOP RT at 6th Control.
- 3. Select **RT_Conc_EOP-Top** for the *Point*.
- 4. Toggle on **Both** for the *Mode*.
- 5. Set the *Control Type* to Alignment.
- 6. Select **US6_EOP1** for the *Horizontal Alignment*. The vertical alignment is automatically set.

7. In the *Station Limits* area, leave the *Start* at *0+00.00* and key in *8+23.46* for the *Stop* station.

Control Description: SE Ramp EOP RT at 6th Control Close Point: RT_Conc_EOP-Top • Station Limits Change Mode Horizontal Vertical Both Stati: 00+0.00 + Control Type: Alignment US6_EOP1 + Stati: 0.00 + Vertical Alignment: US6_EOP1 • Stati: 0.00 + Vertical Alignment: US6_EOP1 • Vertical Offsets Stati: 0.00 + Stati: 0.00 + Vertical Alignment: US6_EOP1 • Stati: 0.00 + Priority: 1 1 • • Horizontal and Vertical Controls: • • •	Point Controls		
Point: RT_Conc_EOP-Top Station Limits Change Mode Horizontal Vertical Both Stati: 00+0.00 + Horizontal Vertical Both Stati: 00+0.00 + Help Control Type: Alignment US6_EOP1 + Horizontal Offsets Stati: 0.00 + Vertical Alignment: US6_EOP1 + Stop: 0.00 + Stop: 0.00 + Vertical Offsets Stati: 0.00 + Stop: 0.00 + + Priority: 1 Horizontal Alignment Vertical Offsets Stati: 0.00 + + Priority: 1 Horizontal and Vertical Controls: + <td>Comidor: SE Ramp</td> <td></td> <td>Add</td>	Comidor: SE Ramp		Add
Mode Mode Start: 00+0.00 Change Mode Horizontal Vertical Both Stop: 8+23.46 + Help Control Type: Hignment US6_EOP1 + Horizontal Offsets Start: 0.00 + Start: 0.00 + Vertical Alignment: US6_EOP1 + Stop: 0.00 + Start: 0.00 + Vertical Offsets Start: 0.00 + Stop: 0.00 + Priority: 1 Horizontal Alignment Vertical Offsets Start: 0.00 + Priority: 1 Horizontal and Vertical Controls: Help Stop: 0.00 +	Control Description: SE Ramp EOP RT at 6th Cor	ntrol	Close
Horizontal Vertical Both Control Type: Alignment Horizontal Offsets Horizontal Alignment: US6_EOP1 Horizontal Offsets Vertical Alignment: US6_EOP1 Start: 0.00 Use as Secondary Alignment Vertical Offsets Start: 0.00 Priority: 1 Horizontal Controls:	R1_conc_EOF-Top •		Change
Horizontal Alignment: US6_EOP1 Use as Secondary Alignment Start: 0.00 + Vertical Offsets Start: 0.00 + Start: 0.00 + Priority: 1 Horizontal and Vertical Controls:	○ Horizontal ○ Vertical	Stop: 8+23.46	. Help
Vertical Alignment: US6_EOP1 Use as Secondary Alignment Use as Secondary Alignment Vertical Offsets Start: 0.00 Priority: 1 Horizontal and Vertical Controls:	/ lighthone		.1
Use as Secondary Alignment Vertical Offsets Start: 0.00 Priority: 1 Horizontal and Vertical Controls:			-
Priority: 1 Horizontal and Vertical Controls:	Use as Secondary Alignment	Vertical Offsets	
	Priority: 1		5
	Horizontal and Vertical Controls:		
E P Name Start St Stop St Mode Type Control Description	E P Name Start St Stop St	Mode Type Control	Description
	< III		

8. **<D> Add** and **Close**.

