Labs for InRoads XM

Colorado Department of Transportation

CADD and Engineering Innovation Updated January 05, 2010



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MicroStation® version 08.09.04.88 InRoads® version 08.09.02.16 0209 – Version 04.00 CDOT Configuration

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 1 - 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
- <D> the Project Creation Utility icon or select Start > All Programs
 >_CDOT_CADD_Information > 8.9.xx XM > Create XM Project Directory Structure to open the *CDOT Project Creation Utility* dialog box.



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

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

MicroStation Manager - C:\Projects\54321\	
Look in: 🚺 54321 🗸 🥑 😰 🖽 🎽 🚰	
Name Date modified Type Size Recent Places Construction Consultants Design Desktop Hydraulics Desktop Hydraulics CDOT User Materials_Geotechnical CONFUter Planning Planning Planning Project_Configuration Project_Configuration File name: 12245DES_Model.dgn Open Use Files of type: CAD Files (".dgn,".dwg;".ddf) Cancel Project	er: CDOT User ct: 54321 ct: 5CDOT

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

Look in: 📙 Reference_Files 🔹 💿 🍞 📴 🐨
Name Date modif Type Size S4321DES_Interchange.dgn S4321DES_Intersec.dam S4321DES_Model.dgn S4321DES_Phasing.dgn S4321DES_Prof.dgn S4321DES_Prof.dgn File name: 12345DES_Model.dgn File of type: CAD Files (*.dgn,*.dwg,*.dwf) Options User: CDOT User Files of type: CAD Files (*.dgn,*.dwg,*.dwf) Options

11. 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_XM Disciplines.reg* file supplied with the CDOT workspace, this job is very simple. The .reg file uses variables stored in the pcf to set the directory paths when opening or saving data 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_XM Disciplines.reg file into the project defaults.
- Load the project alignment, surface, and template data.
- Create a project (rwk) file.

- 1. Start MicroStation and InRoads by selecting Start > All Programs > Bentley > InRoads Group XM > 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.

📕 MicroStation	Manager - C:\Proj	jects\12345\Desig	gn\Drawings\R	eferer	nce_File	s\					×
Look in:	Reference_F	iles	,		3 🤌	بي 🤌	• Ľ) 🔁 (*	3D - V8 DGN	
Recent Places Desktop CDOT User COMPUTER	 12345DES_A 12345DES_Ir 12345DES_Ir 12345DES_N 12345DES_P 12345DES_P 12345DES_P 	nterchange.dgn ntersec100SH86.c Model.dgn hasing.dgn hof.dgn rof.50Scale.dgn		ize							
Network	File name: Files of type:	12345DES_Moo	;*.dwg;*.dxf)			•	Ca	pen ncel tions		User: CDOT User Project: 12345 Interface: CDOT	• •

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

😽 Be	ntley InRo	ads XM Ed	ition				c		8	5
File	Surface	Geometry	<u>D</u> rainage	<u>E</u> valuation	<u>M</u> odeler	Dr <u>a</u> fting	<u>Q</u> uantities	<u>T</u> ools	<u>H</u> elp	
1	New						Ctrl+N			
2	<u>O</u> pen						Ctrl+O			
	<u>S</u> ave							<u>ا</u>		Fi
	Save <u>A</u> s							ion		FI
								• from	r	C
E.	Project Def	aults								
闺	Text Import	t <u>W</u> izard								
	Import							•		
	Export							•		
	<u>T</u> ranslators	1						•		
	1 C:\Projec	ts\CDOT_E)ocumentati	on\\InRoa	ds\12345D	ES_Geom	etry.alg	_		b.
	2 C:\RDT\	New-XIN\R	TD-Civil xin							r .
R	3 C:\Projec	ts\12345\D)esign\InRo	ads\12345D	ES.dtm					

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_XM\ Standards-Global\InRoads\Preferences\ and highlight the CDOT_XM Disciplines.reg file.
- 8. **<D> Open**.

onfiguration 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):								
Drafting Notes (*.dft):						Import		
Pay Items (*.mdb):						Export		
Default Directory Paths	(11)					Help		
ProjectWise Directory:	🚽 Oper	۱				_		
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Report Directory:	G		Name	Date modif	Туре	Size		
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Surfaces (*.dtm):	Recent	Places						
Geometry Projects (*.alg):								
Femplate Libraries (*.itl):	Des	ktop						
Roadway Design (*.ird):	1	7						
Survey Data (*.fwd):		Lines.						
Drainage (*.sdb):	cool	T User						
Style Sheet (*.xsl):								
Quantity Manager (*.mdb):	Com	puter						
gaanay managar (maa).								_
Default Grid Factor			File name:				-	Open

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 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 files are loaded.

Bentley InRoads XM Edition							
<u>File Surface Geometry Drainage Evaluation Modeler Drafting Tools H</u> elp							
<unnamed> < 10 mm 10 m</unnamed>							
	File Name	Туре	Access Mode				
	😭 CDOT_Civil.xin	XIN	Read-Write				
Preferences 💿 Drainage 🚧 Templates 🚺							
Creates transverse features between two linear features							

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 window defaults to the *C:\Projects\12345\Design* folder. <D> <D> on the InRoads folder.
- 14. Highlight 12345DES_Geometry.alg and <D> Open.
- 15. Highlight **DES12345_Templates.itl** and **<D> Open**.

📑 Open				— ×
Look in:	\mu InRoads	*	G 🌶 📂 🛄 -	
(Ha)	Name	Date modified	Туре	Size
	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
CDOT User				
Computer				
	•			•
Network	File name: Files of type: InRoads File	s (*.rwk;*.dtm;*.alg;*.itl;*.		Open Cancel
				Help

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

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

- 🙀 Open × 🛯 DTM Look in: -🌀 🤌 📂 🛄 🔻 R 9 Desktop Network Recent Places Chris Ferree Public Compute Local Disk (C:) Desktop Projects 12345 ROW_Survey CDOT User 📗 InRoads DTM Desid In Roads ADVD RW Drive (D:) Computer 🙀 CDOTDoc\$ (\\a-abq-nas1) (Z:) Adobe Technical Communication Suite 2 File • Open Network Files of type: Surfaces (*.dtm) • Cancel Help
- In the Open window Look In drop down, navigate to C:\Projects\12345\ROW_Survey\InRoads\DTM\ folder.

- 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				X		
Save in:	\mu InRoads	•	G 🍺 📂 🖽 -			
(Pa)	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						
CDOT User						
Computer						
	•	III		•		
Network	File name: 12345DES	· [Save			
	Save as type: Projects (*.rv		Cancel			
				Help		
			C	Options		

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

Drainage	Template Lib	desta and a second s	Roadway Design			
Surfaces Geometry		oject XIN Preferences		-		
		Project Options				
		Drainage	Templa	te Library	Roadway Design	
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	rface Name File			Project Options		
	sfault 345 existing gro C:V			Surfaces	Geometry Project	XIN Preferences
	2345 existing gro C.			Drainage	Template Library	Roadway Design
		Add Update	Geometry Name			More Options
		\boxtimes \boxtimes	12345DES_Geom			more Options
			Default			Help
Name:				Add Update	Template Libra File Name	
					DES12345_Temp C:\Projects\12345	Design\InRoads\DES12345
	ОК	File Name:				
		-				
			OK	Cir Name		
				File Name:		

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_XM 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 pull-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.

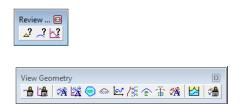
Section Objectives:

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

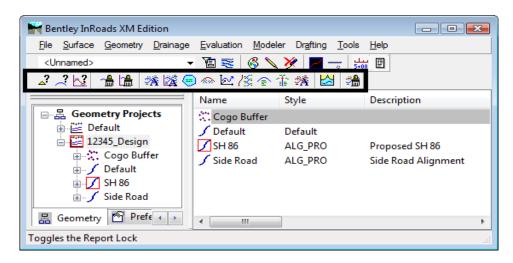
Opening Additional Toolbars

- 🚔 Customize - • • Commands Keyboard Macros Export Import Toolbars Toolbars: Reset Show Tool Tips 🗸 Menu Bar ۰ Reset All Profile With Shortcut Keys Review Geometry New. Snaps (AutoCAL Superelevation Rename. Surface Utilities Tools Delete User Add-ins Help Vertical Curve Set Vertical Element = View Geometry View Surface Volume VMI D..... Close
- 1. From the pull-down menu select **Tools > Customize**. The *Customize* dialog will appear.

- 2. Under the **Toolbars** tab, check that the boxes for **Review Geometry** and **View Geometry** are selected. When checked on, the toolbars become active in the graphics file immediately.
- 3. **<D>** the **Close** button in the *Customize* dialog.



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 MicroStation's.



5. From the pull-down menu, select **Geometry > View Geometry** look at each command and the associated image. Notice the correlation of the graphics between the pull-down menu and the toolbar.

→ Active Horizontal Active Vertical	
🖄 Horizontal Annotation	
🙀 Vertical <u>Annotation</u>	
😑 Closed Areas	
Stationing	
🕰 <u>3</u> -D Alignment	
Station Base/Clearance Annotation	
Curve Set Annotation	
Treventical Change In Plan	
🚝 Geometry Style Manager	
View Geometry	×
	🕺 🛃 🙈

- 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 checkbox 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 *Tools > 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.

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Available:										ок
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Export to MATISA Add-In									C	ancel
Find Near Points Add-In									Help	
	Generate Grade Contour Add-In								<u> </u>	loip
GENIO Translator Add-In										
Global Scale Factors Add-In										
Graphics Translator Add-In										
Horizontal and Vertical Elements Add	d-In									
Hydrology and Hydraulics Add-In								Ψ.		
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Selecting an item will display a description. 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.
- 9. Select Tools > Global Scale Factors...

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

10. Verify all three scale settings are set to *100*.

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: Digital Terrain Models are not a core topic of this course. However, it is worth noting that Global Scale Factors apply to all InRoads data displayed. This includes the display of features from a DTM. While 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 Factor Add-in and how the global scale factor impacts grapics generate from InRoads commands.

Lab 1.4 - Locks

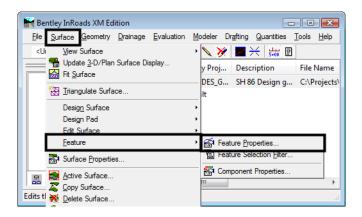
This lab illustrates the use of the Feature Filter lock, Pen/Pencil Mode, and Station Lock.

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.



2. From the InRoads menu bar, select **Surface > Feature > Feature Properties**.



Feature Properties					6	
Surface: 12345 existing ground	•	Style Available:				Apply
Feature: Name Centerine Profile T_Billboard Over 10ft T_Billboard Under 10ft T_Billboard Under 10ft T_Billboard Under 10ft Light T_Billboard Under 10ft Light5 T_Bin Walls T_Bin Walls T_Bin Walls855	Style	B_RAIL_Ty-10 B_RAIL_Ty-10 B_RAIL_Ty-10 B_RAIL_Ty-3 B_RAIL_Ty-7 B_RAIL_Ty-7 Centerline Primary: Breakline Secondary:	R		•	Close Filter List Points New Style Help
T_Bridge T_Bridge Abutment T_Bridge Abutment 745 T_Bridge Abutment 746	T_Bridge T_Bridge Abutme T_Bridge Abutme T_Bridge Abutme	Pay Items Name	Description	From Style	<u></u>	
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: Point Density Ø Exclude from	0.00	• •		

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

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

Hentley InRoads XM Edition		
<u>File Surface Geometry Drainage E</u>	valuation <u>M</u> odeler Dr <u>a</u> fting <u>Q</u> u	antities <u>T</u> ools <u>H</u> elp
T_B*	Ta 📚 🚳 🔪 🂓 🔳 🖂	5+00 E
	Surface Name	Description Fi
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Surfaces 🖁 Geometry 🕢	<	Þ
Toggles Locate Features/Locate Graphi	cs mode	.#

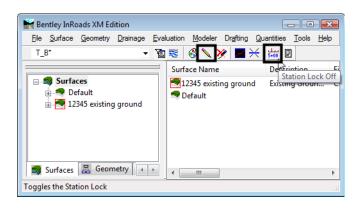
Feature Properties						- • •
Surface: 12345 existing ground Feature:	•	Style Available:				Apply
Name T_Billboard Over 10ft T_Billboard Over 10ft280 T_Billboard Under 10ft Light T_Billboard Under 10ft Light5 T_Bin Walls T_Bin Walls T_Bin Walls854 T_Bin Walls855	Style De T_Billboard Over Bilt T_Billboard Over Bilt T_Billboard Under Bilt T_Billboard Under Bilt T_Billboard Under Bilt T_Billboard Under Bilt T_Billboard State T_Billboard State T_Billboard State T_Bin Walls Bin T_Bin Walls Bin	B_RAIL_Ty-10M B_RAIL_Ty-10B B_RAIL_Ty-3 B_RAIL_Ty-7 B_RAIL_Ty-7 S_RAIL_Ty-7_SECT Centerline Primary: Breakline Secondary:	-A		•	Close Filter List Points New Style Help
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a			Description ATABASE NOT OPEN	From Style Yes	¥ II	
Name: Centerline Profile Description: Parent: Parent: Parent:		Triangulation Feature Type: Point Density Inter V Exclude from Trian		•		

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.

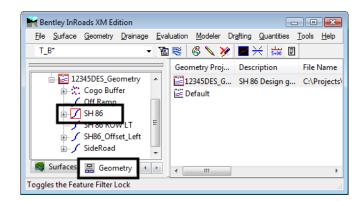
- 4. Close the *Feature Properties* dialog box.
- 5. Set the Feature Filter back to **<Unnamed>**.

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

- 6. On the InRoads main dialog box, set the *Pen/Pencil* mode to **Pencil**.
- 7. Turn the *Station* lock off.



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



- 9. From the InRoads menu bar, select Geometry > View Geometry > Stationing.
- 10. On the *View Stationing* dialog box, **<D> Apply**.
- 11. Examine the stationing displayed. The regular stations end in "+80". This is not CDOT standard.



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

🙀 Bentley InRoads XM	Edition	
File Surface Geome	try <u>D</u> rainage <u>E</u> valuation <u>M</u> ode	ler Dr <u>a</u> fting <u>Q</u> uantities <u>T</u> ools <u>H</u> elp
T_B*	- 🚡 😽 💊 📏	💓 📕 💥 🔛
12345DES_		Proj Description Station Lock On S.G SH 86 Design g C:\Projectsy

13. Redisplay the Stationing.

14. 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.



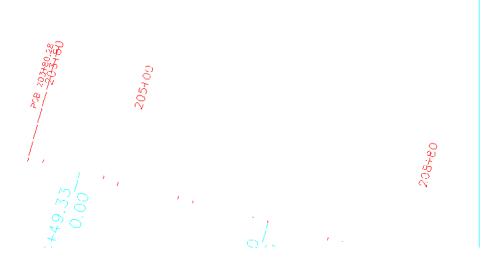
- 15. On the InRoads main dialog box, set the *Pen/Pencil* mode to **Pen**.
- 16. Turn **Delete Ink** off. *Delete Ink* makes *Pen* mode behave like *Pencil* mode. It is turned off here to illustrate *Pen* mode.

F	Be	ntley InRo	oads XM Ed	ition							—
	<u>F</u> ile	<u>S</u> urface	Geometry	<u>D</u> rainage	<u>E</u> va	luation	Modeler	Dr <u>a</u> fting	<u>Q</u> uantities	<u>T</u> ools	<u>H</u> elp
	T_	8*		•	T	1	6 🖊 🤇	🖉 📕	× 🔐 🛙]	
=		12	345DES_Ge	ometry	A A		metry Proj 2345DES_(nk Lock Off Design g	6	Name rojects\

Next, Pen mode is demonstrated.

17. Redisplay the Stationing. The stationing will appear the same as it did in the previous step. This is done so that the stations are displayed with Pen mode. Stationing displayed in Pencil mode will always behave in Pencil mode.

18. 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.



Section Summary:

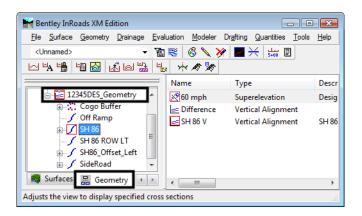
- The Feature Filter lock has two items to set; The Filter Name and the Filter lock On/ Off switch.
- Items placed retain the Pen/Pencil mode they were placed with, regardless of the mode setting at the time the items are placed again.
- Station lock On is the standard operating mode for CDOT.

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 12345DES_Geometry to show the SH 86 alignment.



- 3. From the InRoads menu bar, select **Tools > 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.

📓 Bentley InRoads XM Editi	on			
<u>File Surface G</u> eometry [<u>)</u> rainage <u>E</u> va	luation <u>M</u> odeler	Dr <u>a</u> fting <u>Q</u> uantities <u>T</u> ools	<u>H</u> elp
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		Name	Туре	Descr
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Off Ramp		SH 86 V	Vertical Alignment	SH 86
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😥 🖌 SideRo	Сору			
🕞 Surfaces 🐰 Ge	Delete			•
	Empty			
Adjusts the view to disp	View			н
	Fit			
	Fdit			
	Review			
	Check Integ	rity		

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

Geometry Project: 12345DES_Geometry Horizontal Alignment: SH 86 Project Name: 12345DES_Geometry Description: SH 86 Design geometry Horizontal Alignment Name: SH 86 Description: SH 86 Centerline Style: ALG_PRO Element: Linear POB () PC () Tangent Direction: S 74 45 19 E Tangent Length: 2795.02		- • •
Description: SH 86 Design geometry Horizontal Alignment Name: SH 86 Description: SH 86 Centerline Style: ALG_PRO Element: Linear POB () PC () Tangent Direction: S 74 45 19 E		Close Save As
POB () 203+80.28 1556706.07 3277567.49 PC () 231+75.30 1555971.14 3280264.16 Tangent Direction: S 74 45 19 E	4 III	Append Display Print
		Help Select
Element: Circular PC () 231+75.30 1555971.14 3280264.16 PI () 233+25.05 1555931.76 3280408.64 CC () 1557032.43 3280553.39 PT () 234+72.97 1555932.44 3280558.39 Radius: 1100.00 To 112" T-24	Ŧ	<pre>Previous </pre>

- 6. Close the *Review Horizontal Alignment* dialog box.
- 7. In the *Options* window, change the *Station* precision to **0.1234**.

8. **<D> Apply**.

Options		
Tolerances F Precision	actors Abbreviations Rail General Units and Format	Sight Distance Geometry
Northing/Eastin		Help
Elevation:	0.12 🔻	
Angular:	0 -	
Aspect:	0.12 💌	
Slope:	0.12 💌	
Linear:	0.12 -	
Station:	0.1234 🔹	
Acres/Hectares	0.1234 🔹	
Area Units:	0.12 -	
Cubic Units:	0.12 👻	
Scale:	0.1234 👻	
Apr	Preferences	Close

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

eometry Project: 12345DES_Geometr 💌	Mode	Ali			Close
orizontal Alignment: SH 86 🔹	Curve Sets	Alignment 🔘 Eleme	nt		Save As
Project Name: 123	45DES_Geometry 86 Design geometry			A	Append
Corizontal Alignment Name: SH	86				Display
Description: SH Style: ALG				E	Print
	STATION	NORTHING	EASTING		
lement: Linear					Help
POB () PC ()	203+80.2820 231+75.2986	1556706.07 1555971.14	3277567.49 3280264.16		
Tangent Direction:	S 54^4515 E	10000771.14	0200204.10		Select
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lement: Circular					
PC () PI ()	231+75.2986 233+25.0487	1555971.14 1555931.76	3280264.16 3280408.64		< Previous
		1557032.43	3280553.39		Next >
Radius	234+72.9689 1100.00	1555932.44	3280558.39	-	Last
The 1 +	1E^00117# T	- 4 1		•	Last

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

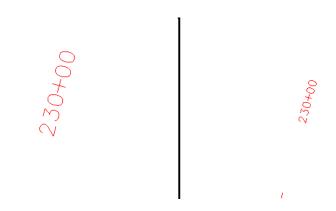
- 10. Reset the *Station* precision back to **0.12**.
- 11. On the *Options* dialog box, **<D>** the **Factors** tab. Notice that the *Text Scale Factor* is set to **100**.

- Rentley InRoads XM Edition File Surface Geometry Drainage Evaluation Modeler Drafting Quantities Tools Help <Unnamed> View <u>G</u>eometry Active Horizontal 🖂 🗠 💾 Eit Alignment 🟦 Active <u>V</u>ertical Horizontal Curve Set 🖄 Horizontal Annotation. Kertical Annotation. Vertical Curve Set 🚊 🧮 12 Closed Area <u>.</u>... Horizontal Element Stationing Vertical Element 3-D Alianment Superelevation Station Base/Clearance Annotation. Curve Set Annotation. Lot Layout Vertical Change In Plan. ÷... Review Horizontal. Annotate Graphics. 📇 Geometry 🔀 Review Vertical... Al Horizontals A? Review Geometry Points. Displays the act
- 12. From the InRoads main menu, select Geometry > View Geometry > Stationing.

- 13. On the *View Stationing* dialog box, **<D> Apply**.
- 14. Zoom in on a station and note the size of the text.
- 15. On the Options dialog box, key in **50** for the **Text Scale Factor** and **<D> Apply**.

Precision	Genera	l	Units and	d For	mat	Geometry
Tolerances	Factors	АЫ	previations	Ra	il	Sight Distance
Text Scale Fa	actor:	50	.0000		_	Help
Cell Scale Factor:		10	100.0000		-⊷	
Line Style Sc	ale Factor:	1.(0000			

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, 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 more detailed review of the contents of the *12345DES_Geometry* geometry project *(12345DES_Geometry.alg)* file used in the previous lab.

The *12345DES_Geometry* geometry project is a collection of all the data from the initial topographic survey. Existing linear objects such as pavement lines, breaklines, streamlines, etc are stored as horizontal alignments. Survey shots of singular features such as signs, utilities, ground shots, trees, etc. are written to the cogo buffer and stored as individual points.

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 exisisting 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
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm

Lab 2.1 - Review Geometry Project

Section Objectives:

- Verify the correct geometry is loaded.
- 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 infomation.
- 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. You should see something similar to the image below.

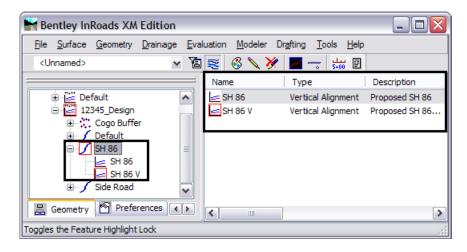
Bentley InRoads XM Edition								
<u>File Surface G</u> eometry <u>D</u> rainage <u>E</u> val	uation <u>M</u> odeler Dr	afting <u>T</u> ools <u>H</u> elp						
<unnamed> 🖌 📔</unnamed>	8 8 X 💥	<u></u>						
	Name	Style	Description	Last Revised				
Geometry Projects Geometry Projects Default Geoge Buffer Gogo Buffer Gogo Buffer Gogo Buffer Gogo Buffer Gogo SideRoad	Cogo Buffer SH 86	ALG_PRO ALG_PRO	Proposed SH 86 Side Road Align	12/31/2009 3/17/2009 11/24/2007				
E Geometry Preferences		croll Bar		>				

- 3. **Expand** the screen display of the geometry project by selecting the + (plus) symbol located to the left of the geometry project name.
- 4. Look to the right side of the InRoads pane. 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 should see but 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 alignmentis 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.

<u>File</u> <u>Surface</u> <u>Geometry</u>	Drainage Ev	aluation <u>M</u> o	deler Dr <u>a</u> fting	<u>T</u> ools <u>H</u> elp			
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		Name	Northing	Easting	Elevation	Style	1
😑 📇 Geometry Proje	cts	1.1	1556963.86	3276609.90	0.00	ALG_EXIST	
🕀 📴 Default		:*** 2	1556883.30	3279660.92	0.00	MON_Sect-corn	-
😑 📴 12345_Design	_	:	1558531.40	3279637.21	0.00	MON_Sect-corn	-
🕀 🎲 Cogo Buffe	er		1558509.37	3279625.93	0.00	RW_Sec-Line_ex	
🕀 🖌 Default	_	100	1555633.69	3279672.47	-0.00	Default	
🕀 🖍 SH 86		101	1556633.64	3279663.14	-0.00	Default	
🗄 🖌 Side Road		1000	1558417.74	3267409.40	0.00	ALG_EXIST	
E Geometry Prefe		1001	1558457.06	3268756.14	0.00	ALG_EXIST	*
🖁 Geometry 🎦 Prefe	rences ()	<				>	

- <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.
- 8. **<D>** on the first horizontal alignment listed. Notice the associated vertical alignment.



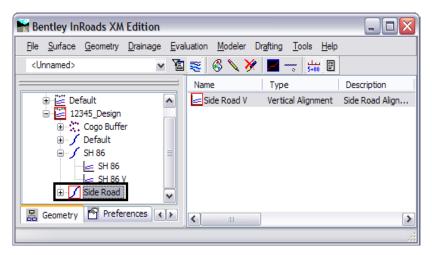
Note: Only one horizontal alignment can be active at a time. Being *active* specifies the alignment to be modified, displayed, or defined by default in dialog boxes.

9. Select Geometry > Active Geometry. The *Active Geometry* dialog will appear.

Kative Geometry	1		_ 🗆 🛛
Туре:	Horizontal Alignment	→ +	Apply
Description	Side Road Alignment		Close
Style:	ALG_PRO	~	Help
Current			Thep
Geometry Project:	12345_Design		
Horizontal Alignment:	Side Road		
Vertical Alignment:	Side Road V		
Name	Description	Style	
Default		Default	
SH 86	Proposed SH 86	ALG P	
Side Road	Side Road Alignment	ALG_P	KU

- 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.



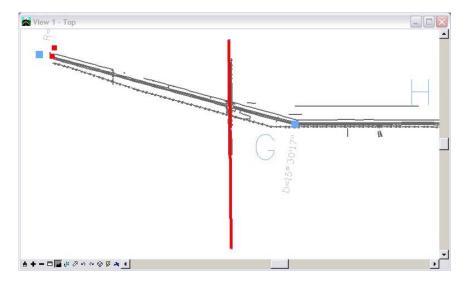
13. Select **Geometry > Review Horizontal** for a textual display of the active alignment. When reviewing an alignment, a temporary dynamic display is shown in MicroStation representing the location of the alignment being reviewed.

Beometry Project: 12345_Design Horizontal Alignment: Side Road		Mode Curve Sets	Alignment O Eleme	ent	Close Save As
Project Name: Description: Horizontal Alignment Name: Description: Style:	SH 86 De Side Roa Side Roa	esign Alignmen ad	NORTHING	EASTING	Append Display Print
Element: Linear POB () PI () Tangent Direction: Tangent Length:	N	9+00.00 22+50.68 0^36'36" W 1350.68	1554533.43 1555884.03	3279686.08 3279671.70	Help Select
Element: Linear PI () POE () Tangent Direction: Tangent Length:	N	22+50.68 32+50.00 0^37'05" W 999.32	1555884.03 1556883.30	3279671.70 3279660.92	<pre>Previous</pre>

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 infomation in the dialog box changes
- Geometry header (in the veiw port)
 - Note the change to the **Project Name, Description, Alignment name, Description,** Geometry Style
- Element Details (in the veiw port)
 - Note how 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. Select **Geometry > View Geometry > Active Horizontal** to write the alignment to the MicroStation file.
 - **Note:** It may appear that nothing happend. This is because the view window is not postioned 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, us the key in dp = -10000, **30000** and left click in View 1 to expand the MicroStation clipping planes.



In the Workspace Bar <R> (right-click) on the active alignment name. Note the *Active*, *View*, *Fit*, and *Review* commands are available from the short-cut fly-out menu.

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😑 📇 Geometry Projects	
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⊡ Default	
E SH 86	
Side Road V	
	New
	Set Active
	Copy
	Delete
	Empty
	View
	Edit
	Review
	Check Integrity
🔚 Geometry 🔊 Preference	
Ready	✓ Parabola Definition

20. Experiment using this fly-out menu with any alignment.

😽 Bentley InRoads XM Ed	lition		_ 🗆 🔀
<u>File Surface G</u> eometry Dr	ainage <u>E</u> val	uation <u>M</u> odeler Dr <u>a</u>	<u>f</u> ting <u>T</u> ools <u>H</u> elp
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	Empty	101	Default
🖹 🖌 Side Road 🚽	View	1000	ALG_EXIST
Side Roa	Fit	1001	ALG_EXIST
	Edit	1002	ALG_EXIST
	Review	1003	ALG_EXIST
-		1004	ALG_EXIST
🖁 Geometry 🔊 Prefere	Read-Only	1005	ALG EXIST
Ba Geometry	Read-Write		>
Toggles the Station Lock	Details		

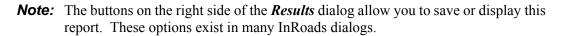
21. In the Workspace Bar **<R>** on the **Cogo Buffer** and select **Review**... The *Review Geometry Points* dialog will appear.

Review Ge	ometry Points	
Mode: 🔿 Align	ment: SideRoad 😽	Apply
💿 All Pe	pints	Close
- Point		
Name:	þ <u>+</u>	Report
Description:		Help
Style:	ALG_EXIST	
Northing:	1556963.86	
Easting:	3276609.90	
Elevation:	0.00	
Synchronize	Shared Point Elevations	
Shared Points		
Point Type	Alignment	
COGO		
First	< Previous Next >	Last

22. **<D>** the **Next** button to review the information about subsequent points. Notice the available navigation buttons *First, Previous, Next,* and *Last*

23. **<D> Report** to list all Cogo points stored in the active geometry project.

Results				_ 🗆 🛛
Report Result	s		^	Close
POINT NAME	NORTHING	EASTING	E:	Save As
1	1556963.86	3276609 90		
2	1556883.30	3279660.92	=	Append
3	1558531.40	3279637.21	1	
4	1558509.37	3279625.93		Display
100	1555633.69	3279672.47		
101	1556633.64	3279663.14		Print
1000	1558417.74	3267409.40		
1001	1558457.06	3268756.14		Help
1002	1558469.66	3270669.73		
1003	1558050.59	3272645.47	-	
1004	1556982.55	3276540.43	~	
<			>	



- 24. They are:
 - *Close* closes the *Results* dialog
 - Save As saves the contents of the dialog 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.
- 25. **<D>** the **Close** button in the *Results* dialog
- 26. In the *Mode* section of the *Review Geometry Points* dialog, toggle the radio button to **Alignment**. Notice how the Alignment drop-down list is activated.

📲 Review Ge	ometry Points	×
Mode: 💿 Alignr	nent. SH 86 🗸	Apply
🔾 All Po	ints	Close
Point		
Name:	+	Report
Description:		Help
Style:	ALG_PRO 🗸	
Northing:	1556706.07	
Easting:	3277567.49	
Elevation:	0.00	
Synchronize	Shared Point Elevations	
Shared Points		
Point Type	Alignment	
PC	SH 86	

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

- 28. **<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	8			Close
POINT NAME 1000	NORTHING 1558417.74 1558450.09 1537339.09 1558458.63 1558467.52 1558467.58 1558402.30 1558117.51 1547356.90 1557965.30 1557001.57	EASTING 3267409.40 3268517.55 3269133.91 3268994.82 3270345.09 3270364.85 3270987.32 3272329.96 3270047.57 3272956.51 3276471.06	E =	Save As Append Display Print Help

29. **<D>** the **Close** button in both the *Results* and *Review Geometry Points* dialogs.

🗑 Bentley Ir	Roads XM Edition		_ 🗆	>
<u>File</u> <u>S</u> urface	Geometry Drainage Evaluation Modeler Drafting	<u>T</u> ools <u>H</u> elp		
<unnamed></unnamed>		 5+00 E		
	📩 <u>F</u> it Alignment	Northing	Easting	
□ 品 Geor		1556963.86	3276609.90	
🗉 🧮 D	Vertical Curve Set	1556883.30	3279660.92	
i 📴 1		1558531.40	3279637.21	
<u>ن</u> ا	Horizontal Element	1558509.37	3279625.93	
<u>ا</u> ا	Vertical Element	1555633.69	3279672.47	
	Superelevation	1556633.64	3279663.14	
		1554533.43	3279686.08	
	Review Horizontal	1555884.03	3279671.70	
	Review Vertical	1556883.30	3279660.92	
	Review Geometry Points	1558417.74	3267409.40	
	Cogo Points	1558457.06	3268756.14	
		1558469.66	3270669.73	
	Locate •	1558050.59	3272645.47	
	☆ <u>T</u> raverse	1556982.55	3276540.43	
	品 Active Geometry	1556716.98	3277527.47	
	。 资 Copy Geometry	1555931.76	3280408.64	
	X Delete Geometry	1555939.60	3282135.29	
	Rename Geometry	1555699.32	3283343.64	ſ
Surfaces	Utilities		>	ľ
its alignment da	a to a view			

Note: The previous steps used the short-cut fly-out menus, all actions can also be found under the *Geometry* pull-down menus.

At anytime during these labs you can 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 can be redisplayed using the InRoads display commands shown in previous sections.

Note: The screened topography and the graphics used as training guides are either locked graphics or are attached as a reference file so they can not be deleted. These graphics will be used in future labs.

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.

Bentley InRoads XM Edition				
<u>File Surface G</u> eometry <u>D</u> rainage <u>E</u> val	uation <u>M</u> odeler D	r <u>a</u> fting <u>T</u> ools <u>H</u> elp		
<unnamed> 🖌 🖌</unnamed>	😤 🚳 🔪 🎽	E		
	Geometry Proj	Description	File Name	Last Revised
E A Geometry Projects	12345_Design	SH 86 Design Al	C:\Projects\123	1/4/2010 3:38:
Default 12345_Design Default SH 86 SH 86 V Side Road Side Road V	Default			1/4/2010 3:34:
🔠 Geometry 🔊 Preferences 🔹	<	IIII		>
Toggles Pencil/Pen mode	In the second			

- 30. Use the previously covered commands to display the horizontal alignments *SH 86* and *Side Road*.
- 31. 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 they are 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: orizontal Alignment:	12345_Design 💙 SH 86 💙 🛉	Curve Sets	Alignment 🔿 Eleme	nt		Close Save As
	Project Name: 1234 Description: SH 8 ignment Name: SH 8 Description: Prop Style: ALG	36 Design Alignmen 36 posed SH 86	ts			Append Display
	00010. MH0	STATION	NORTHING	EASTING		Print
lement: Line						Help
Tang	OB (1000) PC () ent Direction: angent Length:	100+00.00 111+08.62 N 88^19'40" E 1108.62	1558417.74 1558450.09	3267409.40 3268517.55		Select
lement: Circ					1	First
1	PC () PI () CC ()	111+08.62 113+47.31	1558450.09 1558457.06 1537339.09	3268517.55 3268756.14 3269133.91	3	< Previous
1	PT () Radius:	115+85.98 21120.00	1558458.63	3268994.82	~	Next >

- 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 & Style.
- 3. Select **Geometry > Review Geometry Points...** to review Cogo point names, descriptions, and style assignments.

Review Geo	netry Points	
Mode: 🔿 Alignme	ent: SH 86 😽	Apply
 All Point 	ts	Close
Point		Papat
Name:	1000 +	Report
Description:		Help
Style:	ALG_EXIST	
Northing:	1558417.74	-
Easting:	3267409.40	
Elevation:	0.00	
Synchronize St	nared Point Elevations	,
Point Type	Alignment	
COGO		
First	< Previous Next >	Last

Note: This dialog is used to review both alignments and Cogo points based on the *Mode* setting.

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

File Surface Geometry Drainag	e <u>E</u> valuation	n <u>M</u> odeler Dr	<u>afting T</u> ools <u>H</u>	<u>H</u> elp			
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	Name	Northing	Easting	Elevation	Style	Description	
😑 🖁 Geometry Projects 🔺	1.1	1556963.86	3276609.90	0.00	ALG_EXIST		I
🗈 🔛 Default	**** 2	1556883.30	3279660.92	0.00	MON_Sect-corn		T
🖹 📴 12345 Design 🗏	:::3	1558531.40	3279637.21	0.00	MON_Sect-corn		I
E Cogo Buffer		1558509.37	3279625.93	0.00	RW_Sec-Line_ex		1
🕀 🖌 Default	100	1555633.69	3279672.47	-0.00	Default		I
SH 86	: 101	1556633.64	3279663.14	-0.00	Default		I
< SH 86 X	1000	1558417.74	3267409.40	0.00	ALG_EXIST		I
and a second	1001	1558457.06	3268756.14	0.00	ALG_EXIST		1
🖁 Geometry 🔊 Prefer 🔹	<		Ш	L.		>	>

Note: If the *Style* assigned to the data is not a valid name when displaying an alignment or Cogo point (not existing in the Style Manager), a *Style* by the name *Default* will be used.

The *Default* CDOT Style for all geometry elements has the same properties as the defined style *ALG_Proposed*.

Section Summary:

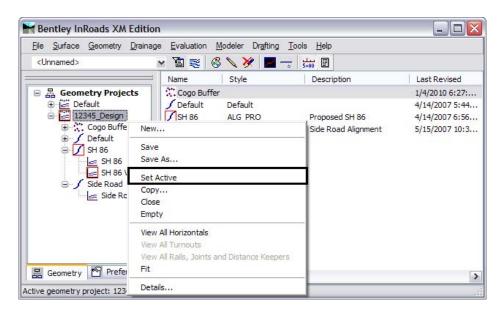
• Geometry styles are stored along with surface and survey styles in the CDOT_Civil.xin file.

Lab 2.3 - Review Alignment Stationing

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

The first thing to do is to determine the existing assigned stationing values by using the alignment review commands.

1. Make **12345DES_Geometry** the active geometry project by **right-clicking** on the geometry name and selecting **Set Active** from the fly-out menu.



2. **Right-click** on the alignment **SH 86** and select *Review* from the Fly-out menu. The *Review Horizontal Alignment* dialog will appear.

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<u>File S</u> urface <u>G</u> eome	etry <u>D</u> rainage <u>E</u> valuation	n <u>M</u> odeler Dr <u>a</u> fting <u>T</u> ools <u>H</u> elp	
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	Name	Type Description	By Whom
😑 📇 Geometry Pi	rojects 🔄 🔄 SH 86	Vertical Alignment Proposed SH 86	
Default Default Default Default Default Default Default Default Default Default Default Default Default SH 86 SH 86 Default	New Set Active Copy Delete Empty View Fit	Vertical Alignment Proposed SH 86	
	Edit Review		
	Check Integrity		
	Read-Only		
	✓ Read-Write		
	Details		
🔚 Geometry 🖄 P	 Arc Definition 	ш	>
Toggles the Style Lock	Chord Definition		

- **Note:** Fly-out menus can be access from either the workspace or feedback 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:

ieometry Project: 12345_Design	Mode O Curve Sets	Alignment O Eleme	nt	[Close Save As
Project Name: 1234		•		•	Append
Horizontal Alignment Name: SH 8		ts			Display
Description: Prop Style: ALG					
00,10. ALO_	STATION	NORTHING	EASTING		Print
Element: Linear				(Help
POB (1000) —	► 100+00.00	1558417.74	3267409.40		
PC ()	111+08.62	1558450.09	3268517.55		
Tangent Direction:	N 88^19'40" E				Select
Tangent Length:	1108.62				First
Element: Circular				1	Filst
PC ()	111+08.62	1558450.09	3268517.55		< Previous
PI ()	113+47.31	1558457.06	3268756.14	1	1101000
cc ()		1537339.09	3269133.91		Next >
PT ()	115+85.98	1558458.63	3268994.82		CARDE 12
Radius:	21120.00		and water a construction in the second	×	Last

4. Review the *Vertical* alignment **SH 86 V** associated with horizontal alignment SH 86.

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<u>File Surface G</u> eometry	<u>Drainage Evaluation Modeler Drafting Tools H</u> elp	
<unnamed></unnamed>	💌 🛅 😴 🚳 🔪 🏏 📕 📼 🔛 📃	
Geometry Project Default Default Default Default Default SH 86 SH 86 SH 86 Side Road Side Road Side Road	New Set Active Copy Delete Empty View Edit Review Check Integrity	

5. Write down the initial station value assigned to vertical alignment SH 86 V:

Geometry Project:	12345_Design 🗸	Mode		Close
orizontal Alignment:	SH 86 🗸 🕈	Alignment		Save As
ertical Alignment:	SH 86 V 🖌 🔶	O Element		Append
	ignment Name: SH 8 Description: Prop Style: ALG ignment Name: SH 8	6 Design Alignments 6 osed SH 86 PRO 6 V		Print Help
	Description: Frop Style: ALG_	osed SH 86 Profile PRO_Vert STATION	ELEVATION	Select
Element: Line	ear POB - PVC - Tangent Grade: angent Length:	► 100+00.00 107+50.00 -3.76 750.00	6630.07 6601.88	First < Previous
Element: Para		107+50.00 109+00.00 110+50.00	6601.88 6596.24 6594.70	Last

If the horizontal and vertical stationing are not sychronized it will cause confusion in the design and construction processes. Is the stationing for the horizontal and vertical alignments synchronized?

Section Summary:

• The beginning and ending stations cna be found in the feedback 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 thereview dialog boxes to move through long reports.
- The attributes for geometry elements can be found in the feedback window 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_Model.dgn
- C:\Projects\12345\Design\InRoads\12345DES_Geometry.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.

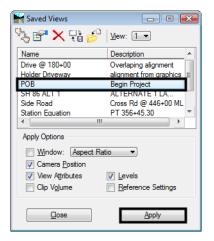
Options for displaying horizontal alignments are available when using the **Horizontal Annotation** dialog.

1. 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	Close
Line Style:	1.0000	

2. Using the *MicroStation* menus, select **Utilities > Saved Views** tools to open the saved views dialog.

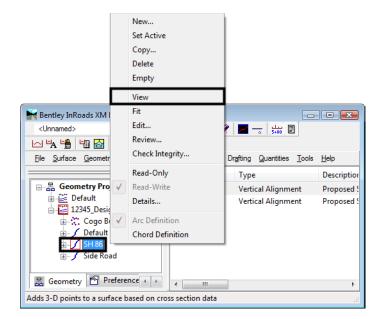
3. **<D>** on the name **POB**, **<D>** Apply for view **1**, and **<D>** Close.

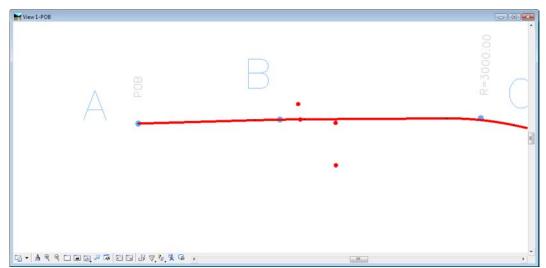


Below is an example of the saved view.

View 1-POB		
View Views Image: State of the state o	Β	
- + + < < C		

4. Display alignment **SH 86** from the Geometry Project *12345_Design* by right-clicking **<R>** on the alignment name and selecting **View** from the fly-out menu.



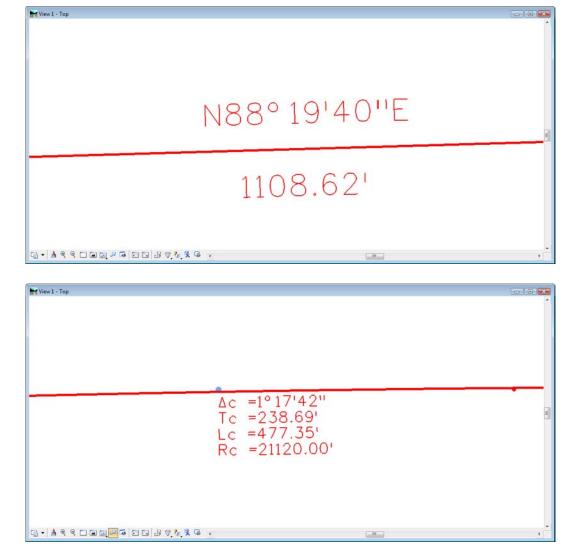


The alignment display is based on the geometry style assigned to the alignment. This display method is suitable but does not allow the user any options or allow annotation of the geometry. The next steps illustrate how to customize the graphics display for geometry elements.

Main Tabling Style	s			
Apply Style Assigned C Horizontal Alignment: Cogo Points:	Active Ove	erwrite	* *	Filter Help
Horizontal Alignments Include: SH 86 Selected:	+	Includ	Points	+
Name Descri	Style	Nam		Style
Display As Comple	x Linestring			
Display	x Linestring		Annotate	
	x Linestring		Annotate Points	
Display Points		ons	Points	
 Display ✓ Points ✓ On-Alignment 	Event Points	ons	Points	sions
Display Points On-Alignment Off-Alignment	Event Points	ons	 Points Elements Duplicates 	
Display Points On-Alignment Off-Alignment Elements	Event Points	ons	Points Center Duplicates Dual Dimention	e Styles
Display Points On-Alignment Off-Alignment Elements Radials	Event Points Station Equatio	ons	Points Clements Duplicates Dual Dimens Try Alternate	e Styles

5. Select Geometry > View Geometry > Horizontal Annotation.

- 6. Key in *SH 86* in the *Annotate* field and *Tab* from the field.
- 7. Set options for the *Display* and *Annotate* sections of the dialog as shown in the above screen shot.
- 8. **<D>** the **Apply** button. This will write alignment *SH 86* to the MicroStation Screen and annotate the alignment.



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

9. Return to the View Horizontal Annotation dialog.

ain Tabling Style:	S				
Apply Style					Filter
Assigned		verwrite			Help
Horizontal Alignment:	ALG_EXISTING			-	
Cogo Points:	Default			~	
Horizontal Alignments		Cogo	Point	s	
Include:	+	Includ	e:		-
Selected:		Sele	cted:		
Name Descri	Style	Nam	e	Descri	Style
	d ALG_P x Linestring				
☑ Display As Comple Display			An	notate	
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✓ Display As Comple Display ✓ Points	x Linestring		✓ ✓	Points	
 ✓ Display As Comple Display ✓ Points ✓ On-Alignment 	x Linestring		V	Points Elements	sions
Display As Comple Display Points On-Alignment Off-Alignment	x Linestring			Points Elements Duplicates	
Display As Comple Display Points On-Alignment Off-Alignment Ememts	x Linestring	ations		Points Elements Duplicates Dual Dimens	e Styles
Display As Comple Display Points On-Alignment Off-Alignment Elements Radials	x Linestring	ations		Points Elements Duplicates Dual Dimens Try Alternate	e Styles

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

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

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

View Horizontal Annotation	
Main Tabling Styles Apply Style Image: Composition of the style	Filter
Include: Include	Points de:
Name Descri Style Nam	ne Descri Style
Display As Complex Linestring	Annotate
Con-Alignment Event Points	V Elements
Off-Alignment Station Equations	
Elements	Dual Dimensions
Radials Tangents	Try Alternate Styles
Chords Subtangents	Extend Beyond Element
Planarize	
Apply Interactive Prefer	ences Close

- 12. Experiment displaying an alignment with *Points* and *Elements* turned on or off on both the *Display* tab and the *Annotate* tab.
- 13. Experiment displaying the various components available in the display portion of the dialog.

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 of 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. It can display other geometry data as well.

Lab 3.2 - Selection of Geometry for display and/or Annotation

Section Objectives:

• Illustrate methods for defining horizontal alignment elements for display and/or annotation.

- 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 Assigned Horizontal Alignment: Cogo Points: Default Default	te v Help v
Include:	go Points slude:
	elected: lame Descri Style
☑ Display As Complex Linestring	
Display	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
Planarize	
Apply Interactive Pre	ferences Close

5. **<D>** the **Filter** button. The *Geometry Selection Filter* dialog will appear.

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

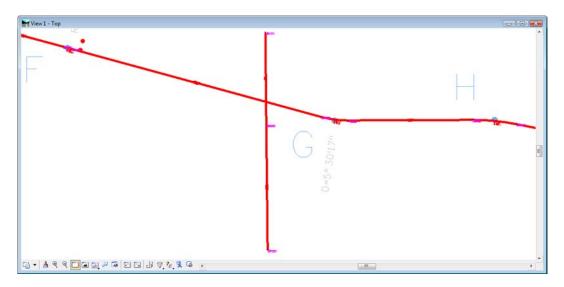
- **Note:** Available alignments are shown on the left, **Selected** (for display or annotation) alignments are shown on the right. This makes it possible to select multiple alignments for display or annotation.
- Move the alignments SH 86 and Side Road from the *Available* list to the *Selected* list by <D> the names in the *Available* list and then <D> the ADD button (or <D><D> on the names).
 - **Note:** The data in this dialog can be sorted by clicking **<D>** on the column headers. Multiple selections of alignments can be made through the use of the <CTRL> or <Shift> keys.

Name:	Selection Filter	•	•				ок
Description:	Included	•	•				Cancel
Style:	Included	•	•				Preferences
Fence Mode:	Ignore	-					Help
Available:					Selected:		пер
Name	Description	Style		Add ->	Name	Description	Style
Default		Default		<- Remove <- Swap -> All None	SH 86 Side Road	Proposed SH 86 Side Road Alignm	ALG_PRO ALG_PRO

7. When done identifying the desired alignments in the Filter dialog, **<D> OK** – the Selected geometry is populated in the *Selected* field

ain Tabling Styles		
Apply Style)verwrite	v Filter
Horizontal Alignments Include:	Includ	Points de:
Name Descri Style SH 86 Proposed ALG P	Nar	ne Descri Style
Display As Complex Linestring		
Display Points		Annotate
Display	s	
Display Points		Points
Display Points On-Alignment Event Points		Points Elements
Display Points On-Alignment Event Point: Off-Alignment Station Equa		Points Elements Duplicates
Display Points On-Alignment Event Point: Off-Alignment Station Equal Events	ations	Points Bements Duplicates Dual Dimensions
Display Points Points On-Alignment Event Point: Off-Alignment Station Equa Elements Radials Tangents	ations	Points Cements Duplicates Dual Dimensions Try Alternate Styles

- 8. **<D> Apply** and the selected alignments will display in MicroStation.
- 9. Review the results in MicroStation.



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 methods 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 to an 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
- 11. **<D>** the **Filter** button. The *Geometry Selection Filter* dialog will appear.

ain Tabling Style	5	
	Active Overwrite	Filter
Horizontal Alignment:	ALG EXISTING	Help
Cogo Points:	Default	
	Dordan	
Horizontal Alignments Include:		o Points
Selected:		de:
		ected:
Name Descri	. Style Na	me Descri Style
Display As Comple	x Linestring	Annotate
Display Points		Points
Display Points V On-Alignment	Event Points	Points
Display Points On-Alignment Off-Alignment		Points Elements Duplicates
Display Points On-Alignment Off-Alignment Elements	Event Points	Points Eements Duplicates Dual Dimensions
Display Points V On-Alignment Off-Alignment Elements Radials	Event Points Station Equations	Points Elements Duplicates Dual Dimensions Try Alternate Styles
Display Points On-Alignment Off-Alignment Elements	Event Points	Points Eements Duplicates Dual Dimensions

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
1006		ALG_EXIST		<- Remove	1000		ALG_EXIST
1007		ALG_EXIST	Ξ	C Homovo	1001		ALG_EXIST
1008		ALG_EXIST		<- Swap ->	1002		ALG_EXIST
1009		ALG_EXIST			1003		ALG_EXIST
1011		ALG_EXIST		All	1004		ALG_EXIST
1012		ALG_EXIST		None	1005		ALG_EXIST
1		ALG_EXIST			1010		ALG_EXIST
100		Default	Ψ.				

13. **<D>** the **OK** button. The points populate the *Selected* field.

in Tabling Styles		Filter	
🖲 Assigned 🛛 🔘 Active 📃 🔾)verwrite		
Horizontal Alignment: ALG_EXISTING		Help	
Cogo Points: Default		-	
Horizontal Alignments		Points	
nclude: 🔶	Inclu		·
Selected:	Sele	ected:	
Name Descri Style	Nar		
	100		
	1002		1
	1003		
	100		
Display As Complex Linestring			
Display		Annotate	
Points		Points	
🔽 On-Alignment 📃 Event Points	5	Elements	
Off-Alignment Station Equa	ations	Duplicates	
Z Elements		Dual Dimensions	
Radials Tangents		V Try Alternate Styles	
Chords Subtangents	3	Extend Beyond Element	
Planarize			

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

View 1 - Top	
1001	Ξ
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15. Experiment displaying various *Alignments* and *Points* with the assorted settings.

Note: Remember to toggle on *Points* in the *Annotation* tab if you need to see Cogo Point numbers, Northing, and Easting. Keep in mind annotation settings are derived from the Geometry Style Manager Type: Points for the assigned Geometry Style.



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 elements.
- The Annotate area is used to turn on and off the text data associated with the geometry elements.

Lab 3.4 - Review Alignment Stationing

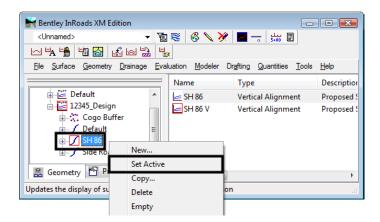
Section Objectives:

• Review the alignmet to determine its current stationing.

The default station at the beginning of a newly created horizontal or vertical alignment is 0+00. This value can be changed as shown later in this lab.

One of the easiest methods for determining assigned stationing values is through the alignment review commands.

1. Make **12345_Design** the active geometry project by **right-clicking** on this geometry name and selecting **Set Active** from the fly-out menu.



2. **Right-click** on the alignment **SH 86** and select *Review* from the Fly-out menu. The *Review Horizontal Alignment* dialog will appear.

Hentley InRoads XM Edition			
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	Name	Description By Who	m
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12345_Design	🖌 Default		
⊕	SH 86	New	
B SH 86	Side Road	Set Active	
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		Delete	
🖁 Geometry 🔊 Preference 🕠			- F
Adds a feature to the surface in a cross sec	tion	Empty	at
		View	
<d> Here /</d>		Fit	
or Here ———		Edit	
		Review	

- **Note:** Fly-out menus can be access from either the workspace or feedback panes. Also note that selecting an alignment for review switches it to being the *active* alignment.
- 3. Investigate the stationing assigned to horizontal Alignment SH 86.



Initial station value is:

- 4. Review the Vertical alignment SH 86 V associated with horizontal alignment SH 86.
 - Is the stationing for the horizontal and vertical alignments synchronized?

Section Summary:

• Use the Review command to find out information about the alignment, like stationing, without having to display it graphically.

Lab 3.5 - 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 lifework for the horizontal alignment SH 86.

Right-click on the alignment name in the InRoads explorer window and select *View* from the fly-out menu.

Hentley InRoads XM Edition			
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	Name	Description By Whom	Last Revised
⊟ ♣ Geometry Projects	Cogo Buffer		1/4/2010 6:27:3
⊕ 🚰 Default	🖌 Default		4/14/2007 5:44:
12345_Design	🖍 SH 86	D	4/14/2007 6:56:
Cogo Buffer	🖌 Side Road	New	5/15/2007 10:3
Default		Set Active	
⊡		Сору	
SH 86 V		Delete	
Side Road		Empty	
🖁 Geometry 🔊 Preference ()		View	
	< III	Fit	<u>۲</u>
Changes the name of a cross section set		Edit	H.

2. Select Geometry > View Geometry > Stationing. The *View Stationing* dialog will appear.

	+ A	Transitio	n Radii	Event	Points	Vert	ical Stations
Main	Regula	ar Stations	Cardina	Stations	Pls	Stat	ion Equation
Horizon	tal Align	ment: S	H 86		•	+	Help
Limits							
Sta	ation						
Sta	art: 100	+00.00		- ф -			
Sto		+60.50	ī	- -			
					Planarize	•	
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	rdinal Le	eader	ALG	PRO_Ca	rdinals	BYL	
	rdinal St	ations	ALG	_PRO_Ca	rdinals	BYL	
🖂 PI	Leader		ALG	_PRO_Ca	rdinals	BYL	
	Stations		ALG	PRO_Ca	rdinals	BYL	
	uation L	eader	ALG	PRO_Ca	rdinals	BYL 🖵	
-						•	

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

Note: The Preferences dialog is used to load preset settings for a particular tool. In the View Stationing dialog the preference is setting the interval and symbology of the display graphics.

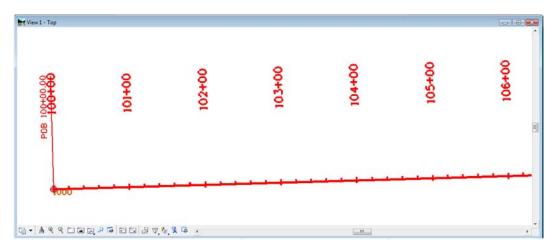
The following steps load the Preference Proposed-100 Ft Interval as the active symbology.

Market Preferences	X
Name:	Close
Existing-100 R Interval Right	Load
Existing-500 R Interval	Save
Existing-500 R Interval Left	ave As
Existing-500 R Interval	Delete
OTHER-100 R Interval	Help

- 4. **<D> Proposed-100 Ft Interval**.
- 5. **<D> Load** then **Close** button.
- 6. In the *Symbology* portion of the dialog, select or de-select the alignment components for display. Loading the preference sets the default interval for major stations.

Main Regular Stations Cardinal Stations PIs Station Equation Horizontal Alignment: SH 86 + Help Limits Station Station Station Station Station * Help Limits Station * Planarize Interval: 100+00.00 * Planarize Interval: 100.00 Drop Station Equation Name Symbology: Object Name Major Ticks ALG_PRO_Sta-Major BYL Minor Ticks ALG_PRO_Sta-Minor BYL Minor Ticks ALG_PRO_Sta-Minor BYL Minor Ticks ALG_PRO_Cardinals BYL Cardinal Leader ALG_PRO_Cardinals BYL PI Leader ALG_PRO_Cardinals BYL PI Leader ALG_PRO_Cardinals BYL PI Stations ALG_PRO_Cardinals BYL Equation Leader ALG_PRO_Cardinals BYL	Radius	s + A	Transitio	n Radii	Event F	oints	Ve	tical Stations
Horizontal Alignment: SH 86 Help Limits Station Static Station Static Interval: 100.00 Planatze Interval: 100.00 Drop Station Equation Name Major Ticks ALG_PRO_Sta-Major BYL Minor Ticks ALG_PRO_Sta-Minor BYL Minor Ticks ALG_PRO_Cardinals BYL Cardinal Leader ALG_PRO_Cardinals BYL PI Stations ALG_PRO_Cardinals BYL PI Stations ALG_PRO_Cardinals BYL PI Stations ALG_PRO_Cardinals BYL Fi Stations ALG_PRO_Cardinals			mannetter					
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Start: 100+00.00 Stop: 366+60.50 Interval: 100.00 Drop Station Equation Name Symbology: Object Name Major Ticks ALG_PRO_Sta-Major Major Stations ALG_PRO_Sta-Major Minor Ticks ALG_PRO_Sta-Minor Minor Ticks ALG_PRO_Sta-Minor Minor Stations ALG_PRO_Cardinals Stations ALG_PRO_Cardinals PI Leader ALG_PRO_Cardinals PI Stations ALG_PRO_Cardinals PI Station Station PI Station Station								
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Cardinal Leader ALG_PR0_Cardinals BYL Cardinal Stations ALG_PR0_Cardinals BYL PI Leader ALG_PR0_Cardinals BYL PI Stations ALG_PR0_Cardinals BYL Equation Leader ALG_PR0_Cardinals BYL			-	_	_			
Cardinal Stations ALG_PRO_Cardinals BYL PI Leader ALG_PRO_Cardinals BYL PI Stations ALG_PRO_Cardinals BYL Equation Leader ALG_PRO_Cardinals BYL				_	_			
PI Leader ALG_PRO_Cardinals BYL PI Stations ALG_PRO_Cardinals BYL Equation Leader ALG_PRO_Cardinals BYL				_	_			
PI Stations ALG_PRO_Cardinals BYL Equation Leader ALG_PRO_Cardinals BYL				ALG F	PRO Car			
Equation Leader ALG_PRO_Cardinals BYL -		ardinal St	lations	-	-			
	X Ca X Ca X PI	ardinal St Leader		_	_			
4 III >	Ca X Ca X PI V PI	ardinal St Leader Stations	3	ALG_F	PRO_Car	dinals	BYL	
	Ca X Ca X PI X PI	ardinal St Leader Stations	3	ALG_F	PRO_Car	dinals	BYL	
	Ca X Ca X PI V PI	ardinal St Leader Stations	3	ALG_F ALG_F	PRO_Car	dinals	BYL BYL	

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



The *View Stationing* dialog is populated with the predefined settings from the stored preferences. Notice the *interval* field and settings under the *symbology* section. The display toggles define what will display; the name column reflects the InRoads named symbology defining graphical attributes for displayed items.

There are several standard CDOT preferences to choose from, depending upon the type of alignment stationed 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 **Tools > 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 until presets becomes familiar.

10. **Experiment** with the various tabs and settings in the *View Stationing* dialog and investigate what changes are made when stationing is redisplayed.

🖌 View Station	ning				
	Transition Radii	Event Points	Vertical Stations		
Main Regu	lar Stations Cardinal		Station Equations		
L	MAJOR	MINC	Help		
Orientation:	Parallel	Orientation: OParallel			
	Perpendicular		Perpendicular		
Direction:	Up Station	Direction:	Up Station		
	Own Station		Down Station		
Placement:	Left -	Placement:	Right -		
Justification:	Right Center 👻	Justification:	Left Center 🔹		
Precision:	0 -	Precision:	0 -		
Format:	SS+SS.SS ▼	Format:	sss[+ss.ss] 🔹		
Offset:	1.00	Offset:	0.04		
Ticks		Ticks			
Left Offset:	-0.04	Left Offset:	t: -0.04		
Right Offset:	0.04	Right Offset	0.00		
Minors/Major: 4					
Include Affixes					
Apply Preferences Close					

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 3.6 - Defining Stationing

Section Objectives:

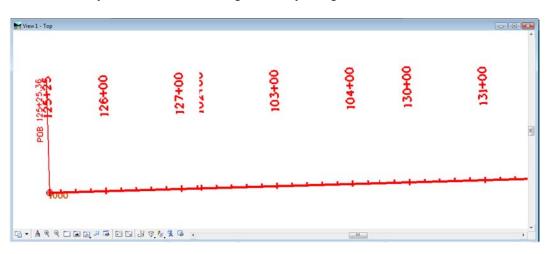
• Change the biginning station of an alignment.