Modify Side Slopes for SE Ramp

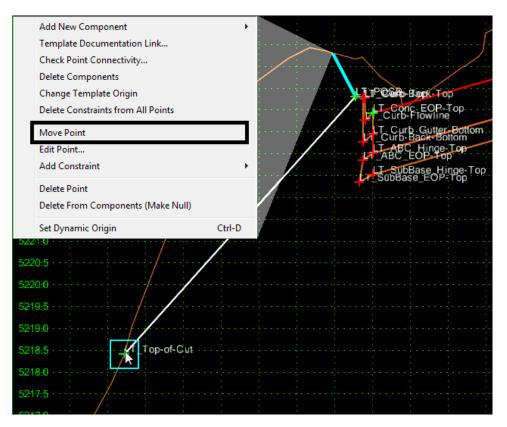
There is a area in this corridor where the computed end condition created an undesirable result. Because this area only covers two template drops, it is corrected by modifying the templates at those stations. If this area were larger, an end condition override or a new template should be used.

- 1. Set the *Station Indicator* to **7+72.79**.
- <D> <D> in the Template View to open the *Edit Template at Station 7+72.79 Only* dialog box.
- 3. Open the *Dynamic Settings* dialog box.
- 4. **<D>** on the Readout button to change it to **X** and **Slope**.

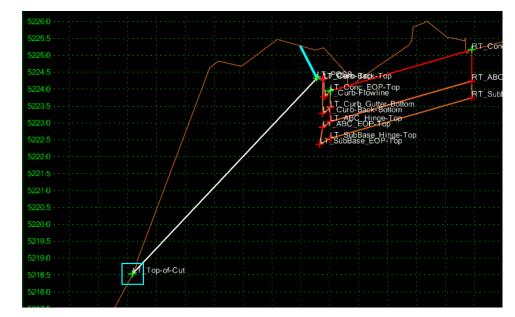
5. Key in **10.00%** for the slope **Step**.

Dynamic	: Settings						
X:	85.42	Step:	0.00				
Slope:	14751.28%	Step:	10.00%				
Point Na	ame:			•			
Point St	yle:			•			
Apply Affixes							
hs=	•						
	Set Dynar	Set Dynamic Origin					

- 6. **<R>** on **the LT_Top-of-Cut** point and select **Move Point** from the menu.
- 7. Move the point to the location shown in the illustration below. **<D>** to place it.



- **Note:** The point will snap to the Existing Ground line when the cursor is moved next to the line.
- 8. **<D> OK** to accept the change and dismiss the dialog box.



9. Modify station **7+75.00** in a similar manner as shown in the illustration below.

Set Up for the Bryant Ramp

Section Objectives:

- Change the end station for the Bryant Ramp corridor
- Add template drops for the new Bryant Ramp templates
- Add point controls to match the template to the SE Ramp edge of pavement
- Define target aliasing to target the SE Ramp surface
- Modify sideslopes in the template view

Edit Corridor Stations

The Bryant Ramp alignment runs past the point where the Bryant Ramp template is no longer used. The corridor is modified to end at the same place where the template needs to end.

- 1. Set the *Corridor* to **Bryant Ramp**.
- 2. Select **Corridor > Corridor Management** from the InRoads menu bar. This displays the *Manage Corridors* dialog box.
- 3. In the *Manage Corridors* dialog box, highlight the **Bryant Ramp** entry from the *Corridors* list.
- 4. In the *Limits* area, toggle on **Station**.
- 5. Key in **8+85.00** for the **Stop** station.

6. **<D> Change** and **Close**.

Name: Bryant Rar Surface Symbology			Station	Add
Type: Horizontal Alignmer	Alignment nt: Bryant Ramp	▼ ▼ +	0+00.00 Stop:	+ Change
/ertical Alignment: PI Rounding Tange	biyant Mamp	_V •	8+85.00	Copy Copy From
Corridors: Name	Туре	Source Name	Start Station	Help Stop Station
SE Ramp	Alignment	SE Ramp	00+-0.00	16+52.23
Bryant Ramp	Alignment	Bryant Ramp	0+00.00	8+85.00

Adding Template Drops

The additional template drops are added to include the modified template properly as explained above.