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

1. Select **Geometry > Horizontal Curve Set > Stationing**. By default, this dialog 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	1					
Vertical and Superelevation Alignments Help								
Synchronize Starting Stations								
Maintain Station Difference								
Station Equations								
Back Station	Ahead Station							
	New	Edit		Delete				

- 2. Select **Synchronize Starting Stations** in the *Vertical and Superelevation Alignments* section.
- 3. Set the beginning station of alignment *SH* 86 by keying in 125+25.36 and choosing Apply.
- 4. Verify the change has been applied by redisplaying the stationing using Geometry > View Geometry > Stationing and clicking Apply. Also, check the beginning station value of any 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.

- Any point along the alignment can be specified as the location for the input stationing value. The alignment location defined by either *name* or the *northing* and *easting* fields is the location the input stationing will propagate from.
- 5. Set the beginning station of alignment *SH* 86 by keying in *32062.24* and choosing **Apply**.

🐂 Stationing			E	- • 💌
Horizontal Alignment:	SH 86	•	÷	Apply
Starting Station:	320+62.24			Import
Name:	1000			Report
Northing:	1558417.7	4	+	Close
Easting:	3267409.4	0		Help
Vertical and Supere Do Not Update Synchronize Star Maintain Station Station Equations	ting Stations			
Back Station		Ahead Static	'n	

6. Verify the change has been applied by redisplaying the stationing. Select Geometry > View Geometry > Stationing then click Apply.

Section Summary:

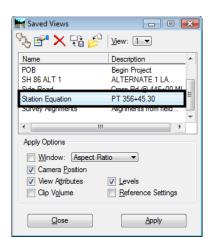
- When stationing is set for a particular point, the stationing for the remainder of the alignment (forwards and backwards).
- The reference to Superelevation in the Vertical and Superelevation Alignments area refers to geometry created in the 2004 edition of InRoads. It does not affect the superelevation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

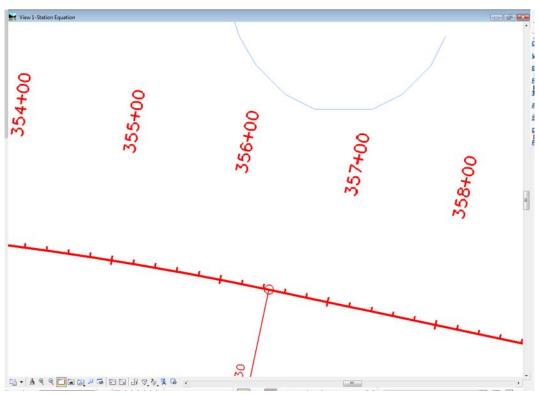
Lab 3.7 - Station Equations

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. Apply saved view Station Equation. Once applied, Close the *Saved View* dialog.





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

```
Back = 356+45.30
Ahead = 356+40.30
```

- 2. Select Geometry > Horizontal Curve Sets > Stationing. The *Stationing* dialog will appear.
- 3. Verify **SH 86** is the horizontal alignment.
- 4. At the bottom of the dialog, choose **New**.

🕌 Stationing				
Horizontal Alignment:	SH 86	•	+	Apply
Starting Station:	320+62.24		Ī	Import
Name:	1000			Report
Northing:	1558417.74 +			Close
Easting:	3267409.4	0		
Vertical and Supere Do Not Update Synchronize Star Maintain Station	ting Stations			Help
Back Station		Ahead Statio	on	
	New	Edit		Delete

- 5. In the resulting box, set the *Mode* to **By Station**.
- 6. Enter the *Back Station* and the *Ahead Station* as shown below.

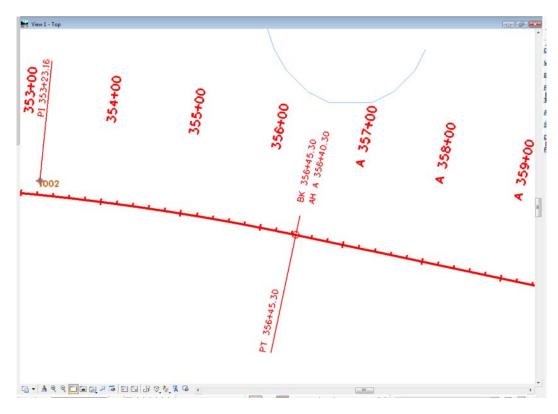
🕍 Add Statio	n Equations		—
Mode:	By Station		Apply
	By Northing/Easting	_	Close
Back Station:	356+45.30	-	Help
Northing:	155-8402.30		Theip
Easting:	3270987.32	+	
Ahead Station:	A 356+40.30		
Add Horizo	ntal Event Point		
Add Vertica	l Event Point		

7. **<D> Apply**.

8. **<D> Cancel** to close the *Add Station Equation* dialog. The station equation will be shown in the parent dialog.

🕌 Stationing				- • 💌
Horizontal Alignment:	SH 86	-	+	Apply
Starting Station:	320+62.24			Import
Name:	1000			Report
Northing:	1558417.74		+	Close
Easting:	3267409.40			Close
 Vertical and Superel Do Not Update Synchronize Star 	-	ments		Help
Maintain Station	-			
Station Equations				
Back Station		Ahead Statio	n	
356+45.30	4	\ 356+40.30		
	New	Edit		Delete

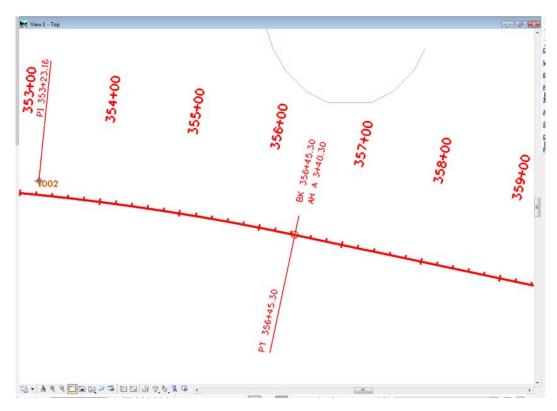
- 9. **<D> Close** in the *Stationing* dialog.
- 10. Redisplay the stationing for alignment **SH 86**.



- *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. If the prefix is undesirable, toggle on *Drop Station Equation Name* in the *View Stationing* dialog and redisplay the stationing.

🗑 View Stationing	- • •
Radius + A Transition Main Regular Stations	Radii Event Points Vertical Stations Cardinal Stations PIs Station Equations
Horizontal Alignment: SH	1 86 🔹 🕈 Help
Limits Station	
Start: 320+62.24	- + -
Stop: A 587+17.74	+
Interval: 100.00	Planarize Drop Station Equation Name
Symbology:	
Object	Name
Major Ticks	ALG_PRO_Sta-Major BYL
Major Stations	ALG_PRO_Sta-Major BYL =
Minor Ticks	ALG_PRO_Sta-Minor BYL
Minor Stations	ALG_PRO_Sta-Minor BYL
Cardinal Leader	ALG_PRO_Cardinals BYL
Cardinal Stations	ALG_PRO_Cardinals BYL
PI Leader	ALG_PRO_Cardinals BYL
PI Stations	ALG_PRO_Cardinals BYL
Equation Leader	ALG_PRO_Cardinals BYL 🚽
Apply	Preferences Close



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 atleast 1 letter, followed by the new station number.

Lab 3.8 - Horizontal Alignment Tracking

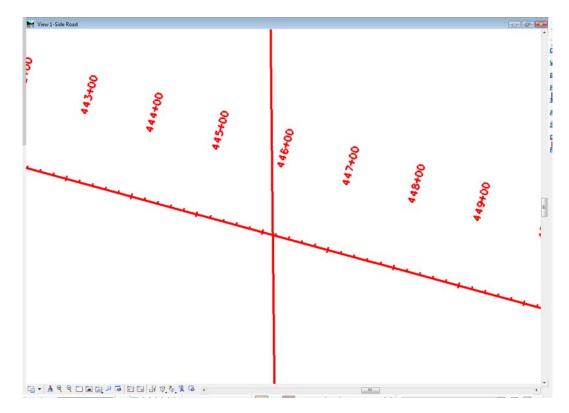
Two methods exist for receiving interactive information relative to a horizontal alignment. Both methods report on stationing, offset, elevation, etc. One method reports the elevation of the active surface, the other reports the elevation of the active vertical alignment.

Section Objectives:

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

Horizontal Alignment & Surface Elevation Tracking

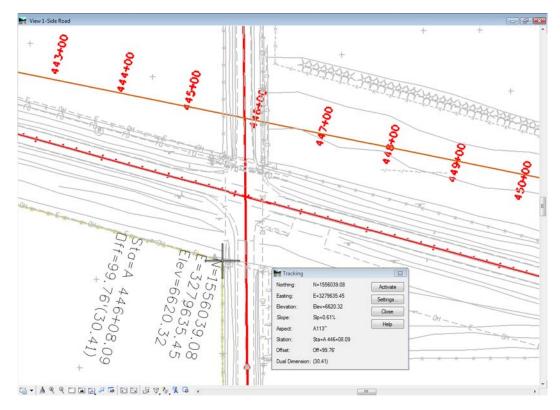
1. Recall Saved View Side Road.



In addition to reporting on station and offset information relative to the active alignment, the following method will report on information relative to the active surface.

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

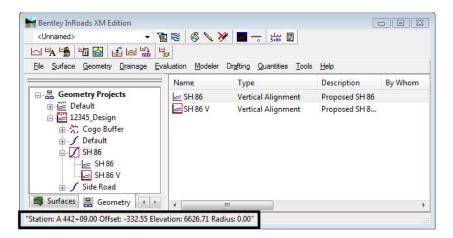
- 3. Select **Tools > Tracking > Tracking** to track both the active horizontal alignment and information relative to the active surface.
- Select Activate to initialize the command. Slide the cursor along the alignment to interactively update the display in the *Tracking* dialog. If a <D> (data point) is entered in the design file the information toggled on is displayed graphically.



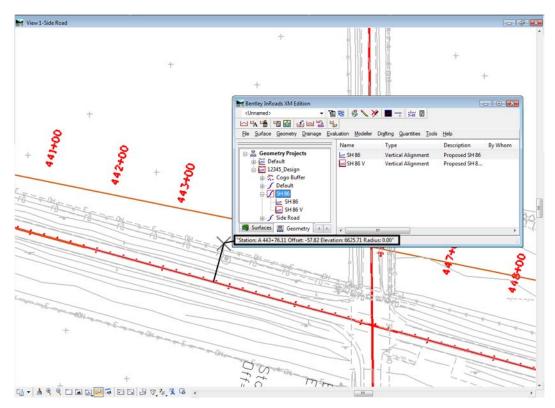
Note: Select the **Settings** button in the *Tracking* dialog to examine the attributes assigned to annotation placed in the MicroStation design file.

Horizontal & Vertical Alignment Tracking

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



- 2. The results display 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, **<D>** the offset displayed will be relative to the two alignments perpendicular to the active alignment.



Section Summary:

• Use the Tracking command to get surface information in relation the 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 disable the graphic display of items in the Tracking dialog box.
- Use the Horizontal Alignments tracking to get vertical alignment information in relation the the horizontal alignment.
- Horizontal Alignments tracking can not be displayed graphically.

Chapter Summary:

- 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. Items in the Stationing dialog box should only be changes 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 sufrace 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.
- Transpose alignments.

The following files are used in this lab:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Projects\12345\ROW_Survey\InRoads\InRoads\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 shortcut menu.



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

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

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

4. **<D> Open** then **Cancel** button. The *Open* dialog will close.

<u>File</u> Surface <u>G</u> eometry <u>Drain</u>	age	Evaluation Mode	eler Dr <u>a</u> fting <u>T</u> ools <u>H</u>	<u>H</u> elp
<unnamed></unnamed>	۷	Ta 📚 🚳 🔪	🔆 😿 🗾 🐜	
	_	Name	Style	Description
La Geometry Projects		\$ 13103	T_Edge of Oil	Edge of Oil
⊕ 📴 Default	_	\$ 13107	T_Edge of Oil	Edge of Oil
12345SURV_Fieldbook	k01	\$ 13205	T_Traffic No Pass	Traffic Control No Pass L
		\$ 13214	T_Traffic Single So	Traffic Control Single Soli
🖁 Geometry 🎦 Preference	< >	<		>

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.

	Verticals Cogo Points	
From Geometry Project:	12345SURV_Fieldbook01	Apply
Name Default 12345SURV_Fieldb	Description	Help
1201000111_10000		
To –		
To	FB-Working Copy]
	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	E dition Drainage <u>E</u> r	valuation <u>M</u> odele	er Dr <u>a</u> fting <u>T</u> ools <u>H</u>	
<unnamed></unnamed>	~ }	1 🛒 🚳 🔪	🏏 🤝 🔚 🐂	E
		Name	Style	Description
🖃 📇 Geometry Projec	ts	13103	T_Edge of Oil	Edge of Oil
🕀 🔛 Default		13107	T_Edge of Oil	Edge of Oil
🕀 🔚 12345SURV Fie		13205	T_Traffic No Pass	Traffic Control No Pass L
🗄 🚰 FB-Working Cop	у	13214	T_Traffic Single So	Traffic Control Single Soli
		13216	T_Traffic Single So	Traffic Control Single Soli
		16101	T_Fence>Barbed	Fence-Barbed Wire
몲 Geometry 🖻 Prefere	ence 🔹 🕨	✓ 16108	T Fence>Barbed	Fence-Barbed Wire

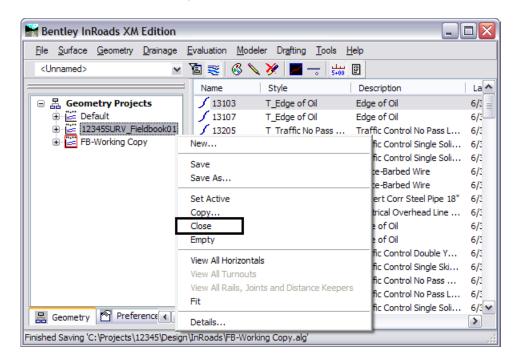
11. In the InRoads explorer window, **<R>** on the **FB-Working Copy** geometry project and select **Save As...** from the shortcut list. The *Save As* dialog will appear.

Bentley InRoads XM Edit	ion			
<u>File Surface G</u> eometry <u>D</u> rain	nage <u>E</u> valuation <u>M</u> od	leler Dr <u>a</u> fting <u>T</u> ools <u>I</u>	<u>H</u> elp	
<unnamed></unnamed>	🔺 🖥 📚 🤞 🕯	🔪 🎉 📕 🛶 🔛		
	Name	Style	Description	
Geometry Projects Default Urit 12345SURV_Fieldbor FB-Working Copy	Image: 13103 Image: 13107 Image: 13107	T_Edge of Oil T_Edge of Oil T_Traffic No Pass	Edge of Oil Edge of Oil Traffic Control No Pass L Traffic Control Single Soli Traffic Control Single Soli Fence-Barbed Wire Fence-Barbed Wire Culvert Corr Steel Pipe 18" Electrical Overhead Line Edge of Oil	
_	Empty		Edge of Oil Traffic Control Double Y	1 1
믎 Geometry 🔊 Preferen –	View All Horizontals View All Turnouts View All Rails, Joints a Fit	nd Distance Keepers	Traffic Control Single Ski Traffic Control No Pass Traffic Control No Pass L Traffic Control Single Soli	1
oggles Pencil/Pen mode	Details			>]

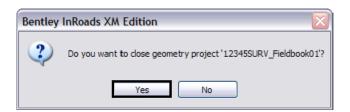
🙀 Save As							×
Save in:	퉬 InRoads			•	G 🤌	بي 🍋	•
œ	Name	Date modif	Туре	Size			
Recent Places	12345_Desi 12345DES_	ign.alg Wall-Lab.alg					
Desktop							
CDOT User							
Computer							
Network	File name:	FB-Working	Copy.alg			•	Save
	Save as type:	Geometry Pro	ojects (*.alg)			•	Cancel
							Help
	Active:	FB-Working (Сору			•	Options

- 12. Navigate to the C:\Projects\12345\Design\InRoads folder. If necessary, use the drop-down arrow in the *Active* field and reselect the desired name 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.

- **Note:** Ensuring that the saved Geometry name in the project folder matches the Geometry name displayed in InRoads explorer will minimizes confusion.
- The original geometry project generated by the survey staff is no longer required. In the InRoads explorer window, <R> on the geometry project name 12345SURV_Fieldbook and select Close from the fly-out menu.



- **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 assigned to some the roadway centerline shots, 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.

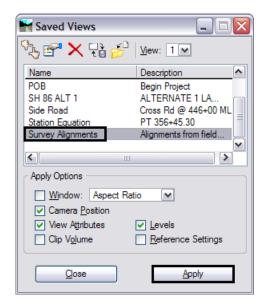
Renaming Horizontal Alignments

1. Right click on the InRoads icon in the top left corner of the view window and choose **View Save/Recall** from the shortcut menu.

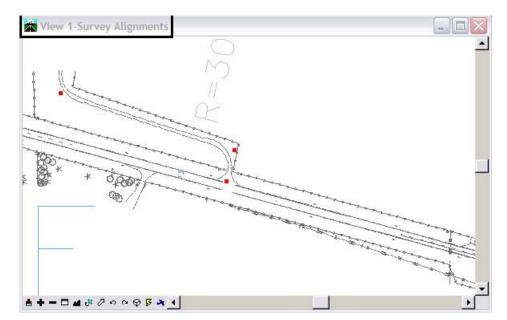


2. From the *Saved View* dialog box click on Survey Alignments.

3. Click on **Apply** and then **Close**.



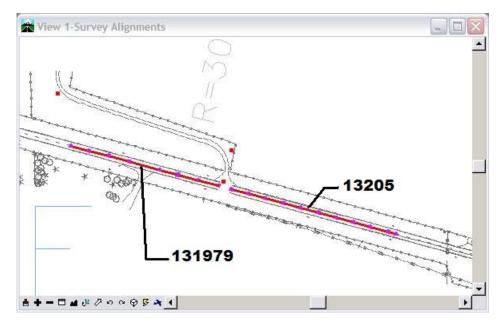
4. Verify that the view name includes Survey Alignments. The view window should look similar to the following image.



5. **Display** alignments **13205 & 131979** by righ clicking on the alignment and choosing **View** from the shortcut window.

Elle Surface Geometry Drainage Evaluation Modeler Drafting Tools Help <td< th=""><th>Bentley InRoads XM Edition</th><th></th><th></th><th>_</th><th></th></td<>	Bentley InRoads XM Edition			_	
Name Style Description 13103 T_Edge of Oil Edge of Oil Set Active 13107 T_Edge of Oil Edge of Oil Set Active 13205 T_Traffic No Pass Traffic Control No Pass L Delete 13214 T_Traffic Single So Traffic Control Single Soli Delete 13216 T_Traffic Single So Traffic Control Single Soli Delete 16101 T_Fence>Barbed Fence-Barbed Wire Fit 20429 T_Cul Corr Stl 18" Culvert Corr Steel Pipe 18" Review 131077 T_Edge of Oil Edge of Oil Edde of Oil Review 131077 T_Edge of Oil Edge of Oil Review Check Integrity 131077 T_Edge of Oil Edge of Oil Review Check Integrity 131081 T_Edge of Oil Edge of Oil Read-Only Read-Write 1312079 T_Traffic No Pass Traffic Control No Pass L Petails 131283 T_Traffic No Pass Traffic Control No Pass L Petails 132083 T_Traffic No Pass Traffic Control No Pass L	<u>File Surface G</u> eometry <u>D</u> rainage <u>F</u>	Evaluation <u>M</u> odel	ler Dr <u>a</u> fting <u>T</u> ools <u>H</u>	<u>H</u> elp	
Name Style Description Image Style Description New Image Image Image Style Description Image Image Image Image Style Description Image Image Image Image Style Description New Image Image Image Image Image Style Description Image Image Image Image Image Image Image New Image	<unnamed></unnamed>	1 😸 🚳 🔪	. 🏏 🗾 📶 😼		
Image: Set Active Set Active Image: Set Active Copy Image: Image: Set Active Copy Image: Image: Image: Set Active Copy Image:					
Image: FB-Working Copy 13205 T Traffic No Pass Traffic Control No Pass L Delete 13214 T_Traffic Single So Traffic Control Single Soli Delete 13214 T_Traffic Single So Traffic Control Single Soli Delete 13216 T_Traffic Single So Traffic Control Single Soli Delete 16101 T_Fence>Barbed Fence-Barbed Wire Fit 20429 T_Cul Corr Stl 18" Culvert Corr Steel Pipe 18" Edit 43132 T_Elect Overhead Electrical Overhead Line Check Integrity 131077 T_Edge of Oil Edge of Oil Review 131081 T_Edge of Oil Edge of Oil Read-Only 131884 T Traffic Single Sk Traffic Control Double Y Read-Write 1312079 T_Traffic No Pass Traffic Control No Pass Petails 132083 T_Traffic No Pass Traffic Control No Pass L Vetails					
16101 T_Fence>Barbed Fence-Barbed Wire View 16103 T_Fence>Barbed Fence-Barbed Wire Fit 20429 T_Cul Corr St 18" Culvert Corr Steel Pipe 18" Edit 43132 T_Elect Overhead Electrical Overhead Line Review 131077 T_Edge of Oil Edge of Oil Check Integrity 131081 T_Edge of Oil Edge of Oil Read-Only 131884 T_Traffic Single Sk Traffic Control Double Y Read-Write 131979 T_Traffic No Pass Traffic Control No Pass Vac Definition	🕀 🚟 FB-Working Copy	13214	T_Traffic Single So	Traffic Control Single Soli	Delete
20429 T_Cul Corr Sti 18" Culvert Corr Steel Pipe 18" Edit 43132 T_Elect Overhead Electrical Overhead Line Edit 131077 T_Edge of Oil Edge of Oil Edwert Corr Steel Pipe 18" 131081 T_Edge of Oil Edge of Oil Check Integrity 131081 T_Edge of Oil Edge of Oil Check Integrity 131884 T_Traffic Double Y Traffic Control Double Y Read-Only 131979 T_Traffic No Pass Traffic Control No Pass Petals 132083 T_Traffic No Pass Traffic Control No Pass L Arc Definition		16101	T_Fence>Barbed	Fence-Barbed Wire	
131077 T_Edge of Oil Edge of Oil Check Integrity 131081 T_Edge of Oil Edge of Oil Check Integrity 131081 T_Edge of Oil Edge of Oil Read-Only 131884 T_Traffic Single Sk Traffic Control Single Sk Read-Write 131979 T_Traffic No Pass Traffic Control No Pass Arc Definition		\$ 20429	T_Cul Corr Stl 18"	Culvert Corr Steel Pipe 18"	Edit
131682 T_Traffic Double Y Traffic Control Double Y Read-Only 131884 T_Traffic Single Sk Traffic Control Single Ski Read-Write 131979 T_Traffic No Pass Traffic Control No Pass Details 132083 T_Traffic No Pass Traffic Control No Pass L Arc Definition		131077	T_Edge of Oil	Edge of Oil	
I 131979 T_Traffic No Pass Traffic Control No Pass Details I 132083 T_Traffic No Pass Traffic Control No Pass L ✓ Arc Definition		131682	T_Traffic Double Y	Traffic Control Double Y	
		/ 132083 / 132128	-		 Arc Definition Chord Definition
Image: Second try Image: Second try Toggles the Feature Filter Lock Image: Second try					> .:

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



6. Select Geometry > Rename Geometry. The *Rename Geometry* dialog will appear.

Rename Geome		
уре:	Horizontal Alignment 🗸	Apply
From		Close
Geometry Project:	FB-Working Copy	Close
Horizontal Alignment:	131979 +	Help
Vertical Alignment:		
Name	Description Style	^
20429	Culvert Corr Steel Pip T_Cul Corr Stl 18"	
43132	Culvert Corr Steel Pip T_Cul Corr Stl 18" Electrical Overhead LT_Elect Overhea.	
43132 131077	Culvert Corr Steel Pip T_Cul Corr Stl 18" Electrical Overhead LT_Elect Overhea. Edge of Oil T_Edge of Oil	
43132 131077 131081	Culvert Corr Steel Pip T_Cul Corr Stl 18" Electrical Overhead LT_Elect Overhea. Edge of Oil T_Edge of Oil Edge of Oil T_Edge of Oil	
43132 131077 131081 131682	Culvert Corr Steel Pip T_Cul Corr Stl 18" Electrical Overhead LT_Elect Overhea. Edge of Oil T_Edge of Oil Edge of Oil T_Edge of Oil Traffic Control Doubl T_Traffic Double.	
43132 131077 131081 131682 131884	Culvert Corr Steel Pip T_Cul Corr Stl 18" Electrical Overhead LT_Elect Overhea. Edge of Oil T_Edge of Oil Edge of Oil T_Edge of Oil Traffic Control Doubl T_Traffic Double Traffic Control SingleT Traffic Single S	
43132 131077 131081 131682	Culvert Corr Steel Pip T_Cul Corr Stl 18" Electrical Overhead LT_Elect Overhea. Edge of Oil T_Edge of Oil Edge of Oil T_Edge of Oil Traffic Control Doubl T_Traffic Double.	
43132 131077 131081 131682 131884 131979 To	Culvert Corr Steel Pip T_Cul Corr Stl 18" Electrical Overhead LT_Elect Overhea. Edge of Oil T_Edge of Oil Edge of Oil T_Edge of Oil Traffic Control Doubl T_Traffic Double Traffic Control SingleT Traffic Single S	
43132 131077 131081 131682 131884 131979	Culvert Corr Steel Pip T_Cul Corr Stl 18" Electrical Overhead LT_Elect Overhea. Edge of Oil T_Edge of Oil Edge of Oil T_Edge of Oil Traffic Control Doubl T_Traffic Double Traffic Control SingleT Traffic Single S	
43132 131077 131081 131682 131884 131979 To	Culvert Corr Steel Pip T_Cul Corr Stl 18" Electrical Overhead LT_Elect Overhea. Edge of Oil T_Edge of Oil Edge of Oil T_Edge of Oil Traffic Control Doubl T_Traffic Double Traffic Control Single T_Traffic Single S Traffic Control No Pa T_Traffic No Pass	

7. From the *Type:* drop-down list select Horizontal Alignment.

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

Note: This alignment represents the centerline of existing pavement.

- 10. In the To section key in the Name: Ex CL Seg A.
- 11. In the *To* section key in the *Description: Ex centerline segment A*.
- 12. In the *To* section set the *Style: ALG_EXISTING*.
- 13. **<D>** the **Apply** button a confirmation dialog will appear.

Bentley InRoads XM Edition			×
Do you want to rename horizontal ali	gnment '131979' to 'Ex Yes	xisting CL Seg A' a	ind update the file on the disk?

- 14. **<D>** the **Yes** button.
- 15. **Rename** the centerline alignment 13205 as follows:
 - **Note:** You can use the dialog selection icon \bullet to graphically identify the alignments for renaming.
 - ♦ 13205

- Name: *Existing CL Seg B*
- Description: *Ex centerline segment B*
- Style: *ALG_EXISTING*
- *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 accomplished prior to the generation of Profile or Cross Section sets.
- 16. When done renaming the alignments **Close** the *Rename* dialog and check the InRoads explorer window to verify the results.

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File Surface Geometry Drainage Evaluation	n <u>M</u> odeler Dr <u>a</u> fting <u>T</u> o	ools <u>H</u> elp	
<unnamed> 🖌 👔 😴</unnamed>	🚳 📏 🎽 📕 🚽	<u>يبل</u>	
	Name	Description	Styl 🔨
🖃 📇 Geometry Projects	🖌 Existing CL Seg B	Ex centerline segment B	ALG_
🕀 📴 Default	🖌 Existing CL Seg A	Ex centerline segment A	ALG_
E-FB-Working Copy	Cogo Buffer		-
	\$ 3033132	Coniferous Tree Grove (T_C(
	\$ 3015105	Coniferous Hedge	T_C(
	\$ 3013111	Coniferous Trees Grove	T_C(
	\$ 3013109	Coniferous Trees Grove	T_C(
🖁 Geometry 🔊 Preferences 🗔 📢	<		>
Changes the snap mode to Element/Point/None			

Renaming Vertical Alignments

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

17. In the Workspace bar under the **Geometry** tab check the horizontal alignments for associated vertical alignments by expanding the + icon.

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	<u>F</u> ile	<u>S</u> urface	<u>G</u> eometry	<u>D</u> rainage	Evaluation	<u>M</u> odeler	Dr <u>a</u> fting	<u>T</u> ools <u>H</u> elp	
	<u< td=""><td>nnamed></td><td></td><td>~</td><td>1</td><td>6 🔨</td><td>💓 📕 ·</td><td> E</td><td></td></u<>	nnamed>		~	1	6 🔨	💓 📕 ·	E	
						Name		Туре	Description
		<u>.</u> /	131884		 • 	= Existi	ng Pave	Vertical Alignment	Surveyed Eleva d
		<u></u>	Existing CL						
				g Pavement					
		- -	Existing CL	-					
			📻 Existin	g Pavement					
			132083						
		÷~ 🖌	132128		~				
	몲	Geometry	🔊 Prefe	rences 🗔		<	Ш]	>
Тс	ggles	s Pencil/Pe	n mode						

18. Select **Geometry > Rename Geometry**. The *Rename Geometry* dialog will appear.

Rename Geomet	ry		
ype:	Vertical Alignment	~	Apply
From			Close
Geometry Project:	FB-Working Copy	~	
Horizontal Alignment:	Existing CL Seg A	+	Help
Vertical Alignment:	131979	+	
Name	D		_
131979	Description	Style	-
131373			
To			
Name:	Existing Pavement		
Description:	Surveyed Elevations		

19. From the *Type:* drop-down list select Vertical Alignment.

- 20. In the *From* section verify the *Geometry Project* is set to **FB-Working Copy**.
- 21. In the From section verify the active Horizontal Alignment is set to Existing CL Seg A.
- 22. In the *From* section *Vertical Alignment* list locate and **<D>** on alignment **131979**.

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

- 23. In the *To* section key in the *Name: Existing Pavement*.
- 24. In the *To* section key in the *Description: Surveyed elevations*.
- 25. In the *To* section set the *Style*: ALG_EXISTING_Vert.
- 26. **<D> Apply** then **<D> Yes** button.
- 27. Now set the active *Horizontal Alignment* to **Existing CL Seg B** to rename the vertical alignment associated with the horizontal alignment Existing CL Seg B.
 - **Note:** You can use the dialog selection icon \bullet to graphically identify the alignments for renaming.
- 28. In the *To* section key in the *Name: Existing Pavement*.
- 29. In the *To* section key in the *Description: Surveyed elevations*.

ype:	Vertical Alignment	*	Apply
From Geometry Project: Horizontal Alignment: Vertical Alignment:	FB-Working Copy Existing CL Seg A 131979	▼ ▼ + +	Close Help
Name 131979	Description	Style	

30. In the *To* section set the *Style*: ALG_EXISTING_Vert.

31. **<D> Apply** then **<D> Yes** button.

32. **<D> Close** the *Rename Geometry* dialog.

These changes have been made in a copy of the geometry project that was exported from the survey fieldbook. In this copy, some key horizontal and vertical alignments have been renamed, described, and assigned appropriate geometry styles to conform to CDOT standards with a naming convention that is more intuitive.

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

33. **<R>** on the geometry project **FB-Working copy** and select **Save As** from the fly-out menu.

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<u>File Surface Geometry Drai</u>	nage <u>E</u> valuation	<u>M</u> odeler D	r <u>a</u> fting <u>T</u> ools <u>H</u> elp	
<unnamed></unnamed>	v 🚡 😴	i 🖉 🔧 🕅	🗾 👓 📴	
		Name	Description	Styl
🖃 📇 Geometry Projects		13103	Edge of Oil	T_Ec
🗄 🔛 Default		13107	Edge of Oil	T_EC
🖃 📑 FB-Working Copy	New		fic Control Single Soli	T_Tr
E Cogo Buffer	C		fic Control Single Soli	T_Tr
1310100	Save		:e-Barbed Wire	T_F€
1310116	Save As		:e-Barbed Wire	T_Fe
	Set Active		ert Corr Steel Pipe 18"	_
1310128	Copy		rical Overhead Line	T_Ek
	Close		e of Oil	T_Ec
··· / 13107	Empty		e of Oil	T_Ec
131077	View All Horizon	tale	fic Control Double Y	T_Tr
🕀 🖌 131081	View All Turnou		fic Control Single Ski	_
🗎 🖌 131682	View All Rails, J		fic Control No Pass L	
🖁 Geometry 🔊 Preferenc	Fit	on na ana pista	fic Control Single Soli	T_Tr
eady	Details			•

 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.

Lab 4.3 - Transposing Alignments

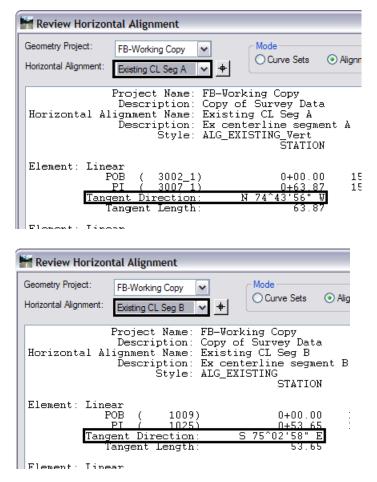
Transposing an alignment reverses the direction of that alignment. Tangent sections are reversed and left-hand curves become right-hand curves. The beginning stationing value is retained; however, any station equations previously defined are deleted. Associated vertical alignments are also reversed.

You may find the need to transpose an alignment if it was surveyed in a direction opposite from the direction you wish to design (up-stream vs. down stream). Other instances may be if you create an alignment by importing from graphics. InRoads will generate the alignment in the direction the MicroStation graphic was drawn which is not necessarily in the direction of 'up-station'. Or you may simply create an alignment in the wrong direction using any of the InRoads geometry commands.

Section Summary:

- Change the stationing direction using the Transpose command.
- 1. Use the review tools to evaluate both of the renamed horizontal alignments. What direction are the tangents running?

 You should notice that the alignment Existing CL Seg A runs northwest and that alignment Existing CL Seg B runs southeast.



- Alignments created by exporting an electronic fieldbook assume the direction of the data collection.
- Both alignments should run in a Southeasterly direction.
- 2. Select Geometry > Utilities > Transpose.

🐂 Transp	_ 🗆 🗙		
Alignment:	Existing CL Seg A	ŧ	Apply
Selected:			Close
Name	Descript Style		Filter
Existing CL	Ex centerlin ALG_EXI		
			Help

3. Select alignment **Existing CL Seg A** for transposing **<D> Apply**.

4. **Review** the alignment to verify the transposition.

ieometry Project: Iorizontal Alignment:	FB-Workin Existing C		Hode Curve	Sets 💿 A	lignment 🔿 Eler	nent	Close Save As
Horizontal Al	Descri ignment	ption: Cop Name: Exi ption: Ex	centerline EXISTING	y Data eg A segment	A NORTHING		Append Display Print
Tang	OB (<u>PI (</u> ment Dir	3039_1) 3034_1) rection: Length:		+00.00 +58_17 '41" E 58.17	1556806.64 1556791.17		Help
Tang	PI (PI (ment Dir	3034_1) 3028_1) Tection: Length:		+58.17 +20.81 '33" E 62.64	1556791.17 1556775.39		First < Previous Next >

5. Save the geometry project **FB-Working Copy**.

Section Summary:

• Always review geometry after making changes like Transpose to ensure that the command was completed as desired.

Chapter Summary:

- Take care not to inadvertently edit or delete other group's work. Communication is the key to reducing data loss.
- Survey geometry has name meaningful to them, but possibly not to other groups. Rename your copy of survey's geometry data.
- The direction of an alignment can be changed using the transpose command. Set the alignment to the direction that makes the most sense for the design.

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 joining cogo points together and the traversing commands.

Another aspect of this lab is to learn how to modify or create new geometry from geometry features that exist in a geometry project. An example of this would be to create parallel/offset alignment such as a centerline to represent the edge of road or other feature that parallels the centerline.

Chapter Objectives:

- Create a new geometry.
- Create alignment tangents.
- Define alignment curves.
- Learn how to define and modify alignment stationing.
- Annotate an alignment.
- Create a horizontal alignment form graphics.
- Modify an existing alignment.
- Create parallel horizontal alignments.

The following files are used in this lab:

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

A predefined workflow for creating geometry is not dictated by InRoads. However, a typical workflow might be:

- 1. Create or open an existing geometry project
- 2. Create horizontal alignments (or Cogo points)
- 3. Assign stationing for alignments
- 4. Define alignment 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

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.

Lab 5.1 - Review Geometry from Survey

Section Objectives:

- Understand the difference between Named and Unnamed cogo points and how to apply cogo point names
- 1. Start InRoads using your desktop icon and opening the file **12345DES_Model.dgn** from the **C:\Projects\12345\Design\Drawings\Reference_Files** directory.
- 2. Open up the InRoads *Options* dialog box from the menu bar under **Tools > Options** and review the settings in the **Geometry** tab.
 - *Note:* For descriptions of each of the items in the **Geometry** tab, refer to the *Practical Guide for Using InRoads*.

Options	Factors Ath	reviations Rail	
Tolerances Precision	Factors Abb General	Units and Format	Sight Distance Geometry
Plotting Heigh	nt:	0.00	Help
Seed Alignme	ent Name:	1	пор
Seed Point N	ame:	1	
Curve Defin	ition	·	
		Always Cor	nfim
Horizontal:	Arc	¥	
Vertical:	Parabolic	▼	
Measure:	 Along Arc 	Along Chord	
Degree of C	urve Length:	100.00	
Unit Station	Length:	100.00	
Define Transi Spiral Definition		Length Co Clothoid	nstant
.ICS Coordina	te Sequence:	Northing/Easting	~
Vertical Angle	Reference:	Zenith	~
Angular Mode) :	Bearings	~
Point Names	During Edits:	Do Not Assign	~
Default Acc		-	
Horizontal A		ad-Only Read-Writ	te
Cogo Buffer	:	0 0]
A	pply Pre	ferences Clos	se

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.

Hentley InRoads XM Edition								
<u>File Surface G</u> eometry <u>D</u> rainage <u>E</u> valu	uation <u>M</u> ode	eler Dr <u>a</u> fting <u>T</u> ools <u>H</u>	<u>l</u> elp					
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	Name	Style		Description				
Geometry Projects	Cogo But							
🕀 📴 Default	🖌 Default	Default	t					
🕀 🔛 FB-Working Copy	🖌 SH 86	ALG P	ŖO	Proposed SH 86				
12345_Design Cogo Buffer Default SH 86 SH 86 V Side Road	Side R	New Set Active Copy Delete Empty View Fit Edit Review Check Integrity Read-Only Read-Write	10	Side Road Alignment				
🔚 Geometry 🔊 Preferences 🔹	<	Details		>				
		Arc Definition		.::				

ieometry Project: 12345_Design 🗸 Iorizontal Alignment: SH 86 🗸	Mode O Curve Sets	Alignment 🔿 Eleme	ent	Close Save As
Project Name: 123			~	Append
Description: SH Horizontal Alignment Name: SH	86 Design Alignmen 86	ts		Disalau
Description: Pro				Display
Style: ALC		NODTUTNO		Print
_	STATION Named Point	NORTHING		
Element: Linear				Help
POB (1000) PC ()	100+00.00	1558417.74		
Tangent Direction:	111+08.62 N 88^19'40" E	1558450.09		Select
Tangent Length:	1108.62			
	Unnamed Point			First
Element: Circular / PC ()	111+08.62	1558450.09		< Previous
PI ()	113+47.31	1558457.06		< rievious
CC () PT ()	115/05 00	1537339.09		Next >
Radius:	115+85.98 21120.00	1558458.63	V	1.2.4
<		3		Last

- **Note:** If *Point Name During Edits* is set to **Named** 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.
- 5. To create point names for all alignment key points and add them to the Cogo Buffer, 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:*, *Proposed Alignment* for *Description:*, and select **ALG_PRO** for the *Style:*.
- 8. Click **Apply**.

efine By	y: Si	ngle Point	~			Apply	0
Add As			Locate By	/		Close	
🔿 Stati	ion and Offs	set	Name:	C			-
Northing and Easting		Northing	Northing 0.00		+ Help		
Cog	o Point		Easting	0.00			
Align	nment Point	to Cogo				ļ	
Seed	d Name: 20	0	Station		Offse	ts	
Description: Proposed Alignm Style: ALG_PRO		Start	and the second se		First		
		100+00.0	0 -	₽ 0.00		+	
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Add	Vertical Ev	ent Points	366+60.5	0	₽- 0.00		+
Comp Events			Vertical Alignmer				
NS	Station	Offset	Northing	Easting	Elevation	Style	

A Results dialog box will appear 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			_ 0
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	Arrest
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
	4117173117		25

- **Note:** The command **Geometry > Utilities > Assign Names** can also be used to add, delete, or rename geometry points.
- 9. Close the Results and Horizontal Events dialog boxes.

Lab 5.2 - Create New Geometry

Section Objectives:

• Learn how to create a geometry project and place holders for horizontal geometry data.

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

1. From the pull-down menu **File > New**.

Type:	Geometry Project	Apply
Name:	Default	Styles
Description:		Help
Style:		
Curve Definition:	Ŧ	
Existing	Description	
Default 12345_Design	SH 86 Design Alignments	

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

Name: Description:	Geometry Project 12345_Geometry Training Geometry Training class	Apply Help
Style: Curve Definition:	✓✓	
Name Default 12345_Design FB-Working Copy	Description SH 86 Design Alig y Copy of Survey Da	

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 into memory.
- 6. **<D> Apply** (Do not Close the New dialog box yet).

Note: InRoads created the geometry project and made it the active geometry project. Any horizontal alignments created will be placed in the active geometry project.

7. Verify that the new geometry project was created.

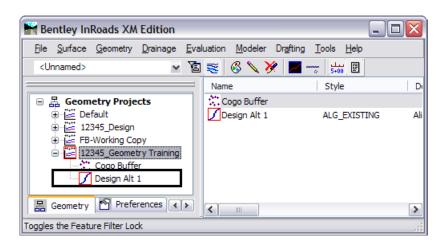


Note: This creates the geometry project where all new alignment data will be stored. At this point, it is held in RAM (Random Access Memory). When saved to the hard drive, the default extension will be *.alg, as was assigned to previous geometry projects.

- 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
 - Curve Definition: **ARC**

Description: Alignment by Alignment by Alignment by ALG_PRO	PI method
Style: ALG_PRO	
	~
urve Definition: Arc	*
Name Descriptio	n Style
Ivanie Descriptio	III Juyie

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



- 10. Verify the horizontal alignment is created in the active geometry project.
- 11. From the MicroStation pull-down menu select **Utilities > Saved Views**.

- 😽 Saved Views t, 🚰 🗙 🖓 <u>View:</u> 1 💌 Description Name Drive @ 180+00 Overlaping alignment Holder Driveway alignment from graphics POB Begin Project ALTERNATE 1 LAYOUT SH 86 ALT Side Road Cross Rd @ 446+00 ML Station Equation PT 356+45.30 Survey Alignments Alignments from fieldbook Apply Options Window: Aspect Ratio \mathbf{v} Camera Position View Attributes Levels Clip Volume Reference Settings Close Apply
- 12. From the *Saved Views* dialog **<D>** saved view name **SH 86 ALT 1**.

13. **<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 steps will be used to construct the tangents, then insert curves between the tangents once constructed.



- **Note:** The following labs 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.
- **Note:** For orientation screened graphics and curve radius values are shown for the alignment that will be created.

Lab 5.3 - Create Alignment Tangents

Section Objectives:

• Learn how to create horizontal alignments from PI to PI.

The first toolbox that we will use is the *Horizontal Curve Set* commands. These commands present an easy way to create alignments. They consist of five primary commands described below and may be accessed from a toolbar (shown) or from the pull-down menu under *Geometry* > *Horizontal Curve Set*.



Add PI is used to create a PI that begins a new alignment, or to add a PI onto either end of an existing alignment thereby extending it.

Insert PI is used to add a PI to an existing alignment between two existing PIs.

Move PI is used to change the location of a PI previously established.

Delete PI is used to remove a PI from an existing alignment. For removing more than one PI, you must choose and *Accept* each one individually. To remove all PIs associated with an alignment, but leave the alignment name, right-click on the alignment name in the Explorer menu and choose *Empty*.

Define Curve is used to either establish curves or to edit curves previously defined.

Stationing for establishing stationing or station equations along an alignment

Events are used to establish unique locations relative to an alignment, Cogo points, or the assignment of Cogo points along an alignments keypoints.

In this lab you will create an alignment using the Horizontal Curve Set, or PI method. First input the tangent sections of the alignment by selecting locations graphically. This is accomplished by $\langle D \rangle$ at the desired location. Once the tangents are in place, curves between these tangents will be defined.

1. Before beginning, verify the proper alignment is *Active*. This is necessary as any geometry entered will be populated in the active alignment.

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<u>File Surface G</u> eometry <u>D</u> rainage <u>Ev</u>	aluation <u>M</u> odeler [Dr <u>a</u> fting <u>T</u> ools <u>H</u> elp	
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	Name	Style	Descri
🖃 🖁 Geometry Projects	Cogo Buffer		
E Default I2345_Design FB-Working Copy I2345_Geometry Training Cogo Buffer Design Alt 1	🖌 Default	Default	
🔚 Geometry 🔊 Preferences 🔹	<		>
Defines a horizontal curve			

Design Alt 1 should be the active alignment. If not, several options exist to define it as the active alignment.

- Right-click <R> on the horizontal alignment name and select Set Active from the flyout menu.
- From the pull-down menu, select Geometry > Active Geometry and use the resulting dialog to set the active alignment.
- To clear the MicroStation view turn Off the Reference Display for the 12345SURV_Topo100Scale01.dgn in the *References* dialog box.

References (7 of 7 unique, 0 displayed)		
Tools Settings		
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Slot 🏱 File Name Model	Description Logical	Presentation 💽 🎜 🦎 🔒
1 12345SURV_Topo100Scale01.dgn CDOT Defau	t Global Origin aligne BM	Wireframe 🗸
Scale 1.000000 : 1.000000		»0'0"
Offset X -178956.971 Y -178956.971	∠ -178956.971 💽 🎝	N 🖓 🛄 🎞 🍌 < 🏢 🚳 😥 🗹
Live Nesting Allow Overrides <u>Depth</u> : 2	New Level Display: Config Variable 💌	

3. Select **Geometry > Horizontal Curve Set > Add Pl.** You are prompted in the MicroStation status bar to *Identify Alignment End*.

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



5. Continue to issue a series of points **<T>** and **<D>** through points **B-M**.



- 6. **<R>** (reset) when complete.
- 7. 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.

- Review Horizontal Alignment - O X Mode Geometry Project: 12345_Geometry Tra 🗸 Close O Curve Sets Alignment O Element Horizontal Alignment: Y Design Alt 1 + Save As. Project Name: 12345_Geometry Training Append. ~ Description: Horizontal Alignment Name: Geometry Training class Design Alt 1 Display Description: Alignment by PI method Style: ALG_EXISTING Print STATION EASTING NORTHING Element: Linear POB Help 0+00.00 13+47.31 N 88[^]19'40" E 1347.31 1558417.74 1558457.06 3267409.40 ΡI 3268756.14 Tangent Direction: Tangent Length: Einst. Element: Linear 13+47.31 32+60.94 ^37'22" E 1913.63 3268756.14 3270669.73 1558457.06 1558469.66 PI < Previous ΡĪ Tangent Direction N 89 Next > Tangent Length: Last < >
- 8. Review the new alignment using **Geometry > Review Horizontal...**

Following is a summary of the PI locations

PI	NORTHING	EASTING	BEARING	DISTANCE	STA.
Α	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.

The next lab teaches how to define the horizontal curves.

Lab 5.4 - Define Alignment Curves

Section Objectives:

- Learn how to add curves to horizontal alignments using various methods
- Learn how the Curve Calculator is useful in calculating an unknown curve radius

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 can 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.

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

	ntal Curve Set			
Horizontal PI				Apply
Define By: Kno	wn PI Coordinates	•	~	Close
Direction Back:	N 88^1	9'40'' E	+	
Length Back:	1347.31	1347.31		Undo
Point Name:				Rate Calc
Northing:	155845	7.06	+	Design Calc
Easting:	326875	6.14		Curve Calc
Direction Ahead:	N 89^3	7'22'' E	+	Report
Length Ahead:	1913.63		+	Help
				(note
- Horizontal Curve Curve Set Type:	⊙ SCS (○ scscs		
Define Transitions I	By: 💿 Length (🔾 Constant		
Leading Transition:	Clothoid	~	0.00	+
Radius 1:			21120.00	+
		_		
Compound Transiti	on: Clothoid	×	0.00	- + -
Compound Transiti Radius 2:	on: Clothoid	~	0.00	- + -
	on: Clothoid	 ✓ 		
Radius 2:	Clothoid	~	0.00	-#-
Radius 2: Trailing Transition: Define By: ③ Radi	Clothoid	Point Name:	0.00	-#-
Radius 2: Trailing Transition: Define By: • Radi	Clothoid us gent to Spiral		0.00	+ +
Radius 2: Trailing Transition: Define By: ③ Radi ① Tang ③ Spira	Clothoid gent to Spiral	Point Name:	0.00	+ +
Radius 2: Trailing Transition: Define By: Tadi Tang Spira Point	Clothoid gent to Spiral	Point Name: Northing: Easting:	0.00 0.00 1558457.0	· + •
Radius 2: Trailing Transition: Define By: ③ Radi ① Tang ③ Spira ③ Point ③ Ang	Clothoid gent to Spiral al to Tangent t on Curve	Point Name: Northing: Easting: PCC)	0.00 0.00 1558457.0 3268756.1	·+

- 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). Use the Curve Calc.... button 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.
- 11. Calculate based on a 5 degree 30 minute 17 second curve.
- 12. Key in **5 30 07** for the **DOC**: the field and verify that the **Lock** field is **Checked On**. (Verify the Radius option is unlocked and that only 2 fields shown below are locked).

H Curve Calculator	
Curve Lock Radius:	0.00
✓]DOC:	5^30'17"
Length:	0.00
<u>✓]Angle:</u>	15^30'17"
Chord:	0.00
Tangent:	0.00
External:	0.00
Ordinate	0.00
Compute: Si	mple Curve
Active Curve	Definition: Arc
Γ	Compute
OK Results	Help Cancel

13. **<D> Compute**.

Notice the changes that occur in the dialog.

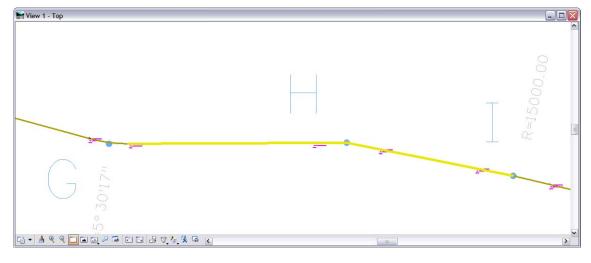
Curve	
Lock	
Radius:	1040.85
DOC:	5^30'17"
Length:	281.66
Angle:	15^30'17"
Chord:	280.80
Tangent:	141.70
External:	9.60
Ordinate:	9.51

14.	4. <d> OK</d> . The <i>Curve Calculator</i> dialog will close	and the calculated radius will be
	populated in the <i>Radius 1</i> field in the parent dialo	g.

		Set		
Horizontal PI Define By: Know	n PI Coordina		~	Apply
Direction Back:		S 74^45'19'' E		Close
Length Back:				Undo
Point Name:	2300).20	+	Rate Calc
Northing:	155	5931.76	- -	Design Calc
Easting:)408.64	= ♥	Curve Calc.
Direction Ahead:		1408.04 1^44'24'' E	+	
Length Ahead:	1726		+	Report
	1720	5.07	Ψ.	Help
Define Transitions By Leading Transition:				
Radius 1:	Clothoid	~	0.00	
naulus I.				-4
Compound Transition	Clatheid		1	
Compound Transition Badius 2:	^{n:} Clothoid	*	0.00	-4
Radius 2:	Ciotnoid		0.00	4
Radius 2: Trailing Transition:	Clothoid	 ✓ 	0.00	-4
Radius 2: Trailing Transition: Define By: ③ Radius	Clothoid		0.00 0.00 0.00	4
Radius 2: Trailing Transition: Define By: ③ Radius ◯ Tange	Clothoid s ent to Spiral	Point Name:	0.00 0.00 0.00	4
Radius 2: Trailing Transition: Define By: ③ Radius ◯ Tange	Clothoid s ent to Spiral to Tangent	Point Name:	0.00 0.00 0.00 155593	4 4 4 1.76 4
Radius 2: Trailing Transition: Define By: Radius Tange Spiral 1 O Point 0	Clothoid s ent to Spiral to Tangent	Point Name: Northing: Easting:	0.00 0.00 0.00 155593 3280403	
Radius 2: Trailing Transition: Define By: ③ Radius ○ Tange ○ Spiral 1 ○ Point o ○ Angle	Clothoid s ant to Spiral to Tangent on Curve	Point Name: Northing: Easting: C to PCC)	0.00 0.00 0.00 155593	

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

The next curve (location H) will also be developed 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*.

🖬 Define Horizontal Curve Set 📃 🗖 🔀							
Horizontal PI					Apply		
	^o l Coordina				Close		
Direction Back:	N 89	N 89^44'24'' E 🔶 🕂		- ф -		_	
Length Back:	1726	.67		+	Undo		
Point Name:					Rate Ca	lc	
Northing:	1555	939.60		-	Design C	alc	
Easting:	3282	135.29			Curve Ca	alc	
Direction Ahead:		^45'12'' E		+	Report		
Length Ahead:	1232	.01		-	Help	_	
Define Transitions By: Leading Transition:	 Length Clothoid 	O Consta	ent	0.00		+	
Radius 1:	Citilitid	U	<u> </u>	D 2-23-14	1	+	
Compound Transition:	Clothoid		~	0.00		+	
Radius 2:						+	
Trailing Transition:	Clothoid	(~	0.00		+	
Define By: 💿 Radius			_			_	
◯ Tangent	to Spiral	Point Nan	ne:				
O Spiral to	Tangent	Northing:		1555939.		+	
O Point on	Curve	Easting:		3282135.	29		
🔿 Angle up	to PCC (P	C to PCC)				+	
◯ Angle aft	er PCC (PC	C to PT)					
First < Previo	ous	Next >		Last	Sele	ect	

- 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 as noted in the drawing and 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:

• Understand how to 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. Key in *Starting Station: 100+00*. (Can be entered as 10000 and then tab out of the field)
- 3. **<D>** the **Apply** button.

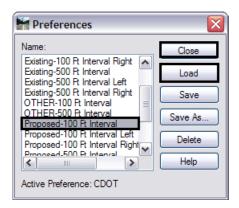
🖌 Stationing			
Horizontal Alignment:	Design Alt 1	+	Apply
Starting Station:	100+00.00		Import
Name:			Report
Northing:	1558417.74	+	Close
Easting:	3267409.40		Close
Vertical and Superel Do Not Update Synchronize Start Maintain Station I Station Equations	ing Stations		Help
Back Station	Ahead	Station	
	New Edi	t	Delete

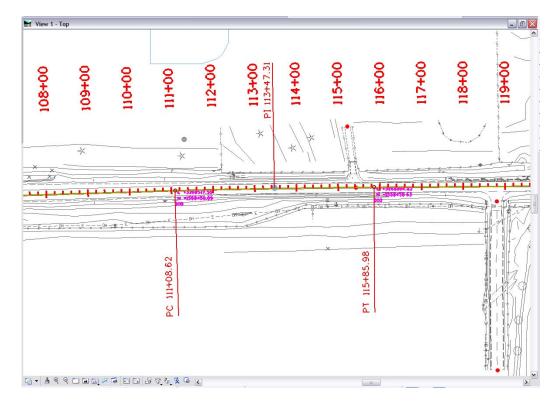
- 4. Verify your results using both of these methods:
 - Geometry > Review Horizontal
 - Tools > Tracking > Horizontal Alignments

	Stationing				
Radius			nt Points		cal Stations
Main	Regular Station	ns Cardinal Station	is Pls	Statio	on Equation
Horizont	tal Alignment:	Design Alt 1	~	+	Help
- Limits					
Sta	ation				
Sta	art: 100+00.00	- + -			
Sto	P: 366+60.60	-+-			
	300400.00		Planarize		
Interval	500.00		Drop Sta	tion Equi	ation Name
in iter ven	00.00				auon name
Symbolo	ogy:				
0)bject	Name			
🖂 Ma	ijor Ticks	ALG_PRO_		BYL	
⊠ Ma ⊠ Ma	ijor Ticks ijor Stations	ALG_PRO_ ALG_PRO_	Sta-Major	BYL	
⊠ Ma ⊠ Ma ⊠ Mir	ijor Ticks ijor Stations nor Ticks	ALG_PRO_ ALG_PRO_ ALG_PRO_	Sta-Major Sta-Minor	BYL BYL	
⊠ Ma ⊠ Ma ⊠ Mir	ijor Ticks ijor Stations nor Ticks nor Stations	ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_	Sta-Major Sta-Minor Sta-Minor	BYL BYL BYL ≣	
Ma Ma Mir Mir Mir Ca	ijor Ticks ijor Stations nor Ticks nor Stations rdinal Leader	ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_	Sta-Major Sta-Minor Sta-Minor Cardinals	BYL BYL BYL ⊟ BYL	
Ma Ma Mir Mir Ca Ca	ijor Ticks ijor Stations nor Ticks nor Stations rdinal Leader rdinal Stations	ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO	Sta-Major Sta-Minor Sta-Minor Cardinals Cardinals	BYL BYL BYL BYL BYL BYL	
Ma Ma Mir Mir Ca Ca Ca PI	ijor Ticks ijor Stations nor Ticks nor Stations rdinal Leader	ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_	Sta-Major Sta-Minor Sta-Minor Cardinals Cardinals Cardinals	BYL BYL BYL ⊟ BYL	
Ma Ma Mir Mir Ca Ca Ca Ca Ca PI	jor Ticks jor Stations nor Ticks nor Stations rdinal Leader rdinal Stations Leader Stations	ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO	Sta-Major Sta-Minor Sta-Minor Cardinals Cardinals Cardinals Cardinals	BYL BYL BYL BYL BYL BYL BYL	
Ma Ma Mir Ca Ca Ca Ca Ca Ca Ca Ca Ca Ca Ca Ca Ca	jor Ticks jor Stations nor Ticks nor Stations rdinal Leader rdinal Stations Leader	ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_	Sta-Major Sta-Minor Sta-Minor Cardinals Cardinals Cardinals Cardinals Cardinals Cardinals	BYL BYL BYL BYL BYL BYL BYL	
Ma Ma Mir Mir Ca Mir Ca Ca P P Eq Eq Eq Eq Eq	jor Ticks jor Stations nor Ticks nor Stations rdinal Leader rdinal Stations Leader Stations uation Leader uation Stations ent Leader	ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PEVEN	Sta-Major Sta-Minor Sta-Minor Cardinals Cardinals Cardinals Cardinals Cardinals Cardinals Cardinals T_Points	BYL BYL BYL BYL BYL BYL BYL BYL BYL BYL	
Ma Ma Mir Mir Ca Ca P P E G E E E E E E E E	jor Ticks jor Stations nor Ticks nor Stations rdinal Leader rdinal Stations Leader Stations uation Leader uation Stations	ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_EVEM	Sta-Major Sta-Minor Sta-Minor Cardinals Cardinals Cardinals Cardinals Cardinals Cardinals Cardinals T_Points	BYL BYL BYL BYL BYL BYL BYL BYL BYL BYL	
Ma Ma Mir Mir Ca Mir Ca Ca P P Eq Eq Eq Eq Eq	jor Ticks jor Stations nor Ticks nor Stations rdinal Leader rdinal Stations Leader Stations uation Leader uation Stations ent Leader	ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PRO_ ALG_PEVEN	Sta-Major Sta-Minor Sta-Minor Cardinals Cardinals Cardinals Cardinals Cardinals Cardinals Cardinals T_Points	BYL BYL BYL BYL BYL BYL BYL BYL BYL BYL	
Ma Ma Mir Mir Ca Ca P P E G E E E E E E E E	jor Ticks jor Stations nor Ticks nor Stations rdinal Leader rdinal Stations Leader Stations uation Leader uation Stations ent Leader	ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_PRO ALG_EVEM	Sta-Major Sta-Minor Sta-Minor Cardinals Cardinals Cardinals Cardinals Cardinals Cardinals Cardinals T_Points	BYL BYL BYL BYL BYL BYL BYL BYL BYL BYL	

5. Select Geometry > View Geometry > Stationing.

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





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

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

🖌 Scale Factors 📃 🗆 🔀						
Text:	40.0000		Apply			
Cell:	40.0000	_ ė [Close			
Line Style:	40.0000					

Lab 5.6 - Annotating an Alignment

Section Objectives:

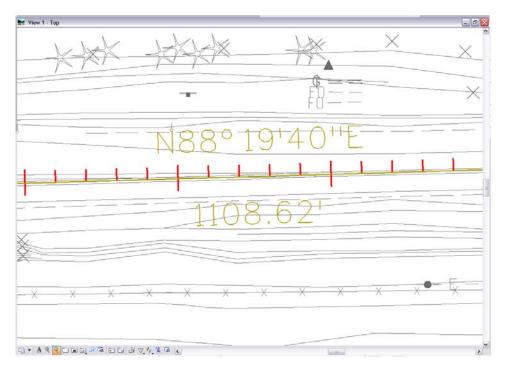
Understand the difference between Named and Unnamed cogo points and how to apply cogo point names.

• Learn how to annotate an alignment.