- 1. Open the **Template Drops** dialog box.
- 2. Key in *5+02.76* for the *Station*.
- 3. Key in *25* for the *Interval*.
- 4. In the *Library Templates* area, highlight the **Bryant Ramp** template.
- 5. **<D> Add**.
- 6. Key in *5+02.77* for the *Station*.
- 7. Key in *25* for the *Interval*.
- 8. In the *Library Templates* area, highlight the Bryant Ramp at SE Ramp template.

Template Drops 💿 💷 💌									
Corridor:	Bryant Ramp	• •		Add					
Station:	5+02.77	+		Close					
Interval:	25.00	+		Change					
Library Tem	Library Templates:								
Help Bryant Ramp at SE Ramp CONC_Divided_TypeA_4L CONC_Off-Ramp CONC_Ramp HMA_Crowned_B10 HMA_Divided_TypeA_4La UMA_E UMA_E UMA_E Uma_e Current Template Drops:									
Station	Interval	Template	Revi	Library					
0+00.00	25.00	Bryant Ramp	ITL	C:\Projects					
5+02.76	25.00	Bryant Ramp	ITL	C:\Projects					
5+02.77	25.00	Bryant Ramp at SE Ramp	ITL	C:\Projects					
	25.00	Bryant Ramp at SE Ramp	ITL						

9. **<D> Add** and **Close**. The completed Template Drops dialog box is shown below.

Add Point Controls for the Bryant Ramp

This point control matches the right edge of pavement of the Bryant Ramp to the left edge of pavement of the SE Ramp. It causes the Bryant ramp to transition to 0 by the end of the merger.

- 1. Select **Corridor > Point Controls** from the InRoads menu bar.
- 2. In the *Control Description* field, key in *Bryant Ramp EOP RT at SE Ramp Control*.
- 3. Select **RT_Conc_EOP-Top** for the *Point*.
- 4. Toggle on **Both** for the *Mode*.
- 5. Set the *Control Type* to Corridor Point.
- 6. Select **SE Ramp** for the *Corridor*.
- 7. Select LT_Conc_EOP-Top for the *Reference Point*.
- 8. In the *Station Limits* area, key in *5+02.77* for the *Start* station and key in *8+85.00* for the *Stop* station.

9. **<D> Add** and **Close**.

Point Controls	
Comidor: Bryant Ramp	Add
Control Description: Bryant Ramp EOP RT at SE Ra	amp Control
Point: LT_ABC_EOP-Top	Station Limits Change Statt: 5+02.77 + Stop: 8+85.00 +
Control Type: Comidor: Reference Point: Priority: Horizontal and Vertical Controls:	Horizontal Offsets Stat: 0.00 \$top: 0.00 \$top: 0.00 \$top: 0.00 \$top: 0.00 \$top: 0.00 \$top: 0.00
E P Name Start St Stop St N	Node Type Control Description
X 1 LT_ABC 5+02.77 8+85.00 Bc	oth Comidor P SE Ramp: Bryant Ramp EO
•	
	Delete

Create Target Aliasing for the Bryant Ramp

Target aliasing is used to tie the Bryant Ramp sideslope to the SE Ramp sideslope in the area before the merger. Without this, the combined surface will not triangulate properly in areas where the toes overlap.

- 1. Select **Tools > Target Aliasing** from the Roadway Designer menu bar.
- 2. Highlight Surface SE Ramp in the Surface or Corridor list.
- 3. **<D> Add**.

🖌 Target Aliasing		—
Target: <a>Active Surface>	•	ОК
Surface or Corridor	Aliases:	Cancel
Corridor - SE Ramp Surface - Bryant Ramp Surface - Default Surface - SE Ramp	Add -> <- Remove Move Up Move Down	Help
	Use Closest	

4. Highlight Surface – Existing_Ground in the Surface or Corridor list.

5. **<D> Add**. The dialog box looks like the illustration below.

🕌 Target Aliasir	ıg			X
Target: Surface or Conido Conidor - SE Rar Surface - Bryant Surface - Default	np Ramp	Add -> <- Remove Move Up Move Down	Aliases: Surface - SE Ramp Surface - Existing_Ground	OK Cancel Help
			Use Closest	

6. **<D>OK**.