View Horizontal Annotation	
Main Tabling Styles	
Horizontal Alignment: ALG_EXISTING	erwrite
Cogo Points: Default	<u> </u>
Horizontal Alignments Include: Design Alt 1 Selected: Name Description Style Design Al Alignment byALG_E	Cogo Points Include: Selected: Name Descr Style
✓ Display As Complex Linestring	
	Annotate
Points On-Alignment Event Points	Points Elements
Off-Alignment Station Equation	
	Dual Dimensions
Radials Tangents	✓ Try Alternate Styles
Chords Subtangents	Extend Beyond Element
Planarize	
Apply Interactive	Preferences Close

1. Select Geometry > View Geometry > Horizontal Annotation.

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



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 an alignment PI
 - Redefine one or more horizontal curves
 - Define alignment stationing as ending 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
 - Create a profile showing the existing ground profile along the copied alignment with a 2x vertical exaggeration

Lab 5.7 - Horizontal Alignment from Graphics

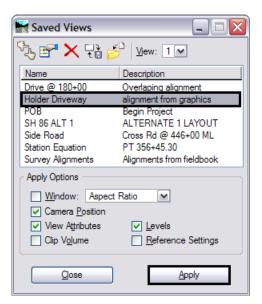
Section Objectives:

• Learn how to create a new horizontal alignment from MicroStation graphics.

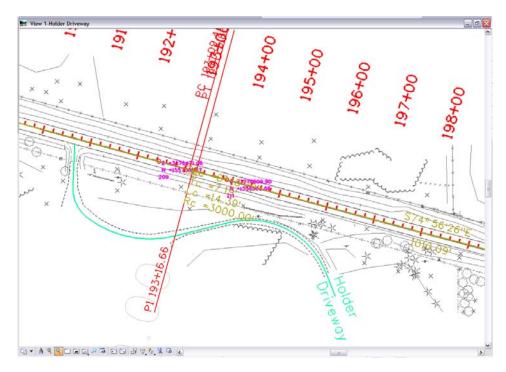
Alignments can be created from existing MicroStation graphics. In this exercise a chained MicroStation element will be used to create an alignment.

1. From the MicroStation pull-down menu select **Utilities > Saved Views**.

2. From the *Saved Views* dialog **<D>** saved view name **Holder Driveway**.



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



4. Select File > Import > Geometry. The Import Geometry dialog will open.

Horizontal Alignments, Horizontal and Vertical Alignments, Cogo Points or Event Points can be imported from MicroStation graphics. If the alignment has curves, it is recommended to toggle on **Resolve Gaps and Nontangencies**. If the alignment was drawn as a series of lines and/or arcs that have not been chained together as complex elements toggle on **All Selected Elements Added to Single Alignment** (you must define a Fence or Selection Set of the elements).

After specifying the *Name*, the *Description* and the *Style*, choose **Apply**. If you created a Selection Set or defined a fence prior to initializing the command, you will be asked to Accept the contents. If this was not done, you'll be asked to identify the element. In either case, after accepting, an alignment or alignments will be added to the geometry project specified in the *Target* section.

- 5. Fill in the following information on the **From Graphics** tab:
 - Type: Horizontal Alignment
 - Name: *Holder Driveway*
 - ♦ Description: *Driveway at Sta 190+80 RT*
 - ♦ Style: *ALG_SECONDARY*
 - Geometry Project: **1234_Geometry Training**
- 6. **<D>** the **Apply** button. The *Import Geometry* dialog will minimize allowing you to see more of your MicroStation view.

🐂 Import Geo	🖬 Import Geometry 📃 🗆 🔀							
From Graphics	ICS Vertical from Surface							
Туре:	Horizontal Alignment	Apply						
~ Geometry -	Geometry							
Name:	Holder Driveway							
Description:	Drive at Sta 190+80 RT							
Style:	ALG_SECONDARY	Help						
Horizontal Cu	rve Definition: Arc							
Vertical Curv	e Definition: 🗸 🗸							
Geometry Pro	ject: 12345_Geometry Training							
Horizontal Ali								
Tionzontai Air	gnment: Design Alt 1							
Use Fence	Resolve Gaps and Nontangencies							
Join Elemer	nts 📃 No Duplicate Cogo Points							
All Selected	Elements Added to Single Alignment							
Attribute Tag	8							
Use Tag I	Data							
Project:	Active 😽							
Name Cor	nflicts: No Overwrite 🗸							
	Close							

- 7. When prompted to Identify Element **<D>** on the MicroStation graphic drawn in the center of the driveway.
- 8. **<D>** again to accept the highlighted graphics in the MicroStation view.
- 9. **<R>** in the MicroStation view to terminate the command. The *Import Geometry* dialog will restore. The MicroStation graphics have been imported as an alignment.

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

- 10. **<D>** the **Close** button to close the *Import Geometry* dialog.
- 11. Verify the alignment was created.

Hentley InRoads XM Edition			_ 🗆 🛛
<u>File Surface Geometry Drainage Eval</u>	uation <u>M</u> odeler	Dr <u>a</u> fting <u>T</u> ools <u>H</u> elp	
<unnamed> 💌 🚡</unnamed>	😣 🗞 📚	🖉 📩 🚽 🖉	
	Name	Style	Descri
🖃 📇 Geometry Projects 🛛 🔺	Cogo Buffer		
	∫ Default	Default	
🖁 Geometry 🔊 Preferences 🔹	<		>
Changes the snap mode to Element/Point/None	2		

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

ieometry Project: 12345_Geometry Tr: Iorizontal Alignment: Holder Driveway	ets 💿 Alignment 🔿 E	Bement		Close Save As
Project Name: 12345_Geometry Description: Geometry Traini Horizontal Alignment Name: Holder Drivevay Description: Drive at Sta 19 Style: ALG_SECONDARY	ng class 0+80 RT			Append Display Print
STA	TION NORTHIN	G EASTING		TIME
PC () 0+8 Tangent Direction: S 2^35'4 Tangent Length: 8	0.00 1557036.2 6.63 1556949.7 1"W 6.63			Help Select First
PI () 1+2 CC () PCC () 1+5	6.63 1556949.7 5.77 1556910.6 1556946.3 8.77 1556886.8 5.00	2 3276293.09 2 3276369.79	~	< Previous Next >

- 13. When finished Close the dialog box.
- 14. Time permitting, display the alignment graphics, stationing, and curve information.

Lab 5.8 - Extend Alignment

Section Objectives:

• Learn one of the tools used to modify existing alignments.

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.

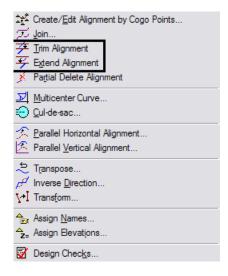
- 1. Select Geometry > Utilities > and hold.
 - **Note:** If the commands for Trim and Extend Alignment are not listed in the menu, this means that they are not enabled. These 2 commands are an extension of the Horizontal & Vertical Elements command set which must be enabled.

粱	Create/Edit Alignment by Cogo Points
\mathcal{T}	Join
×	Pa <u>r</u> tial Delete Alignment
Z	Multicenter Curve
€	<u>C</u> ul-de-sac
12	Parallel Horizontal Alignment
2	Parallel <u>V</u> ertical Alignment
₽	T <u>r</u> anspose
P	Inverse Direction
ΥI	Trans <u>f</u> om
<u>-</u>	Assign <u>N</u> ames
	Assign Elevations
7	Design Chec <u>k</u> s

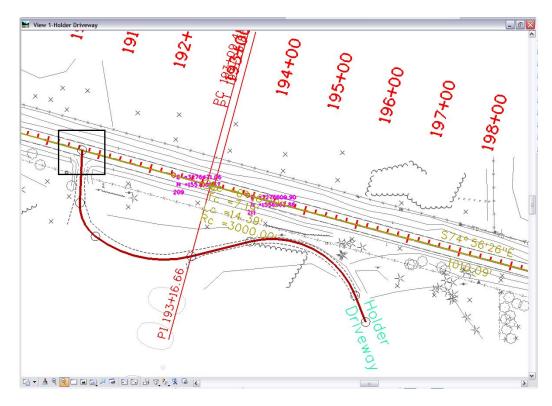
2. Select Tools > Application ADD-Ins.

GENIO Translator Add-In										OK	
IGENIO ITansiator Add-in										UN	_
Global Scale Factors Add-In								100		Canc	el
Graphics Translator Add-In								G			
Horizontal and Vertical Elements Add-Ir										Help	
Hydrology and Hydraulics Add-In											
									1		
Command		ba l		-						42	
Geometry>Horizontal Element>Add Fix	X	X	2	X	X		-		X	-	
Geometry>Horizontal Element>Add Flo	X	X		X	Х	-	20		X	-	1
Geometry>Horizontal Element>Add Fre	X	X	2.5	X	X	-	-	•	X	-	
	X	X		X	X	-	52		X	-	
Geometry>Horizontal Element>Add Fix					20				3.0		
Geometry>Horizontal Element>Add Fix Geometry>Horizontal Element>Add Flo	X	X		X	X	-	-	-	X	-	
		X X	1	XXX	X X X	ŝ.	23		×××	5	
curve sets. These components are then (and a	burden 1		gnmer	nt.			-

3. Enable Horizontal and Vertical Elements Add-In.



- 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 and is assigned a station value of -0+12.41. The negative value is due to the original points in the alignment retaining their assigned station locations.
- 8. From the pull-down menu **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 and are prompted to select alignments. However, the location of the data point in response to *Identify portion to clip* will determine both the alignment and the portion that will be eliminated.

Lab 5.9 - Saving Geometry

Section Objectives:

• Understand the importance of frequently saving InRoads design data.

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.

Geometry projects can be saved using several methods including:

- 1. From the pull-down **File > Save > Geometry Project**. The *Save As* dialog will appear with the *Save as type:* set to **Geometry (*.alg)**.
- 2. Verify you are in the correct project directory C:\Projects\12345\Design\InRoads.

Note: If the geometry project is already saved, then perform a **Save** operation instead of a **Save As** (see below).

Save As						? 🔀
Save in:	inRoads		~	G Ø		
My Recent Documents	間 12345_Design 間 12345DES_W 間 FB-Working C	alls-Lab.alg				
Desktop						
My Documents						
	File name:	12345_Geometry Training.alg			~	Save
	Save as type:	Geometry Projects (*.alg)			~	Cancel
My Computer						Help
	Active:	12345_Geometry Training			~	Options

- 3. The file name should match the *Active:* name at the bottom of the *Save As* dialog. If necessary, use the drop-down arrow in the *Active:* field and reselect the desired name to ensure the saved file name will match the surface 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 will close.

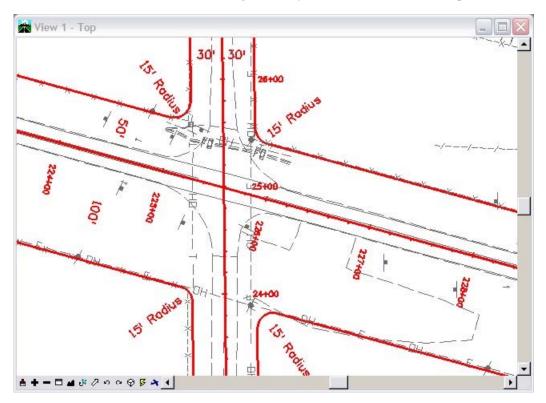
Lab 5.10 - Creating Parallel Horizontal Alignments

Section Objectives:

• Learn additional tools for creating 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.

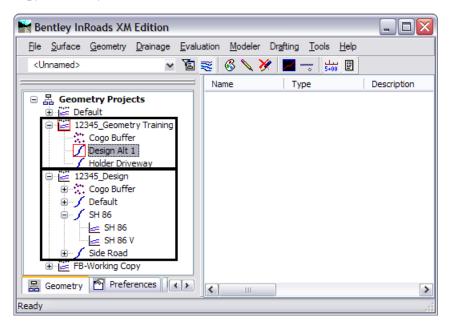
In this lab we will generate right-of-way limits for the mainline road and the side road. The Side Road has a right-of-way width of 60' (30' on each side of centerline). The mainline alignment has a total right-of-way width of 150' being 50' feet north of the reference line and 100' south. At the intersection 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.



1. Select Geometry>Copy Geometry.

rojects Horizontals	/erticals Cogo Points		Apply
Geometry Project:	12345_Design	~	
		- +1	Help
Name Default	Description Style	<u>+</u>	
	oposed SH 86 ALG PRO		
	de Road Alignm ALG_PRO		
Side Road Si			
Side Road Si			
Side Road Si	de Road Alignm ALG_PRO		
Side Road Si ✓ Include All Children To Geometry Project:	de Road Alignm ALG_PRO 12345_Geometry Training		

- 2. Copy the alignment Side Road from geometry project **12345_Design** to the geometry project **12345_Geometry Training**.
 - **Note:** Also copy alignment **SH 86** as **SH 86 ALT 1** if you feel the mainline alignment created by an earlier lab exercise may be problematic.
- 3. Verify the alignment was copied.

Hentley InRoads XM Edition			_ 🗆 🔀
<u>File Surface Geometry Drainage Eva</u>	luation <u>M</u> odeler D	Dr <u>a</u> fting <u>T</u> ools <u>H</u> elp	
<unnamed> 🗸 📔</unnamed>	I 📚 🚳 🔪 🏏		
	Name	Туре	Description
□ ☐ Geometry Projects □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ <td><u> </u></td> <td>Vertical Alignment</td> <td>Side Road Align.</td>	<u> </u>	Vertical Alignment	Side Road Align.
🔚 Geometry 🔊 Preferences 🔹			>
Toggles Pencil/Pen mode			

4. Set the geometry project **12345_Geometry Training** as *Active* causing newly created geometry to populate this project.

The next step is to generate the radius returns. This is done by using the *Multi-Center Curves* command. Begin by creating the radius returns north of the mainline alignment.

- 5. From the *Saved Views* dialog **<D>** saved view name **Side Road**.
- 6. Click **Apply**.

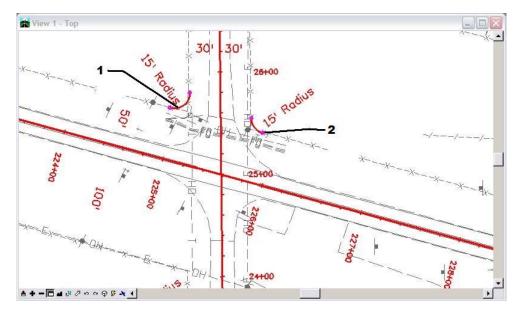
Multicent	er Curve			
	nced			
Curve Type:	One Center	~		Help
Radii				
Radius 1:	15.00	+	⊂ Widths	
Radius 2:	40.00	+	Width 1: 30.00	-
Radius 3:	120.00	- + -	Width 2: 50.00	+
Define By-				
Offsets a	at Shifted PC/PT	Offse	ets at PCC/PCC 🛛 Le	ngth
Use Sec	cond Set of Values			
Offset 1:	2.00	+	Length 1: 0.00	- ф -
Offset 2:	2.00	+	Length 2: 0.00	+
	Width	Alignment	T Alignment 2	

7. Select Geometry > Utilities > MultiCenter Curve.

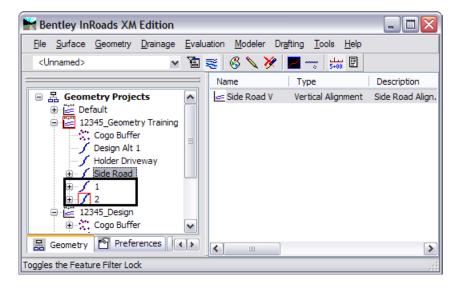
- 8. Choose **One Center**.
- 9. Input the following values:
 - ♦ Width 1: *30*
 - ♦ Width 2: *50*
 - ◆ Radius: *15*
- 10. **<D>** the Apply button. Follow the prompts.
- 11. In the MicroStation view **<D>** on the **Side Road** alignment.
- 12. **<D>** on the **SH 86** alignment.
- 13. **<D>** in the *Northwest* quadrant
- 14. **<D>** to accept and create an alignment representing the radius return.
- 15. **Repeat** steps 7-12 and **<D>** in the *Northeast* quadrant.

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.



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 *Offset Alignments by Station* command.

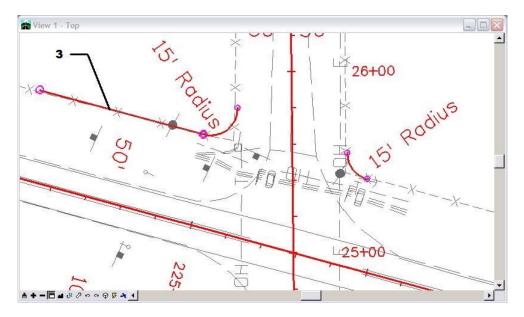
16. From the MicroStation pull-down menu, select Utilities > Keyin. The key in browser is needed to input the desired station limits and offset distances. Without this, they could be defined graphically.

Key-in	$\overline{\mathbf{X}}$
	v 🛱 🕰 🗸

- 17. From the InRoads pull-down menu Geometry > Utilities > Parallel Horizontal Alignment....
- 18. In the *Parallel Horizontal Alignment* dialog box toggle on **Interactive By Station** and then click **Apply**.
- 19. In the MicroStation view **<D>** on the mainline alignment.
- 20. At the prompt *Identify First Station/Key in Station*, key in 224+00.
- 21. **<D>** the **Run** button or press the Enter key.

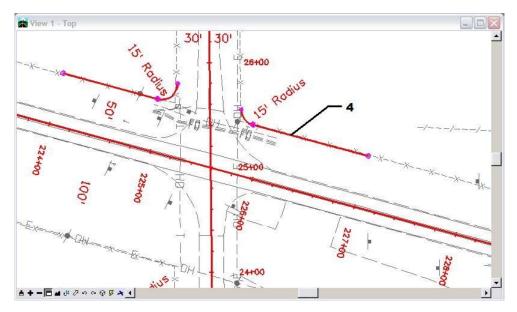
😽 Key-in			X
22400	te	Q	•

- 22. At the prompt *Identify Second Station/Key in Station*, key in 224+93.20.
- 23. **<D>** the **Run** button.
- 24. For *Identify Location:* key in -50(50' to the left).
- 25. **<D>** the in the view window to accept the solution and alignment 3 is created and displayed.

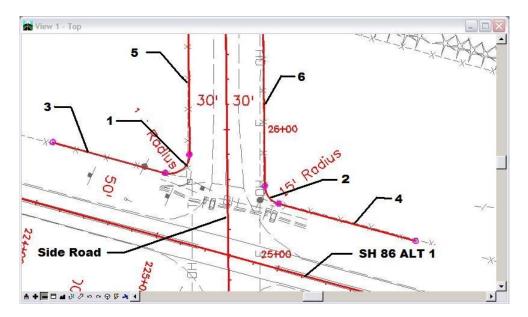


- 26. Repeat the **Geometry > Utilities > Parallel Horizontal by Station** command to the east of the sideroad using the following data:
 - ♦ Station limits of: 225+86.76 to 227+00, 50' left of US 86 Alt 1
 - *Note:* The station limits can be graphically selected by issuing a data **<D>** point in the MicroStation view. The offset distance can also be graphically selected but using the key in field allows a specific distance to be input.

Alignment 4 is created and displayed.



27. Re-execute the command to create the alignments along the Side Road north of the radius returns.



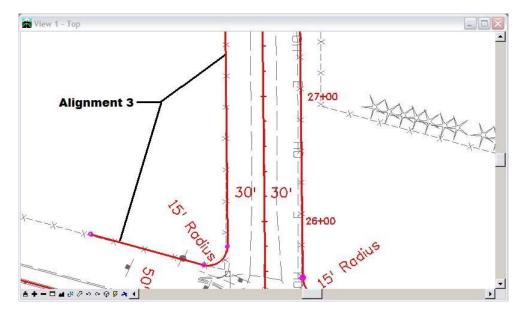
Next we will use the Join Alignment command to connect the alignments created in the previous steps single alignments for each quadrant. This command operates by either connecting the components with a straight line segment or by paralleling an alignment to define the configuration of the created geometry.

Join alignments 3, 1, & 5 to create the Northwesterly right-of-way limits.

28. Select Geometry > Utilities > Join.

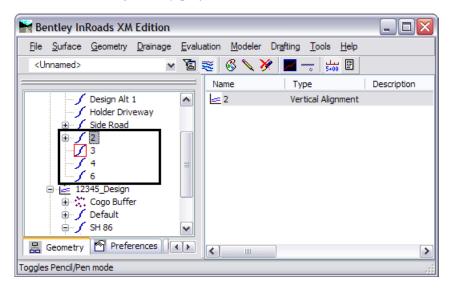
🖬 Join	_ 🗆 🖂
Delete Original Alignments	Apply
	Close
	Help

- 29. Check 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.
- 30. **<D>** the **Apply** button and follow the prompts.
- 31. *Identify Initial Alignment:* **<D>** on alignment **3**.
- 32. *Identify Alignment to Parallel/Skip:* **<D>** alignment **1** to parallel (overlay) this alignment.
 - **Note:** If a reset **<R>** is issued in the above step, a tangent line would be created from the end of alignment 3 to the beginning of alignment 5. By selecting the alignment representing the radius return, a curved section is generated at a zero offset to alignment 1.
- 33. *Identify Next Alignment:* **<D>** on alignment **5**.
- 34. *Accept or Reject:* **<D>** to accept the dynamic display.



35. Reset **<R> <R>** twice to terminate the command.

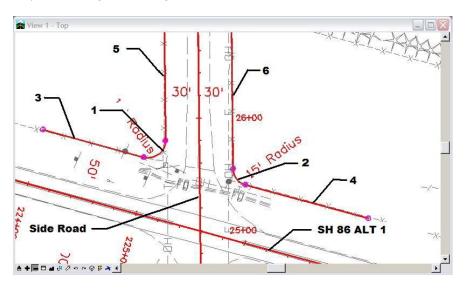
Alignment 3 is now the combination of the alignments 3, 1, and 5. Alignments 1 and 5 are removed from the geometry project.



36. Review alignment 3.

Review Horizontal Alignment					
Geometry Project: 12345_Geometry Tr; Horizontal Alignment: 3	Mode O Curve Sets ③	Alignment 🔿 Elemer	t		Close Save As
Project Name: 12345_C Description: Geometr Horizontal Alignment Name: 3 Description: Style: Default	y Training cla				Append Display
Style. Delault	STATION	NORTHING	EASTING	=	Print
Element: Linear FOB () FC () Tangent Direction: S Tangent Length:	222+13.60 223+06.80 5 74^45'19" E 93.20	1556223.24 1556198.73	3279529.29 3279619.21		Help Select
Non-collinear					First
Element: Circular FC () FI () CC ()	223+06.80 223+26.65	1556198.73 1556193.52 1556213.21	3279619.21 3279638.36 3279623.15	~	< Previous Next > Last
			>		Lust

37. Using the same steps above, join alignments 6, 2, and 4 to create the northeasterly right-ofway limits; begin with alignment **6**.

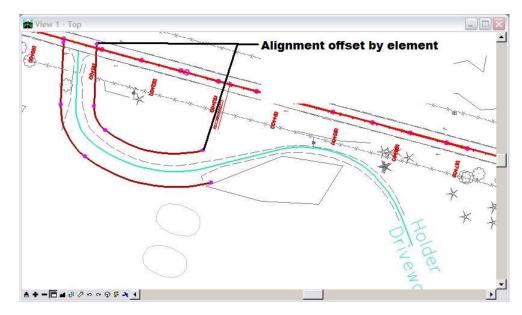


Once the above step is completed, alignments 3 and 6 define the right-of-way limits on the north side of the intersection.

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

38. Choose Geometry > Utilities > Parallel Horizontal by Element.

Parallel *by Element* differs from by Station in that you can select the limits of the alignment to offset by selecting, **<D>**, alignment components (tangent or curve) 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 the path of the horizontal alignment. 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.
- Explore the functionality of the dialog box.

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

1. Select Geometry > Review Vertical.

Review Vertical Alignment			6	- 0 🔀
Geometry Project: 12345_Design Horizontal Alignment: SH 86 Vertical Alignment: SH 86 V	Mode Alignment C Element			Close Save As Append
Horizontal Alignment Name: S Description: D Style: J Vertical Alignment Name: S	SH 86 Design Alignments SH 86 Proposed SH 86 ALG_PRO SH 86 V		-	Display Print Help
Style: , Element: Linear	Proposed SH 86 Profile ALG_PRO_Vert STATION	ELEVATION		Select
POB PVC Tangent Grade: Tangent Length:	100+00.00 107+50.00 -3.76 750.00	6630.07 6601.88		< Previous Next >
Element: Parabola PVC PVI PVT Headlight Sight Distance: Entrance Grade: r = (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	Ŧ	Last
•		4		,

2. The review dialog can also be opened with the right-click fly-out menus.

Bentley InRoads XM Edition	Set Active Copy Delete	 		
Geometry Preference Toggles the Report Lock				

Section Summary:

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

Lab 6.2 - Creating Profiles

Prior to graphically displaying a vertical alignment a profile must be created. These are referred to as profile sets in InRoads. A profile set can be created using a horizontal alignment, a MicroStation element, or interactively to define the horizontal (plan) location the vertical information is extracted from. Upon creation, a profile can display DTM surfaces, vertical alignments and DTM features. Once created, a profile set can be refreshed to display additional data, turn the display or data off, or to redraw the graphics based on current DTM information.

Section Objectives:

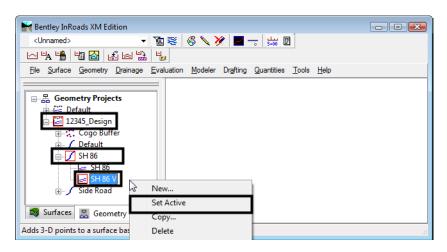
- Examine the profile dialog box.
- Select profile Preferences.
- Display vertical alignment annotation.

Prior to creating a profile set, load the DTM **12345Surv_Surface_Existing** if not already loaded. This surface will be used to display an existing ground-line.

1. Select **File > Open**.

<unnamed> 🗸 🚡 😵 💊 🏏 🎉 🔳 🚽 🐜 🗐</unnamed>					
·····································					
File Surface Geometry Drainage Evaluation	ion <u>M</u> odeler Dr <u>a</u> fting <u>G</u>	uantities <u>T</u> ools <u>H</u> e	elp		
	Data Type	Active	Features	Deleted	
E	€ Breakline Fe	14548	1314	8	
Default	Scontour Fea	0	0	0	
12345Surv_Surface_Existing	Exterior Feat	768	1	8480	
	🕅 Inferred Brea	0	0	0	
🕞 Surfaces 🖁 Geometry 📉 🕠	Interior Feat	0	0	0	
😂 Surfaces 🖁 Geometry 🕋 🔹 🕨					•

- 2. In the workspace bar under the **Geometry** tab, verify that **12345_Design** is the *active* geometry project and that the horizontal alignment **SH86** is the *active* alignment.
 - **Note:** To make something active, **<R>** on the name and select *Set Active* from the fly-out menu.



Create Profile General General Controls Controls Controls Axes Grid Details ASCII	Set Name: SH 86 Direction	Exaggeratio Vertical: Horizontal:	1.0000	
	Surfaces: Object Default X 12345Surv_Surface		BYL BYL All None	

3. Select Evaluation > Profile > Create Profile the Create Profile dialog will appear.

- 4. **<D>** the **Preferences** button. The *Preferences* dialog will appear.
- 5. **<D>** the predefined settings for **2x vertical**.

Name:		Close
10x Vertical 10xVert_Drain 1x Vertical		Load
1xVert_Drain 2x Vertical		Save
2xVert_Urain 5x Vertical		Save As
5xVert_Drain CDOT		Delete
Default SS Drain	-	Help

6. **<D>** the **Load** then **Close** buttons.

Note: Load preferences before making any other menu settings. Loading Preferences resets all menu settings to those predefined in the preference.

7. Note the *Exaggeration* specified.

8. Verify that in the *Surfaces* portion of the dialog, the *Display* box is checked for surface **12345SURV_Surface_Existing**.

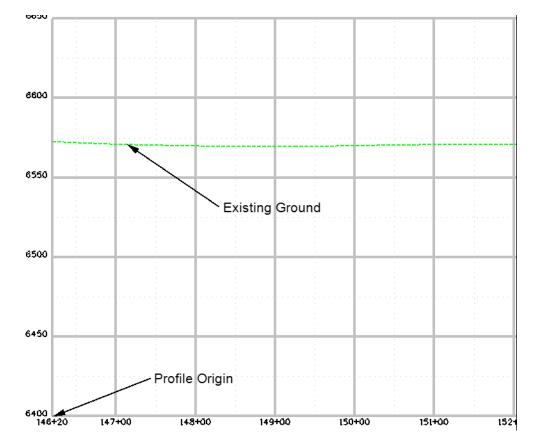
Kreate Profile		
Create Profile Create Profile Source Include Offsets Controls Axes Grid Details ASCII	Set Name: SH 86 Direction © Left to Right © Right to Left Surfaces:	Exaggeration Vertical: 2.0000 Horizontal: 1.0000
	Object Nan Default Defa	
	Appl	ly Preferences) Close Help

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

🕌 Create Profile		
Create Profile	Create:	Window and Data 🔹
General	Alignment:	SH 86 👻 🕈
Offsets	Graphics Alignment:	
Axes	Multipoint Alignment:	
Details	C ASCII File	
		Apply Preferences Close Help

10. **<D>** the **Apply** button. The *Create Profile* dialog will temporarily minimize.

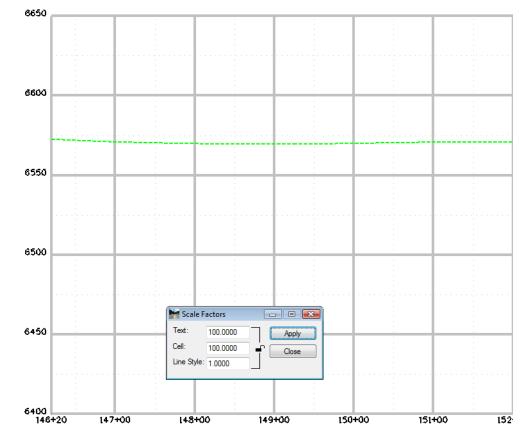
 You are prompted by MicroStation to 'Identify location'. <D> in the MicroStation view. The Profile window will be placed and the *Create Profiles* dialog will restore.



Note: For convenience, we are displaying the profile in our current drawing. Standard practice dictates that separate drawings should be created for profile and cross section display. Consult the directory structure and file naming convention for your specific discipline to determine standards relating to profile display.

Viewing Vertical Alignments

12. 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.

Note: Annotation size for the index elevations and stationing text is generated based on the global scale factor defined for text. The text size specified should be set based on the ultimate plotting scale. To change text size on a profile, delete the displayed profile, change the global scale factor, and regenerate the profile display.

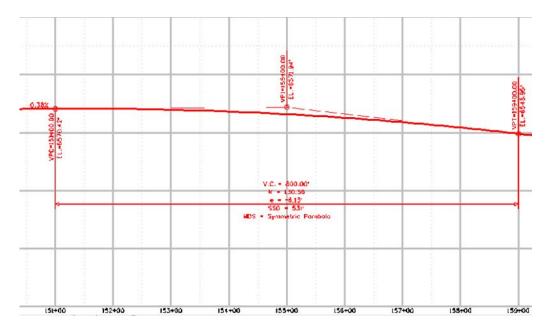
Annotating Vertical Alignments

Similar to horizontal stationing, annotation of vertical alignments is accomplished much the same way.

13. Select **Geometry > View Geometry > Vertical Annotation** to view vertical alignment annotation.

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

- 14. Verify the appropriate *Horizontal*, *Vertical Alignments*, and *Profile Set* are correctly identified.
- 15. Click Apply.



- 16. Take some time and investigate the remaining tabs along the top of the *View Vertical Annotation* dialog and the individual settings for each.
- <D> the Points tab. Note the settings in the *Symbology* portion of the dialog. By default, *Symbology* for a *Proposed* alignment loads.

lain Points (Curves Ta	ingents	Affixes		
Point Type: PV	/1	•]		Help
ustification: Ce	nter	•]		
Drop Station E	quation Na	me	Rotate Sym	ool with	Grade
	Positi	ion	Precision		Format
Station:	1		0.12	• [s	\$+\$\$.\$\$
Elevation:	-1		0.12	•	
Curve Data					
Leaders					
C			num Length		eflection Angle
Segment 1:		0.00		90^0	
Segment 2:		0.00		0^00)'00''
Point Annotation	Location:	Convex	•		
Symbology:					
Object		Nam		-	1
Object		ALG_	PRO_Vert_Dim	BYL BYI	
Object		ALG_ ALG_		BYL BYL BYL	
Object PVC Text PVI Text		ALG_ ALG_ ALG_ ALG_	PRO_Vert_Dim PRO_Vert_Dim	BYL	

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

References	×
Name: CDOT	Close
Default	Load
Other Proposed	Save
Secondary	Save As
	Delete
	Help
Active Preference: CDOT	

- 19. **<D>** the name **Existing**.
- 20. **<D>** the **Load** then **Close** buttons.

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

🕌 View Vertical An	notation		- • •
Main Points C	urves Tange	ents Affixes	
Point Type: PV		•	Help
			nop
Justification: Cer	ter	-	
Drop Station Ed	uation Name	Rotate Syr	mbol with Grade
	Position	Precision	Format
Station:	1	0.12	▼ SS+SS.SS ▼
Elevation:	-1	0.12	•
Curve Data			
Leaders			
	_	Minimum Length	Deflection Angle
Segment 1:	0.0	00	90^00'00''
Segment 2:	0.0	-	0^00'00''
Point Annotation	Location: Co	nvex 🔻	
Symbology:			
Object		Name	
PVC Text		ALG_EXISTING_Ver ALG_EXISTING_Ver	
PVT Text		ALG EXISTING Ver	
PVCC Text		ALG_EXISTING_Ver	
		ALC EVICTING Vor	
	Apply	Preferences	Close

- 22. **<D>** the **Apply** button from the *View Vertical Annotation* dialog. Review the results in the MicroStation drawing. The content of the graphics should remain the same, however, different levels, color, style, and weight are utilized.
- 23. For practice, continue to *Load* and *Display* additional preferences.
- 24. 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 6.3 - 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 pull down menu **Evaluation > Profile > Update Profile.** The *Update Profile* dialog will appear.

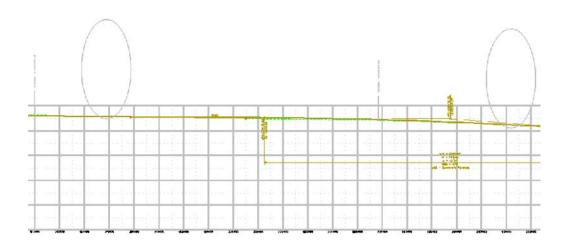
🕌 Update Profile			- • 💌
Profile Set:		0.0.1.0"	
	Mode: Refresh Display On	Display Off	
🚞 Update Profile	Surfaces:		7.71
	Name	Description	+
	12345Surv_Surface_Existing	Existing Ground from mul	
		Apply Close	Help

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

	⊢ Mode: ⊚ Ref	iresh 🔘 Display On	🔘 Display Off	
Update Profile Surface Offsets Projected Peatures Projected Peatures	Name Default	urface_Existing	Description Existing Ground from mul	3
		Style	Description er Billboard 10ft or More	▲ <u>+</u>
	T_Billboar T_Billboar T_Billboar T_Billboar		trl+A or More or Less trl+N t or Less t or Less	-
				Styles Filter
		(Apply Close	Help

6. **<R>** in the *Crossing Features* list and select **All** from the menu.

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



Note: Profile and cross section displays are drawn at true horizontal scale. A vertical distortion will be applied to cells displayed in profiles or cross section views based on the vertical scale applied to the grid. Some DTM features displayed in these graphics are configured to display at their true horizontal (x-direction) sizes. Therefore, prior to displaying features in either profiles or cross sections the global scale factor for cells should be set to 1.

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

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 item 1:

The global scale factor for cells should be set to 1 and a subset of the dtm crossing features should be displayed (or refreshed in this case). This is accomplished with the use of feature filters.

For Item 2:

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

Note: See the following page for information on updating a profile to refresh the graphics.

Refreshing a Profile Display

First, take care of refreshing the display of the true-scale items such as the culverts.

8. Select Tools > Global Scale Factors.

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

- 9. Key in the field *Cell: 1*.
 - **Note:** You may need to *Unlock* the icon to allow modification to the cell scale only. By doing so, when you update the profile, the cells will draw at their true sizes. Leaving the Text field at 100 and Line Style field set to 1. This allows annotation and other commands to remain unaffected by the scale factor that was input specific for cells.
- 10. **<D>** the **Apply** then **Close** buttons in the *Scale Factor* dialog
- 11. In the main InRoads interface, select the filter **CELL_True-Scale** from the drop-down list. Also toggle **On** the *Feature Filter* lock.

Bentley InRoads XM Edition					• •
CELL_True-Scale 🔹 🖬 💐	🚳 🔪 🎽 📕 🚽	5+00 E			
File Surface Geometry Drainage Evaluation		uantities <u>T</u> ools <u>H</u>	elp		
Fea	ture Filter Lock On Data Type	Active	Features	Deleted	
E Surfaces	T Breakline Fe	14548	1314	8	
🗄 🥌 Defaul	鯼 Contour Fea	0	0	0	
🛓 📲 12345Surv_Surface_Existing	Exterior Feat	768	1	8480	
λ Ι	🔆 Inferred Brea	0	0	0	
'Filter List	Interior Feat	0	0	0	
	, Random Fea	19745	377	4184	
😂 Surfaces 🖁 Geometry 🖄 🕢	٠ III				P.

Update Profile				_	60
Profile Set: SH 86	• +	Objects: C Surface	s		Apply
Mode: 💽 Refresh		 Offsets 	and Features	Ē	Close
🔘 Display On		🧮 Show Data Outside	Elevation Rang	je T	Filter
C Display Off				Ē	Help
Surfaces:		Crossing Features:			пер
12345SURV_Surfac	Existing	Name Style T_Cul Corr Stl T_Cu T_Cul Corr Stl T_Cu	Il Corr Stl 24'' Il Corr Stl 24'' Il Corr Stl 24'' Il Corr Stl 24'' Il Corr Stl 24''		All None
Offsets:		Projected Features:			Ŀ
Offsets:		Projected Features:		4	-] All
Offsets:		Projected Features:		4	_
Offsets: Bandwidth		Projected Features:			All
Offsets: Bandwidth		Include Features;		4	All
Bandwidth				4	All

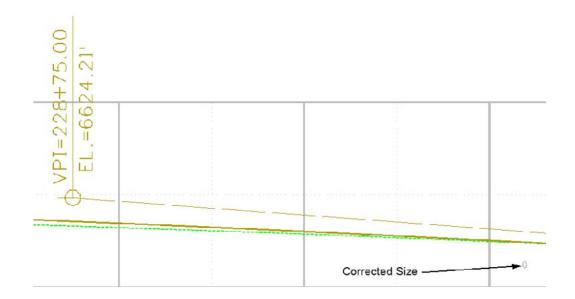
12. Close and reopen the *Update Profile* dialog.

- 13. 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.
- 14. In the *Mode* section toggle the **Refresh** radio button.
- 15. **<D>** the **Crossing Features** leaf.
- 16. **<D>** the surface name **12345SURV_Surface.**

17. Select all of the *Crossing Features* listed.

🕌 Update Profile				- • •
Profile Set: SH 86 + +	Mode:	🔘 Display On 🛛 🔘) Display Off	
Surface	Name		Description	
Offsets Offsets Offsets	12345Surv_Surface_	_Existing E	ixisting Ground from mul	_
Frojecied Features				
	Crossing Features:			-
	Name	Style	Description	<u>+</u>
			Culvert Corr Steel Pip	
			Culvert Corr Steel Pip Culvert Corr Steel Pip	
				Styles
				Filter
			Apply Close	Help

- 18. **<D>** the **Apply** button.
- 19. Using MicroStation viewing tools, locate a crossing culvert and review the results.



- 20. Use MicroStation Measuring tools to verify pipe size(s).
- 21. From the *Locks* toolbar select **CELL_Plot-Scale** filter from the pull down list.

Be	entley InRo	oads XM Ed	lition						
CE	ELL_Plot-So	ale	•	10 😎	ő 🔪	×	–	ىلى 5+0	.
File	<u>S</u> urface	<u>G</u> eometry	<u>D</u> rainage	Evaluation	Model	er D	r <u>a</u> fting	<u>Q</u> uanti	ties]

Note: Verify that the feature filter is toggled on.

22. 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.

23. Close and reopen the Update Profile dialog.

10.00				
🚟 Update Profile				
Profile Set: SH 86 +	Mode: Refresh Surfaces:		Display Off	_
Surface Offsets	Name	D	escription	
Projected Features	12345Surv_Surface_	Existing Ex	isting Ground from mul]
	Crossing Features:			
	Name	Style	Description	<u>+</u>
	T_Elect Overhead Li. T_Traffic No Pass Ri.	T_Elect Overhea T_Traffic No Pass	Bridge Electrical Overhead L Electrical Overhead L Traffic Control No Pa Traffic Control No Pa	
				Styles Filter
			Apply Close	Help

- 24. 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.
- 25. In the Mode section toggle the radio **Refresh** button.
- 26. **<D>** the Crossing Features leaf.
- 27. **<D>** the surface name **12345SURV_Surface**.
- 28. Select all of the *Crossing Features* listed.
- 29. **<D>** the **Apply** button.
- 30. Turn **Off** the *Feature Filter* lock.

	🗑 Be	ntley InRo	oads XM Ed	lition						
	CE	LL_Plot-So	ale	•	12	8 💊	×	2 -	ىيىلى 5+00	
	<u>F</u> ile	<u>S</u> urface	<u>G</u> eometry	<u>D</u> rainage	Evanatio				<u>Q</u> uantitie	s <u>T</u>
=					Feat	ure Filter				Acti

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 6.4 - 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.
- From the *Locks* toolbar select CELL_PLOT-Scale filter and verify the feature filter is toggled On.



3. Select Evaluation > Profile > Annotate Feature in Profile. The *Annotate Feature In Profile* dialog will appear.

🕌 Annotate Feature In Profile		- • •
Profile Set: SH 86 Annotate Feature In Profile General Annotate Points Points Frame Frame	Annotate Projected Line Segments Vertex At Interval: O.00 Vertex Location Object Axis Frame	
	Apply Preferences	Close Help

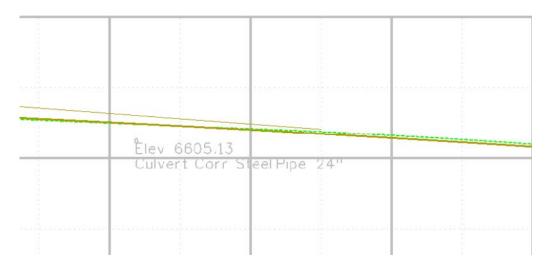
4. **<D>** the **Apply** button and review the results.

	-
6	
Élev 6605.13	
 2.01 9000110	

- 5. **<D>** the **Points** branch.
- 6. Check **On** the **Feature Description**.

H 86 👻 🕂		Object	Column	Bow	Prefix	Suffix	Precision	Format
	Π	Index	1	1	1 TOTAL	Canac	1100101011	1 onnat
Annotate Feature In Profile	Π	Centerline Station	1	2	CL Stn		0.12	SS+SS.SS
Appetate		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	ㅁ	Feature Name	1	6				
	\boxtimes	Feature Description	1	7				
		Feature Style	1	8				
		Drop Station Equation N	ame					

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



8. Experiment with enabling other options in the *Point* tab and redisplaying the annotation

Challenge Exercise:

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

Slp=-0.31%	
	Blev 6624.06 Cutvert Corr SteelPipe 24"

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.

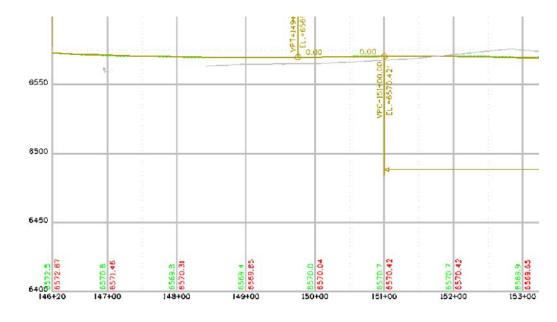
Lab 6.5 - Annotating a Profile

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.

🚔 Annotate Profile						×
Profile Set:		Horizontal Alignment:	SH 86			
SH 86 -	+	Vertical Alignment:	SH 86 V 👻	Annotate at:		
annotate Profile	*	Surface:	12345Surv Surface -	Station Intervals	Only	•
General Selection		Cant Alignment:		Start Station:	146+19.97	-
Station		-	`		140+13.37	+
Cumulative Station		Comidor:	▼	Stop Station:	242+60.12	+
Station Interval		Super Control Lines:		Profiles:		
Station Number	Ξ			146+19.97 - 242	+60.12	+
Curvature						
Existing						
Proposed						
Cut Depth						
Deflection					All None	
Grade and Distance					All None	
Vertical Ordinate						
	Ŧ					
			Apply	Preferences	Close Hel	p



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

- 3. Take some time and review the leaves of the *Annotate Profile* dialog. Investigate the remaining tabs and the individual settings for each.
- 4. Now go back and **<D>** the **Selection** leaf.

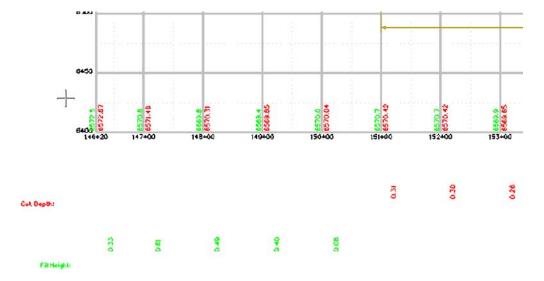
🐂 Annotate Profile					- • •
Profile Set:		Available: Station		Selected:	٦
SH 86 Annotate Profile General Selection Station Interval Station Interval Station Interval Station Number Curvature Existing Proposed Cut Depth Fill Height Deflection Grade and Distance Vertical Ordinate Horizontal Slew Vertical Slew	+ 	Station Station Interval Station Number Superelevation Curvature Cut Depth Fill Height Deflection Grade and Distance Vertical Ordinate Horizontal Slew Vertical Slew Sight Distance Horizontal Slew Vertical Cardinal Vertical Cardinal Vertical Alignment Cant Alignment Speed Rail Elevations	Add-> <-Remove	1 Existing 2 Proposed	
			Apply	Preferences Close	Help

- **Note:** The dialog 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.

🖌 Annotate Profile			
Profile Set: SH 86 Annotate Profile General Selection Station Cumulative Station Station Interval Station Interval Station Number Curvature Proposed Curvature Curvature Grade and Distance Vertical Ordinate Hoizontal Slew Vertical Slew	Available: Station Station Number Superelevation Curdupe	Selected: 1 Existing 2 Proposed All None Move Up Move Down	
		Apply Preferences Close	Help

6. **<D>** the **Add** button. Cut Depth will be added to the *Selected* list.

- 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 6.6 - Vertical Alignment Tracking

Vertical alignments can be interactively queried similar to horizontal alignments.

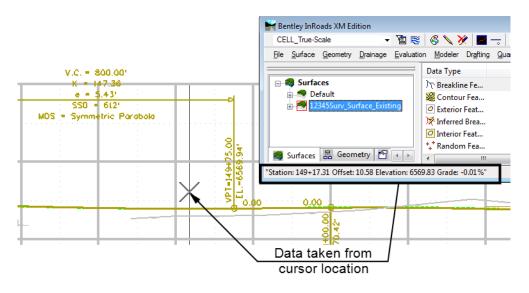
Section Objectives:

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

Tracking Vertical Alignments in Profile View

1. Select Tools > Tracking > Vertical Alignments.

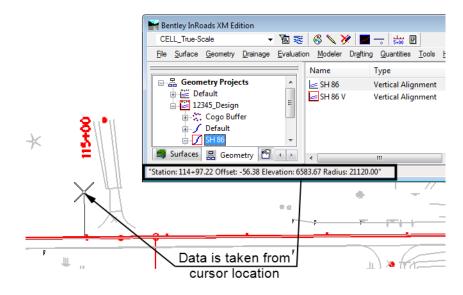
2. Move the cursor inside the Profile Set window and review the output in the InRoads Status bar.



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

Tracking Vertical Grades in Plan View - Review

- 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 6.7 - 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. Choose the **Geometry** tab.
- 3. Toggle the Type to Vertical Alignment and set the following:
- 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**

¶ New		
Surface Geometry	у	
Type:	Vertical Alignment	 Apply
Name:	SH 86 V Alt1	Help
Description:	Alternate vertical align	nment
Style:	ALG_PRO_Vert	•
Curve Definition:	Parabolic	-
Name	Description	Style
SH 86	Proposed SH 86	Default
SH 86 V	Proposed SH 86 Pr.	
SH 86 V Alt1	Alternate vertical al.	ALG_PRO_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.

View 1 - Top		
	No. 2 - Top	
	6559	 -
	*+-□# <i>00</i> • • • • 9 * <u>•</u>	
A+-D###0000000		1 ²¹

Next, add PVIs to the Vertical Alignment.

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

ĺ	🕌 Bentley InRoads XM Edition									
		CEL	.L_True-S	cale	•	1		🖉 🗖 -	<u>5+00</u>	1
		<u>F</u> ile	<u>S</u> urface	<u>G</u> eometry	<u>D</u> rainage	Evaluation	Modeler	Dr <u>a</u> fting	Quantities	Tools

11. Select Geometry > Vertical Curve Set > Add Pl.

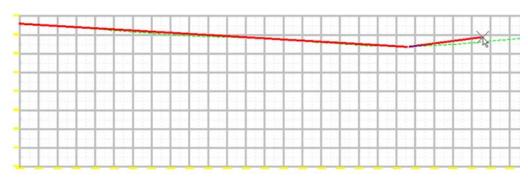
🕍 Add Vertica		
Dynamics		Apply
Station:	0.00	Close
Elevation:	0.00	Help
Grade:	0.00%	

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 your key-in.)



dg=900,-3.76%

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

The dg = key-ins place additional vertical PIs at the specified distance and grade. The last one again places a vertical PI at the station and elevation specified.

- 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.

🕈 Define Vertical	Curve Set	
Vertical PI		Apply
Define PVI By:	Station and Elevation 🔹	Close
Station:	109+00.00 -+	
Elevation:	6596.24	Undo
Entrance Grade:	-3.76% +	Design Calc
Exit Grade:	-1.03% +	Report
N # 10		Help
Vertical Curve Calculate By:		
calculate by.	Length of Curve 🔹	
Length:	300.00 +	
Adiacent Curries		
Adjacent Curves Update By:	Length of Curve 🔻	
Distance:	0.00	
First < Pr	evious Next > Last	Select

17. Select Geometry > Vertical Curve Set > Define 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 category,
 - Set *Calculate By* to Length of Curve.
 - Key in *300* for the *Length*.
- 19. Select **Design Calc**.

Nethod: Look	up Speed	•	ОК
ASHTO Standar	d: 🔘 1990	2001	Cancel
Curve Design			Preferences
Range:	Opper	Lower	Freterences
Speed:	20	•	Help
K Value:	20.00		
Length:	54.63		
Curve Type:	Crest	Sag	
Headlight Sight I Type: Distance:	Stopping 125.00	Passing	
Friction:	0.40		
Deceleration:	11.20		
Eye Height:	3.50		
Object Height:	2.00		

20. Click in the Table Name and Browse to the C:\Program Files\Workspace-CDOT\ Standards-Global \ InRoads\Design Checks folder and choose the file Vertical Design Checks.txt.

Browse										×
Look in:	📙 Design Che	cks		•	0	ø	Þ	•		
Recent Places Desktop Cdot Us er	2000	Date modif Design Checks sign Checks.txt	.txt	Size						
Computer	File name: Files of type:	*.bt Text Files (*.t	xl)				•]]	Ope Can He	cel

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

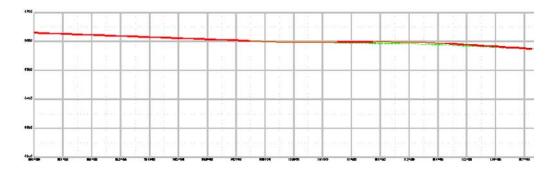
🐂 Vertical Desig	n Calculator		
Method: Look	up Speed	•	ОК
AASHTO Standard	i: 🔘 1990	2001	Cancel
Curve Design Range:	Opper	C Lower	Preferences
Speed:	60	•	Help
K Value:	136.00		
Length:	371.47		
Curve Type:	Crest	Sag	
- Headlight Sight [Type:	Stopping	g 🔘 Passing	
Distance:	570.00		
Friction:	0.29		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

22. Choose **Cancel** when done. You do not want to accept the minimum curve, just verify that yours meets the criteria.

23. Select Apply

🕌 Define Vertical	Curve Set		
Vertical PI Define PVI By:			
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		
First < Pr	evious Next > Last	Select	

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



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 - 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_XM\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 7.1 - 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 Templa <u>te</u>							
File Edit Add	Tools						
Template Library:	Template Library Organizer						
C:\Projects\12	Apply Feature Name Override						
	Options						
	Dynamic Settings						

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

M Template Options	.
Naming Options Components Seed Name:	OK Cancel Preferences Help
Points Seed Name:	•
Prefix Suffix	
Left:L RightR	
Step Options	
X: 0.10 Y: 0.10	Slope: 0.000%

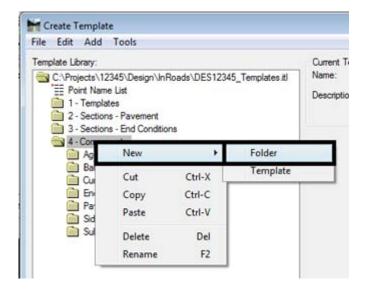
The next series of steps creates a new project specific folder to store the components that will be created in the lab. Creating project specific folders in the template library makes easier to find project specific components.

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.

Create Template			
File Edit Add Tools			
Templete Literer: CVProjectri/12145/Design/Un/Roach/DE512145_Templetes.tl Thirt Nome Dat. 1 - Templetates 2 - Sections - Pavement 2 - Sections - Pavement	Current Template Name : Description:	Daplay @ Components Constraints [2] Daplay Point Namez Display All Components	Clase Help

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.

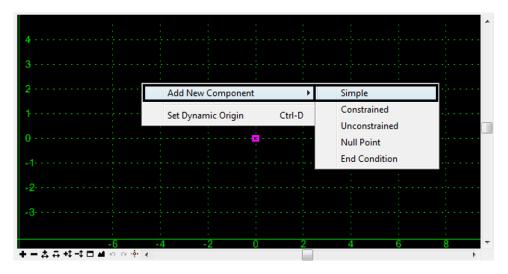
- 14. **<R>** on the **12345** Components folder and select **New > Template** from the right click menu.
- 15. Key in *CONC_Lane_12"x12'* for the component name.

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

ᆃᆖᅕᇴᆓᆍᄫᆖᇔᄵᅆᆤᆗᅦ	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	•	

- 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:			-
-0:4					Point	Style:			-
-0:4					- A	pply Affix	es		
-0:6			•••••		hs=		•		
						Set [Dynamic Orig	gin	
-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		8
Name:	Conc_Centerline-Top 👻 🔶	Apply
Feature Name Override:		Close
Surface Feature Style:	Centerline	< Previous
Alternate Surface:	Ψ	Next >
	Member of: CONC_Lane_12"x12"	Help
Constraints Constra Type: None	int 1 Constraint 2	2
Label: Style Constraint: (a) Horizontal Range: 0.00	Vertical O Both	

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

Centerline	a-Top	Core Longing Ten
		Conc_Laneline-Top
ABC Centerline	Top	
Abc Centerine	i op	ABC_Laneline-Top

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

Lab 7.2 - Build a Constrained Component

In addition to building regular closed shape components, irregular and/or open shaped components can be created using the contrained 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		Simple
Set Dynamic Origin	Ctrl-D	Constrained
		Unconstrained
		Null Point
		End Condition

- 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.

1		
Style:	D_CONC_Pvmt_12in	
	Style:	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	s 💌			
X: 0.00	Step: 0.10			
Y: 0.00	Step: 0.10			
Point Name:	Conc_Laneline-T(-			
Point Style:	D_LANELINE -			
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	js	×	
X: 5.62	Step:	0.10	
Y: -0.88	Step:	0.10	
Point Name: Conc_EOP-Top -			
Point Style:	D_EOP	•	
Apply Affixes			
hs= 🔻	8,02		
Set Dynamic Origin			

- 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 *dI=* (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	5 🖾	
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 Dynamic 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	Apply Affixes			
hs= -8,02				
Set Dynamic 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

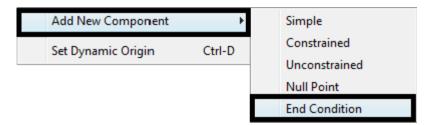
You should now understand how to create a constrained, closed shaped component. By reviewing the steps above, now you should also be able to also create unconstrained and open shaped components simply by choosing different options from the dialog boxes that were introduced.

Lab 7.3 - 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.



- 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
	Horizoni Alignment XY
Offsets: 0.0	Alignment Elevation
	Alignment XYZ
o back, ENTE	R: Finisl 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	e-of-Fill ▼
Target Type:	Surface 👻	Priority:	1
Surface	✓ <active></active>	Benching Count:	0
		From Datum:	0.00
Horizor	ntal 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.

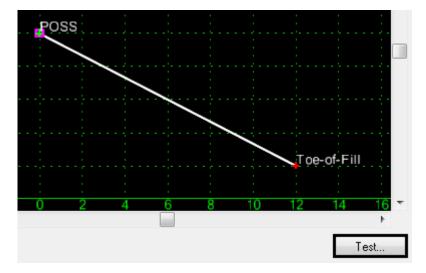
- 10. In the *Dynamic Settings* dialog box, select *POSS* for the *Point Name*.
- 11. Move the pointer on to the template origin and **<D>**.
- 12. In the *Dynamic Settings* dialog box, toggle on *End Condition is Infinite*. This option allows a component to "stretch" until a target is found.
- 13. Select *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 Settings 🛛 🛛 🖸				
X: 0.67	Step:	0.00		
Y: -4.30	Step:	0.00		
Check for Interception				
✓ Place Point at Interception				
End Condition is Infinite				
Do Not Construct				
Point Name:	Toe-of-Fi	∎ -		
Point Style:	D_Toe-o	ıf-Fill ▼		
Apply Affixes				
hs= • 12,1667				
Set Dynamic Origin				

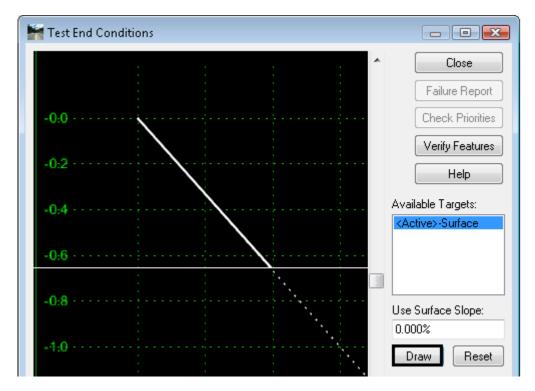
16. **<R>** and select *Finish* from the right click menu.

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.



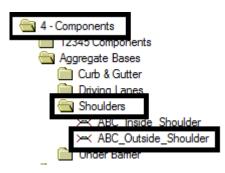
- 19. Move the pointer up and down in the view area to see how the end condition performs.
 - Note: The dotted line in the *Test End Condition* view window shows the component at the defined slope and length. As the proposed surface moves beyond the limits of the defined component, the result of the *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 7.4 - 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.



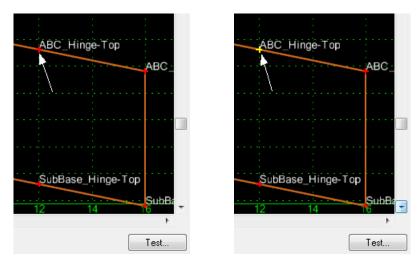
- 4. **<D> <D>** on the **ABC_Hinge-Top** point.
- 5. In the **Point Properties** dialog box, notice that this point has both a *Horizontal* and *Slope* constraint.

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 👻 🔶
Feature Name Override:	ABC_Hinge-Top
Surface Feature Style:	D_HINGE -
🔲 Alternate Surface:	
	Member of:
	ABC_Outside_Shoulder
Constraints	
Constraints	

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. Therfore, 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**.

- M Point Properties X Name: ABC_Hinge-Top + Apply Feature Name Override: ABC_Hinge-Top Close Surface Feature Style: D_HINGE -< Previous Alternate Surface: -Next > Help Member of: ABC_Outside_Shoulder Constraints Constraint 1 Constraint 2 Type: None Slope Parent 1: ABC_Shoulder-Top Rollover Values Value: -2.00%
- 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 teh 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* 7.1 -*Build A Simple Component* showed how to modify point names in using the Point Properties dialog.
- The next lab, *Lab 7.2 -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 7.3 -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 7.4 -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 8 - 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_XM\Standards-Global\InRoads\Preferences\ CDOT_Civil.xin
- C:\Projects\12345\12345\Design\InRoads\DES12345_Templates.itl (This file was modified in Lab 1)

Lab 8.1 - 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.

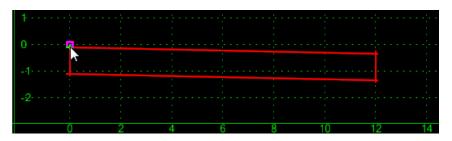
laming Option	s	ОК
Components		UN
Seed Name:		Cancel
From Sty	le	Preference
O Specify:		-
		Help
Points		
Seed Name:		
occo mano.		
Apply Affixe		
1222	Prefix Sulfix	
Left	LT_	
Right	RT_	
tep Options		

- 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.

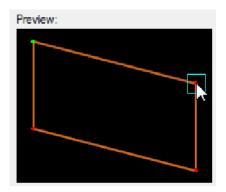


- 6. Create a new template in the **12345 Sections** folder. Name it **Conc_Driving_Lane**.
- 7. Expand the *4 Components* folder. Also expand the *12345 Components* folder created in Lab 1.
- 8. **<D>** on the *Conc_Lane_12"x12'* component. The component is displayed in the Preview window.
 - Preview:
- 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.

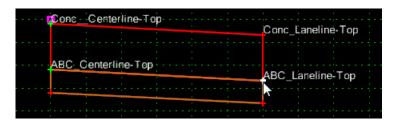


- 11. Expand the *4 Components >Aggregate Bases > Driving Lanes* folder.
- 12. **<D>** on the **ABC_Lane** component.



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 points 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.

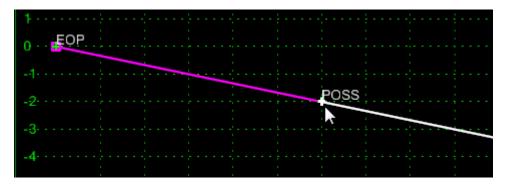
Lab 8.2 - Build an End Condition Section

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.

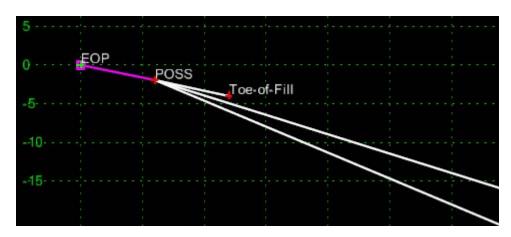
- 1. Create a new template in the **12345** Sections folder named **12345_End-Condition**.
- 2. Expand the 4 Components >End Condition > Z-Slope > High Speed folder.
- 3. **<D>** on the *Z***-***Slope***_12_6_to_1** component.
- 4. **<D> and hold** the component's origin in the preview window.

- 5. **Drag and Drop** the component on the origin in the Template View.

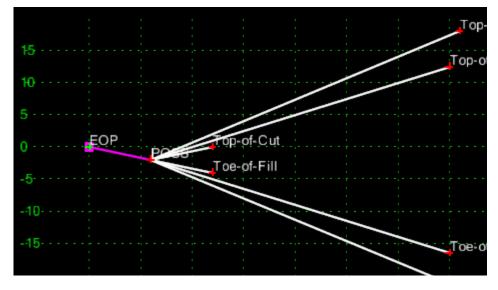
- 6. Expand the **4** Components >End Condition > Fill Slope Components folder.
- 7. **<D>** on the *Fill_6_to_1* component.
- 8. **Drag and Drop** the component on to the *POSS* point.



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**.

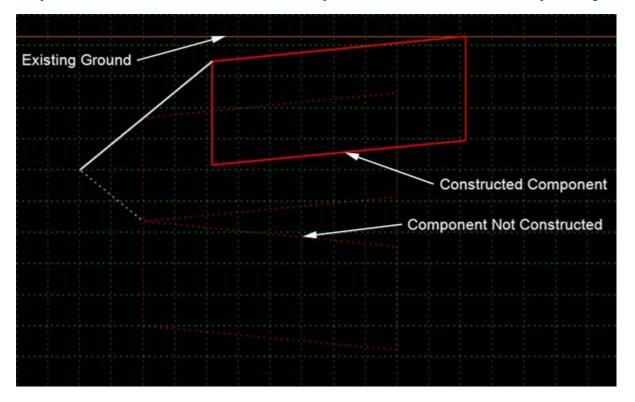
🐂 Component Proj	perties			
Name:	Fil_4/1		+	Apply
Description:				Close
Style:	D_Toe-of-Fill 🔹	·		< Previous
Parent Component:		+		
Display Rules:			Edit	Next >
Exclude from trians	gulation			Help
End Condition Prop	arties			
Target Type:	Surface -	Priority:	2	
Surface	✓ <active></active>	Benching Count:	0	
		From Datum:	0.00	
Horizo	ontal Vertical	Step Elevation:	0.00	
Offsets: 0.00	0.00	Rounding Length	0.00	

- 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 8.3 - 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 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

 Set Dynamic Origin
 Ctrl-D

 Unconstrained
 Unconstrained

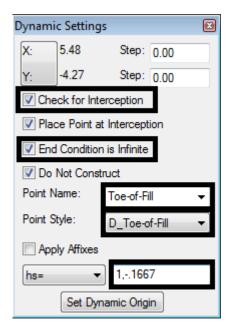
 Null Point
 End Condition
- 2. **<R>** in the Template View and select Add New Component **> End Condition**.

- 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 Positon is not created.

Dynam	nic Setting	js	×	
X:	5.14	Step:	0.00	
Y:	1.85	Step:	0.00	
C +	eck for Int	erception		
V Pla	ace Point a	at Intercept	ion	
🔳 Er	nd Condition	n is Infinite		
V Do	Not Cons	truct		
Point	Name:	Sidewalk	_Positior 👻	
Point Style: D_CONC_Sw -				
Apply Affixes				
hs= • 4,02				
	Set Dy	namic Origi	in	

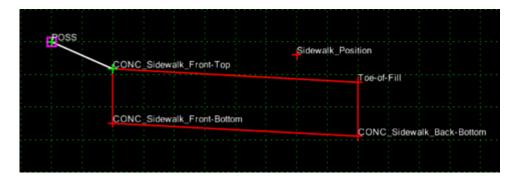
- 15. In the *Dynamic Settings* dialog box, toggle on *Check for Interception*.
- 16. Toggle on *End Condition is Infinite*.
- 17. Set the *Point Name* to **Toe-of-Fill**.
- 18. Key in *1,-.1667* and press *Enter*.



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*.
- 26. Set Contraint 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*.

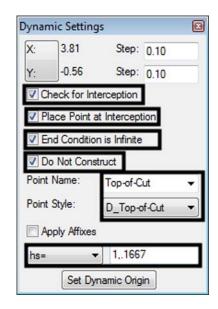
Current Component		-	
Name: Cut		Style: D_Top	o-of-Cut ▼
Target Type:	Surface 🔻	Priority:	2
Surface	✓ <active></active>	Benching Count:	0
		From Datum:	0.00
Horizont	al Vertical	Step Elevation:	0.00
Offsets: 0.00	0.00	Rounding Length	0.00
Surface Horizont	✓ <active></active>	Benching Count:	0.00

- 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 -				
A	Apply Affixes				
hs=		4,.02			
	Set Dy	mamic Orig	in		

- 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.

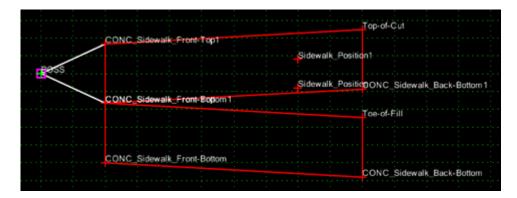


- 49. **<R>** and select **Finish**.
- 50. **<D>** on the **4"_CONC_Sidewalk** component.
- 51. **<D> and hold** on the upper right point in the Preview.
- 52. Drag and Drop the component on the *Top-of-Cut* point.
- 53. **<R>** and select **Finish**.
- 54. **<D> <D>** on the **CONC_Sidewalk_Front-Top1** 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).

- Constraints

 Type: Horizontal
 Parent 1: Top-of-Cut
 Value: -4.00
 Label:
- 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 Properties 🛛 💽					
Name:	Cut_6_to1	+	Apply		
Description:			Close		
Style:	D_Top-of-Cut Close Shape		< Previous		
Parent Component:	CONC_Sidewalk-4" ▼ +				
Display Rules:		Edit	Next >		
Exclude from triangu	lation		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 8.4 - 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.

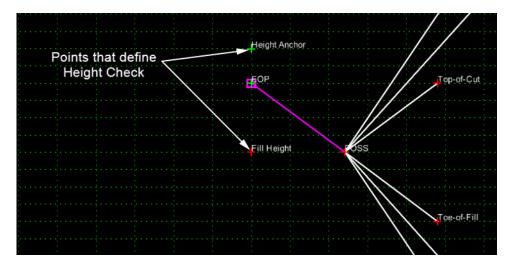
The typical section created in this lab contains two seperate end conditions, the standard Z12_6_to_1 section and an end condition used with guardrail. Both end conditions could apply at any given template drop. To determine which end condition will be used, the *Height Check* component is added to the template. This component determines the fill height from the edge of pavement to the existing ground. If the fill height excedes 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 *Z***12_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:	Default 🔻
Target Type:	Surface 🔻	Priority:	1
Surface	✓ <active></active>	Benching	Count: 0
		From D	atum: 0.00
Horizont	al Vertical	Step Eleva	ation: 0.00
Offsets: 0.00	0.00	Rounding Ler	ngth 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	ic Settin	gs	×	
X:	1.81	Step:	0.00	
Y:	-0.36	Step:	0.00	
Point N	lame:	Height A	nchor 👻	
Point S	ityle:	Default 👻		
🔲 Арр	Apply Affixes			
[xy= ▼] 0,1				
	Set Dy	ynamic Orig	in	

This pointsets 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	Not Const	truct		
Point N	lame:	Fill Heigh	it 🔻	
Point S	ityle:	Default	•]
🔲 Арр	ly Affixes			
xy=	•	0,-2]
	Set Dyr	namic Orig	in	

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.

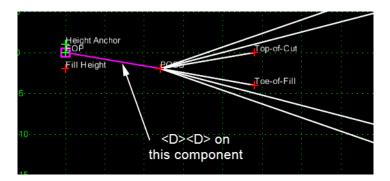
- 16. **<R>** and select **Finish**.
- 17. Select **File > Save**. (This is an intermediate save to prevent loss of information.)

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 +	Name: Description:	Parent_Component_Example	 Components 	Constraints
Point Name List			Display Point N	lames
2 - Sections - Pavement 12345 Sections			Display All Con	nponents

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 Properties 🛛 💽					
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
Туре:	Vertical		Help
Between:	Fill Height	+	
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 Expression for Z-Slope_12_6_to HeightCheck		2_6_to_1 Component		^	_	OK Cancel
	DR NOT	() Selected Rule]	Ŧ		Help
amplate Display Name	y Rules Type Vertical	Expression EOP - Fill Height	Test c	Value 12.00	Result True	
eightCheck						

34. In the *Component Properties* dialog box, **<D> Apply**.

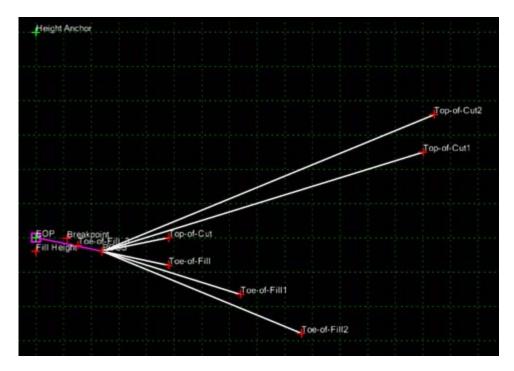
Component Prope	erties		23	
Name:	Z-Slope_12_6_to_1	+	Apply	
Description:			Close	
Style:	D_SHOULDER-Emb Close Shape		< Previous	
Parent Component:	Height Check 👻 🛨			
Display Rules:	HeightCheck	Edit	Next >	
Exclude from triangulation				

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.

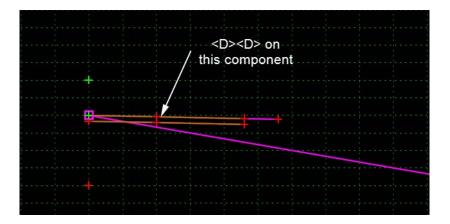


40. **<D> Test**.

- 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.

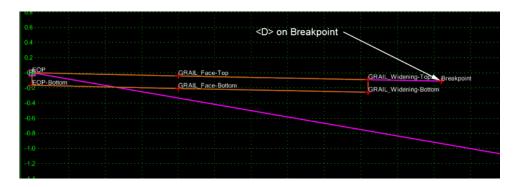


- 48. **<D>** the **Edit** button for the *Display Rules*.
- 49. In the *Component Display Conditional Expression* dialog box, **<D>** the **NOT** button.
- 50. Highlight Height Check in the *Template Display Rules* area, then **<D>** the **Selected Rule** button.
- 51. **<D> OK**.
- 52. In the *Component 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		
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 Dynamic Origin				

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. $\langle D \rangle \langle D \rangle$ 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* 8.2 -*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 8.3 -Using Parent Components and Lab 8.4 -Using Display Rules built sections from new and existing components. A variety of methods can be used to put data into a template.
- Lab 8.3 -Using Parent Components and Lab 8.4 -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 8.4 -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 9 - 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.

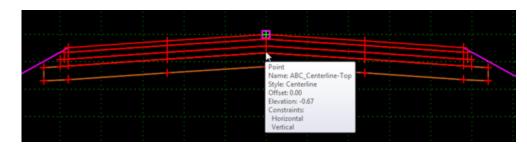
Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Workspace\Workspace-CDOT_XM\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\Combined Surfaces.ird
- C:\Projects\12345\Design\InRoads\DES12345_Templates.itl (This file was modified in Lab 1)

Lab 9.1 - 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.

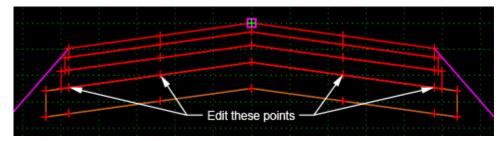


- 5. Key in **-0.33** for the *Value* of the *Vertical* constraint.
- 6. <D> Apply.

7. **<D> Close**.

Point Properties	
Name:	ABC_Centerline-Top 👻 🔶 Apply
Feature Name Override:	ABC_Centerline-Top
Surface Feature Style:	Centerline Centerline
Alternate Surface:	Next >
	Member of:
	ABC HMA_Lift3
Constraints	
Constra	sint 1 Constraint 2
Type: Horizontal	✓ Vertical ✓
Parent 1: HMA_Lift3	Centerlin • + HMA_Lift3_Centerlin • +
Value: 0.00	-0.33
Label:	• •
Style Constraint:	· · · · · · · · · · · · · · · · · · ·
Horizontal	O Vertical O Both
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

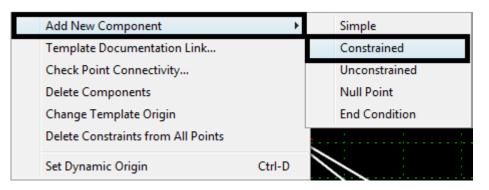


Note: The two outside points (HMA_Lift3_EOP-Bottom and ABC_EOP-Top) do not need to be modified. This is because they are built with Vector/Offset constraints which keeps them in line with the other points on that row.

Lab 9.2 - 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 libraryin order to minimize the amount of editing.

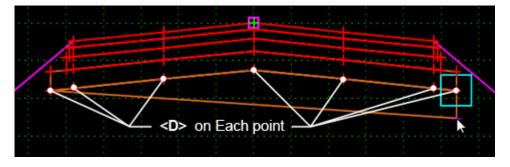
- 1. **<D> <D>** on the **HMA_Crowned_B10** template (if it is not already displayed).
- 2. **<R>** in the template view and select **New Component > Constrained** from the menu.



- 3. Key in *SubBase_2 ft* in the *Name* field.
- 4. Set the *Style* to **D_SUBBASE**.

		+-+++	ား၏ဂလက်•	•	
Current	Component		-		
Name:	SubBase_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 verfiy 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*.

- 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-Bott 👻 🔶	Apply
Feature Name Override:	LT_2	Close
Surface Feature Style:	D_SUBBASE -	< Previous
Atemate Surface:	Ψ	
		Next >
	Member of:	Help
	LT SubBase 2t	
Constraints	int 1 Constraint	2
Type: Horizontal	 Vertical 	•
Parent 1: LT_SubBa	se_EOP + LT_SubBase_	EOP +
Value: 0.00	-2.00	
Label:		.
Style Constraint:		
(a) Horizontal	Vertical Both	
Range: 0.00		

16. Repeat steps 8 through 14 for the remaining points across the bottom of the sub-base component.

Note: The name is the same as the point above it, except that the word Top is replaced with the word Bottom.

The finished template is illustrated below:

: :			

Lab 9.3 - 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		
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**.

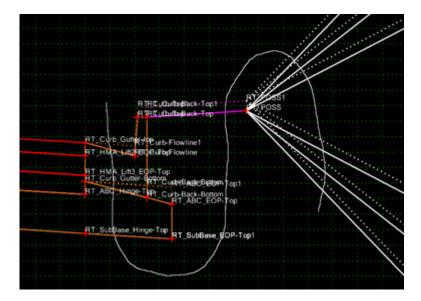
🕈 Template Op	tions		
Naming Options Components			ОК
Seed Name:			Cancel
From Style	•		Preferences
Specify:			Help
Points			
Seed Name:		-	
Apply Affixes	Prefix	Suffix	
Left:	LT_	Julix	
Right:	RT_		
Step Options			
X: 0.10	Y: 0	10 Slo	pe: 0.00%

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.

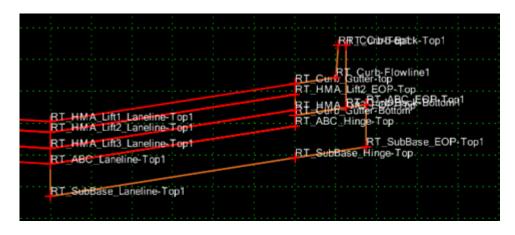
The new section that was added accomodates a design decision on when to generate a gutter with a normal slope and when to generate the gutter with a slope to match the driving lanes. This section has two curb components. Therefore, two end condition sections are required, one attached to each curb. These 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.

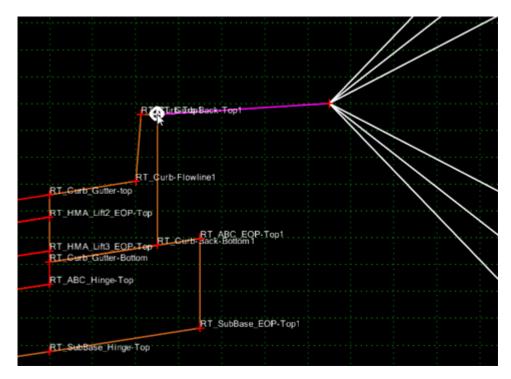
Constraints			
	Constraint 1		Constraint 2
Type:	Horizontal 👻		Slope 👻
Parent 1:	RT_HMA_Lift1_Lan 👻	+	RT_HMA_Lift1_Lan 💌 🕈
			Rollover Values
Value:	12.00		5.00%
Label:	Curb_Gutter-top-Hori 👻		Curb_Gutter-top-Slop 👻

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**.

		PPoss			
RT (RFb/Cont.P)	Component Pro	perties			
	Name: Description:	RT_Benching	+	Apply Close	
RT_Curb-Flowline1	Style: Parent Component:	D_SHOULDER-Emb Cose RT_C/G_Type2-IIB'	e Shape	< Previous Nest >	
Top	Display Rules:	gulation	Edt	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.

					RT POSE	
	RT CURITION				Pross	
					\mathbb{N}	
	T_Curb-Flowline	t				
∿-Top	RT_Curb-Flowline					
P-Top Nom		2.1.2.				
)		-Back-Bottom				
		RT_AE	C_EOP-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.

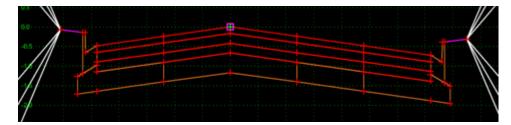
- 36. Expand the *4 Components* > *Aggtegate Bases* > *Driving Lanes* folder in the template library explorer.
- 37. **<D>** on the **ABC_Lane** component to display it in the Preview window.
- 38. **<D> and Hold** on the section's origin in the *Preview* window.
- 39. Drag and Drop the section on to the *RT_ABC_Laneline-Top* point.

RT_HMA_Lift1_Laneline-Top	-			-	-	-	-	-	
RT_HMA_Lift2_Laneline-Top RT_HMA_Lift3_Laneline-Top					and the second second			aneline aneline	
ABC Laneline-Top	 	[: :	: 				aneline e-Top1	
RT_SubBase_Laneline-Top									
				_	RT	SubBa	se_Lar	eline	lob1

40. **<R>** on the vertical line between *RT_ABC_Laneline-Top* and *RT_SubBase_Laneline-Top* and select **Merge Components** from the menu.

RT_HM	IA_Lift1_Laneline-Top IA_Lift2_Laneline-Top IA_Lift3_Laneline-Top	
RT_AB	C_Laneline-Top	
RT	Add New Component Template Documentation Link Check Point Connectivity Delete Components Change Template Origin Delete Constraints from All Points	,
	Edit Component Insert point Merge Components	
	Unmerge Component Points Set Component Display Rules	
	Delete Component	
	Set Dynamic Origin	Ctrl-D

The finished template is illustrated below:



Lab 9.4 - Add a Median Barrier to a Divided Highway Template

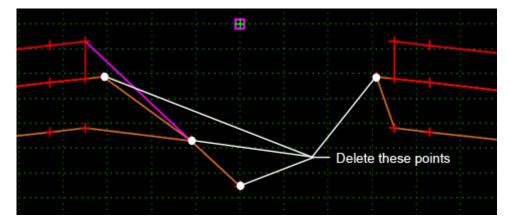
In order to add a median barrier to the CONC_Divided_TypeA_4Lane template, the slope components will be deleted, the ABC components will be modified, a Guardrail_Type 7-CE component will be added, and the pavements will be tied to the barrier.

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.
 - ÷ Add New Component Template Documentation Link... Check Point Connectivity... **Delete Components** Change Template Origin Delete Constraints from All Points Edit Point... Add Constraint **Delete Both Constraints Delete Slope Constraint** Delete Horizontal Constraint Delete Point Delete From Components (Make Null) Set Dynamic Origin Ctrl-D
- 2. <R> on the RT_Median_POSS point and select Delete Point.

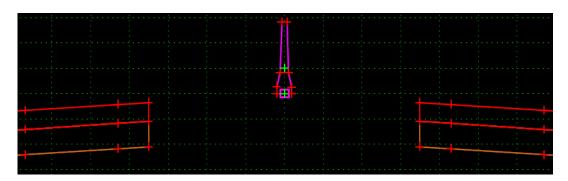
- 3. In the **Delete Point** dialog box, **<D> All.**
- 4. **<D> OK**. This deletes the point from *RT_SubBase_Shoulder* and deletes the *Z-Slope_12_6_to_12* and *RT_Median* components.
- 5. <R> on the RT_Inside_SubBase_EOP-Top2 point and select Delete Point.
- 6. Using the same method as the steps above, 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.



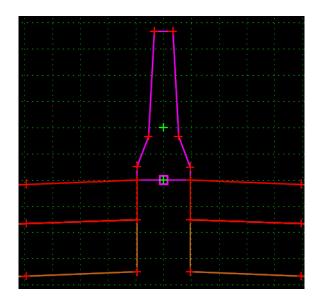
Now the pavement edges need to be attached to the barrier. This is done by modifying the constraints for the those points.

- 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 Properties	×
Name:	RT_Inside_Conc_EOP- Apply
Feature Name Override:	RT_Inside_Conc_EOP-Top
Surface Feature Style:	D_EOP
Atemate Surface:	• Next >
	Member of: RT_CONC_Pvmt_Lane-Layer
Constraints	
Constra Type: Horizontal	
Parent 1: RT Conner	
	🖾 [Rollover Values]
Value: 0.00	0.00%
Label: RT_Inside_	EOP-Hor - RT_Inside_EOP-Slot -
Style Constraint:	
Horizontal (Range: 0.00	Vertical O Both

17. Repeat steps 12 through 15 for point LT_Inside_Conc_EOP-Top using LT_Connect as the *Parent 1* point.



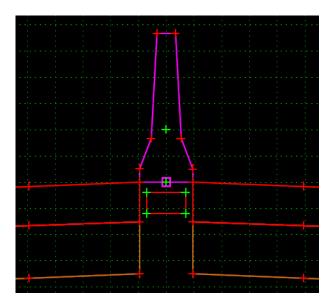
18. Zoom in to the area under the barrier.

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*.

	╡╸╸┍╄╤╪╪╧		
Current	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**.



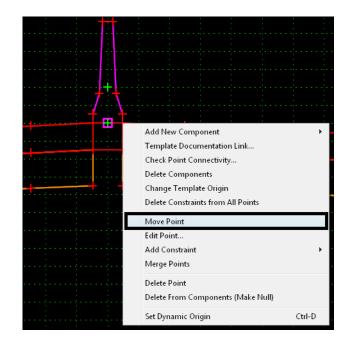
31. **<D> <D>** on the **RT_ CONC_Under_Barrier-Top** point.

- 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_Bam • +	Apply
Feature Name Override:	RT_CONC_Under_Barrier-1	Close
Surface Feature Style:	D_CONC_Pvmt	
Atemate Surface:	· · · · · · · · · · · · · · · · · · ·	< Previous
		Next >
	Member of:	Help
	CONC_Under_Barrier	
	CONC_Under_Barrier1	
Constraints Constra	int 1 Constraint	2
Type: Horizontal	✓ Vertical	•
Parent 1: RT_Conne	ct • RT_Barrier-Bot	tom 🔻 🕈
Value: 0.00	0.00	
Label:	-	-
Style Constraint:		
(i) Horizontal (ii)	🗇 Vertical 💿 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**.

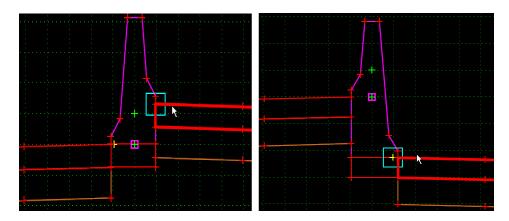


63. **<R>** on the **RT_Connect** point and select **Move Point**.

64. **<D>** on **RT_V_Control** in the box that pops up listing all available points at this location.



- *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

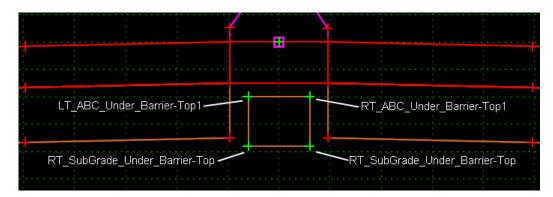


- **Note:** This barrier has both a variable height *and* a variable width. If the height is 34" or less, the base is 23" wide. As the height increases above 34" the base varies from 23" to a maximum of 26.75". The maximum height is 40".
- *Important!* Since the barrier width is variable, the adjacent 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 accomodate 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 **0** 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.

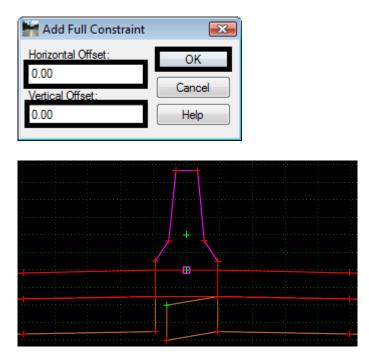
↓ ↓			
	Add New Component Template Documentation Link. Check Point Connectivity		
	Delete Components Change Template Origin		
	Delete Constraints from All Poin Move Point	nts	
	Edit Point Add Constraint	۲	Full Constraint
	Delete Point Delete From Components (Mal	ce Null)	Horizontal Vertical Slope
	Set Dynamic Origin	Ctrl-D	Stope Vector Offset
			Angle Distance Horizontal Maximum Horizontal Minimum
			Vertical Maximum Vertical Minimum

- 82. **<D>** on the **RT_ ABC_Under_Barrier-Top.**
- 83. **<D>** on **RT_ABC_Under_Barrier-Top** on the *Point Selection* dialog box.



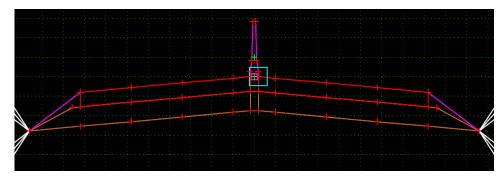
84. In the *Add Full Constraint* dialog box, key in *O* for both offsets.

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 9.1 -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 9.2 -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 9.3 -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 reaults can be achieved working with the points on components. In *Lab 9.4 -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 10 - 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_XM\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 10.1 - Create a Corridor

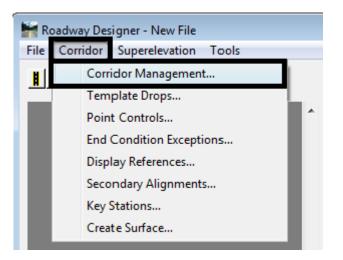
The first step in creating a design model is to create a corridor. The corridor defines where the model is located, both horizontally and vertically. The corridor in this example runs the total length of the alignment so no station limits are needed.

- 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 X	M Edition
<unnamed></unnamed>	- 🚡 🛒 🔇
<u>File S</u> urface <u>G</u> eom	netry <u>D</u> rainage <u>E</u> valuation <u>I</u>
🗠 🗠 🏪 📓	<mark>}</mark> 🔊 🗠 🐘 👘
⊕ <u>e</u> Default	New
	Open
	Active
	Close All
	Empty All
i Surfaces 😤 (Geometry

- 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

Ħ



<D> the corridor management button

- 6. In the *Manage Corridors* dialog box, key in *12345DES* in the *Name* field.
- 7. **<D> Add**.
- 8. **<D> Close**.

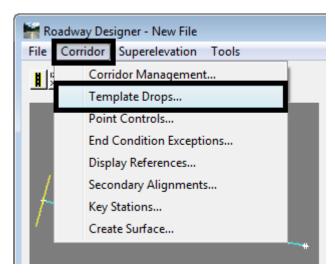
Manage Corridor	s				- • •
Name: 12345DES			Limits Station		Add
Type: Horizontal Alignment: Vertical Alignment: PI Rounding Tangent: Corridors:	Alignment SH 86 SH 86 V 0.00	* * *	Start: 203+80.28 Stop: 260+43.16	+	Close Change Copy Copy From Help
Name	Гуре	Source Name	Start Station	Stop	Station
					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 10.2 - Devlop 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 runse 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 🗮

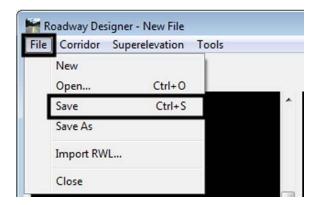
- 2. In the *Template Drops* dialog box, key in *25* for the *Interval*.
- 3. Expand the **1- Templates** folder in the *Library Templates* area. of the *Template Drops* dialog box.
- 4. **<D>** on the **HMA_Crowned_B10** template.
- 5. **<D> Add**.

6. **<D> Close**.

Template	Drops			
Comidor: 1	2345DES	-		Add
Station: 2	03+80.28	+		Close
Interval: 2	5.00	+		Change
Library Temp	ates:			Сору
	CONC_DIVIDED	_TypeA_4Lane	_	
	HMA_Crowned HMA_Divideo_ HMA_Full_Dep HMA_Urban_4 Sections - Paver Sections - End C	Typex_4Lane th_Widening_2Lane Lane ment	-	
	HMA_DIVIDEO_ HMA_Ful_Dep HMA_Urban_4 Sections - Paver Sections - End C	Typex_4Lane th_Widening_2Lane Lane ment	-	
	HMA_DIVIDEO_ HMA_Ful_Dep HMA_Urban_4 Sections - Paver Sections - End C	Typex_4Lane th_Widening_2Lane Lane ment	Revised In	Lbray
2- Current Temp	HMA_Full_Dep HMA_Full_Dep HMA_Urban_4 Sections - Paver Sections - End C Nate Drops:	Typer4Lane th_Widening_2Lane Lane ment Conditione	~	Library C:\Projects\12345
2- Current Temp Station	HMA_Eull_Dep HMA_Full_Dep HMA_Urban_4 Sections - Paver Sactions - End C late Drops: Interval	Typer_4Lane th_Widening_2Lane Lane ment Conditione Template	Revised In	

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*.

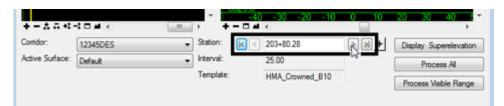
🙀 Save As				×
Save in:	퉬 InRoads	•	G 🤌 📂 🛄 -	
œ	Name	Date modified	Туре	Size
Recent Places	Lab - Interchange Data Lab - Intersections Data	8/24/2009 4:13 PM 8/24/2009 4:13 PM	File Folder File Folder	
Desktop	Combined Surfaces.ird	8/3/2009 7:17 AM	IRD File	13
Chris Ferree				
Computer	•	m		۱.
Network	File name: 12345DES.in			Save
	Save as type: Roadway De	esign (*.ird)	→	Cancel Help
			Ot	ptions

10. **<D> Save** then **<D> Cancel**.

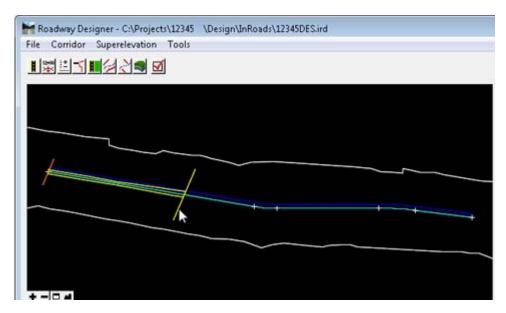
The template data is displayed in the cross section view of the Roadway Design. Notice, in the template view of the Roadway Designer, that the end conditions have already been solved.

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.



 To get a quick overview of how the template is working throught the cooridor, <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 10.3 - Generate Additional Details for Template Drops

Between the regular station intervals defined by a template drop, design data is generated using straing 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 regulare 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 Horizontal Cardinal Points	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

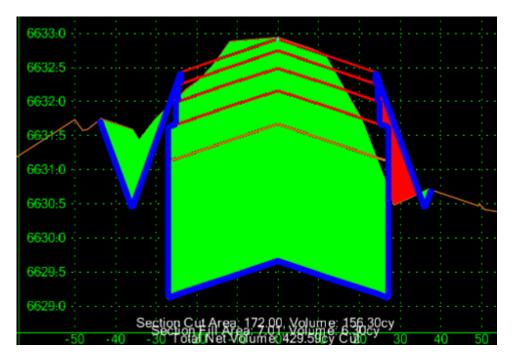
4. Scroll through the stations and notice that some stations do not fall on even intervals. These are the cardinal and event points.

+		
<	204+49.33	<mark>+</mark> 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.

+				F
Station: K	204+49.33	> > +		Display Superelevation
Interval:	25.00]	1	Process All
Template:	HMA_Crowned_B10]		Process Visible Range
				Troccas Habie Hunge
				1

- 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 Station: 203+80.28				lose ve As.
Point Control Usage:			App	end.
Point Node	Туре	Controlled by	D	splay
				Print
Station: 203+87.30				lelp
Point Control Usage: Point 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**.

🕌 Roadway Designer Options	•
Include Critical Sections Horizontal Cardinal Points Vertical Cardinal Points Horizontal Event Points Vertical Event Points External Control Points	OK Cancel Preferences Help
Display Reference Graphics Transition Graphics Triangulated Surface Cut and Fill Graphics Cut and Fill Values Net Volume	Superelevation Display Key Station Lines Station Result Reporting Options End Condition Failures Display Rule Values Point Control Usage Component Information
Null Points Curve Set ID Cardinal Points Cross Section Tracking	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			â	Close Save As
Point Control Usage: Point Mode	Type	Controlled by		Append. Display
Components: Name	Displayed			Print
ABC ABC HMA_Lift1 HMA_Lift3 HT_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			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 10.1 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 10.2 -Devlop 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 10.3 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 11 - 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.

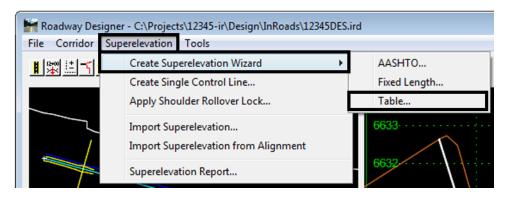
Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Workspace\Workspace-CDOT_XM\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 - 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.



3. **<D>** the **Browse** button and select:

C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Superelevation Tables\AASHTO 2004\06_55.sup.

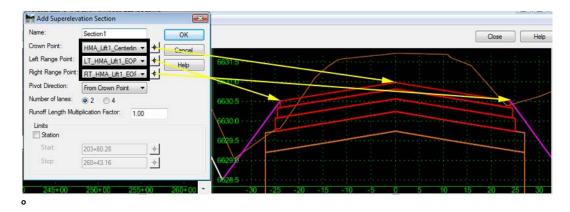
4. **<D>** the **Load Values From Table** button. The superelevation table has been selected.

5. **<D> Next**.

	Xe: C:Works Xenoff on Ta Specify Runout: Non-Linear Curve	ngent	space C 60% 0.00 0.00	Trans	dards Global \In R erpolate Table V tion Lengths Are Runoff	alues
ID	ontal Curve Sets Start Station	Stop Sta		Superelevati		Design
1	231+75.30 248+08.02	234+72: 252+90.		6.00% 4.40%	06_55.sup 06_55.sup	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**.



11. **<D> Next** on the *Superelevation Section Definitions* dialog box. This displays the *Superelevation Controls* dialog box.

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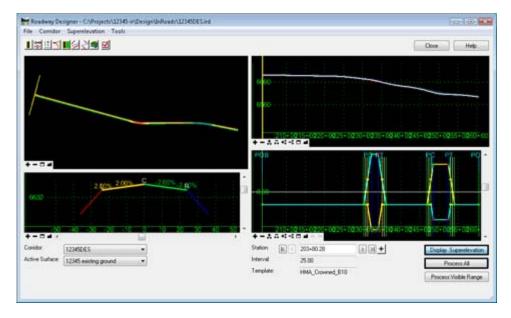
This dialog box is mainly for informational purposes. It is provide so that the superelvation control line properties can be reviewed/updated before they are applied.

- 12. **<D>** the **Finish** button to complete the superelevation entry.
- 13. **<D>** the **Display Superelevation** button on the *Roadway Designer* dialog box.

This adds the superelevation view window to the Roadway Desiner 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:

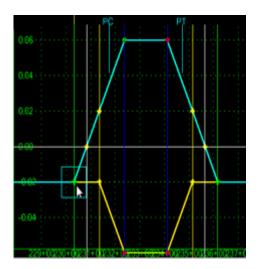
- Green-Blue for slopes from 0.5% to 10% to the right with dark blue representing slopes greater than 10% to the right
- Yellow-Red colors for slopes from 0.5% to 10% to the left with dark red representing slopes greater than 10% to the left
- White for slopes less than 0.5%

16. Select **File > Save** from the Roadway Designer menu bar.

Lab 11.2 - 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 superelvation stations:

- Edit the superelevation points from the superelvation 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.



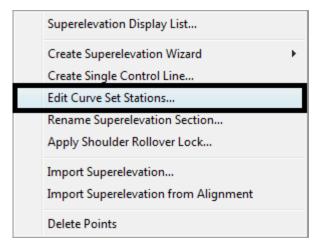
 The *Point Selection* dialog box is displayed. <D> <D> on the Section1 RT_HMA_Lift1_Laneline-Top-RT_HMA_Lift1_EOP-Top - 230+32.50.

Point Selection	
Section1 RT_HMA_Lift1_Laneline-Top-RT_HMA_Lift1_EOP-Top - 230+32	
Section1 LT_HMA_Lift1_Laneline-Top-LT_HMA_Lift1_EOP-Top - 230+32	
Section1 HMA_Lift1_Centerline-Top-LT_HMA_Lift1_Laneline-Top - 230+32	
Section1 HMA_Lift1_Centerline-Top-RT_HMA_Lift1_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 terminolgy used to define superlevation 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.



- 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.

	Section1				•		Apply
Lurve Set:	<] [<] 1		Show Cur	ve Set Informa	ation		Undo
Type	Constrained	Station	Cross Slope	Length	Grade	+	Close
Normal Crown		230+32.00	2.00%		-0.66%		
Super Runoff	X	230 + 83.12	0.00%	51.12	-0.69%		Help
Reverse Crown	\boxtimes	231+34.25	2.00%	51.12	-0.71%		
Full Super		232+36.50	6.00%	102.25	-0.75%		
Full Super	\boxtimes	234+11.77	6.00%	175.27	-0.82%		
Reverse Crown	\boxtimes	235+13.77	2.00%	102.00	-0.87%		
Super Runoff		235+64.77	-0.00%	51.00	-0.89%		
Normal Crown		236+15.77	-2.00%	51.00	-0.91%		

- 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.

Section Name:	Section1				•		Apply
ùrve Set:	< 1	××	Show Cun	ve Set Informa	ation		Undo
Туре	Constrained	Station	Cross Slope	Length	Grade	•	Close
Normal Crown		230+32.00	-2.00%		-0.66%		
Super Runoff		230+83.00	0.00%	51.00	-0.69%		Help
Reverse Crown		231+34.00	2.00%	51.00	-0.71%		
Full Super		232+37.00	6.00%	103.00	-0.75%		
Full Super	\boxtimes	234+12.00	6.00%	175.00	-0.82%		
Reverse Crown		235+14.00	2.00%	102.00	-0.87%		
Super Runoff		235+65.00	-0.00%	51.00	-0.89%		
Normal Crown		236+16.00	-2.00%	51.00	-0.91%		

- **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 11.1 -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 11.2 -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 rember that editing superelevation stations is a design decision based on standard design criteria from the AASHTO manual and project specific conditions.

LAB 12 - 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_XM\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 12.1 - 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 $\downarrow \pm \downarrow$.

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" \clubsuit 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.

ſ	Maint Contro	ls		- • 💌
	Corridor: 12345 Point: Mode Horizontal	DES RT_HMA_Lift1_EOF O Vertical Both	Station Limits Start: 203+80.28 \$top: 260+43.16	Add Close Change
	Control Type: Horizontal Alignm	Alignment ent: SH 86	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.

Com	dar	12345DES						
Point	i: ide		RT_HMA_Lift1_E0	OF • + St	ation Limits art: 220+00.00 op: 222+50.00	+ +		Add Close Change
Cont	rol T	ype:	Alignment		orizontal Offsets			Help
Horia	onta	Algoment:	SH 86	* *	art: 24.00	+		
Prior	ð1.	i and Vertica	1 I Controls:	SI	op: [0.00	+		
Ε.	Ρ.	Name		Start Station	Stop Station	Mode	Туре	Control
х	1	LT_HMA_	Lft1_EOP-Top	203+80.28	260+43.16	Vertical	Superelevation	Section 1 LT_HMA_Lift
х	1	LT_HMA_I	Lift1_Laneline-Top	203+80.28	260+43.16	Vertical	Superelevation	Section 1 HMA_Lift 1_0
х	1	RT_HMA_	Lift1_Laneline-Top	203+80.28	260+43.16	Vertical	Superelevation	Section1 HMA_Lift1_0
x	1	RT HMA	Lift1 EOP-Top	203+80.28	260+43.16	Vetical	Superelevation	Section 1 RT HMA LA
	1	RT_HMA_	Lift1_EOP-Top	220+00.00	222+50.00	Horizontal	Alignment	SH 86
х					101			,
×								

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.

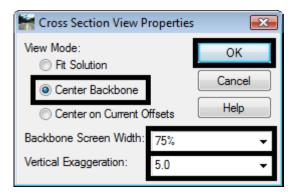
The third point control transitions from three lanes back to two lanes.

- 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 12.2 - 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**.

Name: Scab-on [Detour		Limits V Station	Add
Type:	Alignment	-	Start:	Close
Horizontal Alignme	nt: SH 86	+	206+00.00	+ Change
Vertical Alignment:	SH 86 V	•	Stop:	Сору
PI Rounding Tang	ent: 0.00		215+00.00	+ Copy From
Corridors: Name	Туре	Source Name	Start Station	Help Stop Station
	Type Alignment	Source Name SH 86	Start Station 203+80.28	Help
				Help 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\DE\$12345-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 XM*" 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**.

Mode Morizontal Vertical Control Type: Feature Surface: 12345 exist Feature: T_Traffic S	Shoulder	n Limits 206+00.00 215+00.00 ontal Offsets 0.00	* *			Add Oose Ohange Help
Use as Secondary Algoment	Vertic	al Offsets	*			
Plotty: 1 Horizortal and Vertical Controls:		0.00	* *			
Enabled Priority Name	Start State	n Stop Station	Mode	Туре	Control	
	Shoulder-Top 205+00.00	215+00.00		Feature	12345 existing ground: T_Traffic Sing	e Sold White38

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
x	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 12.3 - 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**.

Name: Off Ramp			Limits V Station	Add
Гуре:	Alignment	•	Start:	Close
Horizontal Alignme	nt: SH 86	• +	205+00.00	+ Change
Vertical Alignment:	SH 86 V	•	Stop:	Сору
PI Rounding Tang	anti a aa		215+00.00	+
ri nounuing tang	ent: 0.00		-	Copy From
	Type	Source Name	Start Station	Copy From Help
Corridors:		Source Name SH 86		Copy From Help
Corridors: Name	Туре		Start Station	Copy From Help Stop Station
Corridors: Name Scab-on Detour	Type Alignment	SH 86	Start Station 206+00.00	Copy From Help 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**.

🖌 Template Drops	
Comidor: Off Ramp	Add
Station: 205+00.00	+ Close
Interval: 25.00	+ Change
Library Templates:	
CONC (Lange Bight Side O	Copy
CONC_4Lane_Right-Side_O	neip
CONC_Ramp	=
HMA_Crowned_B10	
HMA_Full_Depth_Widening	
HMA_Urban_4Lane	- //
<	
Current Template Drops:	
Station Interval Template	Revised Library
205+00.00 25.00 CONC_4Lane_	RightITL C:\Projects\12345\De
<	4
Synchronize with Library	Edit Delete

A horizontal point control is used to widen the template and reposition its components perpendicular to the Off Ramp alignment.

- 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 **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**.

Point Controls				-	- • 💌
	Ider 👻 🕈 Both	Station Limits Start: 205+00 Stop: 215+00	0.00	++++	Add Close Change Help
Control Type: Alignment Horizontal Alignment: Off Ramp	▼ ▼ +	Start: 0.00 Stop: 0.00		+ +	
Priority: 1 Horizontal and Vertical Controls:		Start: 0.00 Stop: 0.00) ÷) ÷	
E P Name	Start Station	Stop Station	Mode	Туре	Control
X 1 RT_Conc_Shoulder-Top	205+00.00	215+00.00	Horizontal	Alignment	Off Ramp
•	III				- F
				[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 12.4 - 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 maner 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.

midor:	12345DES	Station:	KK	215+00.00	>>	Display Superelevation
tive Surface:	12345 existing ground	Interval:		50.00		Process All
		Template:		HMA_Crowned_B10		Process Visible Range

2. Select **Tools > Parametric Constraints** from the Roadway Designer menu bar.

Roadway Designer - C:\Project	s\12345\Design\InRoads\12345DES.ird
File Corridor Superelevation	Tools
	Target Aliasing
	Parametric Constraints
	Curve Widening Vertical Gore Tool
	Design Input Report (ird file) Results Report
+	Options

- 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 C	onstraints				- • •
Corridor:	12345DES		Station Limits		Add
Constraint Label:	LT_EOP-Top-Hori	z 🔻	tart: 237+00.00	*	Close
Start Value:	-24.00	3	top: 239+50.00	+	Change
Stop Value:	-36.00				Help
Ovemide Values:					nep
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: Constraint Label: Start Value: Stop Value: Override Values:	12345DES LT_EOP-Top-Horiz -36.00 -24.00	•		Limits 252+50.00 255+00.00	+	Add Close Change Help
Name	Start Value	Stop Val	ue	Start Station	Stop St	ation
LT_EOP-Top-Hor	iz -24.00	-36.00		237+00.00	239+50.	00
LT_EOP-Top-Hor	iz -36.00	-36.00		239+50.00	252+50.	00
LT_EOP-Top-Hor	iz -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 12.1 -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 12.2 -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 12.3 -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 12.4 -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 13 - 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_XM\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 - 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**.

Manage Corridors				- • • ×
Name: Template Tran	isition		mits 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
Corridors:				Help
Name	Туре	Source Name	Start Station	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
				202 12 12
Template Transition	Alignment	SH 86	203+80.28	260+43.16
Template Transition	Alignment	SH 86	203+80.28	260+43.16
	Alignment		203+80.28	260+43.16

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.

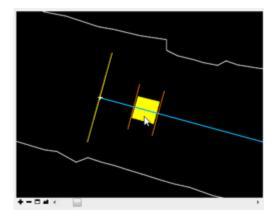
14. **<D> Add**.

🐂 Temp	late Drops			
Corridor:	Template	Transition	•	Add
Station:	208+00.00)	+	Close
Interval:	25.00		+	
Library Te	mplates:			Change
- -	1 Tomplato		-	Сору
2	✓ 12345_H	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.

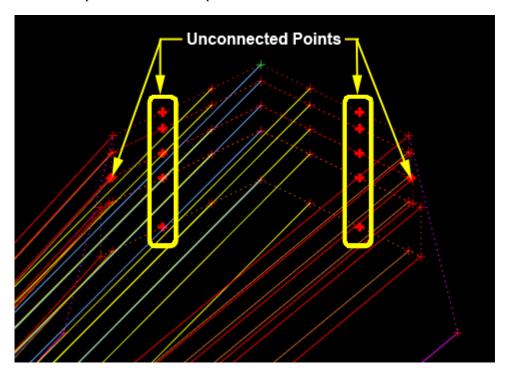
- 15. In the *Template Drops* dialog box, key in *211+00.00* for the *Station*.
- 16. **<D>** on the **12345_HMA_4Lane** template.
- 17. **<D> Add**.
- 18. **<D> Close**.
 - **Note:** Notice in the Plan view a yellow box has been displayed. This is the area of the transition. The yellow indicates that 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.

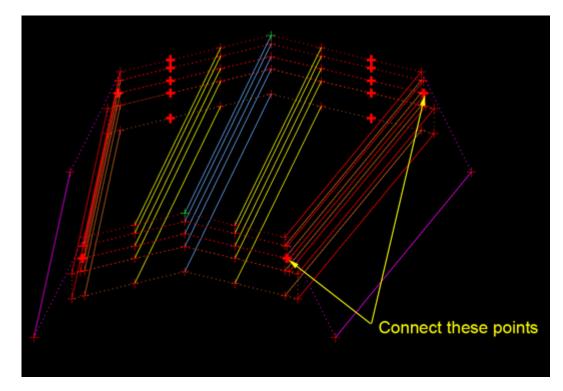


19. **<D> <D>** on the transition area. This displays the *Edit Transition – 208+00.00 to* **211+00.00** dialog box.

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.

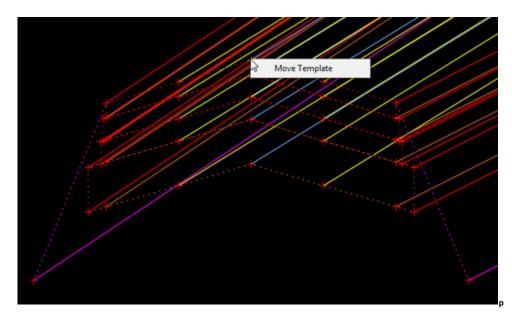


23. **<D>** on the "+". The line is now attached to the "+" and it is unbolded.

24. Repeat steps 19 through 22 on the left side.

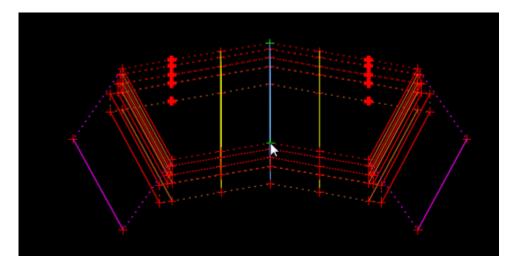
All of the points on the bottom template have been attached to points on the top template. However, points on the top template remain unconnected. These are connected to the appropriate laneline points of the bottom template.

25. **<R>** on the green "+" on the bottom template and select **Move Template**.

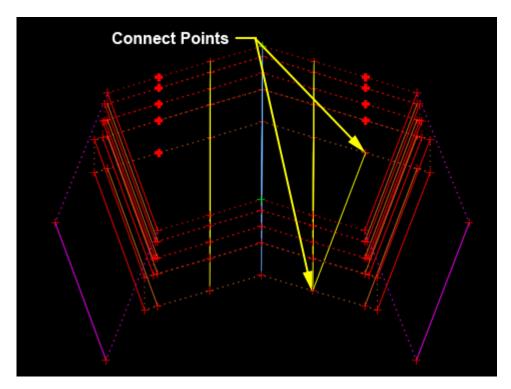


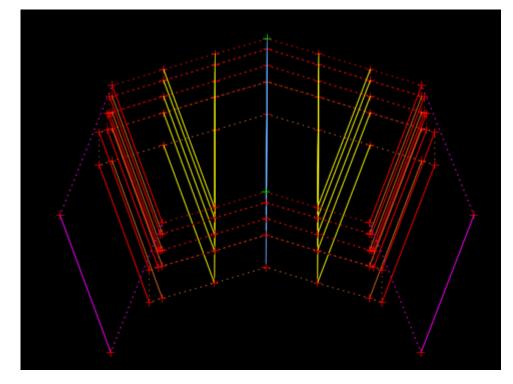
26. Move the bottom template so that it is easier to see the points to be connected.

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.



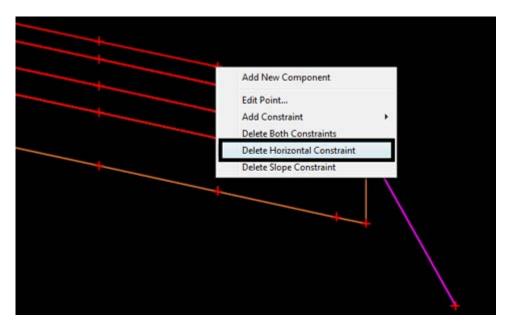


29. Connect the remaining points as shown below.

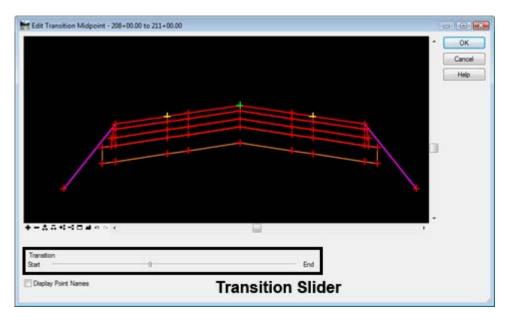
30. **<D> OK**. This displays the *Edit Transition Midpoint – 208+00.00 to 211+00.00* dialog box.

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.

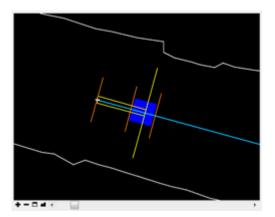


- 32. <R> on the LT_HMA_Lift1_Laneline-Top1 point and select Delete Horizontal Constraint from the menu.
- 33. Move the Transition slider and notice how the template behaves. The additional lane expands and contracts as the slider is moved back and forth.



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 13.2 - 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.

1. In the *Roadway Designer* dialog box, use the station indicator to select station **219+75.00**.

+	M (
Station:	<u> </u> < <	219+75.00	<mark>♦ <</mark> <
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

3.	In the End Condition Exceptions dialog box, note that the desired stations are already
	selected.

- 4. Toggle on *Right Transition*.
- 5. **<D> Add**. This adds the data to the *End Condition Exceptions* list.

H End Condition E	xceptions		- • •
Corridor: Template T Station Range Start: 219+75.00 Stop: 220+00.00	+ (pply To) Left Override) Right Override) Left Transition) Right Transition	Add Close Change Help
Start Station 219+75.00	Stop Station 220+00.00	Type Right Tra	nsition
		Edit	Delete

6. Highlight the entry.

- -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 13.3 - 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.

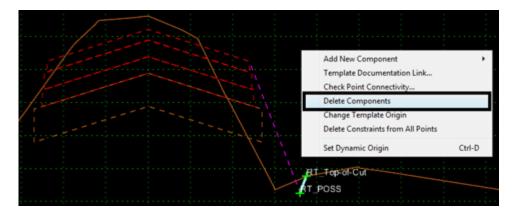
- 1. In the *Roadway Designer* dialog box, use the station indicator to select station 203+80.28.
- Select Corridor > End Condition Exceptions from the Roadway Designer menu bar or <D> the End Condition Exceptions button.
- 3. In the *End Condition Exceptions* dialog box, key in *206+50.00* for the *Stop* 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.

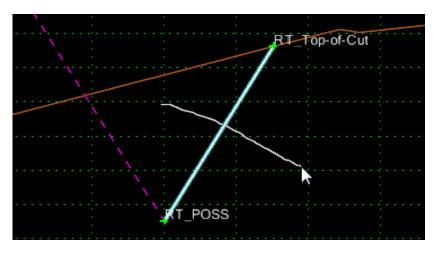
- 6. Highlight the entry.
- 7. **<D> Edit**. This displays the *Right Override 203+80.28 to 206+50.00* dialog box.

Hend Condition Exce	ptions		
Corridor: Template Trans	sition		Add
Station Range Start: 203+80.28	+	Apply To	Close Change
Stop: 206+50.00	+	Right Override Left Transition Dialth Transition	Help
End Condition Exception	15:	Right Transition	
Start Station	Stop Stati	on Type	
219+75.00	220+00.00	Right Tra	ansition
203+80.28	206+50.00	Right Ov	verride
		Edit	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.

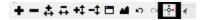
11. Select **Tools > Options** from the menu bar.

File Edit Add To	pols	
Template Library:	Template Library Organizer	
C:\Projects\12	Apply Feature Name Override	
	Options	
_	Dynamic Settings	
		_

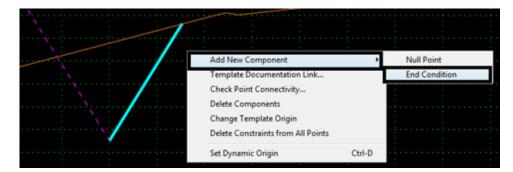
- 12. Toggle on **Apply Affixes**.
- 13. Key in *O. 10* for the *X* and *Y Step Options*.
- 14. **<D> OK**.

Template Options	×
Naming Options	ОК
Components Seed Name:	Cancel
From Style	Preferences
O 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.

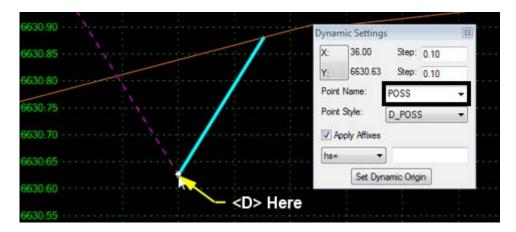


17. In the Current Component area, key in *Special Ditch* for the *Name*.

18. Select **D_Top-of-Cut** for the *Style*.

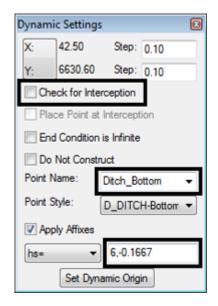
Current Component -			
Name: Special Ditch		Style: D_Top	-of-Cut 🔻
Target Type:	Surface 👻	Priority:	1
Surface	✓ <active></active>	Benching Count:	0
		From Datum:	0.00
Horizon	tal Vertical	Step Elevation:	0.00
Offsets: 0.00	0.00	Rounding Length	0.00

- 19. In the *Dynamic Settings* dialog box, select **POSS** for the *Point Name*.
- 20. **<D>** on the *RT_POSS* point.



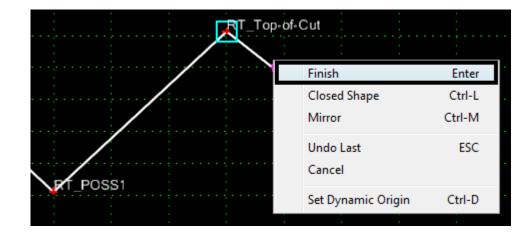
- 21. In the *Dynamic Settings* dialog box, toggle off **Check for Interception**.
- 22. Key in *Ditch_Bottom* for the *Point Name*.
- 23. Set the *Point Style* to **D_DITCH-Bottom.**

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
🔽 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 🔻
🔽 Арр	ly Affixes		
hs=	•	6,0.166	67
	Set Dyna	mic Orig	in



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 13.1 -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 13.2 -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 13.3 -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 14 - 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_XM\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 - 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.

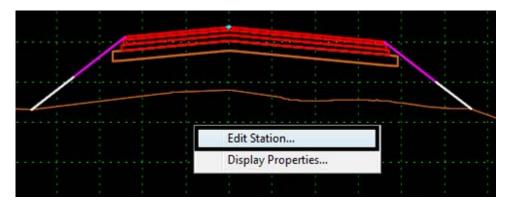
- 1. Select **Modeler > Roadway Designer** from the InRoads menu bar.
- 2. Select **12345DES** for the corridor (created in lab 4).

1		4 🗆 🖬 🗧		+	4 K		
Co	omidor:	12345DES	-	Station:	<u>k <</u>	203+87.30	≥ ≥ +
A	ctive Surface:	12345 existing ground	-	Interval:		25.00	
				Template:		12345_HMA_2Lane	

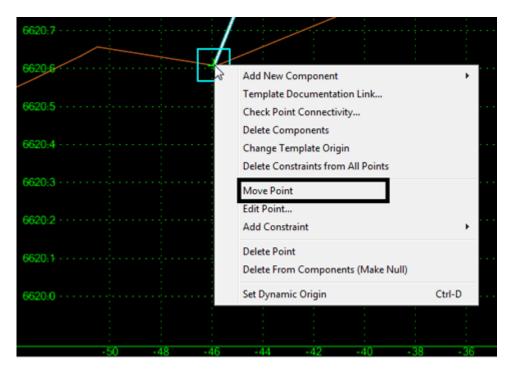
3. Key in **225+50.00** in the Station indicator and press the Tab key.

+-0/	•		
Station:	<	225+50.00	+ < <
Interval:		25.00	
Template:		12345_HMA_2Lane	

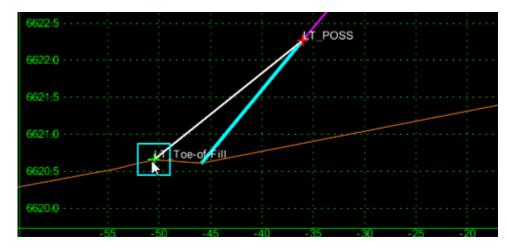
4. **<R>** in the template view and select **Edit Station** from the menu.