Modify Side Slopes for Bryant Ramp

This corridor also has an undesirable result on a sideslope. Again, because this result occurred in a limited area, the template at the station is edited.

- 1. Set the *Station Indicator* to **8+50.00**.
- 2. **<D> <D>** in the Template View to open the *Edit Template at Station 8+50.00 Only* dialog box.
- 3. Move the point **LT_Toe-of-Fill** as shown in the illustration below.
- 4. **<D> OK** to accept the change and dismiss the dialog box



Create the Final Combined Design Surface

The two corridors are combined into one surface of the interchange.

Section Objectives:

- Create a combined surface from the SE Ramp and Bryant Ramp corridors
- 1. Open the *Create Surface* dialog box.
- 2. In the *Name* field, key in *SE-Bryant Ramps*.
- 3. Set the *Default Preference* to **Proposed**.
- 4. In the *Create Surface(s) From* list box, highlight both **Bryant Ramp** and **SE Ramp**.

The clipping options are used to modify the combined surface where the end conditions overlap prior to the merger.

- 5. **<D>** the **Clipping Options** button.
- 6. Set the *Clipping Option* to End Conditions Only.
- 7. **<D> OK** to accept the change and close the *Clipping Options* dialog box.

🗑 Clipping	Options		—
Corridor	Clipping Corridor	Clipping Option	ОК
SE Ramp	Bryant Ramp	Clip End Conditions Only	Cancel
			Help

8. Verify that Add Exterior Boundary, Triangulate, and Remove Loops are toggled on.

🖌 Create Surface		— ×
Name:	SE_Bryant Ramps	- Apply
Default Preference:	Proposed	▼ Close
Create Surface(s) from:		Preferences
Bryant Ramp		
SE Ramp		Help
		All
Clipp	ing Options	
General Options	_	
New Surface for E	Each Corridor 🔲 Cr	eate Alternate Surfaces
Empty Design Sur	face Pr	ocess Visible Range Only
Include Null Point	s 🔽 Re	emove Loops
Triangulate		
Features		
Duplicate Names:		
Append) Replace 🛛 🔘 Ren	ame 🔘 Modify
Add Transverse F	eatures	
Style:	Default	T
Add Exterior Bour	ndary	
Style:	Exterior Boundary	•
Densify using Chord	Height Tolerance	Display in Plan View
Horizontal Curves		Features
Vertical Curves		Components

9. **<D> Apply** and **Close**. Also, close the *Results* window if it is displayed.

- 10. Select **File > Save** from the Roadway Designer menu bar.
- 11. **<D> Close** to dismiss the Roadway Designer dialog box.

Review the Results

Once the design surface is created a review of that surface will determine if additional work is required.

Cross Sections

Cross sections are one of the standard design surface review tools.

Section Objectives:

• Create a set of cross sections

Display Cross Sections with the SE Ramp Alignment

The SE Ramp alignment is the main alignment for this project, so it is used when reviewing the data.

- 1. Set the **SE Ramp** alignment active.
- 2. Open the Create Cross Sections dialog box.
- 3. Set the *Left Offset* to *-150* and the *Right Offset* to *100*.

- 4. Select the Existing_Ground and SE-Bryant Ramps surfaces
- 5. **<D> Apply** and **<D>** to place the set.
- 6. Close the *Create Cross Sections* dialog box.
- 7. Review the cross sections paying particular attention to the merger areas.

View 3D Components

With the advent of template components, a new option has been added to the view surface commands. Viewing the design surface components in 3d is a new tool for reviewing surfaces.

Section Objectives:

- Display surface components into the MicroStation file
- 1. Select **Surface > View Surface > Components** from the InRoads Menu.
- 2. In the View Surface Components dialog box, select SE-Bryant Ramps for the Surface.
- 3. In the *Component* list, **<R>** and choose **Select All** from the menu.
- 4. Hold the *Ctrl* key and **<D>** on the ABC components to deselect them.
- 5. **<D> Apply** and **Close**.
- 6. Examine the components, rotating the view to see different perspectives.