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 14.2 - 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**.

ៅ 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**.

	Drops			- • •
Corridor: Si	H 86_Offset_Left	•		Add
Station: 20	3+80.28	+		Close
Interval: 25	.00	-4-		Change
Library Templa	stes:			Criange
XXXXX	emplates 12345_HMA_2LL 12345_HMA_4LL CONC_4Lane_R CONC_Divided_ CONC_Bamp HMA_Crowned_	ane light-Side_Only TypeA_4Lane B10 ypeA_4Lane	emplates.ti	Help
	HMA Full Denth ate Drops:	Midening 71 sna		
		Template	Revised In	Library
Current Templ	ate Drops:		Revised In ITL	Library C:\Projects\12345\Des

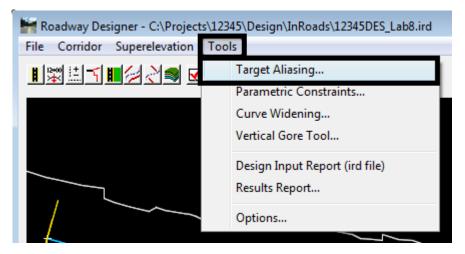
The corridor is built on the same alignment as the 12345DES alignment. A point control is used to move *SH 86_Offset_Left* corridor 80' to the left.

- 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**.

Point Controls					- • •
Corridor: SH 86_Offset_Left Point: HMA_L Mode Mode Vertica	ift1_Centerlin al ⊚ Both	• + Star	ion Limits 203+80.28 260+43.16		Add Close Change
Control Type: Alignme Horizontal Alignment: SH 86	ent	v + Start	zontal Offsets -80.00 -80.00	+ +	Help
Use as Secondary Alignme	nt	Star	ical Offsets 0.00 0.00	+	
Priority: 1 Horizontal and Vertical Control	5:				
En Pri Name	Start Station	Stop Station	Mode	Туре	Control
X 1 HMA_Lift1	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.

arget:	<active surface=""></active>	•		ОК
Surface or Corridor		Aliases:	Cancel	
Corridor - 12345DES		Add ->		Help
Corridor - Scab-on Detour Corridor - Template Transition		<- Remove]	nep
Surface - 12345 existing ground Surface - Default	Move Up			
		Move Down	1	

21. Highlight Surface - 12345 Existing Ground from the Surface or Corridor list.

22. **<D> Add**.

arget:	<active surface=""></active>	•		ОК
Surface or Corrid	for	22	Alases:	Cancel
Corridor - Off Ramp Corridor - Scab-on Detour Corridor - Template Transition Surface - Default		Add ->	Comdor - 12345DES Surface - 12345 existing ground	
		<- Remove		Help
		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 14.1 -Modifying a Single Template Drop* a single template drop was modified by moving a point.
- In*Lab 14.2 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 15 - 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 15.1 - 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)
 - Add Exterior Boundary (to eliminate erroneous triangles in concave areas of the design model)
 - **Triangulate** (to create the triangulated model)
 - **Remove Loops** (to correct areas where template drops cross)
- 6. Set the exterior boundary style to Exterior Boundary or DTM_Exterior.
- 7. Highlight the **12345DES** corridor from the *Create Surface(s) From* list.

8. **<D> Apply**. This creates the surface and displays the *Results* window.

Kreate Surface			×
Name:	12345DES		Apply
Default Preference:	Proposed	*	Close
New Surface for	Each Corridor		Preferences
Empty Design St	uface		Help
Include Null Poir	its		
Add Exterior Bou	ndary - Style:	DTM_Exter	ior 💌
Densify Horizont	al Curves using Cho	ord Height To	lerance
Densify Vertical	Curves using Chord	Height Toler	ance
Triangulate			
Create Surface(s) fro	om:		
12345DES			
Scab-on Detour SH 86_Offset_Left			
Template Transition	ı		Al
			None
Clipping Optic	ons		
Features			
Duplicate Names:	Replace	Rename	Modify
Add Transvers		Torranto	() houry
Style:			
orgie.	Default	Ψ.	
Create Alternate	Surfaces		
Process Visible F	Range Only		
Remove Loops			
Display Features	in Plan View		

- 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.

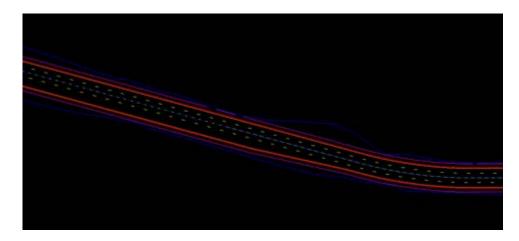
One method of reviewing the dtm is to display the features into the MicroStation file. Follow the steps below to display the features from the newly created surface.

- 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 Feature	S	_	Σ
Surface:	12345DES -		Apply
Fence Mode:	gnore 🔻		Close
			ilter
		Edi	t Style
			Help
Features:		The second second	
Name	Style	Description	<u> </u>
12345DES-ABC	CenCenterline	Created by roadway	. =
12345DES-HMA	Lift Centerline	Created by roadway	
		created by roadway	
12345DES-HMA	_Lift Centerline	Created by roadway	
	_Lift Centerline _Lift Centerline		
	_ _Lift Centerline	Created by roadway	···
12345DES-HMA 12345DES-LT_A	_ _Lift Centerline	Created by roadway Created by roadway	···
12345DES-HMA 12345DES-LT_A 12345DES-LT_A	_Lift Centerline \BCD_EOP	Created by roadway Created by roadway Created by roadway	··
12345DES-HMA 12345DES-LT_A 12345DES-LT_A	Lift Centerline \BCD_EOP \BCD_HINGE \BCD_LANELINE	Created by roadway Created by roadway Created by roadway Created by roadway	··
12345DES-HMA 12345DES-LT_A 12345DES-LT_A 12345DES-LT_A		Created by roadway Created by roadway Created by roadway Created by roadway Created by roadway	··
12345DES-HMA 12345DES-LT_A 12345DES-LT_A 12345DES-LT_A 12345DES-LT_F		Created by roadway Created by roadway Created by roadway Created by roadway Created by roadway Created by roadway	

- 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.

🗠 堝 🏪 🛍 🔂 🖥	£ 🗠 🄛 🗠								
		Data Typ	be	Active	Features	Deleted	Total	Blocks	Min Northin
Surfaces		The Break	dine Fe	9543	46	0	9543	46	1555702.1
😥 🤜 Default		2 Cont	our Fea	0	0	0	0	0	0.0
12345 existing	ground	Exterior	or Feat	505	1	0	505	1	1555702.1
🕂 🌁 12345DES	Save		d Brea	0	0	0	0	0	0.0
	Save As		r Feat	0	0	0	0	0	0.0
	Save As		m Fea	0	0	0	0	0	0.0
	Set Active	8	Points	4	47	0	4	1	1555692.1
	Triangula	te	les	3754	0	530	4284	1	0.0
	Copy		1						
	Close								
	Empty		L						
Г	Properties	·	1						

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.

🐂 Surfa	ce Properti	es
Main	Advanced	
Surface	e:	12345DES -
Name:		12345DES
Descrip	otion:	Created from roadway de
Maximu	um Length:	0.00
Prefere	nce:	
		Proposed
Type:		Proposed

- 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 15.2 - 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.

+			+-++++	► ▲ ∽ ∼ ▲	
Corridor:	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**.

🔚 Create Surface			• ו
Name:	12345DES		Apply
Default Preference	Proposed	*	Close
Vew Surface for	r Each Corridor		Preferences
Empty Design S	urface		Help
Include Null Poi	nts		
Add Exterior Bo	undary - Style:	DTM_Exter	ior 🔻
Densify Horizon	tal Curves using	Chord Height To	lerance
Densify Vertical	Curves using Ch	nord Height Toler	ance
Triangulate			
Scab-on Detour SH 86_Offset_Left Template Transitio			All None
Clipping Opti	ons		
Features Duplicate Names:		Rename	Modify
Add Transvers	-		() Modely
Style:	Default	Ŧ	
Create Alternate			
Process Visible	Range Uniy		
Remove Loops			
Display Feature	s in Plan View		

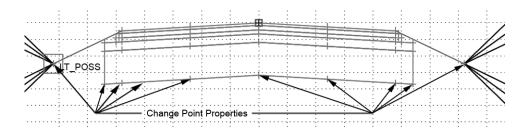
- 8. Examine the contents of the *Results* window. Note the point control information from the previous labs. Close the *Results* winow.
- 9. **<D> Close** to dismiss the *Create Surface* dialog box.
- 10. Minimize the **Roadway Designer** dialog box.
- In the *InRoads* dialog box, notice that there 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 15.3 - 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.

+-++=	· + -	• 🗖 🖬 🗧	
Corridor: SH 86_Offset_Left	Statio	n: 🔣 < 203+80.28	+ K <
Active Surface: 12345 existing ground	Interv	al: 25.00	
	Temp	late: HMA_Crown	ed_B10

- 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			8
Name:	SH 86_Left_C	Offset	Apply
Default Preference:	Proposed	-	Close
New Surface for	Each Comidor		Preferences
Empty Design S	urface		Help
Include Null Poir	nts		
Add Exterior Bou	undary - Style:	DTM_Exte	rior 🔹
Densify Horizont	al Curves using	Chord Height T	olerance
Densify Vertical	Curves using C	hord Height Tole	erance
Triangulate			
Scab on Dotour SH 86_Offset_Left Template transition	1		All None
Clipping Opti	ons		
Features Duplicate Names:	Replace	Rename	O Modify
Add Transvers	-	0	0
Style:	Default	¥	
Create Alternate	Surfaces		
Process Visible	Range Only		
Remove Loops			
Display Features	s in Plan View		

- 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.

<unnamed></unnamed>	1 😤 🚳 🔪 🎽		in E						
File Surface Geometry Drainage E 그 백A, 배월 배월 🖾 🔊 🗟		fting <u>T</u> ools	<u>H</u> elp						
	Data Type	Active	Features	Deleted	Total	Blocks	Min Northing	Min Easting	м
□→ Surfaces	T Breakline Fe	1824	8	0	1824	8	1555797.47	3277581.42	
🕂 🥰 Default	Scontour Fea	0	0	0	0	0	0.00	0.00	
12345 existing ground	Exterior Feat	457	1	0	457	1	1555797.47	3277581.42	
12345DES	M Inferred Brea	0	0	0	0	0	0.00	0.00	
Template Transition	Interior Feat	0	0	0	0	0	0.00	0.00	
E Scab-on Detour	*** Random Fea	0	0	0	0	0	0.00	0.00	
	Range Points	4	9	0	4	1	1555787.47	3277571.42	
Subgrade	Triangles	3178	0	472	3650	1	0.00	0.00	
Surfaces 🔠 Geometry 🕢									

Lab 15.4 - 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:	<	260+00.00	>>+
Active Surface:	12345 existing ground	-		Interval:		25.00	
				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.

arget: https://www.argetscore.com"/>https://www.argetscore.com	•	Aliases:	ОК
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 - Template Transition	Add -> <- Remove Move Up Move Down	Corridor - 12345DES Surface - 12345 existing ground	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.

16. In the *Clipping Options* dialog box, **<D>** on the entry in the *Clipping Option* column until it reads Clip End Conditions Only.

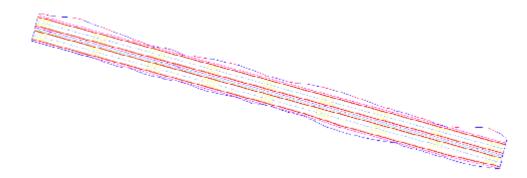
17. **<D> OK**. This dismisses the Clipping Options dialog box.

	A STATE OF STREET, DATE OF STREET, STR	Clipping Option	
12345DES SH	86_Offset_Left	Clip End Conditions Only	Cancel
			Help

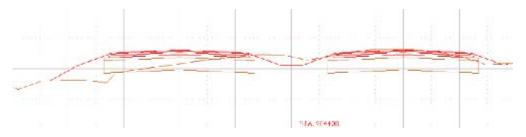
- 18. In the *Create Surface* dialog box, verify that **New Surface for Each Corridor** and **Create Alternate Surfaces** are toggle off.
- 19. **<D> Apply** to create the combined surface.
- 20. Review then **<D> Close** on the *Results* dialog box.
- 21. **<D> Close** to dismiss the *Create Surface* 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 XM Editi	on		
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<u>File Surface Geometry D</u>	<u>)</u> rainage <u>E</u> va	luation <u>M</u> o	odeler Dr <u>a</u> ft
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		Data Typ	e
Surfaces	-	The Break	line Feature
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12345 existing g	round	Exteri	or Features
	Save		Breakline
	Save As		Features m Features
	Set Active		Points
	Triangulat	te	es
	-		
	Copy		
	Close		
🗐 Surfaces 🔠 Geo	Empty		
1	Properties		
Toggles Locate Features/Loc	ate orapriics	moue	_

Chapter Summary:

- In *Lab 15.1 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 15.2 -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 15.3 -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 15.4 -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 16 - Cross Sections, Volumes, and Reports

This lab illustrates the changes in cross sections, volumes, and reporting from InRoads 2004 to InRoads XM. 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_XM\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 16.1 - 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 XM 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 trinagulated design surface only. This is to illustrate what features (template points) are used to create the triangulated surface model.

4. Select **Evaluation > Cross Section > Create Cross Section** from the InRoads menu bar.

5. In the *Create Cross Section* dialog box, toggle on the **12345 Existing Ground** and the **12345DES** surfaces.

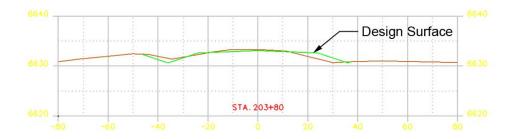
Create Cross Section				
Create Cross Section	Set Name:	SH 86		
General Source	Create:	Window and Data	•	
Include	Interval:	50.00	+	
Controls	Left Offset:	-80.00	+	
Layout	Right Offset:	80.00	+	
Axes	Vertical Exaggeration:	2.0000		
Details	Show Data Outside Surfaces:	e Elevation Range		
	Object	Name		
	Default	Default	BYI	
	12345 existing gro 12345DES	oun T_Existing Gro D_Finished-Gr		All
				None
			Properties	
		Apply Preferen	Close	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.

Create Cross Section General Source Include Controls Custom Layout Axes Grid Details ASCII	Surface Crossing Features Adjust Range Projected Features Ahead Band: 10.00 Back Band: 10.00 Components Annotation Volumes	
	Storm and Sanitary Crossing Structures Projected Structures Ahead Band: 10.00 Back Band: 10.00	

- 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.



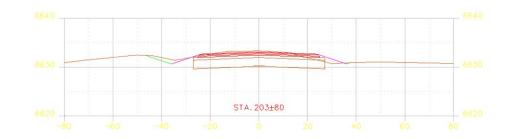
Next, the components are added to the cross sections using the Update Cross Section command.

- 11. Select Evaluation > Cross Section > Update Cross Section from the InRoads menu bar.
- 12. Toggle on the **Display On** radio button.
- 13. **<D> Components** in the *Update Cross Section* explorer.

- LAB 16 Cross Sections, Volumes, and Reports
 - 14. Highlight 12345DES in the Surface area.
 - 15. **<R>** in the *Component* area and select **Select All** from the menu.
 - 16. **<D> Apply**.

,	Mode: © Refre + Start: 203+80.2 Surface:) Display Off 43.16	
Update Cross Section General Surfaces Components Crossing reacures Projected Features Storm and Sanitary	Name Default 12345 existing and 12345DES	und F	Description xisting Ground from multi reated from roadway de	
	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 Cour E Hot Mix Asphalt Pave Hot Mix Asphalt Pave Hot Mix Asphalt Pave	+
	LT_Cut_4/1	D_Top-of-Cut	Select All	Ctrl+A Ctrl+N

- 17. **<D> Close** to dismiss the *Update Cross Section* dialog box.
- 18. 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.



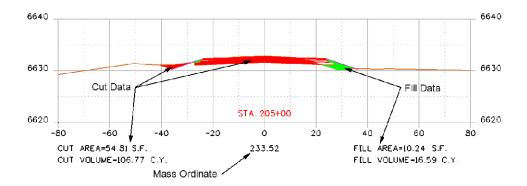
Lab 16.2 - Calculate End Area Volumes

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 >Volume > End Area Volume** from the InRoads menu bar.
- 2. On the *General* leaf, notice the Surfaces selected. Surface 12345 Existing Ground has the Type of Existing and 12345DES has the type of Design.
- 3. Toggle off Create XML Report.
- 4. Toggle on Cubic Yards.
- 5. <D> Apply.



6. Examine the cross sections. Notice the various types of data shown in the illustration below.



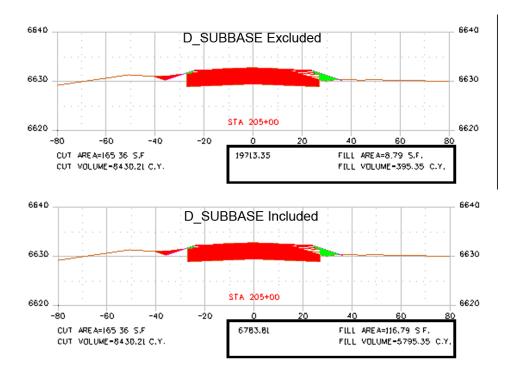
Some materials shown in the template are computed as normal embankment. In this example, the D_SUBBASE material is included as embankment. The steps below change the settings for the subbase so that it can be included as embankment.

 In the *End Area Volumes* dialog box, <D> on Classifications in the End Area Volumes explorer. 8. **<D>** in the cell of the **D_SUBBASE** row and the **Mass Ordinate** column so that it reads **Include**.

Object 12345 existing gn	Source	Parent	Classification	Mass Ordinate	Cut England	DUE .
12245 existing on			Classification	mass Uturiale	Cut ractor	Fill Facto
12345 existing gr	Surface				1.0000	1.0000
D_SUBBASE	Component	12345DES	Designed	Include		1.0000
D_HMA_Pvmt	Component	12345DES	Designed	Exclude	-6	1.0000
D_ABC_Class 6	Component	12345DES	Designed	Exclude		1.0000
•						
	D_HMA_Pvmt D_ABC_Class 6	D_HMA_Pvmt Component D_ABC_Class 6 Component	D_HMA_Pvmt Component 12345DES D_ABC_Class 6 Component 12345DES	D_HMA_Pvmt Component 12345DES Designed D_ABC_Class 6 Component 12345DES Designed	D_HMA_Pvmt Component 12345DES Designed Exclude D_ABC_Class 6 Component 12345DES Designed Exclude	D_HMA_Pvmt Component 12345DES Designed Exclude D_ABC_Class 6 Component 12345DES Designed Exclude

9. **<D> Apply**.

10. Examine the cross sections. Notice the change in the data.



Lab 16.3 - 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* dialog box, **<D> Unsuitable Materials by Station** in the End Area Volumes explorer.
- 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.

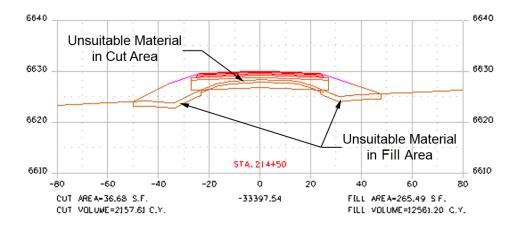
Start Station:	203+80.28	→ +		Add
				Change
				Delete
nii Depin.	.00			
Unsuitable Materi	als:			
Start Station	Stop Station	Material	Cut Depth	Fill Depth
203+80.28	260+43.16	Default	0.50	1.00
	Stop Station: 2 Style: [Cut Depth: 0 Fill Depth: 1 Unsuitable Materi Start Station	Start Station: 203+80.28 Stop Station: 260+43.16 Style: Default Cut Depth: 0.50 Fill Depth: 1.00	Start Station: 203+80.28 + Stop Station: 260+43.16 + Style: Default + Cut Depth: 0.50 - Fill Depth: 1.00 - Unsuitable Materials: - - Start Station Stop Station Material	Start Station: 203+80.28 + Stop Station: 260+43.16 + Style: Default + Cut Depth: 0.50 - Fill Depth: 1.00 - Unsuitable Materials: - - Start Station Stop Station Material Cut Depth

- 7. **<D>** Annotation in the in the End Area Volumes explorer.
- 8. *Toggle off* Cut Shape and Fill Shape. fThis is so that the unsuitable material shapes can be seen.

9. **<D> Apply**.

oss Section Set:	Object	Prefix	Suffix	Precision	Location	Name	
	Cut Shape						
H 86 🔻	Fill Shape						
End-Area Volumes	Shape Area			0.12			
General	Cut Centroid Symbol						
Unsuitable Materials by Feature	Fill Centroid Symbol						
Unsuitable Materials by Station	Cut Area	CUT AF	S.F.	0.12	Bottom Left		
Classifications	Fill Area	FILL AF	S.F.	0.12	Bottom Right		
Compaction/Expansion	Cut Volume	CUT VC	C.Y.	0.12	Bottom Left		
Volume Exceptions Added Quantities	Fill Volume	FILL VC	C.Y.	0.12	Bottom Right		
Forced Balance	Mass Ordinate			0.12	Bottom Center		
As Built	Tabulated Area			0.12	Top Left		
Annotation	Tabulated Volume			0.12	Top Right		

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 16.4 - 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. 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 > Create Cross Section from the InRoads menu bar.

- 2. In the *Create Cross Section* dialog box, on the *General* leaf, verify that the **12345 Existing** Ground and **12345DES** surfaces are selected.
- 3. **<D> Include** in the Create Cross section explorer.
- 4. Toggle on **Components**.
- 5. **<D> Custom** in the Create Cross section explorer.

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**.

Station Type	Type: Station Range
	Details
	Start Station: 203+80.28 +
	Stop Station: 208+00.00 +
	Interval: 50.00 +
	Left Offset: -100.00 +
	Right Offset: 100.00
	Skew Angle: 0^00'00'' -+
Crossing Projected Ahead Band: 0.00	Stom and Sanitary Structures Crossing Projected Ahead Band: 0.00 +
and the second	+ Back Band: 0.00 +
	Features Crossing Projected Ahead Band: 0.00 Back Band: 0.00

The steps below are used to display a single cross section at station 208+15.83 and at station 212+89.50.

- 9. Set the *Type* to **Perpendicular**.
- 10. Key in *208+15.83* for the *Station*.

11. **<D> Add**.

K Create Cross Section			_		
Create Cross Section	Station	Туре	Type: Perp	endicular	•
General Source Include Controls	203+80.28 208+15.83	Station Range Perpendicular	Details Station: Left Offset:	208+15.83 -100.00	+ +
Custom			Right Offset:	100.00	+
	Features Crossing		Storm and Sa	anitary Structures	
	Projected		Projected		
	Ahead Ba	and: 0.00 +	Ahead B	land: 0.00	-ф-
	Back Bar	nd: 0.00 +	Back Ba	and: 0.00	+
	Add	Update Graphics	Import	Save	Save As
		Apply Pre	ferences)	Close	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**.

Create Cross Section General	Station Type	Type: Station Range
General Source Include Controls Custom General Layout Layout	203+80.28 Station Range 208+15.83 Perpendicular 212+89.50 Perpendicular	Details 213+00.00 + Start Station: 260+43.16 + Interval: 50.00 + Left Offset: -100.00 + Right Offset: 100.00 +
Axes Grid Details ASCII		Skew Angle: 0^00'00''
	Features Crossing	Storm and Sanitary Structures
	Projected	Projected
	Ahead Band: 0.00 -+-	Ahead Band: 0.00 🔶
	Back Band: 0.00 +	Back Band: 0.00
	Add Update Graphics	Import Save Save As

- 19. **<D> Apply**. **<D>** a blank area of the MicroStation view window to display the cross sections.
- 20. **<D> Close** to dismiss the *Create Cross Sections* dialog box.

The data used for the custom cross section set can be saved for use at a later time. The steps below save the data.

- 21. **<D> Yes** for the message to save the data for the custom cross sections.
- 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 the volume exception and recalculate the volumes.

- 24. Select **Evaluation >Volume > End Area Volume** from the InRoads menu bar.
- 25. **<D> General** in the End Area Volume explorer.

26. Select **SH 86_1** for the *Cross Section Set*. The other settings are correct.

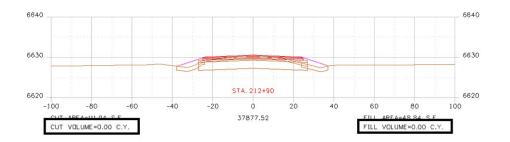
ss Section Set:	Surface	Туре	Method				
I 86_1	 12345 existing 12345DES 	Existing Design	 Standard Correct for Curvature 				
General General General Orsuitable Waterials by Feature Unsuitable Materials by Station Classifications Compaction/Expansion Volume Exceptions Added Quantities			Station Limits Use Station Limits Start Station: 203+80.28 \$top Station: 203+80.28				
Forced Balance As Built Annotation	Imperial Units Cubic Yards Create XML Report	Cubic Feet	Ignore Areas Smaller Than: 0.00				

- 27. **<D> Volume Exceptions** in the End Area Volume explorer.
- 28. Select 208+15.83 for the Start Station.
- 29. Select **212+89.50** for the Stop Station.
- 30. **<D> Add**.

ile Cross Section Set:	Settings Start Station: 208+15.83		Add
SH 86_1 General Unsuitable Materials by Feat Unsuitable Materials by Stati Classifications Connaction/Expansion Volume Exceptions Audeo Goantitues Forced Balance	Stop Station: 212+89.50	▼ * ▼ *	Change Delete
As Built Annotation	Start Station	Stop Station	
		Apply Preferences Close	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 16.5 - 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* dialog box, **<D> General** in the End Area Volume explorer.
- 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.

ools Help																
kspace\WorkspaceCDOT_XM\ aCollection	X > 0	QX	X	90	XX		End	Area V	olume	Repor	i (X			XX		$\langle \rangle \langle \rangle$
luation AverageCrossSlopeArea.xsl BasicEndAreaVolumeBalanc+ BasicVolume.xsl	KX2						F		ited: 3/26/. 1:13pm	2009						
CrossSection xsl CrossSectionAllFeatures xsl CrossSectionASCIIInputForm CrossSectionASCIIInputForm =	Cr	Ali	gnment	Name: S Name: S Factor: 1.	H 86	Note: A	d units in	this report an	e in feet, squ	are feet and	cubic yard	is unless spe	cified othe	rwise.		
CrossSectionDesignSurfaceF CrossSectionGradebook xsl	(XX)	X	Ċ.X.		Station Q	uantitie	s		XiX	Xix	i.x.	Added Q	uantitie		XXX	XX
CrossSectionGradebookNE>	Baseline	C		Cut		×		Fill			Cut			Fill -		Mass
Cross Section Gradebook Wide Cross Section Points xsl	Station	Factor	Area	Volume	Adjusted	Factor	Area	Volume	Adjusted	Factor 1	/olume	Adjusted	Factor	Volume	Adjusted	Ordinate
Cross Section Points List xsl	203+80.28	1.00	177.19	0.00	0.00	1.00	7.01	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00
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	0.00	0.00	44.86
				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 Staking xsl	204+50.00	1.00	171.85												0.00	251.25
Cross Section Staking xsl Cross Section Staking Table xs	204+50.00	1.00	171.85	312 23	312.23	1.00	8.79	14.64	14.64	1.00	0.00	0.00	1.00	0.00		
Cross Section Staking xsl		1.00	165.36		1000	1.00		14.64 18.51	14.64		0.00	0.00	1.00	0.00	0.00	331.15
Cross Section Staking xel Cross Section Staking Table xs Cross Sections ToCSV xel	205+00.00	1.00	165.36 156.92	312.23	312.23		8.79	18.51		1.00	0.00	0.00			0.00	331.15
Cross Section Staking xel Cross Section Staking Table xe Cross Sections ToCSV xel Cross Section Survey Format xe Cross Section Wide xel	205+00.00 205+50.00 206+00.00	1.00 1.00 1.00	165.36 156.92 156.50	312.23 298.41 290.20	312.23 298.41 290.20	1.00	8.79 11.20	18.51 25.90	18.51 25.90	1.00 T.UU	0.00 0.00	0.00	1.00	0.00	0.00	395.46
Cross Section Staking xel Cross Section Staking Table xe Cross Section StroCSV xel Cross Section SurveyFormat xe Cross Section XVYZ xel Cross Section XVYZ xel East-monificant stress rel	205+00.00 205+50.00 206+00.00 206+50.00	1.00 1.00 1.00 1.00	165.36 156.92 156.50 157.81	312.23 298.41 290.20 291.02	312.23 298.41 290.20 291.02	1.00 1.00 1.00	8.79 11.20 16.77 26.59	18.51 25.90 40.14	18.51 25.90 40.14	1.00 1.00 1.00	0.00 0.00 0.00	0.00 U.DO 0.00	1.00 	0.00 7.00 0.00	0.00 0.00 0.00	395.46 446.34
Cross Section Staking xal Cross Section Staking Table xa Cross Sections To CSV xal Cross Section Survey Format x Cross Section SV xal Cross Section XV X xal Erst Area Volume xal Erst Area Volume xal	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	165.36 156.92 156.50 157.81 160.17	312 23 298 41 290 20 291 02 294 42	312.23 298.41 290.20 291.02 294.42	1.00 1.00 1.00 1.00	8.79 11.20 16.77 26.59 35.36	18.51 25.90 40.14 57.36	18.51 25.90 40.14 57.36	1.00 1.00 1.00 1.00	0.00 0.00 0.00 0.00	0.00 U.00 0.00 0.00	1.00 1.00 1.00 1.00	0.00 17.00 0.00 0.00	0.00 0.00 0.00 0.00	395.46 446.34 483.40
Cross Section Staking xel Cross Section Staking Table xe Cross Section StroCSV xel Cross Section SurveyFormat xe Cross Section XVYZ xel Cross Section XVYZ xel East-monificant stress rel	205+00.00 205+50.00 206+00.00 206+50.00	1.00 1.00 1.00 1.00 1.00 1.00	165.36 156.92 156.50 157.81	312.23 298.41 290.20 291.02	312.23 298.41 290.20 291.02	1.00 1.00 1.00	8.79 11.20 16.77 26.59	18.51 25.90 40.14	18.51 25.90 40.14	1.00 T.UU 1.00 1.00 1.00	0.00 0.00 0.00	0.00 U.DO 0.00	1.00 	0.00 7.00 0.00	0.00 0.00 0.00 0.00 0.00	395.46 446.34

- 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.

			$\Delta \Delta \Delta$	Volumes	Report		
			R	eport Created Time: 1:			
Ali	ion Set Name: gnment Name: nput Grid Factor:	SH 86		lote: All units in	this report are in feet, s	quare feet and cubic yards unle	ess specified otherwise
Station	Туре	Area	Volume	Factor	Adjusted Volume	Included in Mass Ordinate?	Mass Ordinate
203+80.28							0.0
	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	
	SUBBASE:	108.00	0.00	1.00	0.00	Yes	
	_HMA_Pvmt:	36.75	0.00	1.00	0.00	No	
D_	BC_Class 6:	27.00	0.00	1.00	0.00	No	
204+00.00							44.8
	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	
XXX	SUBBASE:	108.00	78.87	1.00	78.87	Yes	
	HMA Pvmt:	36.75	26.84	1.00	26.84	No	
	THMPS F WHIL						

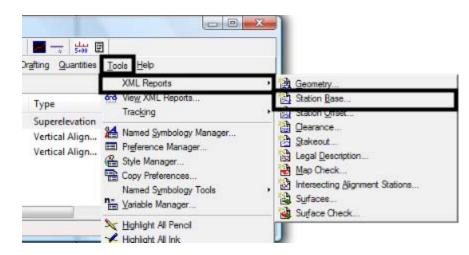
12. Close the *Bentley InRoads Report Browser* and all open dialog boxes (except the main InRoads dialog box).

Lab 16.6 - 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 offste distance from the active alignment to a specified alignment at given intervals along the active alignment. 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**.



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.

Surface: Feature: Limits		12345 existing ground T_Edge of Conc>Parkin	 ng Lot 4
		T_Edge of Conc>Parkir	ng Lot 👻 🛓
Limits			
		+	
	Start:	Start: 203+80.28 Stop: 260+43.16	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**.

Station Base Report	
Station Base Report General Include Honzontal Algnments Features	Horizontal Points On-Alignment Event Vertical Points On-Alignment Event Vertical: 100.00 Cardinal Points of Selected Alignments/Features
	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*.

Station Base Report			l	
Station Base Report General	Include: Off I	Ramp 🔶		Fiter
Ide Horizontal Algoments	Name	Description	Style	
Teatures	Off Ramp		ALG_PRO	
	Apply	Preferences	Close	Help

8. In the *Bentley InRoads Report Browser*, **<D>** the **StationBaseSingle.xls**.

9. Examine the report in the right pane.

Tools Help						
Workspace\Workspace-CDOT_XM\	スススス	ススススス	しんえええる	マススフ	ススススフ	ロススススフ
Custom	$X \times X \times X$	Project	: 12345DES_Geometry			
DataCollection	DX DX DX DX	Description	: SH 86 Design geometry			
Evaluation	Bas	eline (Active) Alignmen				
Geometry	Das			Y.Y.X	MAX YAYA	
ICS III			C:\Projects\12345\Design\InRoa	ds\12345DES_Geom	atry.alg	
Images	NYYYYY	Last Revised	: cferree 3/26/2009 6:20:33 AM			
Intersecting Alignment Stations		Input Grid Facto	r: 1.00000000	Note: All units	in this report are in feet unless	specified otherwise
LegalDescription				<u> </u>		
LightRailManufacturing MapCheck		Baseline Alignme	ent		Offset Alignment	
Obsolete		Distance to			Distance to	
RoadwayDesign	Station	Offset Point	Radial Direction	Station	Offset Point	Radial Direction
Schemas		OlisetTollit	Rudial Direction	Judon	Onject Onic	Nutral Direction
Stakeout	Offset (Specified) Ali	000				
StationOffset	Unset (Specified) All	gnment: Of Ramp				
IHSDMLandXML xsl		X X X X X			X X X	
A: ProfileExistingProposedEleva	205+00.00	0.00	S 15°14'41" W	205+00.00	24.00	S 15"14'41" W
All ProfileStationElevationASCII.	206+00.00	0.00	S 15°14'41" W	206+00.00	24.00	S 15*14'41" W
Ad StationBaseCoordinates vsl	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 xsl						
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] StationOffsetWthVersine.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.
- In the *Include* field, key in a space and press the *Tab* key to accept the entry. This clears the *Selected* list.
- 13. **<D> Features** in the explorer.
- 14. Select 12345 Existing Ground for the Surface.
- 15. In the *Features* list, Highlight **T_Edge of Oil497**.
- 16. **<D> Apply**.

Station Base Report General Include	Surface: 12345 existin Features:	ng groun 🔻	Filter
Horizontal Alignments	Name	Style	Description * +
💠 Features	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
	1_Edge of Oi511	I_Edge of Oil	Edge of Oil
	T_Edge of OI/512	T_Edge of Oil	Edge of OI
	T_Edge of Oil595	T_Edge of Oil	Edge of Oil 💷
	T_Edge of Oil599	T_Edge of Oil	Edge of Oil
	T_Edge of Oil62	T_Edge of Oil	Edge of Oil *
		eferences) Clo	se Help

17. In the *Bentley InRoads Report Browser*, **<D>** the **StationBaseSingle.xls**.

18. Examine the report in the right pane.

		Station Bas	e Report		
		Report Created:	3/26/2009		
		Time: 2:4	11pm		
	Project:	12345DES_Geometry			
	Description:	SH 86 Design geometry			
Baselin	ne (Active) Alignment:	SH 86			
	File Name:	C:\Projects\12345\Design\	InRoads\12345DE	ES Geometry alg	
	Last Revised:	cferree 3/26/2009 6:20:33	AM		
	Input Grid Factor:	1.00000000 N	lote: All units in this	report are in feet unless :	specified otherwise.
	Baseline Alignme	ent	<u> </u>	···· Offset Alignme	ent
Station	Distance to Offset Point	Radial Direction	Station	Distance to Offset Point	Radial Direction
	Allanment T Edae	10107			
fset (Specified)	Angnmenc 1_Eage o	II 011497			
(Specified) 226+50.00	0.00	S 15°14'41" W	0+35.23	-13.20	S 15°34'50" V
XXX			0+35.23 0+85.23	-13.20 -13.36	
226+50.00	0.00	S 15°14'41" W			S 15°00'34" V
226+50.00 227+00.00	0.00 0.00	S 15°14'41" W S 15°14'41" W	0+85.23	-13.36	S 15°00'34" V S 15°34'39" V
226+50.00 227+00.00 227+50.00	0.00 0.00 0.00	S 15°14'41'' W S 15°14'41'' W S 15°14'41'' W	0+85.23 1+35.23	-13.36 -13.11	S 15°00'34" V S 15°34'39" V S 15°20'33" V
226+50.00 227+00.00 227+50.00 228+00.00	0.00 0.00 0.00 0.00 0.00	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+85.23 1+35.23 1+85.23	-13.36 -13.11 -12.99	S 15°00'34" V S 15°34'39" V S 15°20'33" V S 15°16'24" V
226+50.00 227+00.00 227+50.00 228+00.00 228+50.00	0.00 0.00 0.00 0.00 0.00 0.00	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+85.23 1+35.23 1+85.23 2+35.23	-13.36 -13.11 -12.99 -12.94	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
226+50.00 227+00.00 227+50.00 228+00.00 228+50.00 229+00.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	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+85.23 1+35.23 1+85.23 2+35.23 2+85.23	-13.36 -13.11 -12.99 -12.94 -13.07	S 15°00'34" V S 15°34'39" V S 15°20'33" V S 15°16'24" V S 15°01'46" V S 15°01'46" V S 15°09'46" V
226+50.00 227+00.00 227+50.00 228+00.00 228+50.00 229+00.00 229+50.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	S 15°14'41" W S 15°14'41" W	0+85.23 1+35.23 1+85.23 2+35.23 2+85.23 3+35.23	-13.36 -13.11 -12.99 -12.94 -13.07 -13.20	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°01'46" V S 15°01'46" V S 15°09'46" V S 15°00'27" V S 14°49'03" V

- 19. Close the *Bentley InRoads Report Browser* and all open dialog boxes (except the main InRoads dialog box).
- 20. Save the InRoads project then close InRoads.

Chapter Summary:

- In *Lab 16.1 -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 16.2 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 16.3 -Unsuitable Material* an area of unsuitable material was defined using the station method. This was used to modify the volume calculation.
- In *Lab 16.4 -Volume Exceptions* A set of custom cross sections was created, then a volume exception was defined.
- In *Lab 16.5 -Volume Reports* the various templates for End Area Volume reports were examined.
- In *Lab 16.6 -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 17 - 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\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 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 17.1 - 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 Tools > 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.

Precision	Gener	al	Units and	d Format	Geom	etry
Tolerances	Factors	Abb	previations	Rai	Sight Dist	ance
Text Scale F	actor:	10	0.0000	_	Help	
Cell Scale Fa	actor:	10	0.0000			
Line Style So	cale Factor:	1.0	0000			
		1	Scale Fi	actors		
			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 an	d Title	Symbo	Is and Details	_	Match Lin	es	Sheet	Index	
Main	Plan Co	ontrols	Profile Contr	rols	Sheet L	ayout	View	Layout	
Method			Horizontal A	Nignment:			Ed	it	
Plan Only	/		SH 86		•	·			
Plan and	Profile		Geometry P	rojects in	this VDF:				
Profile Or	nly]			
Plan Views							He	elp	
🔘 Use Plan	Views								
Ose Stati	on Limits						: Unless oth d. all measur		
Profile Views	s					for th	is command		
Use Profi	le Views					mode	el units.		
Ose Stati	on Limits		Station Lin	mits		D	efault		
Sheets			Start:	203+80.2	0	-	03+80.28		
Generate	Sheets		_		-	<u> </u>	60+43.16		
VDF I	nformation O	nly		260+43.1	6	<u>+</u> 2	00743.10		
VDF I	nformation ar	nd Host Files	Length:	1400.00		+			
lan Views:			Total: 0	Profile Vie	🐂 Prefer	ences			
In	Name	Start	Stop	Name	Name:			0	los
						le Full Pro le Full Pro			.03
					100 Sca	le Full Pro	ofile 2x		00
•			•		100 Sca	le Full Pro		S	٥a
					100 Sca	le P&P (2	x Vert)	Sav	e
		Apply	Preferen	ces	100 Sca		Plan Sheet		ele
						Full Plan		-	_
					•		+	H	le

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.

 Use Station Limits Sheets Generate Sheets VDF Information Only VDF Information and 	Host Files	Station I Start: Stop: Length: tal: 0	imits 204+00.00 260+00.00 1400.00 Profile Views:	Default + 203+8 + 260+4 +	D.28
In Name	Start	Stop	Name	Start	Stop

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	le Sy	mbols and Details	Match Lines	Sheet Index
Main	Plan Controls	Profile 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

- 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	e	Symbo	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:	-200.00)	+		
Width Right:	200.00		-		
Overlap:	0.00		- + -		
Boundary Chords:	6				Help
	wings\R	_	345DES_Model.dgn iles\12345SURV_Top	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. In the *Surface* area, toggle off all surfaces except **12345** existing ground.
- 20. Verify that the surface **12345** *existing ground* is toggled on and highlighted. The illustration below shows the tab as completed.

Border and Title			Symbols and Details		Match Lines		Sheet Index
Main	Pla	an Cor	trols	Profile Controls	Sheet Layout		View Layout
Seed View Name: Set Name: Profile Preference: Vertical Alignment: Surface: Default		STA SH 86 2x Vertical • None • Profile Elevation Shifts @ Shift at Major Stations		Horizontal		Help Right to Left	
	45 existing gro 45DES	Junuj	 Shift W Do Not Note: High 	Minor Stations here Needed Shift lighted surfaces vation shifts.	Distance: Vertical Sp Bottom Distance:	500 acing to Bottom 500	Top to Bottom
Profile Height: 200		200.	00		- Example -		
Profiles p Margin:	er Column: s	1			Ļ	~	
Top:	125.00		Bottom: 2	25.00	└ ╹	\sim	
Left:	75.00		Right:	75.00	t	t	

With the exception of the Host File, the Sheet Layout tab is set by the prererence 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.

- 21. **<D>** the **Sheet Layout** tab.
- 22. **<D>** in the *Host File* field, then **<D>** the button. This displays the *Save As* dialog box.
- 23. In the Save As dialog box, navigate to the C:\Projects\12345\Design\Drawings\ folder.
- 24. In the *File Name* field, key in *12345DES_PnP.dgn*.

- 🚔 Plan and Profile Generator T Border and Title Symbols and Details Match Lines Sheet Index Sheet Layout Main Profile Controls Plan Controls View Layout Sheet Number: 1 Host File Content Name: 1 Host File: Single Sheet Each C:\Projects\12345\Design\Drawing Seed Host File: C:\Workspace\Workspace-CDOT_ All Sheets in One Edit Symbology... Sheet Location L Kave As × 🗸 R Save in 📗 Drawings 🕝 🤌 📂 🛄 - E A Name Date modified Туре Size 2 Cross_Sections 11/21/2007 3:38 PM File Folder First **Recent Places** Reference_Files 4/14/2009 8:39 AM File Folder 퉬 Tabs 1/26/2009 1:10 PM File Folder 12345DES_EarthworkQ... 11/20/2007 9:46 AM Bentley MicroStati... Desktop 🔏 12345DES_GenlNote##... 11/20/2007 9:46 AM Bentley MicroStati... She 🕺 12345DES_Plan##.dgn 11/20/2007 9:46 AM Bentley MicroStati... 84 Clipp 🛃 12345DES_PnP##.dgn 👘 11/20/2007 9:46 AM Bentley MicroStati... Leve Chris Ferree 🕺 12345DES_Prof##.dgn 11/20/2007 9:46 AM Bentley MicroStati... Symb 🔏 12345DES_SAQ01.dgn 11/20/2007 9:46 AM Bentley MicroStati... 🔏 12345DES_SAQ##.dgn 11/20/2007 9:46 AM Bentley MicroStati... 🔳 U 12345DES_StdPlanList.... 11/20/2007 9:46 AM Bentley MicroStati... Computer File name 12345DES PnP.dan Save Network Save as type: MicroStation Design Files (*.dgn) Ŧ Cancel Help
- 25. **<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.

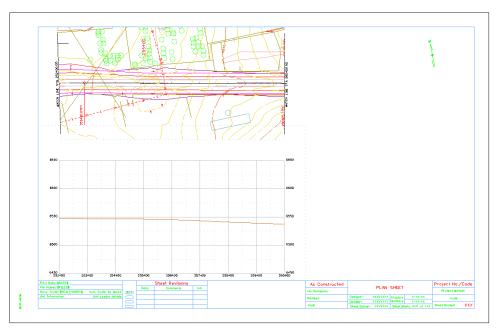
- 26. **<D>** the **Border and Title** tab.
- 27. Verify that the **Sheet_Design-Sheet** cell is selected for the cell *Name*.

Main	Plan Controls	Pro	ofile Controls	Sheet Layout	View Layout
Border and Title Symbols		Symbols and	Details	Match Lines	Sheet Index
Border					Browse
Cell		Ô	Reference File	e Name:	5101100
Name:	SHEET_Desig	n-⊱ ▼	C:\Program Fi	les\Workspace-CDOT\	
Retain C	ell Levels for Ea		Sheet Size:	B (11 x 17) 📼	
0	evel for Each Sh		Custom Width:	16.00	Help
0			Custom Heigh	t 10.50	Tiop
	level for Each S	heet	Title Block Da		
Sheet Level:	1				
Level Step:	1				
Scale:	100.00			Edit	
ymbology:					
Object		Name		Location in Paper U	nits:
Rotation				×: 13.42	
Date				Y: 0.92	
User Text 1			Ц	User Text:	
User Text 2 User Text 3				Enter the Desinger	
User Text 4				Station Format:	
User Text 5					-
				*	
•			1	Use Sheet Level	

28. Verify that all of the check boxes in the *Symbology* area are toggled off.

- 29. **<D>** the **Apply** button.
- 30. **<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.

- 31. **<D>** the **Sheet Index** tab.
- 32. Highlight sheet **1** in the *Sheet Index* list.
- 33. **<D>** the **Show Sheet** button.

Main	Plan C	Controls	Profile Controls	Sheet Layout	View Layout		
Borde	Border and Title Symbols and Details Match Lines			Sheet Index			
/DF File I				New	Open		
Show Sheet Clipping Boundary Mode: Calculate Use Existing							
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		

34. Repeat steps 31 and 32 for the remaining sheets.

Lab 17.2 - 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

- 2. **<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.

DT.dgn (3D - V8 DGN) - MicroStation V8 XM Edition	
T Help	
	े • 🔌 • 🕧 🖶 🐨 • 阕
Models C C C C C C C C C C C C C C C C C C C	
Type 2D/3D Name	Description
Model Properties	Master Model
Type: Design ▼ 3D ▼ Name: CDOT Default	
Description: Master Model	
Ref Logical:	
▲ 1"=50' 5 0.0000(): 1.00000	
Line Style Scale: Annotation Scale	
Update Fields Automatically	
Cell Properties	
Can be placed as an annotation cell	
<u>Q</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**.

F	C	\Worksp	pace\Works	space-CDO	T_XM\S	tandards-(Global\MicroSt	tation\Seed	\3D-See	d_CDOT.dgn (3D - V8
÷	<u>F</u> ile	<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>W</u> indow	<u>H</u> elp	CDOT Help
	2	New								Ctrl+N
4	3	Open								Ctrl+O
Ţ		<u>Close</u>								Ctrl+W
1		<u>S</u> ave								Ctrl+S
		Save <u>A</u> s								
		Compre	ess							+
l	I	Sa <u>v</u> e Se	ttings							Ctrl+F
_ 0	a,	Project	Explorer							
E		<u>R</u> eferen	ce							

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.
- 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 1x 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)	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 ProfileViews?" 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
Type: Design
Name: CDOT Default
Description: Master Model
Ref Logical:
<u></u>
Line Style Scale: Annotation Scale
Update Fields Automatically
Cell Properties
<u>C</u> an be placed as a cell Cell Type: Graphic
Can be placed as an annotation cell
<u>Q</u> K Cancel

- 34. **<D> Cancel** to dismiss the *Model Properties* dialog box.
- 35. Close the *Models* dialog box.

Lab 17.3 - Edit Sheet Extents

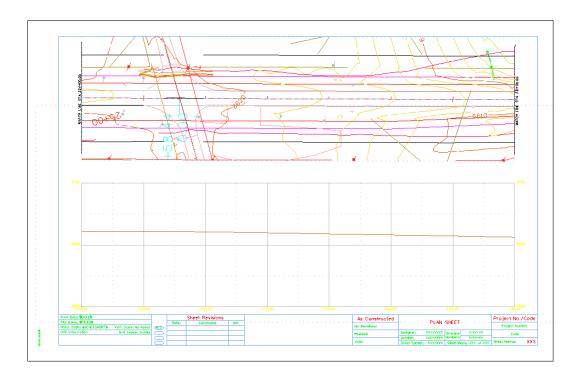
After examining the sheets created in the last lab, the intersection on sheet 4 should be centered on the sheet. In this lab, the sheet extents are changed to center the intersection.

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.

Main	Plan	Controls	Profile Controls	Sheet Layout	View Layout					
Borde	er and Title	Symt	ools and Details	Match Lines	Sheet Index					
		ects\12345\l	Design\InRoads\50scal	e.vdf New	Open					
	Show Sheet Clipping Boundary Mode: Clipcing Boundary Mode:									
Sheet Inc	lex:				Save As					
Sheet	Sheet Name		Host File	Sheet Rotation	Help					
1	1	C:\Projects	\12345\Design\Drawin	gs 105^00'00'' 📃	Create Plot Set					
2	2	C:\Projects	\12345\Design\Drawin							
3	3		12345\Design\Drawin							
4	4 5		\12345\Design\Drawin	-	All					
5 ∢	5	C. (FIOJECIS	III	+ 0000 +	None					
	Delete Sł	neet Re	generate Sheet	Show Sheet						
Sheet Vie Sheet	ews: View T	ine.	View Name	Anchor X	Anchor Y					
4	Plan		TA 224+00.00	1.75	8.50					
4	Profile	-	TA 224+00.00	1.75	1.75					
					Edit					

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	Symbo	ls and Details	Mato	h Lines	Sheet Index
Main Plan	n Controls	Profile Co	ntrols Sh	neet Layout	View Layout
Method		Horizonta	Alignment:		Edit
Plan Only		SH 86		+	
Plan and Profile		Geometry	Projects in this V	DF:	
Profile Only		12345DE	S_Geometry		
Plan Views	-	51			Help
Use Plan Views					
Use Station Limits	-				Unless otherwise all measurements
Profile Views		51		for this	command are in
Use Profile Views				model u	inits.
Ose Station Limits		Station	Limits	Defa	
Sheets		Start:	204+00.00		un +80.28
Generate Sheets		Stop:	260+00.00		+43.16
VDF Information	n Only			Ψ	
VDF Information	n and Host Files	Length:	700.00	-#-	
lan Views:		Total: 9	Profile Views:		Total: 9
In Name	Start	Stc 🔦	Name	Start	Stop
3 STA 217+00.0		00 224+	STA 204+00.0		
4 STA 224+00.0		0 231+	STA 210+00.0		
	w ->21±00/	10 238T	STA 217±00 0	n <u>217</u> ⊸∩n ∩n III	224*UU UU

- 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 Plar	n View	1	1	×			
View Name:	STA 224+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	Next >			
Model Files:) D (
-		_	iles\12345DES_Model.dgi ence_Files\12345SURV_1	Help			
•	4 III >						
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	<u> </u>
Adjust all views to maintain view lengths	

15. **<D> Yes** on the *"Update view names in corresponding sheets?"* Message box.

Bentley InRoads XM Edition	<u> </u>
Update view name in correspon	ding sheets?
Yes	No

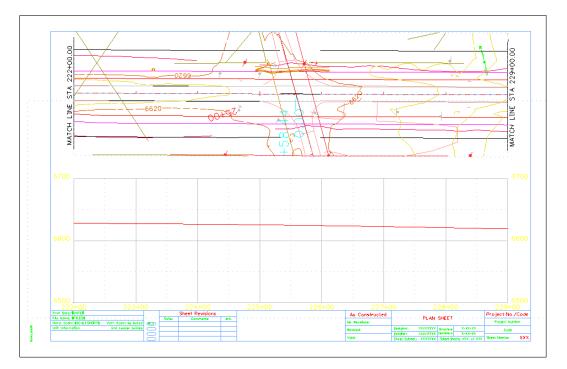
16. In the *Edit Plan View* dialog box, **<D> Close**.

Edit Plan				
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 >
		_	les\12345DES_Model.dgi ence_Files\12345SURV_1	Help
•	III		۱.	
Nested A	ttachments			

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.

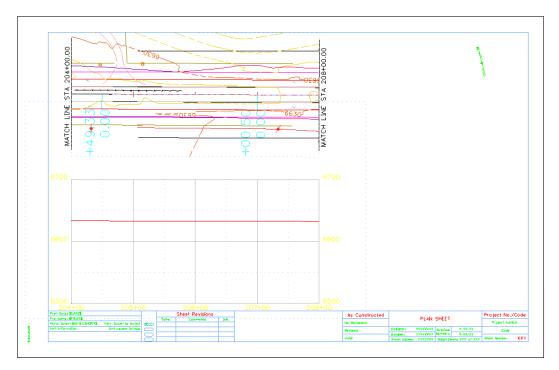


Lab 17.4 - Moving Reference Files Within the Sheet Border

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.**

- 🐂 Plan and Profile Generator - • 💌 Main Plan Controls Profile Controls Sheet Layout View Layout Symbols and Details Sheet Index Match Lines Border and Title VDF File Name: :\Projects\12345\Design\InRoads\50scale.vdf New. Open. Show Sheet Save Clipping Boundary Mode:

 Calculate
 Use Existing Save As. Sheet Index: Help Sheet Sheet Name Host File Sheet Rotation Create Plot Set. 01 C:\Projects\12345\Design\Drawings 105^00'00' C:\Projects\12345\Design\Drawings 105^00'00 02 3 03 C:\Projects\12345\Design\Drawings 105^00'00'' 04 C:\Projects\12345\Design\Drawings 105^00'00" 4 All 05 C:\Projects\12345\Design\Drawings 99^00'00'' 5 • None ш Delete Sheet Regenerate Sheet Show Sheet Sheet Views: Sheet View Type View Name Anchor X Anchor Y 1 Plan STA 204+00.00 1.75 8.50 Profile STA 204+00.00 175 1.75Edit.. Apply Preferences... Close
- 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	X
Sheet:	1	ОК
View Type:	Plan	Cancel
View Name:	STA 204+00.00	Help
Anchor X:	7.75	Trep
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.

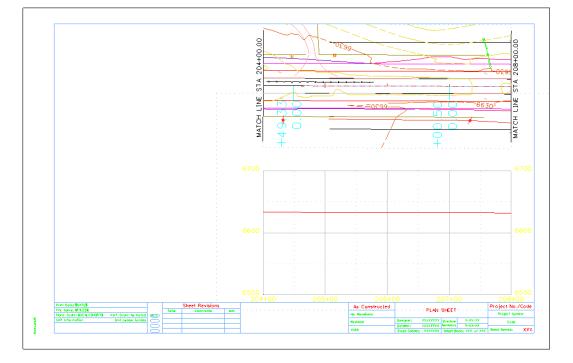
10. **<D> OK**.

Edit Shee	t View	X
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.

Main	Plan (Controls	Profile Controls	She	et Layou		View Layout	
Borde	er and Title	Symi	ools and Details	Match	Lines		Sheet Index	
VDF File	2. (110)0	ects\12345\	Design\InRoads\50sc	ale.vdf	New		Open	
- Show S Clipping	sheet Boundary Mode	e: 💿 Calcu	ılate 🔘 Use Existir	ng			Save	
Sheet Inc	dex:						Save As	
Sheet	Sheet Name		Host File	Sheet F	Rotation	*	Help	
1	01	C:\Projects	\12345\Design\Draw	ings 105^00	'00''	=	Create Plot Set	
2	02	C:\Projects	\12345\Design\Draw	ings 105^00	'00''	_		
3	03	C:\Projects	\12345\Design\Draw	ings 105^00	''00''			
4	04	C:\Projects	\12345\Design\Draw	ings 105^00	''00''		All	
5	05	C:\Projects	\12345\Design\Draw	ings 99^00	00"	-		
•			111		•		None	
Sheet Vie Sheet	Delete Shr ews: View T		generate Sheet	Show Shee	t			
1 1	Plan Profile	<u> </u>		and its data	a will be	delet	ed and re-created. E)o you
						Г	Yes	No

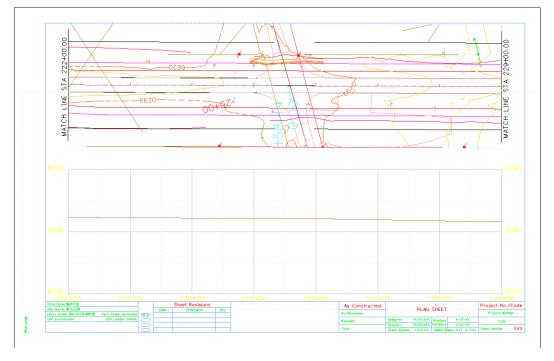


The sheet now looks like the illustration below.

Lab 17.5 - 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 T	ìtle	Symbols	and Details		Match Line	s	Sheet Index
Main	Plan Cor	-	Profile Cor		Sheet La	-	View Layout
Method			Horizonta	Alignment:		 	Edit
Plan Only			SH 86		+		
Plan and Property Plan and Plan and Property Plan and	ofile		Geometry	Projects in	this VDF:		
Profile Only			12345DE	ES_Geomet	ny		
Plan Views						[Help
🔘 Use Plan Vie	ews						
Use Station	Limits						nless otherwise
Profile Views			1				I measurements ommand are in
Use Profile \	∕iews					model un	iits.
Use Station	Limits		Station	Limits	,		
Sheets			Start:	204+00.0		Defau	
✓ Generate Sh	neets					Ŧ	
VDF Info	rmation On	ly	Stop:	260+00.0	00	- + 260+	43.16
VDF Info	mation and	d Host Files	Length:	700.00			
lan Views:		1	fotal: 9	Profile Vie	ws:		Total: 9
In N	ame	Start	Stc 🔦	Name		Start	Stop
3 STA 215	5+00.00	215+00.00	222+	STA 204	+00.00	204+00.00	208+00.00
4 STA 222		222+00.00		STA 208		208+00.00	215+00.00
5 <u>97∆</u> 220 ∢ ∭	<u>1-00 00</u>	220*UU UL	1 2367	CT∆ 215 ∢		015±00 00	00 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	ctangular Boundary Bou	undary Chords:	6					
Model Files:				Next >				
-	C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgr C:\Projects\12345\ROW_Survey\Drawings\Reference_Files\12345SURV_1							
•			Þ					
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.

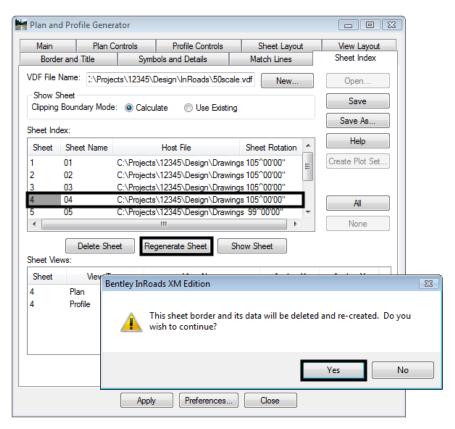
- 10. **<D> No** in the message box that is displayed.
- 11. **<D> Close** to dismiss the *Edit Plan View* dialog box.

Edit Pla	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			
Force R	ectangular Boundary B	oundary Chords:	6				
Model Files				Next >			
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			iles\12345DES_Model.dg ance Files\12345SURV 1	Help			
C:\Project	s\12345\Traffic_ITS\Dra	awings Bentley	InRoads XM Edition		23		
Rested #	III	Upda	Update view name in corresponding sheets				
			Yes	No			

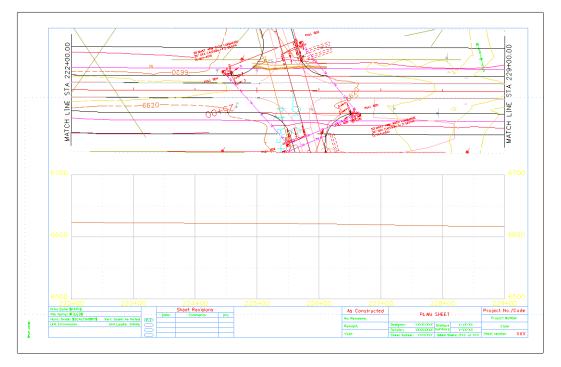
Since the added model file only affects on sheet (sheet 4), there is no need to generate a new complete set. Instead, only sheet 4 is updated. The steps below are used to update the sheet.

- 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.

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 17.1 Creating 100 Scale P and P Sheets* the input data for the initial 100 scale Plan and Profile Generator run was described
- In *Lab 17.2 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 17.3 -Edit Sheet Extents* the sheet extents for the 50 scale plans were modified to center the intersection and the sheets were regenerated
- In *Lab 17.4 -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 17.5 Adding a Model File to a Single Sheet* a traffic signal plan model file was added to sheet 4 only

LAB 18 - Tab Sheets

This lab demonstrates the functionality build 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:

- 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 18.1 - Update the Pay Item File location

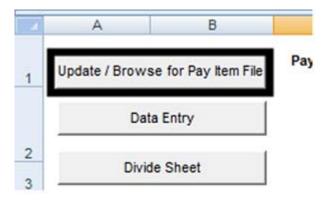
In order for the tab sheet to function properly, it must access the Trnsport_Itemlist.csv file. The location of this file is specified in cell D1 of the Surfacing Sheet worksheet. This exercise demonstrates how to select the the Trnsport_Itemlist.csv file's location.

- 1. Start Excel and select **File > Open**.
- 2. In the *Open* dialog box, navigate to *C:\Projects\12345\Design\Drawings\Tabs*.
- 3. Highlight the **12345DES_Tabulation of Surfacing.xls** file and **<D> Open**.

20	A	В	C	D	F	G	н	1	JK
1	Update / Brow	se for Pay Item File	Pay Item File:	C:\Workspace-C	CDOT_XM\Stand	lards-Global\Trnsp	ort_Itemlist.csv		
	Da	ta Entry		Pay Item:	202-05011	304-06000	403-00721		403-34841
2	Divi	de Sheet	N	umber of Lifts:	n/a	n/a	1		4
4			%	Irreg to Apply:			5%	5%	
5		ſ							Tabulation of S

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.



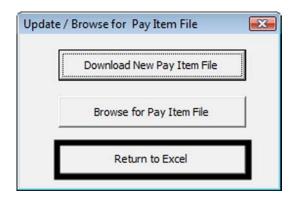
5. **<D>** The **Browse for Pay Item File** button. This displays the *Open* dialog box.

Update	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_XM\Standards-Global\ directory.

- 💽 Open × /orkspace-CDOT_XM\Standards-Global Search 2 $\Theta \Theta$ 🍓 Organize 👻 🎬 Views 👻 📑 New Folder ? Name Date modified Size Туре Favorite Links CFG Files Documents lnRoads Desktop MicroStation Recent Places Computer Trnsport_Itemlist.csv Pictures Music B Recently Changed P Searches Public Folders ~ File name: CSV Files (*.csv) -Tools -Open Cancel
- 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.



The text for the Pay Item File is now black, indicating that the Trnsport_Itemlist.csv file is available for use.

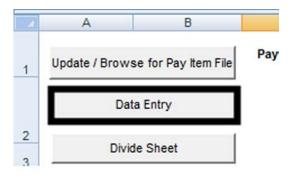
Lab 18.2 - Adding a Pay Item

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.

	Pay Item:	202-05011	304-06000	403-00721		403-34841		
	Number of Lifts:	n/a	n/a	1			4	
	% Irreg to Apply:			5%	5%			
						Tab	ulation of	Surfacing
St	ation	Sawing Concrete (10.5 Inch)	Aggregate Base Course (Class 6)	Hot Mix Asphalt (Patching) (Asphalt)	Hot Mix A:		ing SX) (100)	
		LF	TON	SY		Т	DN	
From	То			Bottom	Bottom	Lift 2	Lift 3	Тор
1+00	5+00							
5+00	12+00							
12+00	19+00							
19+00	26+00							
26+00	31+00							
31+00	38+00							
38+00	45+00							
45+00	52+00							
52+00	59+00							
59+00	66+00							
66+00	73+00							
73+00	80+00							
80+00	87+00	24	890		488	366	366	366
87+00	94+00		890		488	366	366	366

The illustration above shows the sheet before adding the column.

1. **<D>** the **Data Entry** button. This displays the *Surfacing Data Entry* dialog box.



2. Scroll down the list of pay items and highlight the **202-00210 Removal of Concrete Pavement** pay item.

Automatic Pay Item Entry		
	LS	
ring Concrete Pavement	SY	
e	LS	
e Median Cover Material	SY	
Cover	SY	
k	SY	
	LF	
	LF	
d Gutter	LF	
	Gutter	and Si
Stop	EACH	
te Curb Ramp	SY	
re Pavement	SY	
e Pavement	51	
e Pavement (Planing)	SY	
Mat	SY	
Mat (Special)	SY	
Mat (Planing)	SY	
Mat (Planing)	TON	
Mat (Planing) (Special)	SY	
Mat (Planing)	LS	
Strips	LF	
nt Marking	SF	
(s)	LS	
	EACH	
Special)	EACH	
m Bridge	SY	
	LF	
Railing	LF	
of Present Structure (Class	s 1) SY	
Delete a Pay Item	Close	
		Delete a Pay Item

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.

	Pay Item:	202-00210	202-05011	304-06000	403-00721	403-34841			
	Number of Lifts: % Irreg to Apply:	n/a	n/a	n/a	1 5%	5%	4		
	% irreg to Apply:				576	576			
						Та	bulation of	of Surfacin	ng
Sta	ition	Removal of Concrete Pavement	Sawing Concrete (10.5 Inch)	Aggregate Base Course (Class 6)	Hot Mix Asphalt (Patching) (Asphalt)	Hot Mix Asphalt (Grading SX) (100) (PG 64		(PG 64-22)	
		SY	LF	TON	SY		т	ON	
From	То				Bottom	Bottom	Lift 2	Lift 3	Тор
1+00	5+00								
5+00	12+00								
12+00	19+00								
19+00	26+00								
26+00	31+00								
31+00	38+00								
38+00	45+00								
45+00	52+00								
52+00	59+00								
59+00	66+00								
66+00	73+00								
73+00	80+00								
80+00	87+00		24	890		488	366	366	366
87+00	94+00			890		488	366	366	366

The illustration above shows the sheet after the new column is added.

Lab 18.3 - 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	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	There	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.

Pay Item:	202-00210	202-05011	304-06000		403-34841
Number of Lifts:	n/a	n/a	n/a		4
% Irreg to Apply:				5%	

						Tab	ulation of	Surfacing
St	ation	Removal of Concrete Pavement	Sawing Concrete (10.5 Inch)	Aggregate Base Course (Class 6)	Hot Mix A:	sphalt (Grad	ing SX) (100)	(PG 64-22)
		SY	LF	TON	TON			
From	То				Bottom	Lift 2	Lift 3	Тор
1+00	5+00							
5+00	12+00							
12+00	19+00							
19+00	26+00							
26+00	31+00							
31+00	38+00							
38+00	45+00							
45+00	52+00							
52+00	59+00							
59+00	66+00							
66+00	73+00							
73+00	80+00							
80+00	87+00		24	890	488	366	366	366

Lab 18.4 - 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 thickness could be a different thickness and/or a different grade (which uses a different pay item code). The DES_Tabulation of Surfacing.xls In addition, extra material is often added to the first (Bottom) lift of asphalt to account for irregularities in the ground surface. These items are accounted for in the tabulation sheet with two fields outside of the table and a heading row within the table. For the exercise below, the pavement contains three lifts of PG 64-22 asphalt and one lift (the top lift) of PG 76-28 asphalt. The sheet shows four lifts of PG 64-22 asphalt and one lift of PG 76-28 asphalt listed as a bottom lift. It will also use an irregularity factor of 2% where the sheet currently shows 5%. The sheet will be modified to match the pavement description given above.

1. **<D>** in the Number of Lifts cell for the *403-34841 Hot Mix Asphalt (Grading SX) (100)* (*PG 64-22)* pay item. (cell I4 in this exercise)

Н	1	J	К	L	М
al\Trnsport_Iteml	ist.csv				
304-06000		403-3	4841		403-34871
n/a		4			v 1
	3				5%
	5	Tap	liation of	Surracing	
Aggregate Base Course (Class 6)	Hot Mix As	phalt (Gradi	ng SX) (100)	(PG 64-22)	Hot Mix Asphalt (Grading SX) (100 (PG 76-28)
TON		тс	DN		TON
	Bottom	Lift 2	Lift 3	Тор	Bottom

2. Use the drop down menu and select **3** from the list.

The original Lift 2 row was deleted (including the data). The Lift 3 and Top rows were shifted over and renamed. The illustration below shows the results.

Н	1	J	К	L	
bal\Trnsport_Item	list.csv				
304-06000		403- <mark>34</mark> 841		403-34871	
n/a		3	1		
	5%			5%	
		Tabulatio	on of Surf	acing	
Aggregate Base Course (Class 6)					
TON		TON		TON	
	Bottom	Lift 2	Тор	Bottom	

Next, the lift headings for the Top lift of the PG 64-22 asphalt and the lift of PG 76-28 are modified.

- 3. **<D>** in cell **K9** (it reads Top under the PG 64-22 main heading).
- 4. Key in *Lift 3* and press the Enter key.
- 5. **<D>** in cell **K10**.
- 6. Key in *Top* and press the Enter key.

This changes the lift headings for the two asphalt items. The spreadsheet looks at these headings to determine if the irregularity factor is applied. The irregularity factor is applied to the Bottom lift only and if the PG 76-28 lift heading was not changed it would result in an erroneous total. The illustration below shows the changes made.

н		J	К	L	
al\Tmsport_ItemI	ist.csv				
304-06000		403-34841		403-34871	
n/a		3	1		
	5%			5%	
		Tabulatio	n of Surf	acing	
Aggregate Base Course (Class 6)	Hot Mix As	phalt (Gradin (PG 64-22)	g SX) (100)	Hot Mix Asphalt (Grading SX) (100) (PG 76-28)	
TON		TON	TON		
	Bottom	Lift 2	Lift 3	Тор	

Finally, the irregularity factor for the PG 64-22 is changed. The irregularity factor for the PG 76-28 does not have to be changed because it is not a Bottom lift.

- <D> in cell 14. This is the % Irreg to Apply: cell for the 403-34841 Hot Mix Asphalt (Grading SX) (100) (PG 64-22) pay item.
- 8. Key in **2** and press the Enter key. The change is made in cell I4. This value is used to determine the total amount of material used for irregularities at the bottom of the sheet.

Lab 18.5 - Adding Additional Rows

It is possible that additional rows for data are required. These can be added using the functionality built into Excel. In this exercise, two additional rows are needed.

1. Highlight rows **32** and **33**. To do this, **<D>** and hold on the row number 32 and drag through number 33 and release.

29			129+00	136+00	
30	Aria	al - 10 - A A	\$ ~ % ,	143+00	
31				450.00	
32					
33	*	Cu <u>t</u>			
34		<u>С</u> ору			
35	2	<u>P</u> aste Paste <u>S</u> pecial		es	
36		Insert			0
37		Delete		als	0
38		Clear Co <u>n</u> tents			
39	1	<u>F</u> ormat Cells			
40		<u>R</u> ow Height			
41		Hide			
42		<u>U</u> nhide			

2. **<R>** in the highlighted area and select **Insert** from the menu.

The additional rows are added above row 32.

Lab 18.6 - Add Additional Data to the Sheet

Now that the sheet is set up, the quantities for the new columns and rows can be added. Station extents for the last five rows are needed. At the top of the sheet, quantities for removal of concrete pavement are added. At the bottom, the quantities associated with the asphalt pavement are added. (Note: on an actual project the quantity values are calculated based on design data prior to creating this sheet. Here we are inserting an arbitrary value to demonstrate the functionality of the sheet.)

- 1. **<D>** in cell **F10**. This is the first quantity cell of the removal of concrete pavement pay item.
- 2. Key in **132** and press the **Enter** key. This represents the number of square yards of concrete pavement removed between station 1+00 and 5+00.

- 3. Press Enter twice more. The cursor is in cell I13.
- 4. Key in *247* and press Enter.
- 5. Key in *316* and press Enter. This is in cell I14.
- 6. Scroll so that the **Project Totals** line is visible. The total for removal of concrete pavement is 695.

Next enter the station numbers for the last three lines. The stations are in 700 foot intervals.

- 7. **<D>** in field **C32**. This is the first empty cell in the *From* station field.
- 8. Key in *15000* and press the **Enter** key. This is 700 more the value in the cell above.
- 9. Continuing entering stations (adding 700 each time) down to cell C36.
- 10. Repeat this process in the To station column. The illustration below shows the completed station columns.

136+00	143+00		
143+00	150+00		
150+00	157+00		
157+00	164+00		
164+00	171+00		
171+00	178+00		
178+00	185+00		
Irregu	larities		
SubT	lotals	695	
Project	t Totals	695	

	Tabulation of											
Sta	ation	Removal of Concrete Pavement	Sawing Concrete (10.5 Inch)	Aggregate Base Course (Class 6)	(0)		Hot Mix Asphalt (Grading SX) (100) (PG 76-28)	Englsified Asphalt (CSS-1)	Concrete Parement (11 Inch)	Geotextile (Paring)	Notes	
		SY	ur	TON		TON		TON	GAL	sy	۶Y	
From	To				Bottom	Lift 2	Lift 3	Тор				
1+00	5+00	132								1334		
5+00	12+00									1867		
12+00	13+00									1867		
19+00	26+00	247								1867		
26+00	31+00	316								1867		
31+00	38+00									1867		
38+00	45+00									1867		
45+00	52+00									1867		
52+00	59+00									1867		
53+00	66+00									1867		
66+00	73+00									1867		
73+00	80+00									1867		
80+00	87+00		24	890	488	366	366	245	176		2667	
87+00	34+00			890	488	366	366	245	176		2667	
34+00	101+00			890	488	366	366	245	176		2667	
101+00	108+00			890	488	366	366	245	176		2667	
108+00	115+00			890	488	366	366	245	176		2667	
115+00	122+00			890	488	366	366	245	176		2667	
122+00	123+00			890	488	366	366	245	176-		2667	
129+00	136+00			890	488	366	366	245	176		2667	
136+00	143+00			890	488	366	366	245	176-		2667	
143+00	150+00			890	488	366	366	245	176		2667	
150+00	157+00			890	488	366	366	245	176		2667	
157+00	164+00			890	488	366	366	245	176		2667	
164+00	171+00			890	400	366	366	245	176		2667	
171+00	178+00			890	488	366	366	245	176		2667	
178+00	\$85+00			890	488	366	366	245	176-		2667	
kregu	alarities				146.4							
SubT	Totala	635	24	13350	7466.4	5430	5490	3675	264.0	21871	40005	
Projec	t Totals	635	24	13350		18446.4		3675	264.0	21871	40005	

11. To finish the data entry, copy the data from row 31 – columns H through O into rows 32 through 36. The illustration below shows the completed data entry.

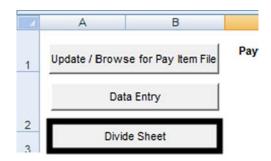
- 12. Examine the totals for the Asphalt pay items. Note:
 - An irregularities total only for the bottom lift of asphalt
 - Sub totals for each lift of PG 64-22
 - A grand total for PG 64-22

	acing				
Aggregate Base Course (Class 6)	Hot Mix As	phalt (Gradii (PG 64-22)	ng SX) (100)	Hot Mix Asphalt (Grading SX) (100) (PG 76-28)	Emulsified Asphalt (CSS-1)
TON		TON		TON	GAL
	Bottom	Lift 2	Lift 3	Тор	
890	488	366	366	245	176
890	488	366	366	245	176
890	488	366	366	245	176
	146.4				
13350	7466.4	5490	5490	3675	2640
13350		18446.4		3675	2640

Lab 18.7 - Dividing the Surfacing Sheet into Sub Sheets

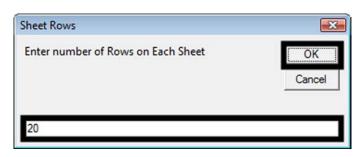
It the sheet is too long to fit inside the sheet border, there is a option to divide the master sheet into sub sheets of a specified number of data rows. When this option is selected, additional worksheets are added to the file that contain a part of the master sheet along with a sheet totals table. In this exercise, it was decided the 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.)

- 1. Scroll to the top of the sheet (if it is not there already).
- 2. **<D>** the **Divide Sheet** button. This displays the *Sheet Rows* dialog box.



3. Key in *20*. This is the number of data rows used on each sub sheet.

4. **<D>OK**.



Two sub sheets (Sub Sheet 1 and Sub Sheet 2) were created along with Sub Sheet Totals.

29		Sheet 1 Subtotals	695	24	7120	
30						
31						
32						
14	↔ ► ► Surfacing Sheet Sul	b Sheet 1 / Sub Sheet 2 / S	Sub Sheet Totals 📈	Surfacing Data 📈	Instructions 📈 🞾	
Rea	ady					

The master sheet (Surfacing Sheet) is left intact. To re divide the master sheet by a different number of rows, delete the sub sheets and run through the process again.

5. **Save** but do not close the file.

Lab 18.8 - Link the Sub Sheets to a MicroStation Sheet Border

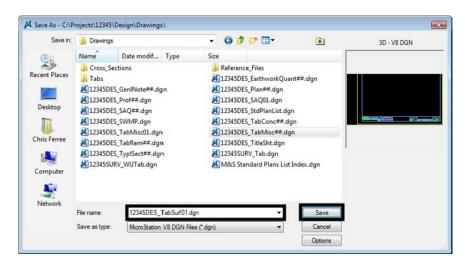
The final step in creating the tab sheet is to link the Excel file to the MicroStation sheet border. Linking allows the Excel file to be updated and reflect those updates in the MicroStation file. In this exercise, Sub Sheet 1 is linked to the sheet border file. The process is the same for the other 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	Wor <u>k</u> space	Window	Help	CDOT Help	
1	New									Ctrl+N
3	Open									Ctrl+0
1	Close									Ctrl+W
1_	Save									Ctrl+S

3. Key in *12345DES_TabSurf01.dgn* in the File name field.



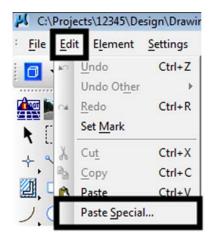
4. **<D> Save**. This creates the new file and opens it.

- 5. Bring Excel to the front.
- 6. Select the **Sub Sheet 1** worksheet.
- 7. Highlight cells **C2** through **P29**. This is the entire table.

						Tabulatio	on of Sur	facing				-
Sta	ation	Removal of Concrete Pavement	Sawing Concrete (10.5 Inch)	Aggregate Base Course (Class 6)	Hot Miz / (1	Asphalt (Gr DD) (PG 64-	ading SX) 22)	Hot Miz Asphalt (Grading SX) (100) (PG 76-28)	Emulsified Asphalt (ICSS-1)	Concrete Pavement (11 Inch)	Geotextile (Paving)	Notes
		SY	LF	TON	TON			TON	GAL	SY	SY	
From	То				Bottom	Lift 2	Lift 3	Тор				
1+00	5-00	132								1334		
5+00	12+00									1967		
12+00	19+00									1967		
19+00	28+00	247								1867		
26+00	31+00	316								1967		
31+00	38-00									1967		
38+00	45+00									1867		
45+00	52-00									1967		
52+00	59-00									1967		
59+00	68+00									1867		
66+00	73-00									1967		
73+00	80+00									1867		
80+00	87+00		24	890	400	366	366	245	176		2667	
87-00	94-00			890	400	366	366	245	176		2667	
94+00	101+00			890	488	366	366	245	176:		2667	
101-00	108+00			890	408	366	366	245	176		2667	
108+00	115+00			890	488	366	366	245	176		2667	
115+00	122+00			890	488	366	366	245	176		2667	
122+00	129+00			890	408	366	366	245	176		2667	
129+00	136+00			890	488	366	366	245	176:		2667	
irreg.	alarities				78.08							
Sub	Totals	695	24	7120	3982.08	2928	2928	1960	1408	21871	21336	
Sheet 1 Subtotals 695		695	24	7120	9838.08		1960	1408	21871	21336		

- 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.

Data Type	
Linked Microsoft Office Excel 2003	Works -
Picture of Microsoft Office Excel 20 Embedded Microsoft Office Excel 2	
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.

Object: Microsof		2003 Work
Paste as		_
Method	By Size	•
		<u>د</u>
Display as id	on	
Transparent	Background	
Transparent		_
Rotate With		1

- 15. A dashed 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.



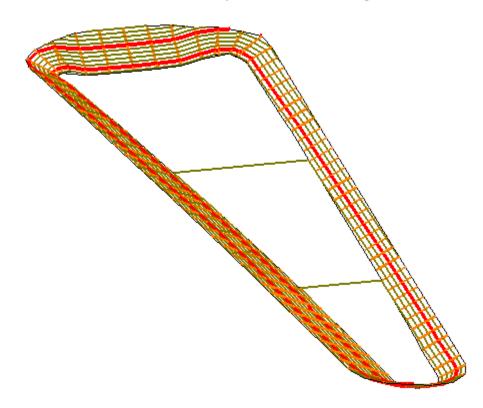
17. Close MicroStation.

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 19 - 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:

- To learn the process of using the combination of several feature tools to create a proposed design.
- To understand the concept of creating a surface of features solely for use as a target.
- To realize the value of using Generate Longitudinal Feature and Generate Sloped Surface in creating proposed designs.

Lab 19.1 - 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 ground.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 the *Name* 12345 pond.
- 13. Key in the *Description Pond training example*
- 14. Set the *Preference* to *Proposed*
- 15. **<D> Apply** and **Close** the *New* dialog.

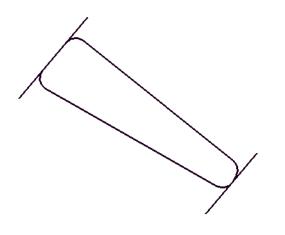
🐂 New				×
Surface Geometry				
Туре:	Design	•	Apply	
Name:	12345 pond		Help	
Description:	Pond training exa	ample		
Maximum Length:	0.00			
Preference:	Proposed	-		
Name		Descriptio	n	
Default				
12345 existing gro	und	Existing Gr	ound from	
	Close			

Lab 19.2 - Display the Pond Graphics

1. Toggle on the display for the *12345DES_Pond.dgn* reference file.

🗄 🕶 陰 🕵 🗂	🕺 🔷 🗇 🏂	i i i	문 🏦 🏥 📦 :	🗙 <u>H</u> ilite Mode:	Boundaries	•				
lot 🍸 🏱 File Name		Model	Description	Logical	Presentation	0	•	لك	۲ 🕒	
1 12345 Design P	ond.dgn	CDOT Default	Aligned with Master File	в	Wireframe	0	\checkmark	~	V V	
cale 1.000000	: 1.000000	Ori	entation Top	Rotation 0°0	יחי					

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 19.3 - 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 the feature *Name Pond top*.
- 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*.

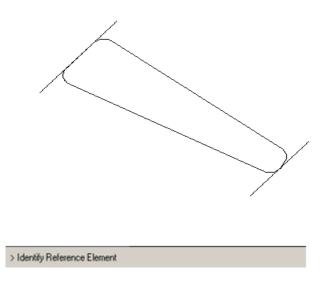
🚔 Generate Lon	igitudinal	Feature		- • ×
Main Control:	s			
Surface:	12345 pc	ond 👻		Filter
Exterior Arc:	5^00'00) ⁽¹		New Style
Reference Fe	ature			Help
🔽 Interval:		10.00	÷	Пор
📃 Stroke Tol	erance:	0.01]	
Longitudinal F Mode:	eature	ew 🔘 Modify		
Name:		Pond top 🗸 🗸	+	
Feature Style:		H_Detention_Pond-Top 🔹		
Point Type:		Breakline 🔹		
Point Density	Interval:	0.00	+	
Duplicate Nan		eplace 🍥 Rename		
Exclude fro	om Triangu	ulation		
Remove L	oops	Cenerate Graphics Only		
Triangulate	Surface			
	Appl	y Preferences Cl	ose]

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 ground.
- 14. **<D> Apply**, then **<D>** to Identify and **<D>** to Accept the pond outline as the *Primary Element*.

Generate Longit	udinal Feature	
1ain Controls		
Horizontal		
Method:	Offset from Primary Feature 🔷 🔻	
Start Offset:	0.00 🔶	
Stop Offset:	0.00	Help
Vertical		
Method:	Drape 👻	
Drape Surface:	12345 existing grou 💌	
	Apply Preferences Clo	

> 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.

Lab 19.4 - Review the feature

- 1. Select Surface > Feature > Feature Properties.
- 2. Set the *Surface* to *12345 pond*.
- 3. Highlight the *Pond top* feature and choose *List Points*.

🖮 Feature Pro	operties					
Surface: Feature: Name Pond top	12345 pond • Style • H_Detention_Pond-Top	Style Available: B_RAIL_Ty-1 B_RAIL_Ty-1 B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-7 Breakline Primaty: H_Detention_ Secondaty:	_SECT-A		•	Apply Close Filter List Points New Style Help
		Pay Items Name	Description	From Style	6	
Name: Description: Parent: Refresh/Dis	Pond top Created by Generate Longitudinal Feature command splay in 3-D/Plan View		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 Description: Created by Generate Longitudinal Feature command Surface: 12345 pond Type: Breakline Style: H_Detention_Pond-Top					
L	ength: 848.73				Ξ	Append
Point	X	V	Z	Distance Along Feature		Display
1	134921.58	291319.73	5150.97	0.00		
2 3	134914.48	291326.62	5150.55	9.90		Print
	134911.52	291336.06	5150.42	19.80		
4 5	134913.49	291345.75	5151.53	29.75		Help
6	134919.40 134925.85	291353.78 291361.42	5153.95 5154.07	40.01 50.01		
ь 7	134922.30	291369.06	5154.07	60.01		
, 8	134938.76	291376.70	5154.00	70.01		
9	134945.21	291384.33	5153.62	80.02		
10	134951.66	291391.97	5151.37	90.26		
11	134958.28	291399.46	5150.59	100.29		
12	134966.97	291404.18	5149.34	110.25		
13	134976.85	291404.07	5150.05	120.16		
14	134985.57	291399.38	5149.22	130.10		
15	134993.37	291393.12	5149.07	140.10		
16	135001.17	291386.87	5148.92	150.10		
17	135008.98	291380.62	5148.77	160.10		
18	135016.78	291374.36	5148.62	170.10		
19	135024.58 135032.39	291368.11 291361.86	5148.47 5148.30	180.10 190.10		
20						

- 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* box and again on *Feature Properties*.

Lab 19.5 - 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**.
- 2. Set the *Type* to *Design*.
- 3. Key in the Name: 12345 dummy pond bottom.
- 4. Key in the *Description*: *Pond training example*.
- 5. Set the *Preference* to *Proposed*.

6. **<D> Apply** and **Close** the *New* dialog.

🐂 New		- • ×
Surface Geometry	V	
Туре:	Design 👻	Apply
Name:	12345 dummy pond bottom	Help
Description:	Pond training example	
Maximum Length:	0.00	
Preference:	Proposed 👻	
Name	Descriptio	n
Default		
12345 pond	Pond trainir	ng example
12345 existing gro	bund	
	Close	

On the *Surface* tab:

Select Surface > Design Surface > Generate Longitudinal Feature (GLF).

7. Set the *Surface* to *12345 dummy pond bottom*.

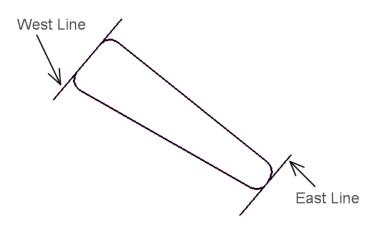
🕌 Generate Longitudina	I Feature	- • •
Main Controls		
Surface: 12345 c	lummy pond 🔻	Filter
Exterior Arc: 5^00'0	0''	New Style
Reference Feature	Help	
V Interval:	10.00 +	(nop
E Stroke Tolerance:	0.01	
_ Longitudinal Feature		
	New 🔘 Modify	
Name:	Pond target 🛛 👻 🕈	
Feature Style:	Default 👻	
Point Type:	Breakline 🔹	
Point Density Interval:	0.00 🕂	
Duplicate Names: Append	Replace (@ Rename	
Exclude from Triang	ulation	
Remove Loops	C Generate Graphics Only	
Triangulate Surface		
App	ly Preferences Close]

8. Set the other criteria as shown to create a new feature.

🦮 Generate Longit	udinal Feature	- • ×
Main Controls		
Horizontal		
Method:	Offset from Primary Feature	
Start Offset:	0.00 🔶	
Stop Offset:	0.00 🔶	Help
_ Vertical		
Method:	Elevation/Elevation	1
Start Elevation:	5144.00 -+	
Stop Elevation:	5144.00 +	-
		-
-		
	Apply Preferences	Close

9. **<D> Apply**.

10. Select the West linestring with a data point **<D>**.



The linestring highlights and you are prompted to Accept/Reject.

11. **<D>** to accept.

You are prompted to *Identify Reference Element*.

12. 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)*.

- 13. **<R>** Reset to copy the entire element.
- 14. **<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 shape is made into a feature at elevation 5144 in the surface dummy pond bottom.

Lab 19.6 - Review the feature

- 1. Select Surface > Feature > Feature Properties.
- 2. Set the *Surface* to *12345 dummy pond bottom*.
- 3. Highlight the *Pond target* (5144 elevation) feature and choose *List Points*.

You should see all 5144 elevations for the feature.

4. Repeat section 1.5 steps 7-13 to create a feature in the same surface for the East line, which should be set to an elevation of *5141*.

iurface:	12345 dummy pond bottor	•		Style					Apply
eature:				Available:					Close
Name		Style	÷	B_RAIL_Ty-10M B_RAIL_Ty-10R					
Pond target		Default		B_RAIL_Ty-3 B_RAIL_Ty-7					Filter
Pond target1		Default		B_RAIL_Ty-7_SE	ECT-A			-	List Points.
				Breakline				•	New Style.
				Primary:					
				Default				•	Help
				Secondary:					
				Pay Items					
				Pay Items Name	Desc	ription	From Style		
				-		ription BASE NOT OPEN	From Style Yes		
				-		•	-	%	
				-		•	-	-	
٠	111	×		-		•	-	-	
∢		Þ		Name		•	-	-	
ame: p	Pond target	P		-		•	-	-	
lame: p		udinal Feature command		Name Triangulation	DATA	BASE NOT OPEN	Yes	-	

You should now have two features in 12345 dummy pond bottom.

- 5. Select **Close** to dismiss the *GLF* dialog box.
- 6. Turn off the reference with the original pond graphics.

References (1 of 1 unique,	, 0 displayed)								
<u>T</u> ools <u>S</u> ettings									
🗄 • 陸 🔖 🗅 💈	🤹 🎲 😓 🧽 🕻	් 🚹 🐔	🛱 ᢪ 📦	X <u>H</u> ilite Mode:	Boundaries	•			
Slot 🎽 🏲 File Name	Mode	Des	cription	Logical	Presentation		• 4	*	(<u>A</u>
1 12345 Design Pond	d.dgn CDOT	Default Alig	ned with Master F	ïle	Wireframe	0	\checkmark	\checkmark	\checkmark
Scale 1.000000	: 1.000000	Orientatio		Rotation 0°0					
Offset X -178956.971	<u>Y</u> -178956.971	∠178	956.971	📃 🖸 🏅 🔧	نا الله الله الم	<u> </u>	* 🌐 🚯	Q	P
No Nesting	Overrides 🔻 Depth: 1	Ne <u>w</u> Leve	l Display: Config	Variable					

7. **Triangulate** the dummy pond bottom surface.

	valuation Modeler Drafting Iools Help			
	Data Type	Active	Features	^
🖃 🗐 Surfaces	ℜ Breakline Features	0	0	
📄 🌧 Default	Sontour Features	0	0	
12345 existing ground	Exterior Features	0	0	=
12345 Design pond	🥂 Inferred Breaklines	0	0	
🗄 🌄 12345 dummy pond botto		0	0	
	Save	0	0	
	Save As	0	0	-
💐 Surfaces 🖁 Geometry 📉 P	Set Active			•
Toggles the Station Lock	Triangulate			H
	Сору			
	Close			
	Empty			
	Properties			

Lab 19.7 - 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*.



Since the source for the slopes is the feature created for the bottom of the pond, you must first change the *Locate* mode.

2. Select the Surface > Design Surface > Generate Sloped Surface (GSS).

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* category:

- 9. Turn 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 🗸 🗸		
Interval:	10.00	+	
Cut Slope: 50.00%	To:	33.00%	
Fill Slope: -50.00%	🗖 To:	-33.00%	
Apply to Both Sides	Triangulate S	Surface	
Feature			
Name		Style:	
	verse 🔻	+ DTM_Transverse	-
Tick Marks			
Source: Pond	iTop 👻 👻	+ Breakline	T
Catch Point: Ponc	i bottom 👻	+ H_Detention_Pond	-Bottom 🔻
Point Type:	Breakline 👻		
Point Density Interval:	10.00	.	
Duplicate Names:			
🔘 Append 🛛 🔘 F	Replace 🧿 Rename		
Exclude from Triang	ulation 📃 Generate Gr	raphics Only	
	Apply Preference	es Close	

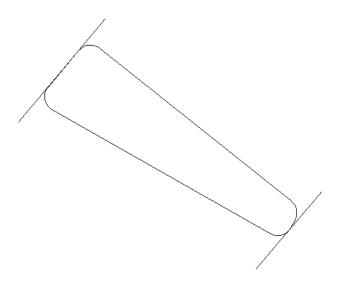
15. On the *Advanced* tab, key in *5^00'00.00"* for *Exterior Arc*.

🗑 Generate Sloped Su	urface	- • • •
Main Advanced		
Corners		
Exterior Arc:	5^00'00''	
Fillet Interior		Help
Berm Cut Slope:	5.00%	Нер
Berm Fill Slope:	-5.00%	
Transverse Feature		
🔲 Maximum Distano	ce: 100.00 +	
	Apply Preferences Close	

16. **<D> Apply** to run the **GSS** command.

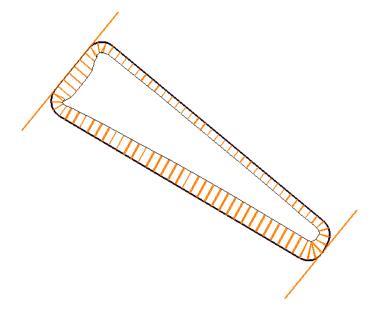
You will be prompted to *Identify Feature*.

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 will appear as shown.

21. **<R>** and then select **Close** to dismiss the dialog box.

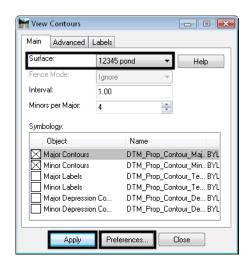
Lab 19.8 - Evaluate the pond surface

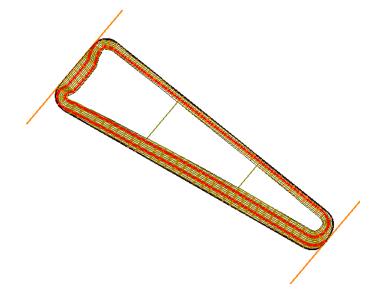
1. Right-click on the pond surface in the Explorer portion of the InRoads menu and select **Tri-angulate**.

File Surface Geometry Drainage	e <u>E</u> valuation	<u>M</u> odeler Dr <u>a</u> fting <u>T</u> ools <u>H</u> e	lp		
<unnamed></unnamed>	- 🚡 😹	🚳 🔪 🏏 🔍 🥩 🚺]		
		Data Type	Active	Features	
Surfaces		ר Breakline Features €	708	20	
🔒 🔫 Default		繼 Contour Features	0	0	
🛊 🍣 12345 existing ground		Exterior Features	0	0	
💿 🎫 12345 Design pond		Breaklines	0	0	
12345 aummy pone	Save	eatures	0	0	
	Save As	Features	0	0	
	Set Active	pints	4	20	
Surfaces 🖁 Geometry	Triangula	te			•
oggles the Feature Filter Lock	Copy				
	Close				
	Empty				
	Properties	s			

- 2. Select Surface > View Surface > Contours.
- 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 19.9 - Save the pond surface to the hard disk

- 1. Select File > Save As.
- 2. Set the *Save as type* to *Surfaces (*.dtm)*.
- 3. Set the *Active Surface* to *12345 pond*.
- 4. Verify the *Name* is *12345 pond.dtm*.
- 5. Verify the folder is *c*:*12345**Design**InRoads*.
- 6. Select Save.
- 7. **Cancel** the *Save As* box.

Lab 19.10 - Calculate the pond's capacity

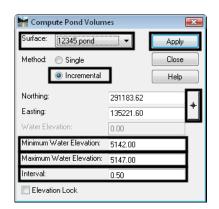
1. Select **Tools > Application Add-ins**, toggle on *Hydrology and Hydraulics Add-in* (if it's not already on) and choose **OK**.

										ОК
Graphics Translator Add-In										OIX.
Horizontal and Vertical Elements Add-In									C	ancel
Hydrology and Hydraulics Add-In								1	_	
Import AMSA Add-In										lelp
Import LAS Add-In										
Import SRV Add-In										
Import Subsurface Add-In										
Import Versine Add-In								Ξ		
Light Rail Manufacturing Add-In										
Lot Layout Add-In										
Multiple Horizontal Element Regression Analysis Add-In										
Multiple Vertical Element Regression Analysis Add-In										
Named Symbology Tools Add-In										
Place Cell/Block Add-In										
Quantity Add-In								-		
Description The Hydrology and Hydraulics Add-In lets you display features that affect w	unter flow		тм -	liantau	flow o	atha (tr	iaklaa)	and b	ibut sri	
compute water volume in retention ponds, and generate water surface dec							ickiesj	ana a	batan	,
			-	-				X		1
Command	M		100							
	×	X	X	X	X	X	×	-	-	
Evaluation>Hydrology and Hydraulics>Generate Water Surface Data	-	-		_				:	:	
Evaluation>Hydrology and Hydraulics>Generate Water Surface Data Evaluation>Hydrology and Hydraulics>Pass through Contours	×	Х	×	X	Х	Х	Х	-	•	•
valuation>Hydrology and Hydraulics>Generate Water Surface Data Evaluation>Hydrology and Hydraulics>Pass through Contours Evaluation>Hydrology and Hydraulics>Display Flat Areas	×××	× ×	× ×	× ×	× ×	× ×	× ×		•	•
Command Evaluation>Hydrology and Hydraulics>Generate Water Surface Data Evaluation>Hydrology and Hydraulics>Pass through Contours Evaluation>Hydrology and Hydraulics>Display Flat Areas Evaluation>Hydrology and Hydraulics>Display Valleys and Ridges Evaluation>Hydrology and Hydraulics>Display Peaks and Rits	× × ×			•						

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.

- 2. Select Evaluation > Hydrology and Hydraulics > Compute Pond Volumes.
- 3. Set the *Surface* to *12345 pond*.
- 4. Set the *Method* to *Incremental*.
- 5. For the *Minimum Water Elevation* key in **5142**.
- 6. For the Maximum Water Elevation key in *5147*.
- 7. For the *Interval* key in *0.5*.
- 8. 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.
- 9. **<D> Apply** and the volume is calculated for the range of elevations you entered. A report is shown with the incremental volumes.

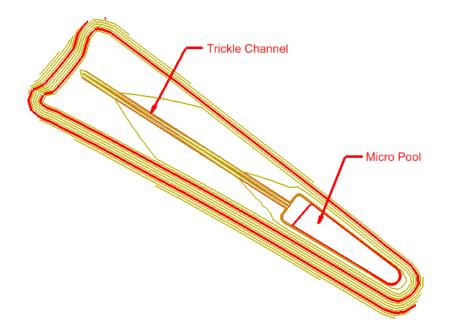


Elevation	Incremental Volume	Cumulative Volume	Acre-Feet	Surface Area	Close
	cu ft	cu ft		sq ft	Save A
5142.00	1076.01	1076.01	0.02	2865.92	- Saver
5142.50	2071.19	3147.20	0.07	5544.57	Appen
5143.00	3605.25	6752.45	0.16	9019.63	Displa
5143.50	5558.26	12310.71	0.28	13348.39	Print
5144.00	7826.31	20137.02	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	

- 10. **Save** the report to your hard drive if desired.
- 11. Close the Compute Pond Volumes dialog.

Lab 19.11 - 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 proficient tool for creating 3D features.
- Simple sideslopes can be formed with GSS.
- Staged water volumes can be computed for DTMs using the **Pond Volumes** command on the **Hydrology and Hydraulics Add-in**.

LAB 20 - Constructing A Driveway

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

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

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

The following files are used for this lab:

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

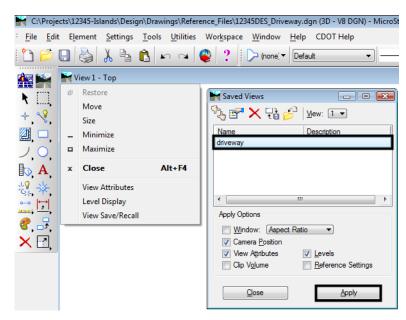
The driveway is 12' wide extending from the proposed edge of pavement to the right of way, 60' to the right of the SH 86 centerline. The driveway returns have a 15' radius. There is a 12:1 slope for 20' from the edge of pavement.

Lab 20.1 - Locating The Driveway

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

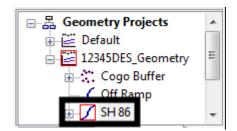
Section Objectives:

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

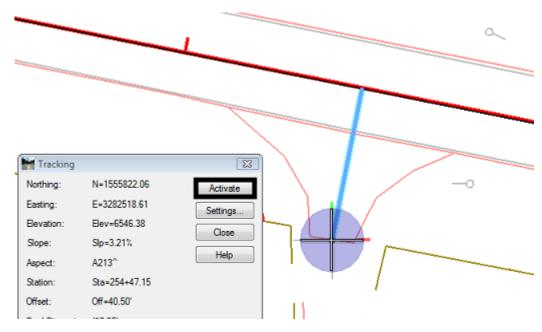


c. **<D> Apply** and then **<D> Close** to dismiss the *Saved Views* dialog box.

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

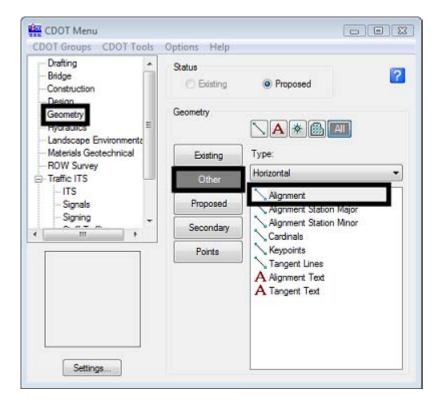


5. Select **Tools > Tracking > Tracking** from the InRoads menu bar.



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

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



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

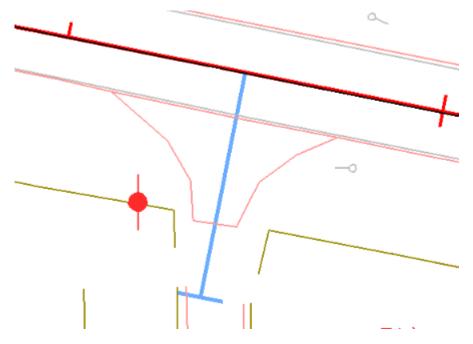


Note: Use the station that you wrote down in step 6.

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

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

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



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

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

Section Summary:

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

Lab 20.2 - Setting Elevations

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

Section Objectives:

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

New			
Surface Geom	etry		
Type:	Design	-	Apply
Name:	Driveway	254+47.15 Rt	Help
Description:	Driveway a	at station 254+47	
Maximum Leng	th: 0.00		
Preference:	Proposed	•	
Name		Description	1
Default			
12345 existing SH86	ground	-	und from n roadway

- 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.

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

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

19. <D> Apply.

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

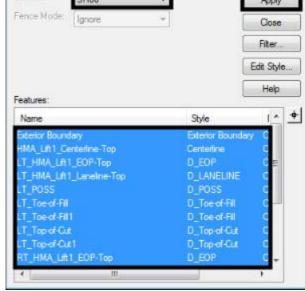
The driveway end line is now stored as a surface feature. To place the driveway center line at the correct location, the features of the SH86 surface must be displayed. Use the feature filter to display only the triangulated features of the SH86 surface, then move the driveway centerline to the proper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

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

Í	•	Bei	ntley InRo	oads XM Ed	lition				
						Evaluation			1
		XS	_Exluded f	rom Triangul	ation 👻	12 😴	6 🔨 🏷	🗶 🗖 -	 I

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

- 26. Highlight all of the features in the *Features* list.
- View Features x Surface SH86 Apply Fence Mode: Ignore Close Fiter
- 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.

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

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

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

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

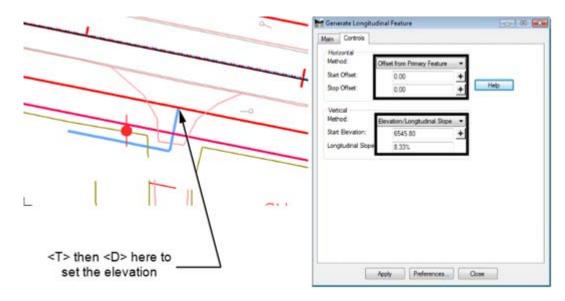
Now the 12 to 1 slope is added to the line. The Generate Longitudinal Feature command is used to create the sloped element. The Generate Graphic Only option is used because additional editing is required.

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

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

37. Toggle on Generate Graphic Only.

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

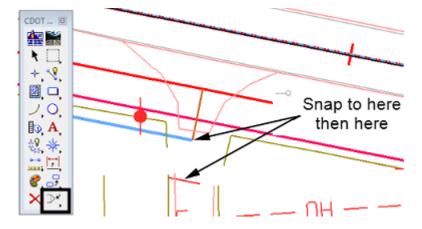


42. Key in *1/12* for the *Logitudinal Slope*. The result will be 8.33%.

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

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

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



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

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

Section Summary:

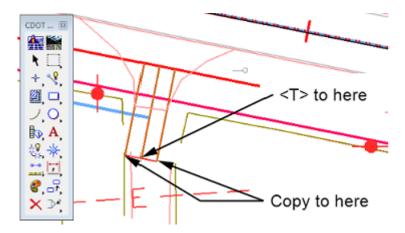
In this section, the features of the mainline road were displayed as an aid in designing the ramp. The driveway end line was draped to the existing ground and stored in the diveway surface. A 3D centerline was created with the desired slopes.

Lab 20.3 - Create Driveway Edges

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

Section Objectives:

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



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

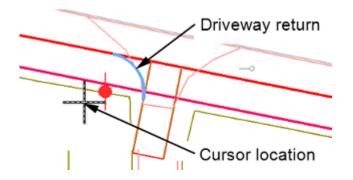
- 6. **<D> Apply** the **<D>** on one of the edge lines. Repeat the process with the other edge line.
- 7. **Close** the Import Surface dialog box.

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

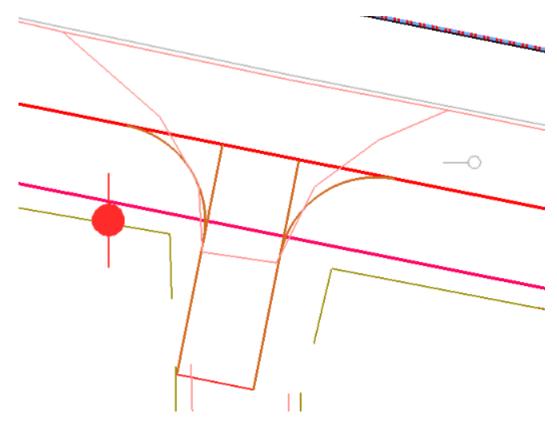
- 8. Select **Surface > Design Surface > Fillet Feature** from the InRoads menu bar.
- 9. Make the settings as shown in the illustration below.

Destination Surfa	ce: Driveway 254+47.	Elevations from De	etination Surface		
Radius:	15.00 4	Copy Reference Fe			Apply
Fillet Feature		Reference Feature 1			Filter
Stroke Toler		T	Driveway 254+47.15 Driveway_Edge	• • +	Preferences
Name:	Driveway_Return +	∳Offset:	0.00	+	Help
Feature Style:	Breakline 👻	Transverse Slope:	0.00%	+	07
Point Type:	Breakline 👻	Elevation Adjustme	ent: 0.00	+	
Duplicate Name	s: () Replace () Renam				
Exclude from	Triangulation		SH86	•	
Generate Gr	aphics Only		RT_HMA_LA1_EOF	+ +	
Extension Ler	gth: 0.00 4	Offset: Transverse Slope:	0.00%	+	
Triangulate Si	100	Elevation Adjustme		+	

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



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



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

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

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

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

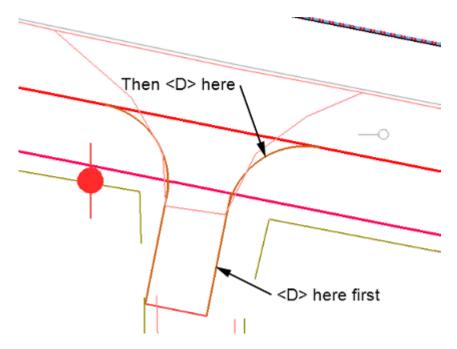
- 19. **<T>** to the end of the fillet on the drive way edge line then **<D>** to complete the partial delete.

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

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

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

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



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

This completes the backbone of the driveway.

Section Summary:

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

Lab 20.4 - Sideslopes and the Exterior Boundary

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

Section Objectives:

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

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

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

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

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

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

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

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

mplate Library: C:\Projects\12345\Design\In Road: E Point Name List 1 - Templates 2 - Sections - Pavement	Current Template Name: Description:	
 2 - Sections - Pavement 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*.
- 12. Drag the component from the *Preview* into the *4_to_1-Existing* section by its origin and place it on the origin on the new section.
- 13. Expand the *Cut Slope Components* folder and **<D>** on the **Cut_4_to_1** component.
- 14. Drag and drop this component into the new setion on the origin.
- 15. Edit the fill component.
- 16. In the *Component Properties* dialog box, *End Condition Properties* area, set the *Surface* to **12345 Existing Ground**.

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

Name:		Fil_4/1			+	Apply
Description	ę.					Close
Style:		D_Toe-of-f	ii •	•]	12	< Previous
Parent Com	ponent:			+		
Display Rul	es:				Edit	Next >
Exclude	from triangu	ilation				Help
End Cond	ition Propert	ies				
End Conc Target Ty	200 - N. W. W.	Surface		Priority:	1	
	200 - N. W. W.	Surface	existing grou		1	
Target Ty	200 - N. W. W.	Surface	existing grou		1 0 0.00	
Target Ty	200 - N. W. W.	Surface • 12345 e	existing grou Vertical	n Benching Count:		

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

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

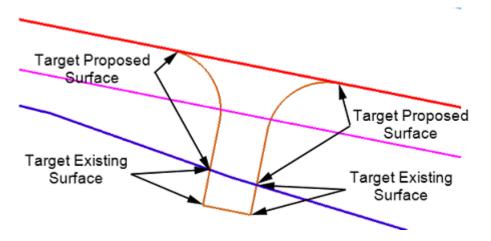
- 22. **<R>** on the **4_to_1-Existing** section and select **Copy**.
- 23. **<R>** on the *Driveway End Conditions* folder and select **Paste**.
- 24. Rename the section to 4_to_1-Proposed.
- 25. **<D> <D>** on the **4_to_1-Proposed** section to make it active.

Name:	Fil_4/1			+ Apply			
escription:				Cree			
tyle:	D_Toe of fil	-	Component Pro				
arent Component:	_	- +	Name:	Cut_4/1		- ±	Apply
isplay Rules:			Description:				Close
Exclude from trian	pulation		Style	a Tub to day			< Previous
End Condition Prope	aties	_	Parent Component:		• ±		Net >
Target Type:	Suface	• Pi	Display Rules:			Edit	Help
Surface	▼ SHB6.	E	Exclude from trian	gulation			(hop
	<i>.</i>		End Condition Prop	erties	-		
Horizo	ontal Vertical	_	Target Type:	Surface	Priority:	2	
Offsets: 0.00	0.00	B	Surface		Benching Count:	0	
					From Datum:	0.00	
			Horiz	ontal Vertical	Step Elevation	0.00	
			Offsets: 0.00	0.00	Rounding Length	0.00	

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

27. Save the template library.

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

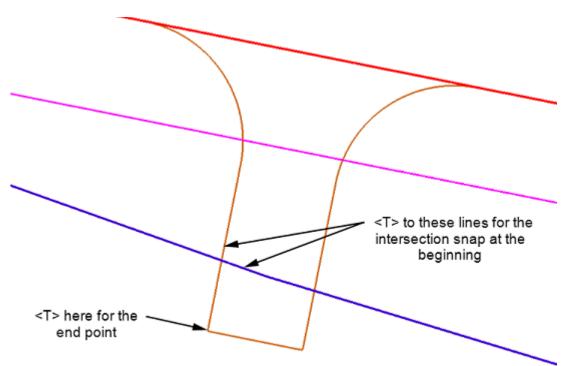


- 28. Select **Surface > Design Surface > Apply Template** from the InRoads menu bar.
- 29. In the Apply Template dialog box, set the Design Surface to Driveway 254+47.15 Rt.
- 30. Toggle on **Interval** and key in **1.00** for the value.
- 31. Toggle on **Stroke Tolerance** and key in **0.01** for the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

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

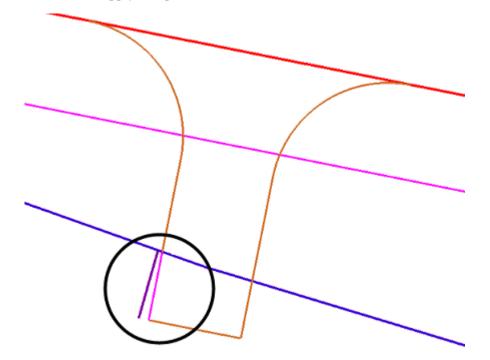
Apply Template	- • 💌
Design Surface: Driveway 254+47.15 Rt 👻	Apply
Exterior Arc: 5 ^{^0} 0'00"	Close
Mirror Reflect	Preferences
Reference Feature	
✓ Interval: 1.00	Help
Stroke Tolerance: 0.01	
Templates: C:\Projects\12345\Design\InRoad 1 - Templates 2 - Sections - End Conditions Curb & Gutter Sections Curb & Gutter Sections Durbeway End Conditions 2-Slone End Conditions THE Sections Features Duplicate Names: Append Replace @ Rename Output Sections Remove Loops Generate Graphics Only	Modfy
✓ Triangulate Surface	

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



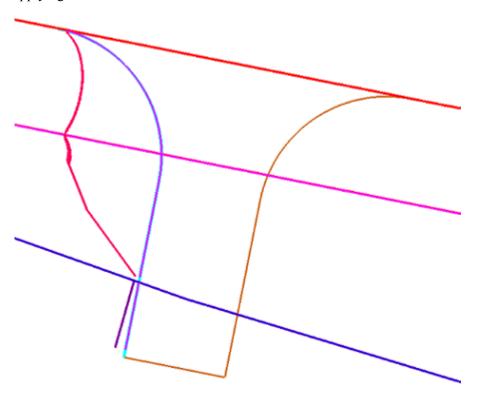
39. At the prompt, "Identify Beginning/Reset for Entire", Set the MicroStation snap mode to Intersection.

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



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

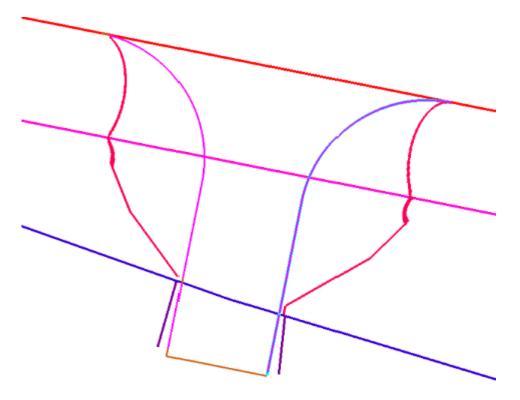
42. Repeat the Apply Template process, using the *4_to_1-Proposed* section, to model the sideslope to the (proposed) SH86 surface. The illustration below shows the results after applying both sections to the left side.



	Driveway 254+47.15 F	t +	Apply
sterior Arc:	5^00'00"	-	
Mirror	Reflect		Close
Beference Feature	Le rierce		Preferences.
Interval:	1.00	+	Help
Stroke Tolerance:	0.01	-	
C.\Projects\12345			
× 4_to_1	tter Sections End Conditions	<	\langle

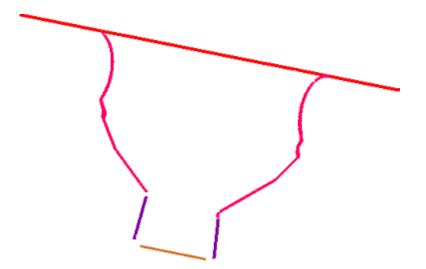
43. In the Apply Template dialog box, toggle on Reflect.

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



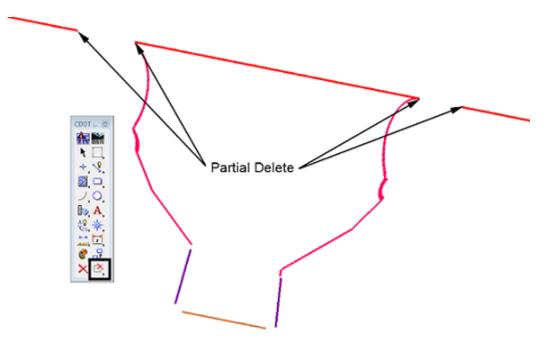
The final step for the drive is to create an exterior boundary. The boundary is defined using the graphics of the cut and fill features along with the driveway end feature and the proposed edge of pavement from Sh86.

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

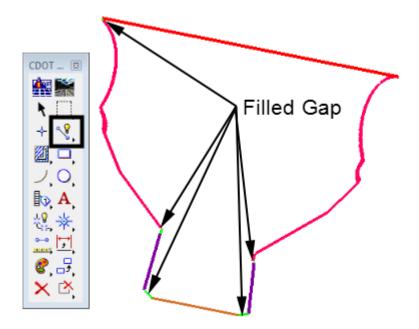


To create the boundary, the edge of pavement line needs to be trimmed and the gaps between elements need to be filled.

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

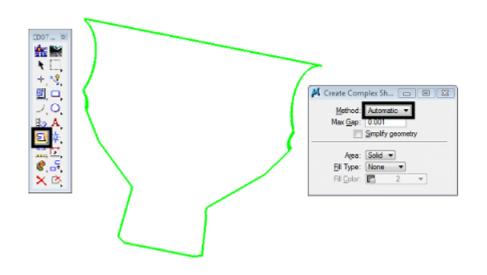


50. Select the MicroStation Place Smartline command. Use this command to fill in the gaps between elements. Be sure to <T> to the ends of the lines. This will ensure that the elements are connected properly. Not snapping to the lines could result in erroneous elevation data. The gaps filled are illustrated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



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

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

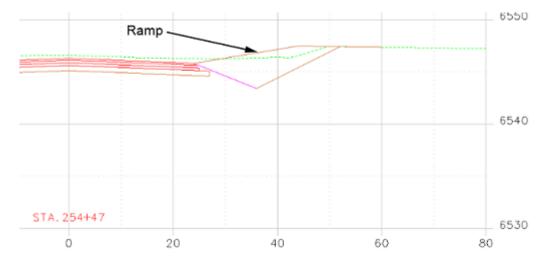


Import complex shape into the driveway surface as an exterior boundary, to complete the model.

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

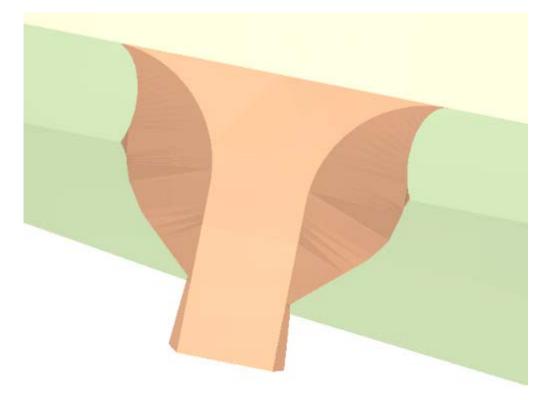
import Surface			- • •
From Graphics DEM	From Geometry		
Surface:	Driveway 254+47.15	Rt 👻	Apply
Load From:	Single Element	-	Filter
Level:	ALG_COGO_Points	~	Results
Elevations:	Use Element Elevation	ns 🔻	Preferences
Intercept Surface:	Default	-	
Drape Vertices Or	ily		Help
Thin Surface			
Tolerance:	5.00		
Features	phics Information		
Seed Name:	Exter	ior Boundiary	- +
Feature Style:	Exter	ior Boundlary	-
Point Type:	Exter	ior	•
Maximum Se	ment Length: 0.00		
Point Density	Interval: 0.00		
Duplicate Names:	🗇 Replace 🛛 🔍 Ren	ame	
Exclude from Tri	angulation		
	Close		

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



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

Below is a rendered view of the driveway



Section Summary:

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

Chapter Summary:

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

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

From MicroStation, the following tools were used:

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

LAB 21 - 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 21.1 - 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 laidout 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 *Preferance* to **Proposed**.
- 10. **<D> Apply** then **<D> Close**.

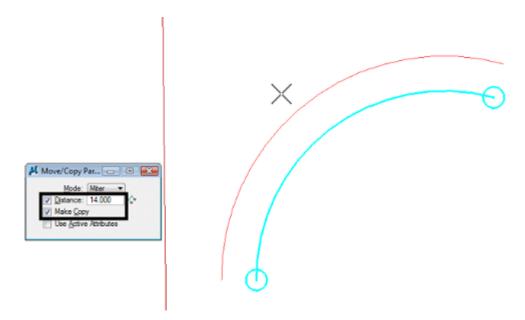
Type: Name: Description:	Design SE Island uad SH 86	• 6 and Side Road	Apply Help
Maximum Length Preference:	D.00 Proposed		
			1
Name		Description	1

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.

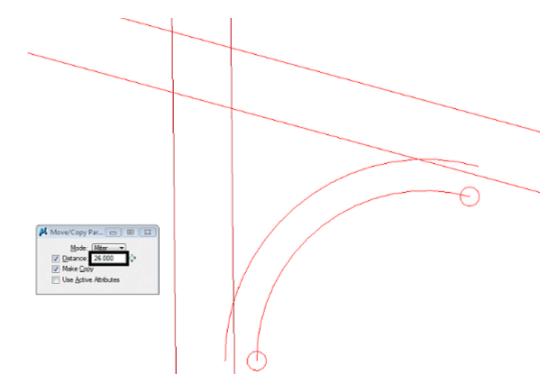
- 11. In the InRoads Explorer, expand the **12345DES_Geometry** geometry project.
- 12. **<R>** on the **SH 86** horizontal alignment and select **View** from the menu.
- 13. Repeat the process for the SideRoad and SE Curb Return horizontal alignment

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 $\langle D \rangle$ to make the copy. $\langle R \rangle$ to exit the command.



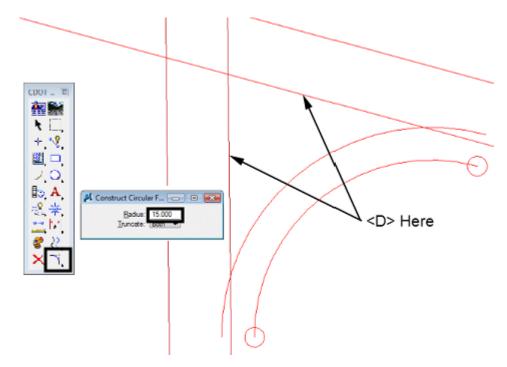
- 20. In the *Move/Copy Parallel* tool settings box, key in *26* for the value.
- 21. **<D>** on the **SH 86** line the **<D>** to the right of the line. **<R>** to exit the command.



22. **<D>** on the **SideRoad** line the **<D>** to the right of the line. **<R>** to exit the command. The illustration below shows the results.

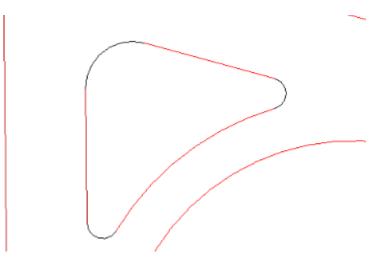
Next the radii for the island corners are added. The corner facing into the intersection has a 15' radius. The other two have a radius of 5'. These are placed using the Construct Circular Fillet command.

- 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.

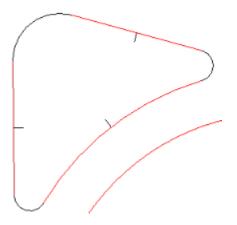
- 27. In the tool settings box, key in **5** for the *Radius*.
- 28. Place the other two fillets as done in step 25. The illustration shows the results.



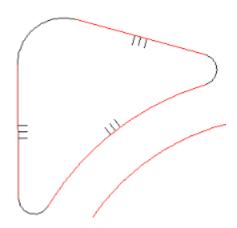
With the outline of the island in place, the pedestrain ramps can be located. These are placed in the center of each side of the island. The MicroStation Construct Line At Active Angle command is used to place the ramp centerline perpendicular to the island side.

- **Note:** The dimensions for the pedestrain 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.

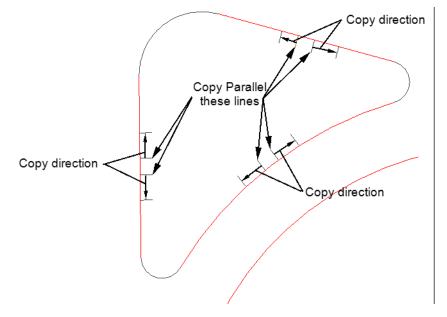
- 30. In the tool settings dialog box, set the *Method* to From Point.
- 31. Set the *Active Angle* to **90^00'00**".
- 32. Toggle on *Length* and key in *3* for the value. This is the length of the 20:1 slope at the mouth of the ramp.
- 33. **<T>** to the center of a side of the island, move the cursor inside the island and **<D>**.
- 34. Repeat step 32 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 pedestrain ramps were added using the Construct Line At Active Angle command.

Lab 21.2 - 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.

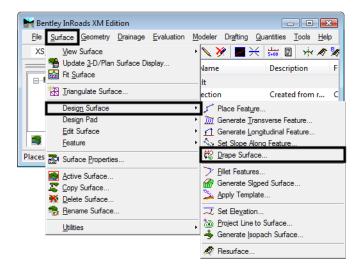
Section Objectives:

- 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.

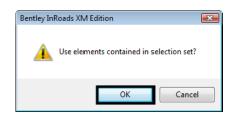
2. Select **Surface > Design Surface > Drape Surface** from the InRoads main menu. This displays the Drape Surface dialog box.



- 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	NT_Secti 👻	Preferences
Destination Level:	DES_ROADWAY	Curb-Fla 👻	Help
🔽 Delete Original Graph	nics		
Features Surface:	Intersection	-	
Name	Style	Description	-+-
Scale:	1.0000		
Elevation Adjustment:	0.00		
Drape Vertices Only			

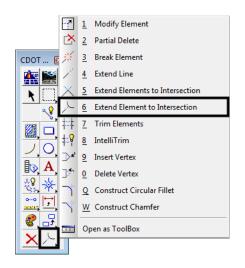
<D> Apply. This displays a message window asking, "Use elements contained in selection set?". <D> OK to complete the processing.



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 **Extend Element to Intersection** from the MicroStation main menu.



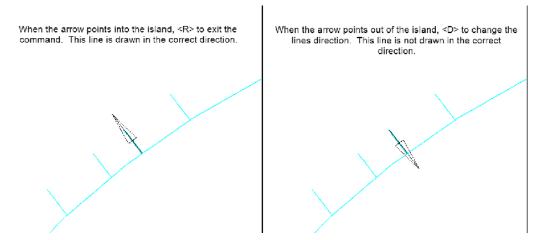
11. Extend the outside ramp line to meet the Island line.

Next, check the direction of the lines. This will affect how the Generate Longitudinal Feature command operates.

<D> the Change Element Direction tool from the Misc. Tools bar. The toolbar is usually docked at the top of the MicroStation window. If it is not docked, select CDOT Tools > Misc. Tools from the CDOT Menu menu bar.



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.

Bentley InRoads XM Edition	
File Surface Geometry Drainage Evaluation	Modeler Drafting Quantities Tools Help
 <ut li="" surface<="" view=""> Surface 3-D/Plan Surface Display Fit Surface Fit Surface Trangulate Surface </ut>	Y Image: Second seco
Design_Surface Design_Pad Edit Surface Feature Drapes Copy Surface Copy Surface Ename Surface Lutities	 Place Feature Projects/12 M Generate Transverse Feature Generate Longitudinal Feature Set Slope Along Feature Drape Surface Ellet Features Generate Sloped Surface Apply Template Z Set Elevation Project Line to Surface Generate Isopach Surface Kesurface

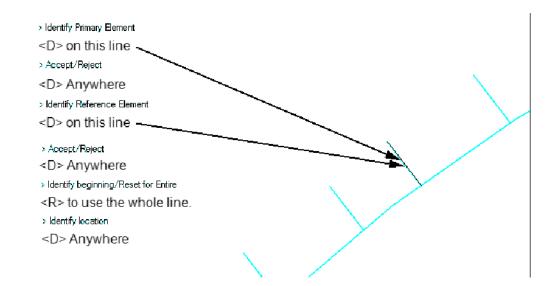
- 16. On the *Generate Longitudinal Feature* dialog box *Main* tab, Toggle on **Interval** and set the value to **1.00**.
- 17. Toggle on **Stroke Tolerance** and set the value to **0.01**.
- 18. Use the *Feature Style* drop down menu and select **D_CONC_Sw**.

lain Controls			
Surface: SE Is	land 👻		Filter
Exterior Arc: 5^(0'00''		New Style
Reference Feature Interval: Stroke Tolerance	1.00 e: 0.01	÷	Help
Name:	New Modify Enter New Ftr Name	* +	
Feature Style: Point Type:	D_CONC_Sw	-	
Point Density Interv	Breakline al: 0.00	*	
Duplicate Names:	Replace @ Rename	T	
Exclude from Tri	angulation		
Remove Loops	Generate Graphics Only		

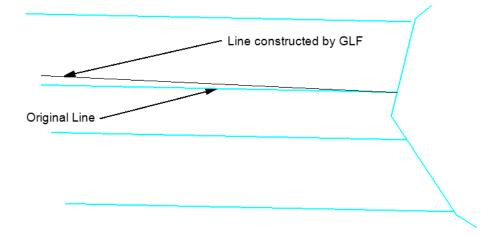
19. Toggle on Generate Graphics Only.

- 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.

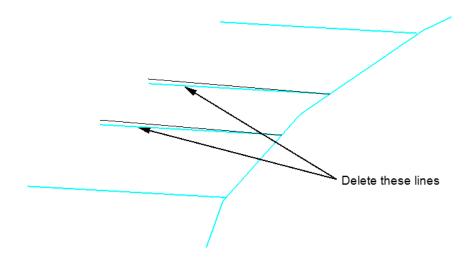


The illustration below shows the results of the *Generate Longitudinal Feature* command in a rotated view.

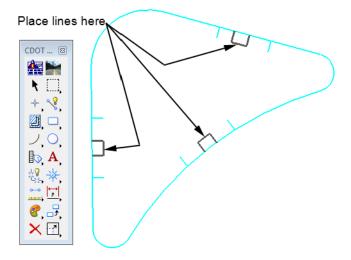


- 26. Repeat steps 23 through 25 for the remaining ramp landing lines (there are 5 more).
- 27. Rotate the view so the the originl ramp tread lines can be seen under the new lines.

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 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.

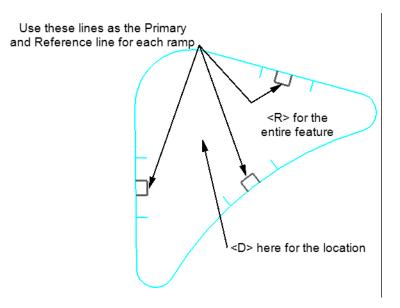
Generate Long	itudinal Feature	- 0 🛃
Main Controls		
Surface:	6E Island 👻	Filter
Exterior Arc:	5^00'00''	New Style
Reference Feat		Help
Interval:	1.00 +	Help
V Stroke Toler	ance: 0.01	
Name:	Enter New Ftr Name 👻 🔶	
Mode: Name:	New Modify	
Feature Style:	D_CONC_Sw 👻	
Point Type:	Breakline	
Point Density In	terval: 0.00 +	
Duplicate Name O Append	s: Replace Rename	
Exclude from	Triangulation	
Remove Loc	ps 🕼 Generate Graphics Only	
Triangulate Su	urface	
(Apply Preferences Close	

- 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.

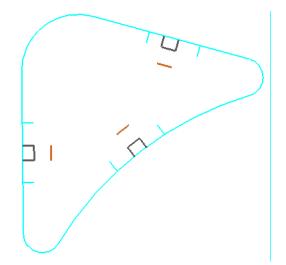
37. Key in *0.32* for the *Start Offset* and *Stop Offset*. This is the difference in height from the end of the 20 to 1 tread slope to the top of the curb.

🔚 Generate Longitudinal Feature	- • ×
Main Controls	
Horizontal Method: Offset from Primary Feature Start Offset: 4.50 Stop Offset: 4.50	Help
Vertical Method: Offset/Offset Start Offset: 0.32 Stop Offset: 0.32 +	
Apply Preferences C	lose

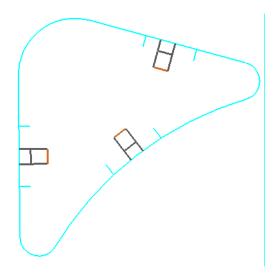
38. <D> Apply. Then follow the prompts. Use the ramp tread end line as the primary and reference element. <R> to use the entire line. <D> in the middle of the Island for the location.



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 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.

sland -	Filter
00'00''	
	New Style
1.00 +	Help
e: 0.01	
Enter New Hr Name	1
D_C/G_Ty-2_Sect II-B	
Breakline 👻	
al: 0.00 +	
Replace 🔘 Rename	
angulation	
Generate Graphics Only	
	e: 0.01 e Solution e D_C/G_Ty-2_Sect II-B Breakline

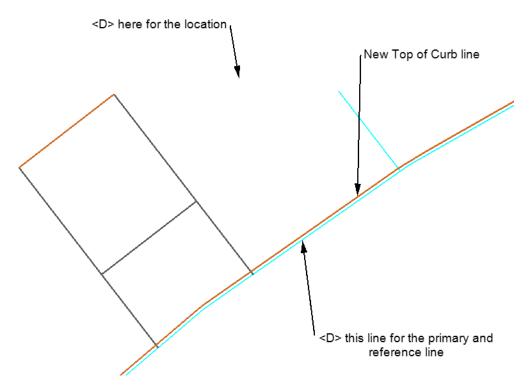
44. Set the *Feature Style* to **D_C/G_Ty2_Sect II-B**. The other settings remain as set.

- 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 Longit	idinal Feature	
lain Controls		
Horizontal		
Method:	Offset from Primary Feature -	
Start Offset:	0.13 +	
Stop Offset:	0.13 +	Help
Vertical		
Method:	Offset/Offset 🗸	
Start Offset:	0.50 +	
Stop Offset:	0.50 +	
	1	
	Apply Preferences C	

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.

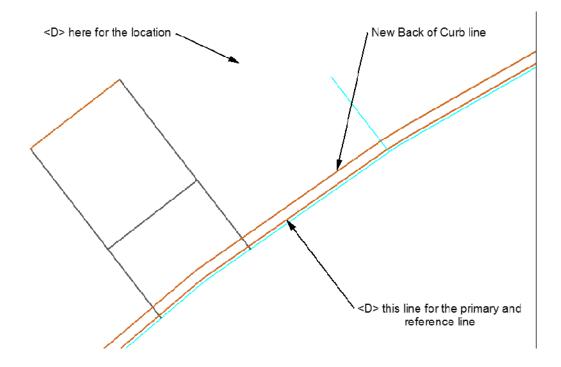


51. Repeat step 49 for each element in the island outline.

- 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.

Nain Controls]	
Horizontal Method:	Offset from Primary Feature 🔹	
Start Offset:	0.38 +	Help
Stop Offset:	0.38 +	
Vertical		
Method:	Offset/Offset	
Start Offset:	0.00 +	
Stop Offset:	0.00 ++	

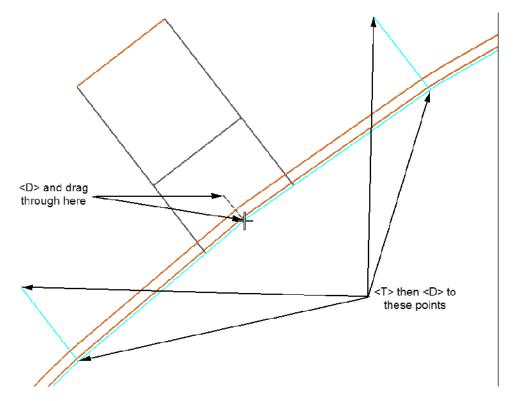
54. **<D> Apply**. Then follow the prompts. **<D>** a top of curb element for the primary feature and use the same one for the reference feature. **<D>** in the middle of the Island for the location. The illustration shows an example of the results.



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>** the **<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.

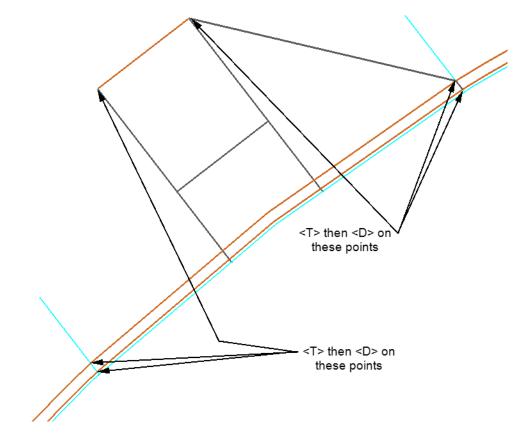


This has broken each of the curb top lines into four sections. The sections inside the ramp area will be modified after they are imported into the surface. Those outside will be left as is.

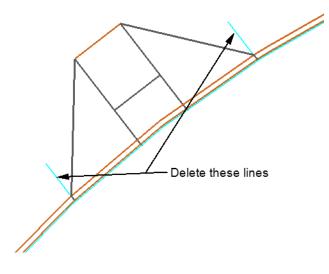
Next the lines representing the ramp wings are drawn.

62. From the MicroStation main toolbar, select the Place SmartLine command.

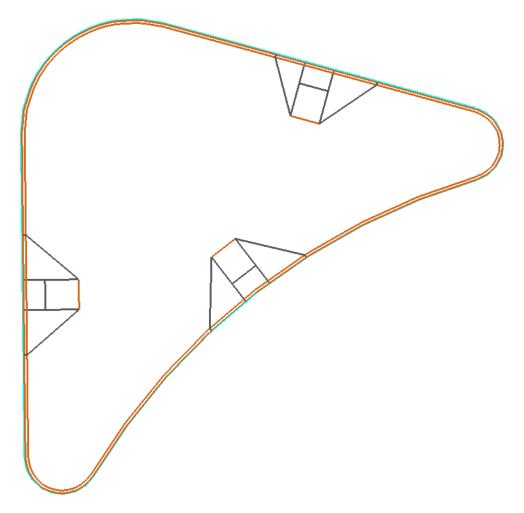
- 63. **<T>** then **<D>** to the points indicated in the illustration below.
 - *Important!* Be sure to snap to the curb top lines. Snapping to any othe line in this area will result in the wing being placed at the wrong elevation.



- 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.

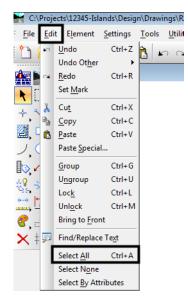
Lab 21.3 - Importing Graphics to Surface and Modifying Features

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:	SE Island	-	Apply
Load From:	Single Elemen	nt 🔻	Filter
Level:	ALG_COGO_	Points 👻	Results
Elevations:	Use Element	Elevations 🔻	Preferences
Intercept Surface:	Default		
Drape Vertices Or	nly		Help
Thin Surface			
Tolerance:	5.00		
Features	aphics Informatio	on	
Seed Name:		SE_Island	+ +
Feature Style:		D_CURB	•
Point Type:		Breakline	•
Maximum Seg	gment Length:	0.00	
Point Density	Interval:	0.00	
Duplicate Names:	Replace	Rename	
Exclude from Tri	angulation		
		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 save 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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File Surface Geometry [<u>Prainage</u> <u>E</u> valuation	Modeler	Dr <u>a</u> fting <u>Q</u> uantities <u>T</u> o	ools <u>H</u> elp	
View Surface			<u>P</u> erimeter	Features	Deleted
🖃 📲 Update <u>3</u> -D/Plan S	urface Display		<u>T</u> riangles	78	0
🚵 Fit <u>S</u> urface			<u>C</u> ontours	0	0
Triangulate Surface	e		Label Contours	0	0
Design Surface			Features	0	0
Design Pad			Components	0	0
Edit Surface			<u>Annotate Feature</u> Surface Elevations	0	0
Feature			Slope Vectors	0	0
Surface Properties.			Single Point	. 0	0

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.

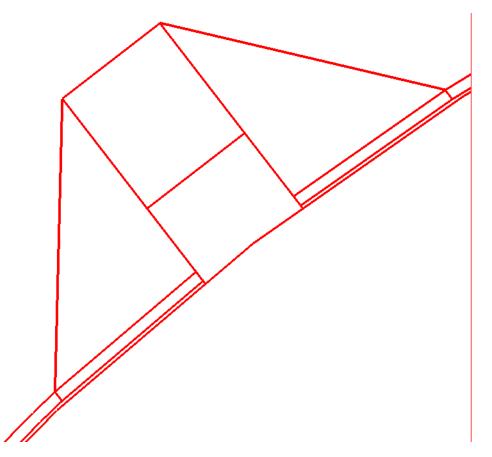
View Features			×
Surface: SE	Island 🔻		Apply
Fence Mode: Igno	ore 💌		Close
			Filter
			Edit Style
			-
Features:			Help
Name		Style	<u> ^ </u>
SE_Island		D_CURB	
SE_Island1		D_CURB	
SE_Island10		D_CURB	
SE_Island11		D_CURB	
SE_Island12		D_CURB	
SE_Island13		D_CURB	
SE_Island14		D_CURB	
JE_ISIGHU 14			
SE_Island15		D_CURB	
		D_CURB D_CURB	
SE_Island15			

- 19. In the MicroStation view, zoom in on one of the ramps.
- 20. From the InRoads menu bar select **Surface > Edit Surface > Trim Features**.

Bentley InRoads XM Edition Unnamed>	Ma			
View Surface	Trim Features.		Features	Deleted
🖃 📲 Update <u>3</u> -D/Plan Surface Display	intersect Featu	ires	78	0
Fit Surface	Copy Portion o	-	0	0
Triangulate Surface	🐇 Merge Surface		0	0
Design Surface	→ ^{∰‡} Tra <u>n</u> sform Surf	ace	0	0
Design Pad	, 🚧 Delete <u>T</u> riangle	ə	0	0
Edit Surface	, om Fea	0	0	0
<u>F</u> eature	Points	0	0	0
Surface Properties	gles III	0	0	۰ ۱
1oves 🛃 Active Surface		-		

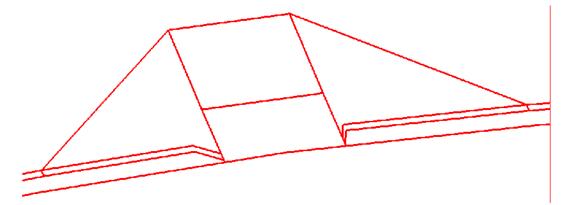
- 21. In the *Trim Features* dialog box, in the *Elevation* area, toggle on Match at Intersection.
- 22. **<D>** the target button **D** the curb back line. This highlights that feature in the list.
- 23. **<D> Apply** then **<D> to Accept**.
- 24. **<D>** the ramp tread line then **<D>** again to accept it.
- 25. **<D>** inside the tread area to accept the command and trim the curb feature.

Trim Features				X	✓ 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				↑ \	
SE_Island46	D_CURB					
SE_Island47	D_CURB		*			
Elevation						
Do Not Change	Mat	ch at Intersection				
Mode						✓ <d> this Line and</d>
One Section	🔘 To (One Side				
						<d> to accept</d>
						∽ Then <d> here.</d>
				TX/	1	
Rai	mn trea	d area 🦯		XX		
i tu	np ueu	u alea -				
					J Ramp tread lines	
					•	
				/		
			X//			
			/ //			



26. Repeat steps 22 through 25 for the other curb top features in the ramp area. The illustration shows the results.

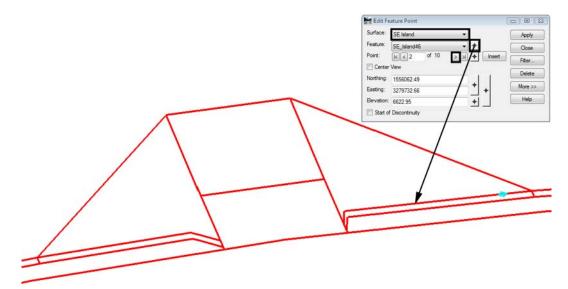
In a rotated view, notice that the curb top lines do not slope consistantly from the wing to the tread. This is because the Trim Feature command matches the elevation from the intersection of the features to the next vertex in the trimmed feature.



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**.

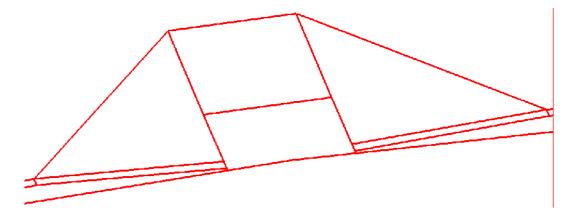
- 29. **<D>** the target button for *Feature*, then **<D>** on the curb back line.
- 30. **<D>** the advance point button \triangleright to select point **2** on the feature.



- 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	<u>k <</u>	+ Insert	Filter
Center	View				Delete
Northing:	1556059.58			_	
Easting:	3279728.51			+	More >>
Elevation:	6622.44			+	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.

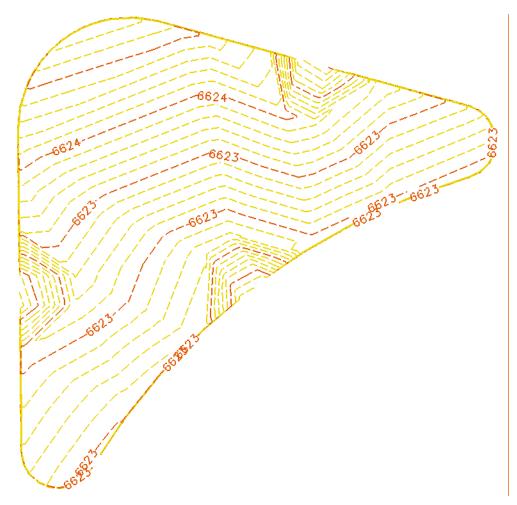


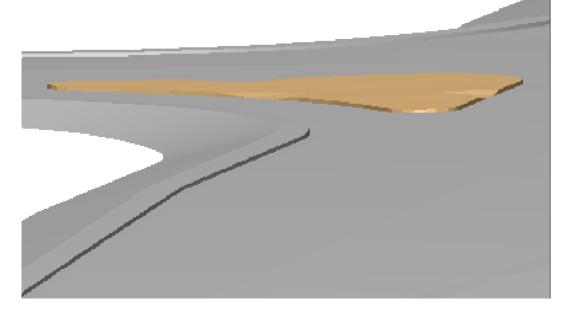
34. Repeat steps 19 through 33 for the other two ramps.

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 22 - 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::

- To develop an understanding of modeling surfaces without templates.
- To learn how some of InRoads' Surface tools can create breaklines necessary for modeling surfaces at the ends of a bridge.

Lab 22.1 - Create the Surface East of the Bridge

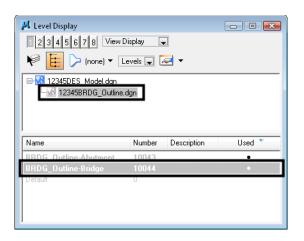
In this section, the design surface is used to create a smaller surface for the portion of the roadway East of the bridge. This surface will subsequently be used as the basis for the grading around the bridge abutment.

Open MicroStation and InRoads using the 12345DES_Model.dgn file.

- 1. Select **File > Open** from the InRoads menu.
- 2. Open 12345 SH52 71st intersection.dtm, 12345 SH119 SH52 interchange.alg, and 12345 existing ground for interchange.dtm.
- 3. Select **File > Reference** from the MicroStation menu.
- 4. Select Tools > Attach.
- 5. Select C:\Projects\12345\Bridge\Drawings\Reference_Files\12345BRDG_Outline.dgn.

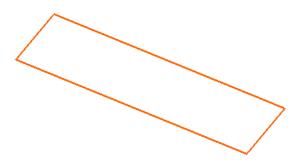
-	5BRDG_Outline.dgn awings\Reference Files\12345BRDG Outline.dgn
	Default
Logical Name:	
Description: Align	ed with Master File
Orientation:	
View	Description
Coincident	Aligned with Master File
Coincident - World	Global Origin aligned with Master File
E Standard Views Top	
Front	
Right	
Isometric	
Bottom	
Toggles:	
Sc <u>a</u> le (Master:Ref)	1.000000 : 1.000000
Named Group:	
Revision:	
Clip Boundary Element:	Copy To Master
Level:	
Nested Attachments:	No Nesting Depth: 1
Display Overrides:	
New Level Display:	
Global LineStyle Scale:	
ciopal Linestyle scale:	Master 🖉

- 6. **<D> OK** to accept the default reference settings.
- 7. In the *Level Display* dialog, toggle on the reference file level *BRDG_Outline-Bridge*.



8. *Fit* the view.

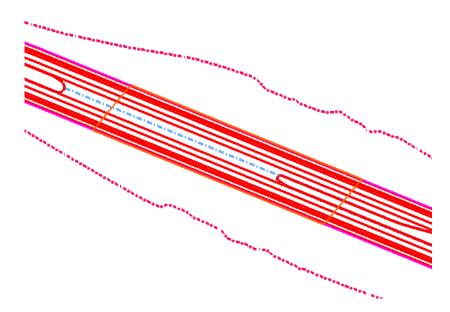
An outline of the proposed bridge is shown in the file.



- 9. Set the *Pen/Pencil* lock to *Pencil*
- 10. Select Surface > Update 3D/Plan Surface Display.
- 11. Toggle *Display On* and highlight the intersection surface.
- 12. Toggle on *Features*.

- 🕌 Update 3-D/Plan Surface Display - • 💌 Mode: Oisplay On Display Off Apply Fence <u>M</u>od Ignore ÷ Close S<u>u</u>rfaces: Filter.. Name Description Edit Style. Default SH52 71st intersection <u>H</u>elp 7345 evicting Perimeter Surface Elevations Color-Coded Aspects Triangles Slope Vectors Color-Coded Elevations Contours Profiled Model Color-Coded Slopes Gridded Model V <u>F</u>eatures: + Style 71 RT_Edge-of-Pavement D_CONC_Pvmt 71 RT_Laneline 71 RT_POSS D_CONC_Pvmt D_POSS 71 RT_Shoulder D_SHOULDER 71 Toe-of-Fill D_Toe-of-Fill 71 Top-of-Cut D_Top-of-Cut
- 13. Right-click in the feature list and choose Select All.

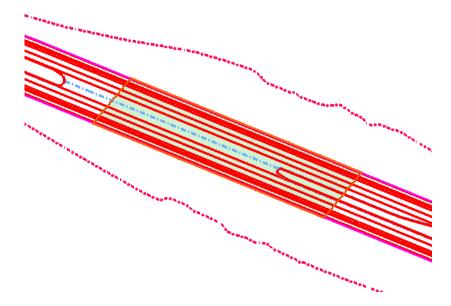
14. **<D> Apply**.



All of the features are shown in the file.

- 15. On the MicroStation menu, choose Place Fence.
- 16. In the *Tool Settings* box, change the *Fence Type* to *Element*.

17. **<D>** on the bridge outline in the design file.

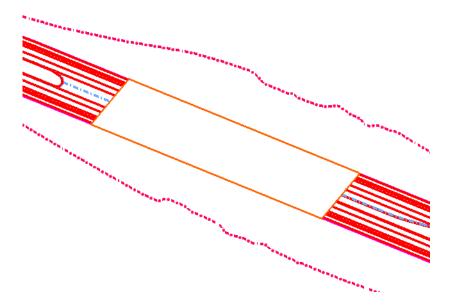


- 18. Choose Surface > Edit Surface > Delete Feature.
- 19. Set the *Surface* to *SH5271st Intersection*.
- 20. Set the *Fence Mode* to *Inside*.
- 21. Right-click in the feature list and choose Select All.

Surface: SH52 71st Fence Mode: Inside	t 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	
710 1 1		- · · ·	

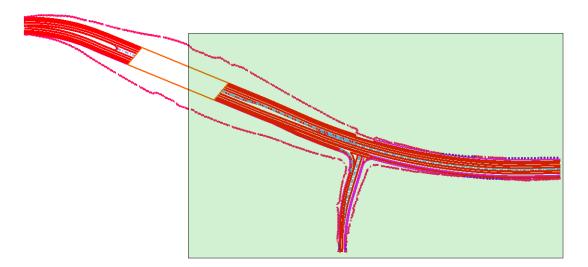
- 22. **<D> Apply**.
- 23. When prompted to *Delete selected feature(s)*, select **OK**.
- 24. **Close** the dialog box.
- 25. Clear the fence.

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.



26. Choose Place Fence.

- 27. In the *Tool Settings* box, change the *Fence Type* to *Block*.
- 28. Place a fence that encompasses all features East of the bridge as shown.



- 29. Select Surface > Edit Surface > Copy Portion of Surface.
- 30. Set the *Surface* to *SH52* 71st intersection.
- 31. Key in the Destination Surface SH52 71st East of Bridge.
- 32. Set the *Fence Mode* to *Inside*.

33. If all Features are not highlighted, Right-Click in the feature list and choose 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		

- 34. **<D> Apply**, then **Close** the dialog box.
- 35. Choose File > Save As.
- 36. Set the *Save As Type* to *Surfaces (*.dtm)*.
- 37. 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.
- 38. **<D> Save**.
- 39. Select Surface > Update 3D/Plan Surface Display.
- 40. Toggle *Display Off* and highlight the intersection surface.
- 41. Toggle on *Features*.

42. Right-click in the feature list and choose Select All.

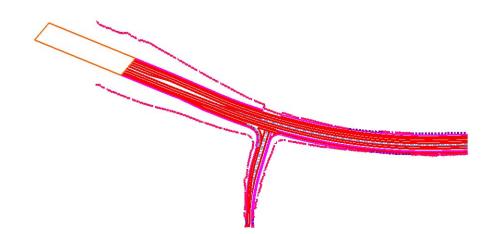
🐂 Update 3-	D/Plan Surface Display		- • •
Mode:	💿 Display <u>O</u> n 🚺 💿 <u>D</u> is	splay Off	Apply
Fence <u>M</u> ode:	Inside		Close
S <u>u</u> rfaces:		_	
Name		Description	Filter
Default			Edit Style
SH52 71 st int	ersection		Help
SH52 71st Ea	g ground for interchange ast of Bridge	5H1195H 52 existing gr	
Perimeter	Surface <u>E</u> levations	Color-Coded Aspects	
Triangles	Slope Vectors	Color-Coded Elevations	
Contours	Profiled Model	Color-Coded Slopes	
<u>▼</u> Eeatures:	🔲 <u>G</u> ridded Model		
Name		Style	+
71 RT_Edge-	of-Pavement	D_CONC_Pvmt	1
71 RT_Laneli	ne	D_CONC_Pvmt	
71 RT_POSS		D_POSS	
71 RT_Shoul	der	D_SHOULDER	
71 Toe-of-Fill		D_Toe-of-Fill	
71 Top-of-Cul	:	D_Top-of-Cut	-

43. **<D> Apply**.

- 44. Toggle *Display On* and highlight the *SH52 71st East of Bridge* surface.
- 45. Toggle on *Features*.
- 46. Right-click in the feature list and choose Select All.

🕌 Update 3-D/Plan Surface Displ	lay	- • •
Mode: 💿 Display <u>O</u> n 🔘	<u>D</u> isplay Off	Apply
Fence <u>M</u> ode: Inside	•	Close
Surfaces:		Filter
Name	Description	
Default		Edit Style
SH52 71st intersection		Help
12345 evisting ground for interchang	ge SH119 SH 52 existing gr	
SH52 71st East of Bridge		
Perimeter Surface Elevation	ns 📃 Color-Coded A <u>s</u> pects	
Triangles Slope Vectors	Color-Coded Elevations	
<u>Contours</u> Profiled Model	Color-Coded Slopes	
V Features: Cridded Model		
Name	Stule	+
71 RT_Edge-of-Pavement	D_CONC_Pvmt	J
71 RT_Laneline	D_CONC_Pvmt	
71 RT_POSS	D_POSS	
71 RT_Shoulder	D_SHOULDER	
71 Toe-of-Fill	D_Toe-of-Fill	
71 Top-of-Cut	D_Top-of-Cut	
· · · · · · · · · · · · · · · · · · ·		

47. **<D> Apply**.



Lab 22.2 - 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, toggle off the reference file level *BRDG_Outline-Bridge*.

۴ .	_evels 🖵		
12345DES Model.dan	_		
- <u>v</u> 12345BRDG_Outline	.dgn		
		D. L.C.	
lame	Number	Description	Used 🔨
BDG Autline-Abutment	10043		•
	10044		•
RDG_Outline-Bridge			

- 2. Select Surface > Design Surface > Place Feature.
- 3. Set the *Surface* to *SH52* 71st East of Bridge.
- 4. Type in *abutment1* for the *Feature Name*.
- 5. Type in a description if desired.
- 6. Set the *Feature Style* to *D_CONC_Pvmt*.

7. Set the *Point Type* to *Breakline*.

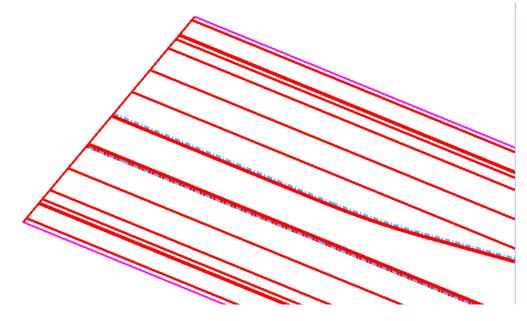
🚔 Place Feature			- • ×
S <u>u</u> rface:	SH52 71st East of Bridge 🛛 👻	[Apply
Feature N <u>a</u> me: Descrip <u>t</u> ion: Feature Style: P <u>o</u> int Type:	abutment1	+	Close Ne <u>w</u> Style <u>H</u> elp
Duplicate Names Append Exclude from	Repla <u>c</u> e		
- Dynamics Setting	gs and Intervals		
Northing/East	ting: 0.00		
Elevation:	0.00		
Distance:	0.00		
Direction:	0^00'00''		
Diectori.			

8. **<D> Apply**.

9. *Do not* toggle on either option on the *Set Elevation* dialog that appears.

🐂 Set 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.

Lab 22.3 - 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, toggle on the reference file level *BRDG_Outline-Abutment*.

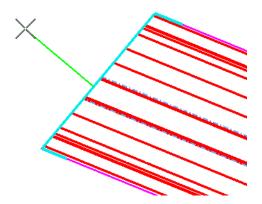
📕 Level Display			- • •				
2 3 4 5 6 7 8 View Display 🖵							
🌾 📴 ≽ (none) 🔻 🛛	🌾 🔛 խ (none) 🔻 Levels 🖵 🐖 🔻						
B-W 12345DES Model.dan	dan						
	agn.						
Name	Number	Description	Used 🔻				
Name BRDG_Outline-Abutment	Number 10043	Description	Used 🔻				
		Description	Used 🔻				
BRDG_Outline-Abutment	10043	Description	Used V				
BRDG_Outline-Abutment BRDG_Outline-Bridge	10043	Description	Used T				
BRDG_Outline-Abutment BRDG_Outline-Bridge	10043	Description	Used V				

- **Note:** A green line displays that wraps around the edge of the roadway. This is the line from which the sloped surface is generated.
- 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 dialog. Be sure to toggle on and key in the feature names for *Transverse*, *Source* and *Catch Point*.

🦮 Generate Sloped Surf	ace		- • •
Main Advanced			
Current Locate Mode:	Graphics		Filter
Source Surface:	SH52 71st East of B 💌		New Style
Intercept		7	
Surface:	12345 existing grour 🔻		
Elevation:	0.00		
Destination Surface:	SH52 71st East of B 👻	1	
Inter <u>v</u> al:	10.00	+	
Cut Slope: 33.00%	📃 To:	33.00%	
Fill Slope: -33.00%	; 📃 To:	-33.00%	
Apply to <u>B</u> oth Sides	<u> </u>	Surface	
Feature		0 . 1	
Name	e: t-Transverse 🛛 👻	Style: + Default	
Tick Marks	-Transverse +		•
	t-Top 👻	+ Default	-
	t-Toe-of-Fill 🔹	+ D_Toe-of-Fill	•
Point Typ <u>e</u> :	Breakline 🔻	1	,
Point Density Interval:	0.00		
Duplicate Names:			
O Append O	Repla <u>c</u> e 💿 Rena <u>m</u> e		
Exclude from Triang	gulation 📃 Generate <u>G</u>	àraphics Only	
	Apply Preference	ces Close	

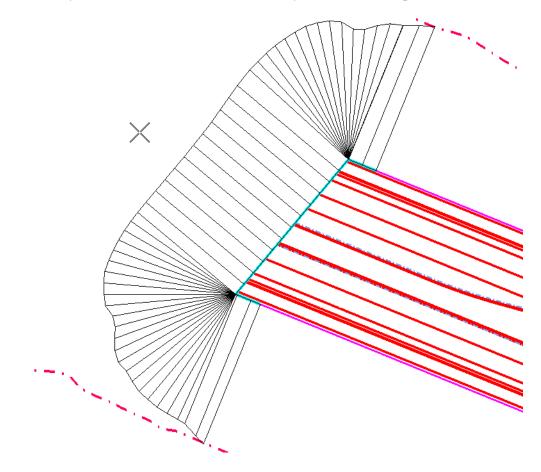
- 7. **<D> Apply**.
- 8. **<D>** to select the green line at the edge of the roadway.
- 9. **<D>** again to accept the line.



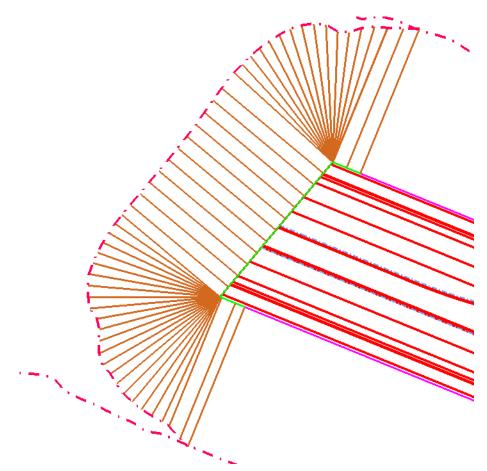
10. **<R>** to Reset for Entire Line.

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.

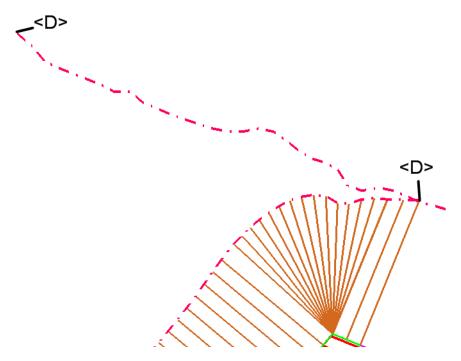


12. **<D>** to Accept the location.



- 13. **<R>** to exit the command.
- 14. **<D> Close** to close the dialog.
- 15. Save the Surface.
- 16. Select Surface > Edit Surface > Partial Delete.
 - **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*.

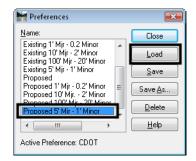


- 19. Repeat for the Toe-of-Fill on the South side of the roadway.
- **Note:** You may want to toggle off *Line Styles* under **Settings > View Attributes** to see the ends of the lines more clearly.
- 20. Save the Surface.
- 21. Choose Surface > Triangulate Surface.

🐂 Triangulate Su	ıface		- • •
Surface:	SH52 71st East of Brid	<u>c</u> •	Apply
Description:			Close
Maximum Length:	0.00	+	Help
🔲 Extended Data	Checks	Lock Triangulation	
Features	Graphics	Results Number of Points:	
🔲 Delete Surfac	e Contents	Number of Triangles:	
Filter Toleranc	e: 0.00	Elapsed Time (Secor	nds):
			More

- 22. **<D> Apply**.
- 23. Select Surface > View Surface > Contours.

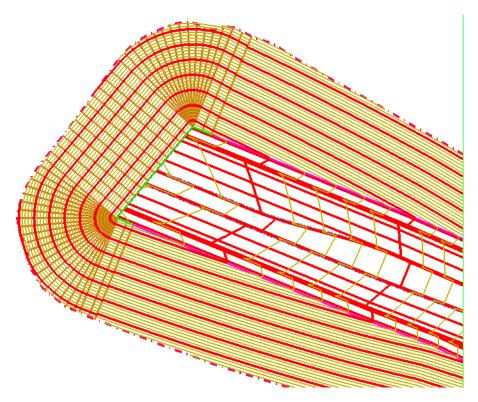
24. **<D>** Preferences and highlight *Proposed 5' Mjr – 1' Minor*.



- 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**.

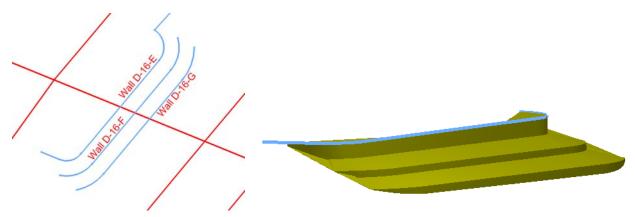
Chapter Summary:

- 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 23 - 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 XM*.

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.

Lab 23.1 - Open Data Files

If you have not exited since the last lab, you can skip this section.

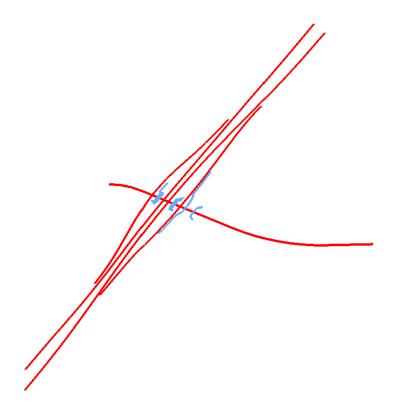
- 1. Open MicroStation and InRoads using the C:\Projects\12345\Design\Working \CU12345DES_Model.dgn file.
- 2. Verify the correct *XIN* file is loaded.
- 3. Select File > Open from the InRoads menu.
- 4. Open C:\Projects\12345\Design\InRoads\12345 SH119.dtm, 12345 SH52.dtm, 12345DES_Templates.itl and 12345 SH119 SH52 interchange.alg.
- 5. Open C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange.dtm.

Lab 23.2 - Create Components for the Wall and Slope

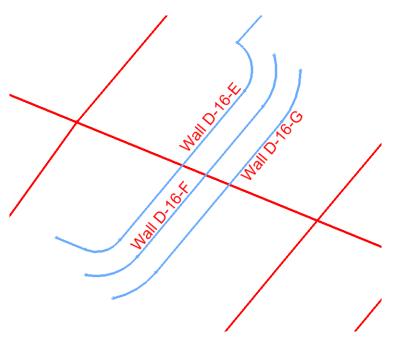
The three walls are very similar and therefore one set of components can be created and used multiple times in the final template. To start, components are created that will be run off of Wall D-16-E and will 'find' or 'target' Wall D-16-F. This is used in areas where there is a terrace.

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.
 - **Note:** The wall names in the illustration below are for information only. The walls are not labeled in your file.

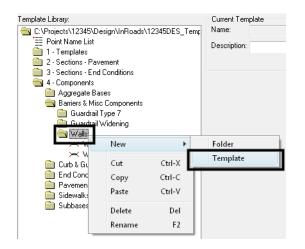


Note: Walls D-16-E, D-16-F and D-16-G will be created using a terraced wall template.

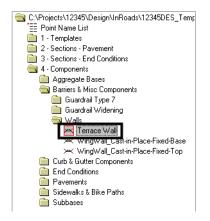
- 5. Select Modeler > Create Template.
- 6. Verify the template library is *12345DES_Templates.itl*.

Note: Since there are 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 Apply Affixes off.

12. For **X** and **Y** Step, key in *O.1*.



- 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: Finds next wall align				Style:	D_Wal	I-Retaining	•	
Target Typ	be:	Alignm	ient XYZ	•	nonty:		1	
Horizontal Alignment: Wall D-16-F		-16-F	•	Benching C	Count:	0		
Vertical Ali	gnment:	Wall D-16-F 🔹 👻		•	From Da	atum:	0.00	
	Horizor	ital	Vertical		Step Elevat	ion:	0.00	
Offsets:	0.00		0.00		Rounding Leng	gth	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* box, key in *Wall_E_Top-Front* for the *Name*.
- 20. Select *D_Wall-Retaining* for the *Style*.

Dynami	c Setting	gs		×			
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						
П Арр	Apply Affixes						
hs=		•					
Set Dynamic Origin							

- 21. **<D>** on the origin point (0,0).
- 22. Back in the *Dynamic Settings* box, change the name to *Wall_F_Top-Front*.

1											
÷,	Dynamic Settin	gs	×								
÷	X: 4.00	Step: 0.10									
	Y: -1.50	Step: 0.10	-	Wall	ET	op-Fr	ont				
	Check for In	terception			-						
	📝 Place Point	at Interception									
÷	📃 End Conditio	on is Infinite									
1	📃 Do Not Con:	struct						W	all_F	Top-Fr	ont
	Point Name:	Wall_F_Top-Fron	•								
÷.	Point Style:	D_Wall-Retaining	•								
	Apply Affixes										
4	hs=	•									
i.	Set Dy	namic Origin									

23. **<D>** on a point down and to the right of the first point as shown.

- 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_Top-	Front 👻	+	Apply
Feature Name Override:	Wall_F_Top-	Front		Close
Surface Feature Style:	D_Wall-Reta	ining 🔻		Previous
Alternate Surface:		-		Next >
End Condition Propertii Check for Intercepti Place Point at Interc End Condition is Infi Do Not Construct	on Me ception	mber of: nds next wall a	align	Help
Constraints				
Constra Type: Slope	iint 1	Con Horizon	straint 2	_
Parent 1: Wall_E_To	• p.Front ▼		Top-Front	• • •
	ver Values			
Value: -50.00%		15.00		
Label:	•			-
🔲 Style Constraint:			-	
Horizontal	Vertical	🔘 Both		
Range: 0.00				

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.
- 31. Right-click again and make certain all options are toggled off.

1			
	Finish	Enter	
	Closed Shape	Ctrl-L	
÷	Mirror	Ctrl-M	
4	Undo Last	ESC	
	Cancel		
	Set Dynamic Origin	Ctrl-D	

- 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*.

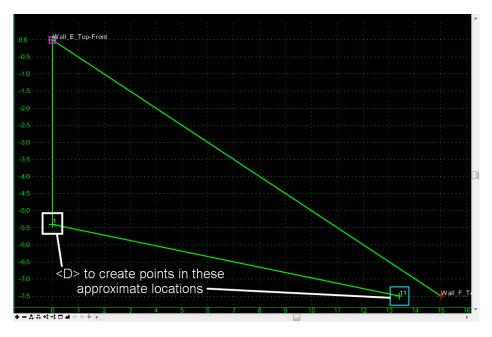
Component Wall face and terrace	Style:	D_Wall-Retaining	•

35. In the *Dynamic Settings* box, select *D_Wall-Retaining* for the *Style*.

36. Key in *1* for the *Point Name*.

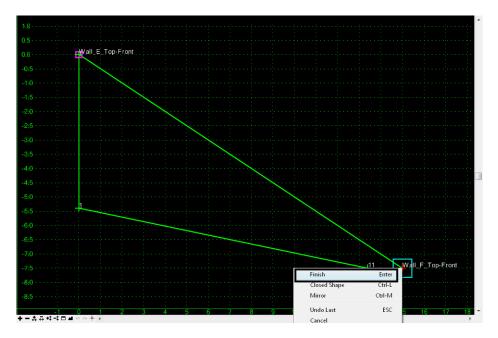
Dynar	nic Setting	s		×		
X:	9.10	Step:	0.10			
Y:	-6.10	Step:	0.10			
Point	Point Name: 1					
Point Style: D_Wall-Retaining						
	. otyle.	U_wall-	Hetaining	•		
	pply Affixes		hetaining	•		
	-		hetaining	•		

- *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*.

-Wall E Tap Front					
0.0 Wall_E_Top-Front					
-0:5	🞽 Point Properties				
-1:0	Name:	Wall_F_Top-Back 🗸 🗸	+ Apply		
-1.5	Feature Name Override:		Close		
-10	Surface Feature Style:	D_Wall-Retaining -	< Previous		
-2:0	Alternate Surface:	· · · · · · · · · · · · · · · · · · ·	Next >		
-2:5			Help) 	
-3:0		Member of: Wall face and te	rrace		
-3:5					
-4:0 · · · · · · · · · · · · · · · · · · ·	Constraints				·····;······;······;
-4:5	Constra		straint 2		
-5:0	Tronzoritai	▼ Vertical	T		
1 C C C	Parent 1: Wall_F_To	pp-Front • • wai_F_	Top-Front ▼ 🕈		
-5:5	Value: .1.00	0.00			
-6:0	Label:	-	-		
-6:5	Style Constraint:		¥		
-7:0	Horizontal (🔿 Vertical 💿 Both			\sim
	Range: 0.00				
-7.5					HI Wall F To
0 1 2 3 · ᆍᆕᅕᇊ葉ᅾ⊟≝୰ୣ୰∳∢	56	7 8 9		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*.

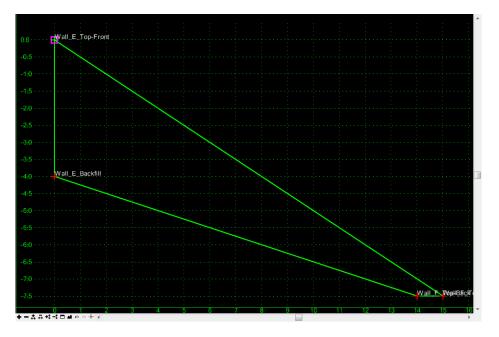
Note: This will force a small slope on the front face of the wall to allow triangulation.

- 55. Set *Constraint 2* to *Slope*.
- 56. Set *Parent 1* to *Wall_F_Top-Back*.

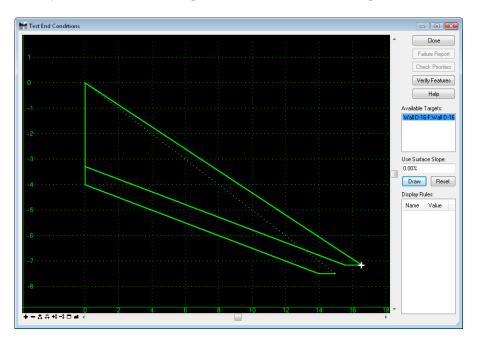
57. Key in a Value of -25.00%.

					· · · · · · · · · · · · · · · · · · ·
0.0 Wall_E_Top-F	ront				
	Maria and a		1 1		1.1.1.1.1.1.1.1
-0:5		X			•••••••••••••••••••••••••••••••••••••••
-1:0	Name: Wal_E_Backfill 👻 🛉	Apply			
-1.0	Feature Name Override: 1	Close	1.1.1		1.
-1:5	Surface Feature Style: D_Wall-Retaining -				
	Alternate Surface:	< Previous			
-2:0 · · · · · · · · · · · · ·		Next >			
-2:5		Help			
-2:5	Member of:				
-3:0	Wall face and terrace				
-3:5 · · · · · · · · · · · · ·	e e e e e e e e e e e e e e e e e e e				
-4:0 · · · · · · · · · · · · · · ·	Constraints				
-4:5	Constraint 1 Constraint	2			
	Type: Horizontal	•			
-5:0 · · · · · · · · · · · · · · · ·	Parent 1: Wall_E_Top-Front 🔹 🜩 Wall_F_Top-B	ack 🔻 🖊			
1	Tullover	values			
-5:5 · · · ·	Value: 0.10 -25.00%		· · · · · · · · · · · · · · · · · · ·		
-6:0	Label.				
-0:0		· ·			
-6:5	Style Constraint:		· · · · · · · · · · · · · · · · · · ·		
	Horizontal Overtical Oboth				CE E
-7:0 · · · · · { · · · · · } · · ·	Range: 0.00				
					Wall F TopHBEck
-7:5					
0 1	2 3 4 5 6 7	8	9 10 11	12 13	14 15 16
ᆃᆕᅕᇊᅓᅾᄅᇔᄵᅆᅘ	4				F

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

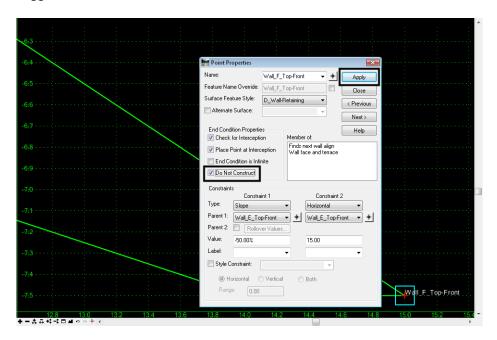


- **Note:** Since the horizontal and slope constraints have two different parent points, the location of this point varies when either of the parents moves.
- 59. **<D> Test**.
- 60. Under *Available Targets*, **<D>** on the wall alignment.
- 61. **<D> Draw**.



62. Move your cursor into the template view to see how the components react.

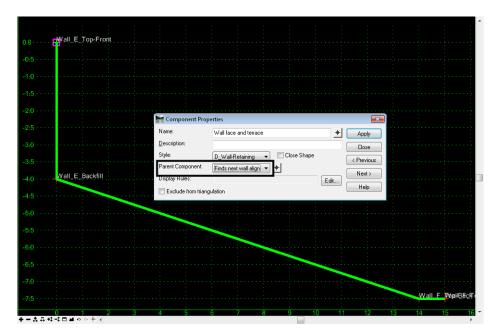
- **Note:** The original component has a variable slope, while the *Wall face and terrace* component maintains all slopes. It should also be noted that there is no need to display the original component. Also, if the original component fails the *Wall face and terrace* component should not display either. Both of these situations will be taken care of next.
- 63. **<D> Close** on the *Test End Conditions* 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.

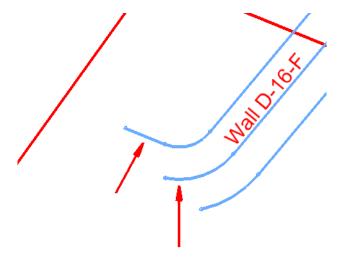
70. **Test** the template again to see the difference.



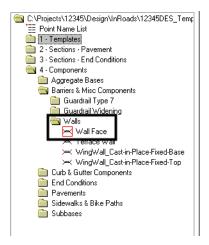
- **Note:** Now, only a dashed line is shown initially, indicating when the end condition fails, nothing is displayed. When the end condition succeeds, only the *Wall face and terrace* is displayed.
- 71. **<D> Close** on the *Test End Conditions* box.
- 72. **Save** the template library.

Lab 23.3 - 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 *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.

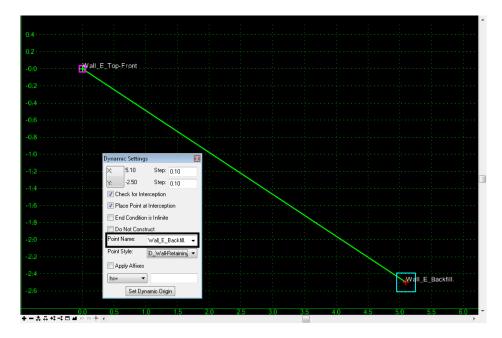
Name: Finds activ		Style: D_Wa	II-Retaining 🗾 👻
Target Type:	Surface 🔻	Priority:	2
Surface	✓ <active></active>	🔲 Benching Count:	0
		From Datum:	0.00
Hori	ontal Vertical	Step Elevation:	0.00
Offsets: 0.00	0.00	Rounding Length	0.00

9. In the *Dynamic Settings* 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* box, change the name to *Wall_E_Backfill*.
- 13. **<D>** on a point down and to the right of the first point as shown.

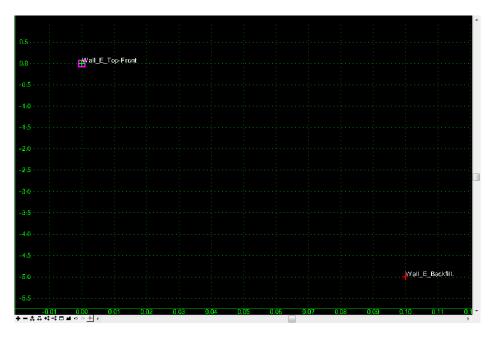


- 14. Right click and select Finish.
- 15. Edit the second point, *Wall_E_Backfill*.
- 16. Change the *Slope Constraint* to *Vertical* and set the *Value* to -5.00
- 17. For the *Horizontal Constraint*, set the *Value* to *0.1*.
- 18. Toggle on *End Condition is Infinite*.

19. Toggle on *Do No Construct*.

0.4		<u>^</u>
0.2	Point Properties	
-0:0	Name: Wall_E_Backfill.	
-0:2	Feature Name Override: Wall_E_Backfill. Surface Feature Style: D_Wall-Retaining	
-0:4	Alternate Surface:	
-0:8	End Condition Properties Help Check for Interception Finds active surface	
1:0	Place Point at Interception End Condition is Infinite	
-1:2	Do Not Construct	
-1:4	Type: Vertical	·····
-1:8	Parent 1: Wall_E_Top-Front	
-2:0	Value: -5.00 0.10	
-2:2	Style Constraint:	
-2:4	Horizontal Vertical Both Range: 0.00	wa <mark>ll_E_Backfill</mark>
-2:6		
0.0 0.5 1.0 1.5 +=☆尋☆⊐■∞∞☆∢	2.0 2.5 3.0 3.5 4.0 4.5	5.0 5.5 6.0 ▼ ►

- 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

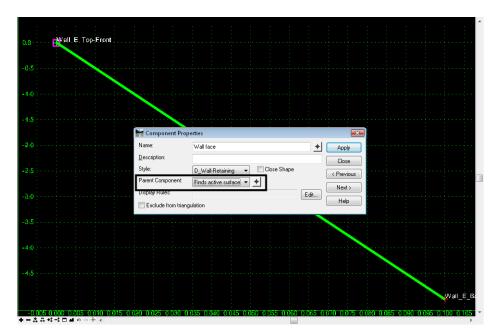
 Undo Last
 ESC

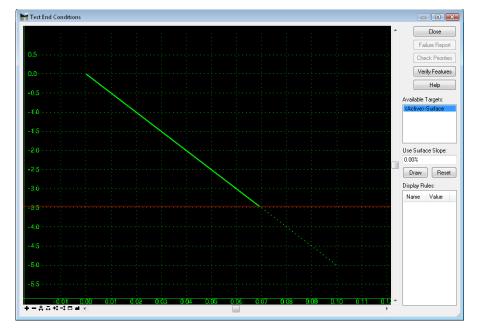
 Cancel
 Set Dynamic Origin
 Ctrl-D
- 23. Right-click again and make certain all options are toggled off.

- 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*.

	Component			
Name:	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*.





Note: Now, if the *Finds active surface* end condition fails, neither component is used.

32. **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* box.
- 34. **Save** the template library.

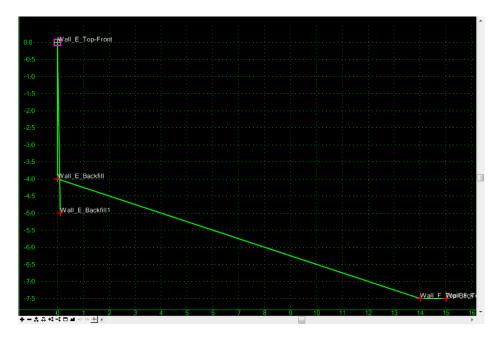
Lab 23.4 - Create the Final Wall Template

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**.

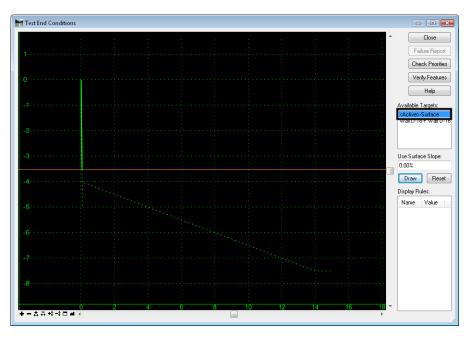
- 😋 C:\Projects\12345\Design\InRoads\12345DES_Temp E Point Name List 1 - Templates 2 - Sections - Pavement 3 - Sections - End Conditions 💼 4 - Components 🚞 Aggregate Bases 💼 Barriers & Misc Components 📋 Guardrail Type 7 Guardrail Widening 🗟 Walls 🖂 3_Terraced-walls wairrace 🛏 Terrace Wall → WingWall_Cast-in-Place-Fixed-Base → 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 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 and drop it on the origin, making certain the *Wall_E_Top-Front* point turns white.

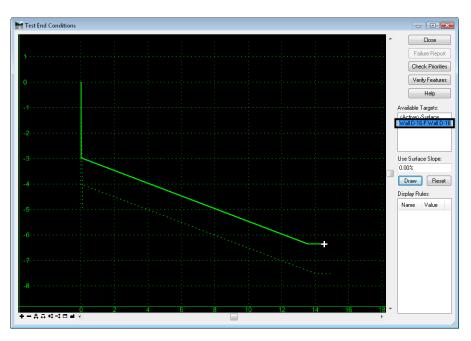


- 7. **<D> Test**.
- 8. **<D>** on the **<***Active***>**-*Surface* under *Available Targets*.
- 9. **<D>** on **Draw**.

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** on the *Test End Conditions* dialog.

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:	
Wall_E_Backfill	Close
Apply to points:	Help
Feature Name	Feature Override Name
Wall_E_Backfill1	
Wall E Top-Front	
Wall_E_Backfill	
Wall_F_Top-Back	
Wall_F_Top-Front	

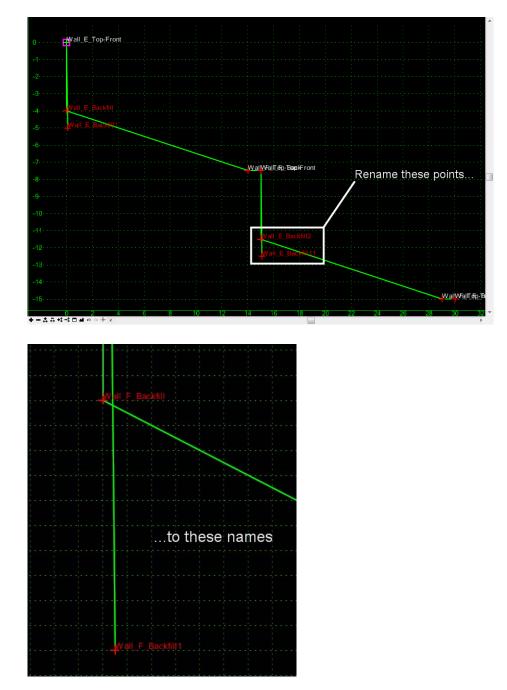
18. **<D> Apply**, then **Close**.



- **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.

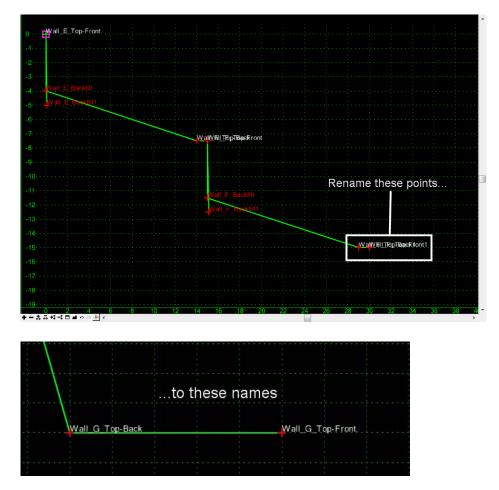


21. Drag and drop the template from the preview onto the *Wall_F_Top-Front* point, making certain the point turns white.



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*.

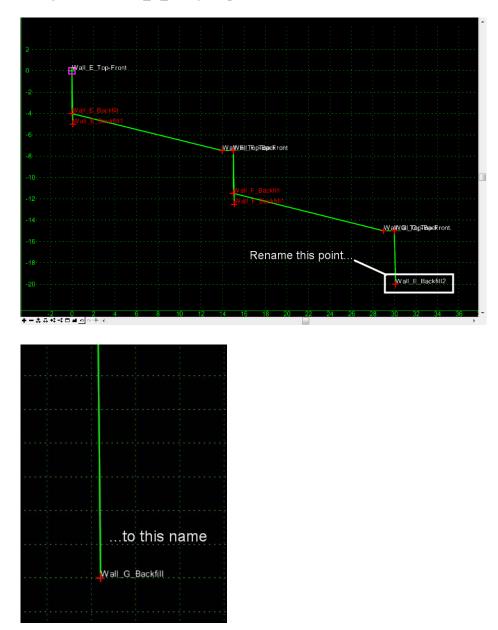
- 25. Select Tools > Apply Feature Name Override.
- 26. Highlight the two *Wall_F_Backfill* points
- 27. Key in *Wall_F_Backfill* for the *Feature Name Override*.

🐂 Apply Feature Name Ove	erride to Points 🛛 🔍
Feature Name Override: Wall F Backfill	Apply
wai_r_backiii	Close
Apply to points:	Help
Feature Name	Feature Override Name
Wall_E_Backfill	Wall_E_Backfill
Wall_F_Top-Back	
Wall_G_Top-Front.	
Wall G Top-Back	E
Wall_F_Backfill	Wall_E_Backfill
Wall_F_Backfill1	Wall_E_Backfill
wai_r_rop-ront	
 I 	•

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

- 29. Highlight, but do not make active, *Wall_Face*.
- 30. Drag the *Wall_Face* template from the preview 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.

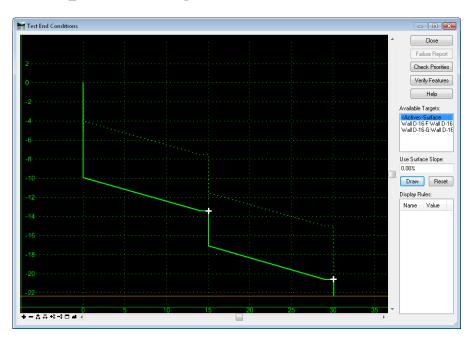
🗧 Create Temp	late
Einds ne Finds ne Finds ne Finds ne Wall fac	tive surface tive surface1 tive surface2 st wall align1 e and terrace e and terrace1 e1 e2
Item	Value
Name	Finds next wall alig
Description	
Style	D_Wall-Retaining
Parent	
Triangulated	True
End Condition	True
Library Active	Template

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 Prop	erties			.
Name:	Finds next wall align1		+	Apply
Description:				Close
Style:	D_Wall-Retaining 🔻	•		< Previous
Parent Component:				
Display Rules:			Edit	Next>
Exclude from triang	ulation			Help
- End Condition Prope	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.
- 41. **<D> Close** on the *Create Template* dialog.

Lab 23.5 - 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*.

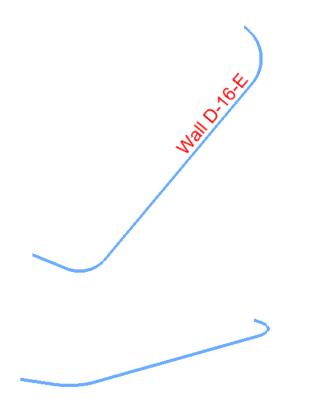
- 4. Toggle on *Station Limits*.
- 5. Leave the *Start Station* set to *0+00.00*.
- 6. Key in **1+98.35** for the *Stop Station*.
 - **Note:** This is the station at the end of the second curve in the wall alignment. From that point on, the wall will be created with the ramp.
- 7. Under *Include Cardinal 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.

ኵ View 3-D Alignm	ent			
Apply Style:	Assigned	Active:		Apply
	ALG_EXISTIN	G 👻	- '	Close
Horizontal Alignment:	Wall D-16-E	•	+	Preferences
⊻ertical Alignment:	Wall D-16-E			Help
⊂ Limits ▼ Statio <u>n</u>			-	
<u>S</u> tart: 0+00.00	+			
Stop: 1+98.35	+			
- Include Cardinal Po	ints	Atta <u>c</u> h Ta	g	
🔽 Horizontal		Interval: 1.0	0	+
Offsets		-		
Horizontal		Vertical		
Start: 0.00	+	Start: 0.0		
Stop: 0.00	<u>+</u>	Stop: 0.0	0	

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

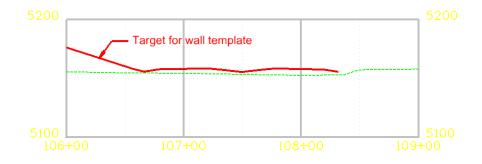
10. **Fit** the view.



- **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.

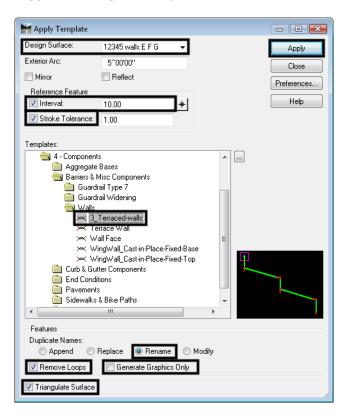
<u>File Surface Geometry D</u>	rainage <u>E</u> valuation <u>M</u> odeler Dr <u>a</u>	afting <u>T</u> ools <u>H</u> elp		
<unnamed></unnamed>	- Ta 😹 🚳 🔪 🏏	📕 🔛 🗉		
		Data Type	Active	
🖃 😂 Surfaces		♪ Breakline Features	12365	
🗄 🥌 Default		鯼 Contour Features	0	
⊕ 🛃 12345 SH119	C	Exterior Features	0	l
🖮 🤜 12345 existin	Save	🕅 Inferred Breaklines	0	
	Save As	Interior Features	0	
😂 Surfaces 🛛 📇 Geo	Set Active			E.

- **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.

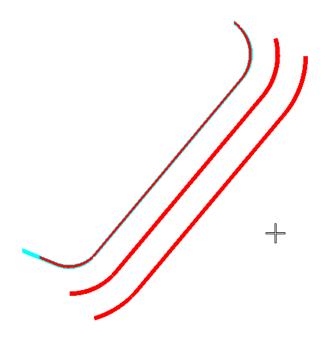


- 12. Set the *Locate Features / Locate Graphics* toggle to *Locate Graphics*.
- 13. Select Surface > Design Surface > Apply Template.
- 14. Key in *12345 walls E F G* for the *Design Surface*.
 - **Note:** The design surface does not have to exist. It is created when the command is applied.
- 15. Set 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 *Replace*.
- 19. Toggle on *Remove Loops*.
- 20. Toggle off Generate Graphics Only.

21. Toggle on *Triangulate Surface*.

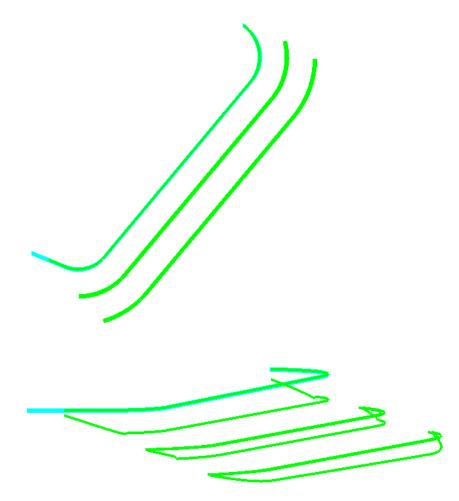


- 22. **<D> Appl**y.
- 23. **<D>** on the 3D alignment graphic to identify the *Primary Element*.
- 24. **<D>** anywhere in the view to accept.
- 25. **<D>** on the 3D alignment graphic again to identify the *Reference Element*.
- 26. **<D>** anywhere in the view to accept.
- 27. **<R>** to apply the template to the entire element.

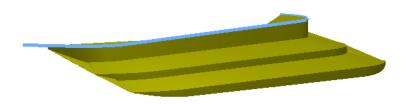


Note: Temporary graphics appear showing the resulting feature locations.

28. **<D>** anywhere in the view for the location.



- **Note:** The *Results* dialog 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. Toggle on *12345 existing ground for interchange*, *12345 SH52*, *12345 SH119* and *12345 walls E F G*.

🐂 Create Profile				- • •
Create Profile Create Profile General Controle Controls Grid	Set Name: SH52-H Direction	Exaggerati Vertical: Horizontal:	on 1.0000 1.0000	
ASCI	Object ☐ Default ⊠ 12345 existing groun ⊠ 12345 walls E F G ⊠ 12345 SH119	Name Default T_Existing_Ground Default D_Finished-Grade	BYL	All
	C	Apply Prefere	ences) Clos	e Help

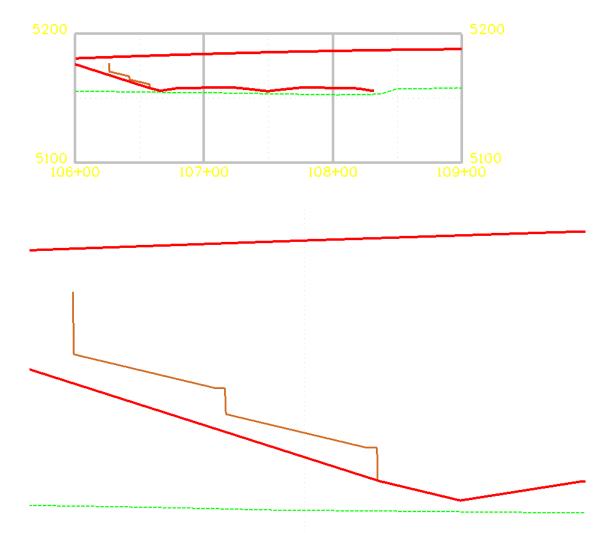
- 34. Select the *Controls* branch.
- 35. Set the *Station Limits* to *106+00* to *109+00*.

🕌 Create Profile		
Create Profile General Source Include Offsets Controls Limits Axes	Elevation Use High: 1000.00 Low: 0.00 From Cogo Points From Regression f	Points
Grid Details	Station ✓ Use Start: 106+00.00	
	Window Clearance Top: 0.00 + Bottom 50.00 +	
	Apply Pr	eferences) 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 24 - Widening and Overlay

Widening and overlay projects are and increasingly large part of the CDOT workload. This lab illustrates the MicroStation and InRoads tools used for this type of project.

Chapter Objectives:

- Create a complex chains for the pavement edges from existing ground features.
- Import the chains as horizontal and vertical alignments.
- Develop a widening and overlay template.
- Define a corridor for the project.

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_XM\Standards-Global\InRoads\Templates\ CDOT_Template-Library.itl
- C:\Projects\12345\DesignROW_Survey\InRoads\DTM\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.

Lab 24.1 - Chain Pavement Edge Features

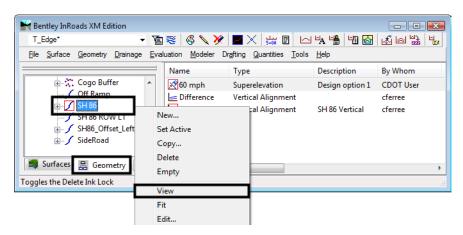
As single continuous lines are easier to use for point controls than a number of unconnected lines. Creating the complex chain also provides the opportunity to close gaps in the pavement edge features.

- 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_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.

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.

Drafting	* Status		
Bridge Construction	Existing	Proposed	?
···· Design ···· Geometry ···· Hydraulics	Drafting		
Landscape Environmentz Materials Geotechnical ROW Survey	Border	Clip Boundary	Ŀ
Traffic ITS	Border RE	Utility Revision Cloud	
Signals	Dimensions	 ✤ Border (Plan 11"x17") ✤ Border (Plan 11"x8.5") Po 	
Signing	Linework	☆ Border (Plan 8.5'x11'') La ☆ Border (PnP 11'x17'')	nds _≣
	Patterning	☆ Border (Profile 11"x17") ☆ Border (Title 11"x8.5") Po	rtrait
	Symbols		1"x
	Text		JN

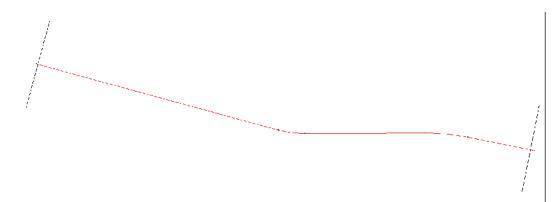
10. In the MicroStation key-in window, key in *so=204+00,500* and press *Enter*.

T 2 3 4 5 6 7 8 . T'=100'	- 🛱 🗟 🗸 🎆
Filled Placement : OFF	2

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.

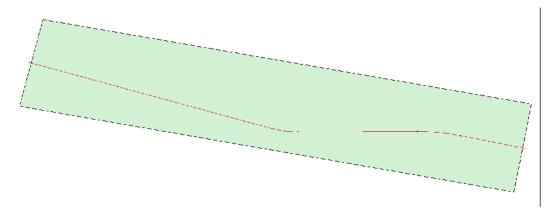
- 12. The Place SmartLine command is still active. Key in *so=260+00,500* and press *Enter*.
- 13. Key in *so=260+00,-500* and press *Enter*. <**R**> to finish the line.



- 14. From the MicroStation Main toolbar, **<D> Place Fence**.
- 15. In the Tool Settings dialog box, set the *Fence Type* to **Shape**.

|--|

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.

- Hentley InRoads XM Edition - - -<Unnamed> - 🛅 📚 | 🚳 🔪 🏏 📕 🗉 🗉 너 비A 🖷 🛍 🔂 🗔 🔛 🖳 <u>File Surface Geometry Drainage Evaluation Modeler Drafting Quantities Tools Help</u> View Surface ٠ By Whom Last Revis Description Hold Surface Display... - 5 Buffer 9/11/2009 cferree Fit Surface amp cferree 3/19/2009 🗄 🖷 📉 <u>T</u>riangulate Surface... SH 86 Centerline cferree 8/3/2009 ROW LT 7/14/2009 cferree Design Surface Offset... cferree 8/3/2009 Desi<u>a</u>n Pad (500 501 502) CDOT User 11/24/200 oad Edit Surface Feature Propertie Feature Feature Selection Filter Surface Properties. 몲 Þ Component Properties. Edits tl 📄 <u>A</u>ctive Surface. 2 Conv Surface
- 17. From the InRoads menu bar, select **Surface > Feature > Feature Selection Filter**.

- 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: <pre></pre>	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 Oil*	Move Up Move Down Delete Rule Clear All
Current Results: T_Edge of Oil Parking Lot876 T_Edge of Oil Parking Lot877 T_Edge of Oil Parking Lot893 T_Edge of Oil Park	

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	X
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.

ſ	ę	Bei	ntley InRo	oads XM Ed	ition								
	I	T_E	Edge of Oil		4	1	i / 🗞	🖉 🗖 🕻	يبلغ 🗵]			
	ļ	<u>F</u> ile	<u>S</u> urface	<u>G</u> eometry	<u>D</u> rainage	<u>E</u> valuation	<u>M</u> odeler	Dr <u>a</u> fting	<u>Q</u> uantities	<u>T</u> ools	<u>H</u> elp		
	_							~	5 at 1			•	 •

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.

😽 Ber	Bentley InRoads XM Edition					
T_E	idge of Oil 🗾 👻 🔀	🚳 🔪 🏏 📕 🖉 🔪				
File	$\underline{S} urface \underline{G} eometry \underline{D} rainage \underline{E} valuation$	<u>M</u> odeler Dr <u>a</u> fting <u>Q</u> uantities <u>T</u> ools	<u>H</u> elp			
	<u>V</u> iew Surface	<u>Perimeter</u>	m Last Revi			
···品	Update <u>3</u> -D/Plan Surface Display	Triangles	9/11/200			
	Fit Surface	Contours	3/19/200			
±	Triangulate Surface	Label Cont <u>o</u> urs	8/3/2009			
	Design Surface	Components	7/14/200			
	Design Pad	Annotate Feature	8/3/2009			
	<u>E</u> dit Surface	Elevations	Jser 11/24/20			
	<u>F</u> eature	Slope Vectors				
•	Surface Properties	Si <u>ng</u> le Point	•			
몲	Active Surface	*ℵ T <u>w</u> o Point Slope				
	Copy Surface	Crossing Segments	-			
Display	Molete Surface					

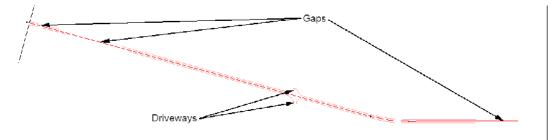
- 29. In the *View Features* dialog box, verify that **12345 existing ground-Overlay** is set as the *Surface*.
- 30. Set the *Fence Mode* to **Inside**.
- 31. Hold the *Ctrl* key and **<D>** on each of the *Parking Lot* features to de-select them.

32. **<D>** the **Apply** button to display the features inside the fenced area.

View Features	X
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 Lot876	T_Edge of Oil Par E
T_Edge of Oil Parking Lot877	T_Edge of Oil Par E
T_Edge of Oil Parking Lot893	T_Edge of Oil Par E
T_Edge of Oil116	T_Edge of Oil E
T_Edge of Oil119	T_Edge of Oil E
T_Edge of Oil123	T_Edge of Oil E
T_Edge of Oil13	T_Edge of Oil E
T_Edge of Oil15	T_Edge of Oil E T_Edge of Oil E
T_Edge of Oil17	T_Edge of Oil 🛛 E 👻
•	4

- 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.

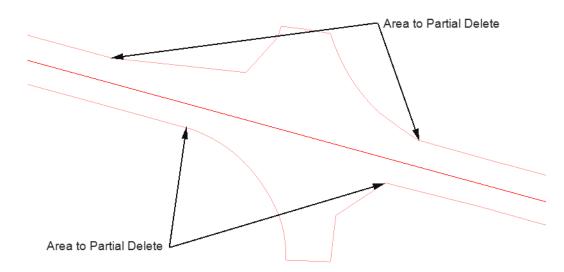


35. Use the MicroStation view controls to zoom in on the area with the driveways.

-1] 1	Modify Element
	< <u>2</u>	Partial Delete
срот 🖻 🇯	<u>3</u>	Break Element
/ 🚞 📈	<u>4</u>	Extend Line
► n×	5	Extend Elements to Intersection
+ ~ /	- <u>6</u>	Extend Element to Intersection
	÷ <u>7</u>	Trim Elements
	8	IntelliTrim
	<u>و</u> ۲	Insert Vertex
	۰ <u>م</u>	Delete Vertex
※ ※ 〜	Q	Construct Circular Fillet
<u>, 1</u>	w	Construct Chamfer
	0	pen as ToolBox

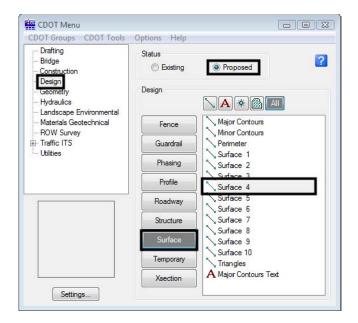
36. From the InRoads main toolbar, select the **Partial Delete** command.

37. **<D>** on the lines as indicated in the illustration below to remove the driveways.

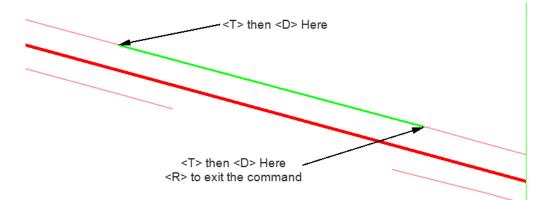


- 38. On the *CDOT Menu*, select the **Design** group.
- 39. Verify that the *Status* is set to **Proposed**.
- 40. **<D>** the **Surface** button.

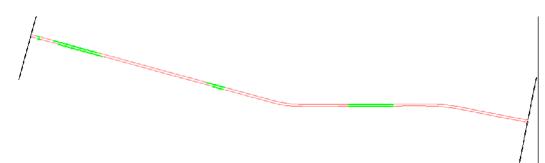
41. Highlight **Surface 4** from the item list. This level was selected because of the contrast to the features displayed.



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**.

- 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.

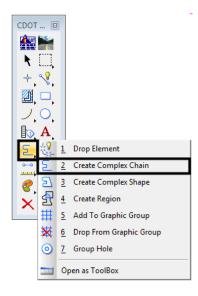
49. Toggle on Delete Original Graphics.

🕌 Drape Surface			
Current Locate Mode:	Graphics		Apply
Destination Surface:	12345 existing g	round-Ove 🔻	Close
Graphics Input Mode:	Level	•	Filter
Source Level:	DES_SURFACE	_4 🗸 🗸	Preferences
Destination Level:	DES_SURFACE	_3 🗸	Help
Features Surface:	12345 existing g	ground-Ove 🔻	
Name	Style	Description	- ф -
Scale:	4 0000		
	1.0000		
Elevation Adjustment:	0.00		

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:

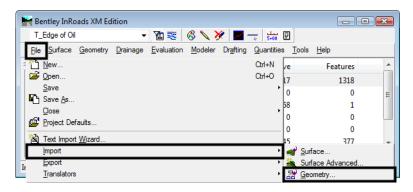
- Use Feature Selection Filters to limit the number of features to those needed.
- Use a MicroStation fence to further limit what is displayed to the area of the project.
- Once displayed, the feature graphics are like any other MicroStation element.
- Be careful is the Gap setting is increased for the 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 24.2 - 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 Geometr	1				
From Graphics ICS	Vertical from	Surface			
Type: Ho	rizontal and Vertic	al Alignment	•	Apply	
Geometry			Z)		
	EOP edge of pavement				
	G OTHER	for point con	ILITOI	Help	
Horizontal Curve	-		_		
Vertical Curve De		lio	-		
Target Geometry Project	12345DES_0	Geometry_O	•		
Geometry Project Horizontal Alignm	nt: SH 86	and Nontang	*		
Geometry Project Horizontal Alignm	nt: SH 86 Resolve Gaps ; No Duplicate C	and Nontang	Jencies		
Geometry Project Horizontal Alignm Use Fence Join Elements All Selected Ele	nt: SH 86	and Nontang	Jencies		
Geometry Project Horizontal Alignm	nt: SH 86 Resolve Gaps ; No Duplicate C	and Nontang	Jencies		
Geometry Project Horizontal Alignm Use Fence Join Elements All Selected Ele Attribute Tags	nt: SH 86 Resolve Gaps ; No Duplicate C	and Nontang	Jencies		
Geometry Project Horizontal Alignm Use Fence Join Elements All Selected Ele Attribute Tags Use Tag Data	nt: SH 86	and Nontang ogo Points ngle Alignmen	Jencies		

- 9. **<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 24.3 - Creating a Widening and Overlay template

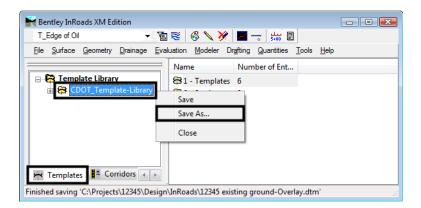
Now that the geometry required for the project is completed, the template and then the corridor can be defined. The template for this project has a 2" overlay of the existing pavement and 8' paved shoulders added to the existing pavement width.

Section Objectives:

- Copy the standard template library into the project folder
- Create a new template placeholder
- Add simple components to define the overlay.
- Change the constraints on the overlay to Project to Surface.
- Add shoulder and end condition sections.

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.



- 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**.

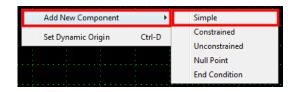
🙀 Save As				×
Save in:	📗 InRoads		- 🗿 🏚 📂 🛄	
Recent Places	Name Lab - Interch Lab - Intersed DES12345_Te	ctions Data	Date modified 10/30/2009 6:13 AM 10/30/2009 6:13 AM 5/28/2009 4:04 PM	Type File Folder File Folder ITL File
Desktop Disktop Chris Ferree				
Computer	•			Þ
Network	File name: Save as type:	DES12345_Templates-Overlay Template Libraries (*.itl)	4 -	Save Cancel
				Help Options

Next, a new template is created in the template library.

- 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_Overlay* for the template name.
- 10. Display the **Dynamic Settings** dialog box.
- 11. Key in *0.10* for the *X* and *Y Steps*.
- 12. Toggle on Apply Affixes.

Dynamic Settings	; 🛛 🛛
X: 0.00	Step: 0.10
Y: 0.00	Step: 0.10
Point Name:	
Point Style:	-
Apply Affixes	
hs= 🔻	
Set Dyn	amic Origin

13. **<R>** in the template view and select **Add New Component > Simple** from the right click menu.

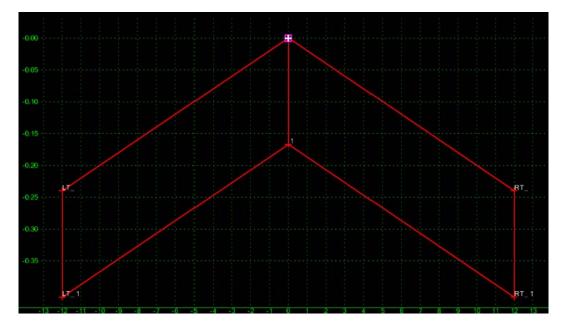


- 14. In the *Current Component* area, key in *HMA_Overlay* for the *Name*.
- 15. Select **D_HMA_Pvmt** for the *Style*.
- 16. Key in *0.1667* for the *Thickness*. Note: this will round to 0.17 in the dialog box.

+ - ☆ ↔ + + - + □ Current Component Name: HMA_Overla		Style:	D_HMA_Pvmt -
Slope:	-2.00%		
Thickness:	0.17		
Width:	12.00		

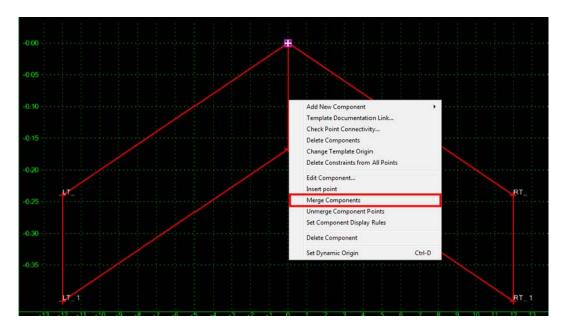
17. **<R>** in the template view and select **Mirror** from the right click menu.





18. **<D>** on the template origin. This creates the two components shown in the illustration below.

19. **<R>** on the vertical line in the center of the template and select **Merge Components** from the right click menu.



- 20. <D> <D> on the centerline point of the template to display the *Point Properties* dialog box.
- 21. In the *Point Properties* dialog box, select **HMA_Liftx_Centerline-Top** in the *Name* field. This also sets the *Surface Feature Style* to **Centerline**.
- 22. Change the *x* to a **1** in the *liftx* part of the name.

Point Properties	
Name:	HMA_Lift1_Centerline-T 👻 🕂 Apply
Feature Name Override:	Close
Surface Feature Style:	Contadion -
Alternate Surface:	Ceriterine
	Next >
	Help
	Member of:
	RT_HMA_Overlay
Constraints	
Constra	int 1 Constraint 2
Type: None	▼ None ▼
Label:	
Style Constraint:	· · · · · · · · · · · · · · · · · · ·
() Horizontal ()	Vertical 🔿 Both
Range: 0.00	
U.UU	

23. **<D> Apply** to accept the change.

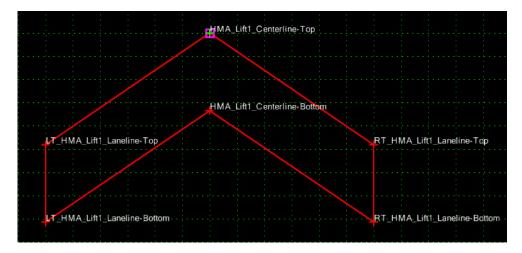
- 24. **<D>** the **Next** button to select the center bottom point (*1*).
- 25. Select HMA_Liftx_Centerline-Top in the *Name* field.
- 26. Change the *x* to a **1** in the *liftx* part of the name and change *Top* to *Bottom*.
- 27. Change the Vertical constraint (Constraint 2 in this example) to Project To Surface.
- 28. Set the *Parent 1* of the above constraint to Any Direction.

29. Verify that the *Value* for the *Project To Surface* constraint is set to **12345** existing ground-Overlay.

🐂 Point Properties		×
Name:	HMA_Lift1_Centerline-B 👻 💠	Apply
Feature Name Override:	HMA_Lift1_Centerline-Bottc	Close
Surface Feature Style:	Centerline 🔹	< Previous
Alternate Surface:	•	Next >
	Member of:	Help
	RT_HMA_Overlay	
Constraints		
Constra		_
Type: Horizontal	▼ Project To Sur	face 🔻
Parent 1: HMA_Lift1_	Centerlin 👻 🔶 Any Direction	•
Value: 0.00	12345 existing	groun 👻
Label:	▼	•
Style Constraint:	· · · · · · · · · · · · · · · · · · ·	
Horizontal	🔿 Vertical 💿 Both	
Range: 0.00		

- 30. **<D> Apply** to accept the change.
- 31. **<D>** the **Next** button to select the right top point (RT_{-}).
- 32. In the same manner as done in steps 22 and 26, change the name of the point to *RT_HMA_Lift1_Laneline-Top*.
- 33. **<D> Apply** to accept the change.
- 34. **<D>** the **Next** button to select the right bottom point (*RT_1*).
- 35. Change the name of the point to *RT_HMA_Lift1_Laneline-Bottom*.
- 36. Change the Vertical constraint (Constraint 2 in this example) to Project To Surface.
- 37. Set the *Parent 1* of the above constraint to Any Direction.
- 38. Verify that the *Value* for the *Project To Surface* constraint is set to **12345 existing** ground-Overlay.
- 39. **<D> Apply** to accept the change.
- 40. **<D>** the **Next** button to select the right top point (LT_{-}) .
- 41. In the same manner as done in steps 22 and 26, change the name of the point to *LT_HMA_Lift1_Laneline-Top*.
- 42. **<D> Apply** to accept the change.
- 43. **<D>** the **Next** button to select the right bottom point (LT_1) .

- 44. Change the name of the point to *LT_HMA_Lift1_Laneline-Bottom*.
- 45. Change the Vertical constraint (Constraint 2 in this example) to Project To Surface.
- 46. Set the *Parent 1* of the above constraint to Any Direction.
- 47. Verify that the *Value* for the *Project To Surface* constraint is set to **12345** existing ground-Overlay.
- 48. **<D> Apply** to accept the change.
- 49. **<D> Close** to dismiss the *Point Properties* dialog box. The template looks like the illustration below:



Now the shoulders and end conditions are added.

50. 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
- 51. **<D>** on the **HMA_Outside_Shoulder_3Lifts-12z** section.

- 52. In the Preview window, **<D>** and hold on the shoulder's origin (the upper left point).
 - M 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 All 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 . Library Active Template +-++++===+++++= Test....
- 53. Drag and drop the section onto the **RT_HMA_Lift1_Laneline-Top** point.

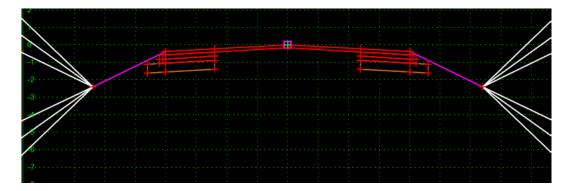
Note: Because *Mirror* was turned on when placing the overlay component, both shoulders are now placed in the template.

- 54. **<D> <D>** on the **RT_HMA_Lift1_EOP-Top** point to display the *Point Properties* dialog box.
- 55. Change the *Value* of the *Horizontal* constraint (*Constraint 1* in this example) to *8.00*.
- 56. Change the *Slope* constraint (*Constraint 2* in this example) to a **Vector-Offset** *Type*.
- 57. Set the *Parent 1* to HMA_Lift1_Centerline-Top.
- 58. Set the *Parent 2* to **RT_HMA_Lift1_Laneline-Top**.

Point Properties				×
			1 -	
Name:	RT_HMA_L	ft1_EOP-Tc	• +	Apply
Feature Name Override:	RT_HMA_L	ft1_EOP-Top) 🗖	Close
Surface Feature Style:	D_EOP		- i	< Previous
Alternate Surface:				
			- [Next >
		ember of:	[Help
	-	emperor: T_HMA_Shid	lr lift1	
Constraints		6-	nstraint 2	
Type: Horizontal	ame i	Vector		-
	Lift1 Lan: 🔻		Lift1_Cen	terlin 🔻 🕂
Parent 2:			_	
Value: 8.00		0.00	MA_Lift1_	
0.00		0.00		_
Label: EOP-Top-H	loriz 🔻			•
Style Constraint:			-	
Horizontal) Vertical	🔘 Both		
Range: 0.00				

- 59. **<D> Apply** and then **<D> Close** to dismiss the *Point Properties* dialog box.
- 60. Repeat steps 54 through 59 on 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 in step 55.
- 61. Expand the template library to show the contents of the 3 Sections End Conditions
 > Z-Slope End Conditions > High Speed End Conditions folder.
- 62. **<D>** on the **Z12_6_to_1** section.
- 63. In the Preview window, **<D>** and hold on the section's origin (the upper left point).
- 64. Drag and drop the section onto the **RT_HMA_Lift1_EOP-Top** point.
- 65. This completes the template. Select **File > Save** from the *Create Template* menu bar.
- 66. **<D> Close** to dismiss the *Create Template* dialog box.

The illustration below shows the completed template:



Section Summary:

- Using the Project to Surface point constraint will cause the bottom of the overlay to match the existing ground exactly.
- Once the right click options of Mirror and Reflect are turned on, they remain active until they are turned off.

Lab 24.4 - 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.

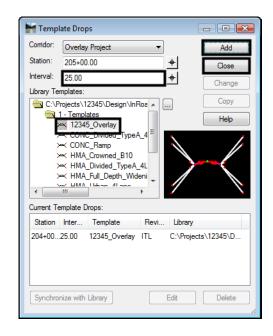
This corridor contains a single template drop and three point controls. These control the two laneline points with a horizontal and vertical control and the centerline with a vertical control. Superelevation is not required for this corridor because the laneline point controls will cause the template to match the existing superelevation.

- 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 *Overlay Project* for the *Name*.
- 4. Toggle on **Station Limits**.
- 5. Key in *205+00.00* for the *Start* station.
- 6. Key in *259+00.00* for the *Stop* station.

Name: Overlay P	roject		imits V Station	Add
Type: Horizontal Alignme Vertical Alignment:	01100		Start: 205+00.00 Stop:	Close Change Copy
PI Rounding Tang	ent: 0.00		259+00.00	+ Copy From.
	Tune	Source Name	Start Station	Help
Corridors: Name Overlay Project	Type Alignment	Source Name SH 86	Start Station 205+00.00	Help Stop Station 259+00.00

7. **<D>Add** then **<D> Close** to dismiss the dialog box.

- 8. In the *Roadway Designer* dialog box, select **Corridor > Template Drops** from the menu bar.
- 9. In the *Template Drops* dialog box, key in *25.00* for the *Interval*.
- 10. Expand the C:\Projects\12345\Design\InRoads\DES12345_Templates-Overlay template library to show the contents of the 1 - Templates folder.
- 11. Highlight the **12345_Overlay** template.
- <D> the Add button then <D> the Close button to dismiss the *Template Drops* dialog box.



The template is now displayed in the cross section view. Next, point controls are added to raise the template up 2" and match the existing cross slopes of the original surface.

- 13. In the *Roadway Designer* dialog box, select Corridor > Point Controls from the menu bar.
- 14. In the *Point Controls* dialog box, set the Point to HMA_Lift1_Centerline-Top.
- 15. Toggle on **Vertical** for the *Mode*.
- 16. In the *Vertical Offsets* area, key in *0.1667* for the *Start* and *Stop* offset. Note: these will be rounded to 0.17.
- 17. **<D>** the **Add** button.

Point Controls	
Conidor: Overlay Project	Add
Point: HMA_Lift1_Centerlin 👻 🕈	Station Limits Start: 205+00.00 + Close
Mode Morizontal Vertical Both	Stop: 259+00.00 + Change
Control Type: Alignment Horizontal Alignment: SH 86 Vertical Alignment: SH 86_Existing-V	Horizontal Offsets Start: 0.00 + Stop: 0.00 +
Print	Vertical Offsets Start: 0.17 + Stop: 0.17 +
Priority: 1 Horizontal and Vertical Controls:	
En., Pri., Name Start Stati., Stop Sta	ti Mode Type Control
X 1 HMA_Lift1 205+00.00 259+00.0	
	Delete

- 18. In the *Point Controls* dialog box, set the Point to **RT_HMA_Lift1_Laneline-Top**.
- 19. Toggle on **Both** for the *Mode*.
- 20. Select **Rt_EOP** for the *Horizontal Alignment*. This automatically sets the vertical alignment.
- 21. In the Vertical Offsets area, key in **0.1667** for the Start and Stop offset.

22. **<D>** the **Add** button.

Point Controls		- 0 🔀
Corridor: Overlay Project Point: RT_HMA_Lift1_Lant Mode O Horizontal O Vertical O Both	Station Limits Stati: 205+00.00 + Stop: 259+00.00 +	Add Close Change
Control Type: Alignment Horizontal Alignment: Rt_EOP + Vertical Alignment: Rt_EOP + Use as Secondary Alignment Priority: 1	Horizontal Offsets Start: 0.00 ↓ Stop: 0.00 ↓ Vertical Offsets Start: 0.17 ↓ Stop: 0.17 ↓	Help
Horizontal and Vertical Controls:	ati Mode Type (Control
X 1 HMA_Lift1 205+00.00 259+00.0 X 1 RT_HMA_Li205+00.00 259+00.0	00 Vertical Alignment S	H 86:SH 86 tt_EOP:Rt
		Delete

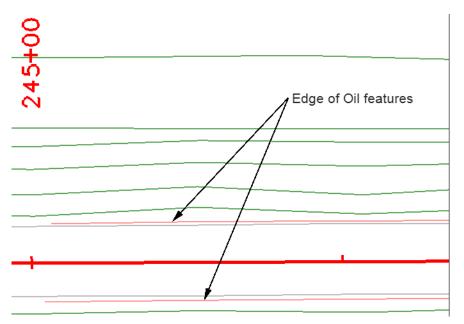
- 23. In the *Point Controls* dialog box, set the Point to LT_HMA_Lift1_Laneline-Top.
- 24. Select Lt_EOP for the *Horizontal Alignment*. This automatically sets the vertical alignment.
- 25. In the Vertical Offsets area, key in O. 1667 for the Start and Stop offset.
- 26. **<D>** the **Add** button the **<D> Close** to dismiss the Point Controls dialog box.

Point Controls	
Corridor: Overlay Project Point: LT_HMA_Lift1_Lane ▼ ♥ Mode ○ Horizontal ○ Vertical ◎ Both	Station Limits Add Start: 205+00.00 + Close Stop: 259+00.00 + Change
Control Type: Alignment Horizontal Alignment: L_EOP Vertical Alignment: L_EOP Use as Secondary Alignment Priority: 1 Horizontal and Vertical Controls:	Horizontal Offsets Start: 0.00 + Stop: 0.00 + Vertical Offsets Start: 0.17 + Stop: 0.17 +
En Pri Name Start Stati Stop S	tati Mode Type Control
X 1 HMA_Lift1 205+00.00 259+00	.00 Vertical Alignment SH 86:SH 86
X 1 RT_HMA_Li205+00.00 259+00	.00 Both Alignment Rt_EOP:Rt
X 1 LT_HMA_Lif205+00.00 259+00	.00 Both Alignment Lt_EOP:Lt_E
	Delete

This completes the corridor definition. Now the corridor can be reviewed in Roadway Designer.

- 27. Scroll through the template drops using the station controls under the cross section view. Notice that the template top in the backbone of the template maintains a constant slope from the centerline to the edge of pavement.
- 28. Also notice that some areas did not appear to work properly. This is especially noticeable in the area between station 240+00 and 250+00. There are two causes for these anomalies. The first is the existence of additional features inside the Edge of Oil features used for point control alignments.

The illustration below shows the area where other features are inside the edge of oil features.



In the example above the grey lines are pavement striping features.

The other situation is similar and occurs where there were gaps in the edge of oil feature. Again features may occur inside where the lines were drawn to fill in these gaps.

- 29. From the Roadway Designer menu bar select **Tool > Options**.
- 30. In the *Roadway Designer Options* dialog box, toggle on Cut and Fill Graphics, Cut and Fill Values, and Net Volumes.

🕌 Roadway Designer Options	
Include Critical Sections	ок
Vertical Cardinal Points	Cancel
Horizontal Event Points	Preferences
Vertical Event Points	Help
External Control Points	
Display	Superelevation Display
Reference Graphics	✓ Key Station Lines
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
Vet Volume	Component Information
Null Points	Point Information
Curve Set ID	
Cardinal Points	
Cross Section Tracking	Process Aliases Automatically

31. **<D> OK** to accept the changes and dismiss the dialog box.

- 32. Scroll through the template drops again.
- 33. Notice the heavy blue line in the cross section display. This represents the design surface used to compute volumes. Under the overlay component, this line exactly matches the existing ground line. This is a result of the Project to Surface constraint defining each end of a segment. When a Project to Surface constraint is used on each end of a template segment the line between the points follows the target surface.
- 34. Also notice that there are no cut or fill areas in the overlay area.
- 35. From the Roadway Designer menu bar, select **File > Save**.
- 36. In the *File name* field of the *Save As* dialog box, key in *12345_Overlay_Project*.

37. **<D> Save** then **<D> Cancel** to dismiss the dialog box.

Save As				— ———————————————————————————————————
Save in:	🐌 InRoads		- 🕝 🎓 📂 🛄 -	,
æ	Name		Date modified	Туре
Recent Places	🌗 Lab - Interch 🌗 Lab - Interse	-	10/30/2009 6:13 AM 10/30/2009 6:13 AM	File Folder File Folder
	Combined S	urfaces.ird	8/3/2009 6:17 AM	IRD File
Desktop				
Chris Ferree				
Computer				
Network	File name: Save as type:	12345_Overlay_Project Roadway Design (* ird)	-	Save Cancel
	заче аз куре.	(10auway Desigli (.lid)	¥	Help
				Options

- 38. **<D> Close** to dismiss the Roadway Designer dialog box.
- 39. Exit InRoads and MicroStation.

Section Summary:

- Point controls can be used to match the existing cross slope of the road.
- Displaying Cut and Fill graphics shows the design surface line used to compute volumes.

Chapter Summary:

- 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, Copy Parallel the edge of pavement chain the distance of the saw cut before importing the alignment. Also, in this case, the vertical alignment should be created separately, using the Vertical from Surface command.
- The Project to surface command is used to make a template segment match the existing ground.
- Because the point controls force the template to match the existing cross slope, superelevation is not used.
- With minor modification to the template and adjustments in point controls, the exercise can be use to rehabilitate existing cross slopes.

LAB 25 - 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-Lab.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

Lab 25.1 - Create Median Ditch Components

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.

- 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_XM\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 'E: Point Name List 1 - Templates 2 - Sections - Pavemer 3 - Sections - End Con	nt	Current Templ Name: (Description:	late Compound_Ditch4
4 - Components	New		Folder
Aggregate Ba	New Cut Copy Paste	Ctrl-X Ctrl-C Ctrl-V	Folder Template

- 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*.

File Edit Add Tools					
Template Library: Template Lib	rary Organizer	-			Displa
	e Name Override	1			🔘 Co
Point Nam Options					🔲 Dis
1 - Templa Dynamic Sett	inas	1			V Dis
3 - Sections - End Conditions					
4 - Components					
Aggregate Bases					
Barriers & Misc Components	4				
Curb & Gutter Components	3				
End Conditions	3				_
Pavements	2	Dynan	nic Settings		8
Sidewalks & Bike Paths	-	X:	33.66	Step: 0.10	
Compound Ditch1	1		0.04	0	_
Compound Ditch2		Y:	0.04	Step: 0.10	
Compound Ditch3	0	Point	Name:		•
→ Compound_Ditch4		Point	Style:		
→ V_and_Compound_Median	4		Style.		•
🔄 Variable Median Ditch		A A	oply Affixes		
6:1/6:1_V_Ditch	-2				
		hs=	•		
	-3		Set Dyna	amic Origin	
III ► 1	-6	- 4	-2	0	2

12. Verify that **Apply Affixes** is toggled off.

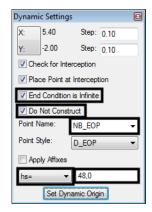
- 13. **<R>** in the template view and select **Add New Component > End Condition** from the right click menu.
- 14. In the *Current Component* area, key in *Ditch_Width* for the *Name*.
- 15. Set the *Style* to **Breakline**.
- 16. Set the *Target Type* to Feature XYZ.
- 17. Set the *Surface* to **12345DES_Northbound**.
- 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	pply Affixes		
hs=	•	·	
		namic 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**.

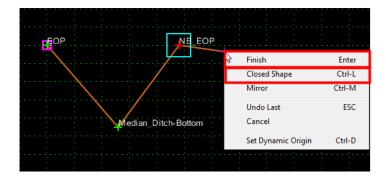
╪╼┇╬╬╡╗╗╔╬╡		
Current Component	-	
Name: V_Ditch	Style:	D_MEDIAN -
	-	

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	t Style:	D_DITC	H-Bottom	-
A	oply Affixes			
hs=	•	•		
	Set Dy	namic Orig	in	

- 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 >
		l	
	Member of:	l	Help
	V_Ditch		
Constraints			
Type: Constra		nstraint 2	_
зюре	✓ Slope		 .
Parent 1: EOP)P	- +
D 10 E			
		ollover V	alues
Parent 2: Rollov Value: -16.67%	rer Values 🔲 🕅 R		alues
			alues
Value: -16.67%			alues
Value: -16.67%	▼		alues

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 triangu	lation		Help

- 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
Туре:	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 Properties					
Name:	V_Ditch	+	Apply		
Description:			Close		
Style:	D_MEDIAN Close Shape		< Previous		
Parent Component:	+				
Display Rules:	V_DitchWidth	Edit	Next >		
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.

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.

- 61. Create a new template in the *Variable Median Ditch* folder as described in steps 6 through 9 above. Name the template *Standard Compound Ditch*.
- 62. **<R>** in the template view and select **Add New Component > End Condition** from the right click menu.
- 63. In the *Current Component* area, key in *Ditch_Width* for the *Name*.
- 64. Set the *Style* to **Breakline**.
- 65. Set the *Target Type* to Feature XYZ.
- 66. Set the *Surface* to **12345DES_Northbound**.
- 67. Set the *Feature* to Northbound-Conc_EOP-Top.
- 68. In the *Dynamic Settings* dialog box, select **EOP** for the *Point Name*.
- 69. Move the cursor to the template origin (0.00, 0.00) and **<D>** to place the point.
- 70. In the *Dynamic Settings* dialog box, key in *NB_EOP* for the *Point Name*.
- 71. Toggle on End Condition is Infinite and Do Not Construct.

- 72. Set the key in mode to **hs=**.
- 73. Key in *48,0* in the precision key in field and press *Enter*.
- 74. **<R>** and select **Finish** from the right click menu.
- 75. **<R>** in the template view and select **Add New Component > Unconstrained** from the right click menu.
- 76. In the *Current Component* area, key in *Std_Compound_Ditch* for the *Name*.
- 77. 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
- 78. **<D>** on the **EOP** point to start the component at the origin.
- 79. 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.
- 80. In the precision key in field, type 12,-0.1667 and press Enter.

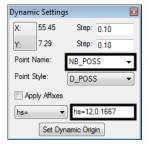
Dynar	nic Setting	5	×		
X:	58.20	Step: 0.10			
Y:	7.30	Step: 0.10			
Point	Name:	SB_POSS	Ŧ		
Point	Style:	D_POSS	-		
A	pply Affixes				
hs=	hs= • 12,-0.1667				
	Set Dynamic Origin				

- 81. In the *Dynamic Settings* dialog box, key in *Median_Ditch-Bottom* in the *Point Name* field.
- 82. Select **D_DITCH-Bottom** for the *Point Style*.
- 83. In the precision key in field, type *12,-0.100* and press *Enter*.

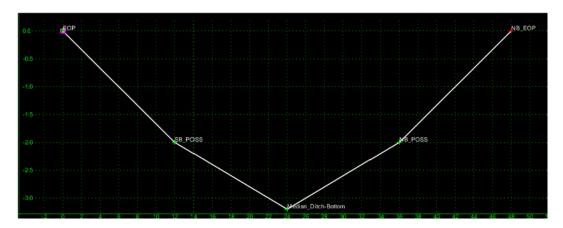
Dynamic Setting	js 🔛				
X: 56.50	Step: 0.10				
Y: 7.20	Step: 0.10				
Point Name:	Median_Ditch-Bo' 👻				
Point Style: D_DITCH-Bottom -					
Apply Affixes					
hs= • 12,-0.100					
Set Dynamic Origin					

In the *Dynamic Settings* dialog box, select **POSS** for the *Point Name*. Then key in *NB_POSS* for the *Point Name*.

85. In the precision key in field, type 12,0.100 and press Enter.



- 86. **<D>** on the **NB_EOP** point.
- 87. **<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.

- 88. **<D> <D>** on the **SB_POSS** point.
- 89. In the *Point Properties* dialog box, set the *Constraint 1 Type* to Horizontal.
- 90. Set the *Constraint 2 Type* to **Slope**.
- 91. Set the *Parent 1* for both constraints to EOP.

92. **<D> Apply**.

Name:	SB_POSS		+ +	Apply
Feature Name Override:	SB POSS			Close
Surface Feature Style:	D POSS		•	
Alternate Surface:			-	< Previous
				Next >
		lember of:		Help
	-	Std_Compou	und_Ditch	
			-	
Constraints				
Constraints	int 1		Constraint	2
Constra	int 1		Constraint	2
Constra Type: Horizontal	int 1	Slop	e	-
Constra	int 1 •)e	▼
Constra Type: Horizontal Parent 1: EOP	int 1 T	Slop	e	▼
Constra Type: Horizontal	int 1	Slop	Rollover	▼
Constra Type: Horizontal Parent 1: EOP	int 1 •	Slop + EOF	Rollover	▼
Type: Horizontal Parent 1: EOP Value: 12.00 Label:	int 1 •	Slop + EOF	Rollover	▼
Type: Constra Type: Horizontal Parent 1: EOP Value: 12.00	int 1 •	Slop + EOF	Rollover	▼
Type: Horizontal Parent 1: EOP Value: 12.00 Label:	•	Slop + EOF	Rollover 67%	▼

- 93. **<D>** the **Next** button to select **Median_Ditch-Bottom**.
- 94. Set the *Type* of both constraints to **Slope**.
- 95. Set the *Parent 1* of *Constraint 1* to **SB_POSS**.
- 96. Set the *Parent 1* of *Constraint 2* to NB_POSS.

97. **<D> Apply**.

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: Std_Compound_Ditc	Help
Constraints Type: Slope Parent 1: SB_POSS	int 1 Constrain ▼ Slope ▼ ◆ NB_POSS	nt 2 ▼ ▼
Parent 2: Rollov	rer Values 🔲 Rollove	er Values
Value: -10.00%	10.00%	
Label:	•	•
Style Constraint:		
Horizontal Range: 0.00	Vertical 🔘 Both	

- 98. **<D>** the **Next** button to select **NB_POSS**.
- 99. Set the *Constraint 1 Type* to Horizontal.
- 100.Set the *Constraint 2 Type* to Slope.
- 101.Set the *Parent 1* for both constraints to NB_EOP.
- 102.<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.

- 103.<D> <D> on the line forming the ditch to display the Component Properties for the Std_Compound_Ditch component.
- 104.In the *Component Properties* dialog box, **<D>** the **Edit** button. This displays the *Component Display Conditional Expression* dialog box.
- 105.In the *Component Display Conditional Expression* dialog box, **<D>** the **Add** button. This displays the *Display Rule* dialog box.
- 106.In the *Display Rule* dialog box, key in *Std_Compound_DitchWidth* for the *Name*.
- 107.Key in *Sets minimum width for the standard compound ditch* for the *Description*.

108.Set the *Type* to Horizontal.

109.Set *Between* to SB_POSS.

110.Set *And* to NB_POSS.

111.Set the operator to < and key in **0.00** for the value. The dialog box with completed entries is illustrated below:

🖼 na 💷 n	1		X
🔚 Display R	ule		
Name:	Std_Compound_DitchWidth		ОК
Description:	Sets minimum width for the standard compound ditch		Cancel
Туре:	Horizontal		Help
Between:	SB_POSS	+	
And:	NB_POSS	+	
	< 0.00		

- 112.< D> OK. This dismisses the *Display Rule* dialog box.
- 113.In the *Component Display Conditional Expression* dialog box, **<D>** the **Add** button.
- 114.In the *Display Rule* dialog box, key in *Std_Compound_DitchVertical1* for the *Name*.
- 115.Key in **Sets minimum height for the standard compound ditch** for the **Description**.
- 116.Set the *Type* to **Vertical**.
- 117.Set *Between* to NB_POSS.
- 118.Set And to Median_Ditch-Bottom.
- 119.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		

- 120.<D> OK. This dismisses the *Display Rule* dialog box.
- 121.In the *Component Display Conditional Expression* dialog box, **<D>** the **Add** button.
- 122.In the *Display Rule* dialog box, key in *Std_Compound_DitchVertical2* for the *Name*.
- 123.Key in **Sets maximum height for the standard compound ditch** for the **Description**.

124.Set the *Type* to Horizontal.

125.Set *Between* to SB_POSS.

126.Set *And* to **Median_Ditch-Bottom.**

127.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_DitchVertical2		ОК
Description:	Sets maximum height for the standard compound ditch		Cancel
Type:	Horizontal 🗸		Help
Between:	SB_POSS	+	
And:	Median_Ditch-Bottom 💌	+	
	< ▼ 0.00		

- 128.**<D> OK** to accept the entries and dismiss the dialog box.
- 129.In the *Component Display Conditional Expression* dialog box, highlight **Std_Compound_DitchWidth** in the *Template Display Rules* area.
- 130. **<D>** the **Selected Rule** button.
- 131.**<D>** the **AND** button.
- 132.Highlight Std_Compound_DitchVertical1 in the Template Display Rules area.
- 133.<D> the Selected Rule button.
- 134.**<D>** the **AND** button.
- 135.Highlight Std_Compound_DitchVertical2 in the Template Display Rules area.
- 136.<D> the Selected Rule button. The dialog box with completed entries is illustrated below:

🕌 Component Disp	lay Conditional Express	ion				- • •
Conditional Expression for Std_Compound_Ditch Component StandardCompoundDitch AND Std_Compound_DitchVertical1 AND Std_Compound_DitchVertical2 AND OR NOT () Selected Rule						OK Cancel Help
Template Display Rule Name Type		Expression	Test	Value	Result	
StandardCoHorizor Std_Compo Vertical Std_Compo Horizor		SB_POSS - NB_POSS NB_POSS - Median_Ditch-Bottom SB_POSS - Median_Ditch-Bottom	<	0.00 0.00 0.00	True True True	
			Add	Edit	Delete]

- 137.<D> OK. This dismisses the *Component Display Conditional Expression* dialog box and adds the rule to the component properties of *Std_Compound_Ditch*.
- 138.<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.

139.**<D>** the **Test** button.

- 140.In the *Test End Conditions* dialog box, **<D>** the **Draw** button.
- 141.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.
- 142.<D> Close to dismiss the Test End Conditions dialog box.

143.Select File > Save from the *Create Template* menu bar.

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.

- 144.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*.
- 145.<**R**> in the template view and select **Add New Component** > **End Condition** from the right click menu.
- 146.In the *Current Component* area, key in *Ditch_Width* for the *Name*.
- 147.Set the *Style* to **Breakline**.
- 148.Set the *Target Type* to Feature XYZ.

149.Set the *Surface* to **12345DES_Northbound**.

150.Set the *Feature* to Northbound-Conc_EOP-Top.

151.In the *Dynamic Settings* dialog box, select **EOP** for the *Point Name*.

152. Move the cursor to the template origin (0.00, 0.00) and **<D>** to place the point.

153.In the *Dynamic Settings* dialog box, key in *NB_EOP* for the *Point Name*.

154.Toggle on End Condition is Infinite and Do Not Construct.

155.Set the key in mode to **hs=**.

156.Key in 48,0 in the precision key in field and press Enter.

157.**<R>** and select **Finish** from the right click menu.

158.Add a new unconstrained component.

159.Key in *NB_EOP-High* for the *Name*.

- 160.Select **D_CONC_Sw** for the *Style*.
- 161.**<D>** on the **EOP** point to start the component at the origin.
- 162.In the *Dynamic Settings* dialog box, key in *Median_Ditch-Bottom* in the *Point Name* field.
- 163.Select **D_DITCH-Bottom** for the *Point Style*.
- 164.**<D>** between and below the *EOP* and *NB_EOP* points.
- 165. In the *Dynamic Settings* dialog box, key in *NB_POSS* in the *Point Name* field.
- 166.Select **D_POSS** for the *Point Style*.
- 167.<D> to the right and above *Median_Ditch-Bottom* and to the left and below *NB_EOP*.
- 168.**<D>** on the **NB_EOP** point.
- 169.<**R>** and select **Finish** from the right click menu. The illustration below shows the component as it appears at this point.



170.<D> <D> on the Median_Ditch-Bottom point.

171. In the *Point Properties* dialog box, set the *Type* to **Slope** on both constraints.

172.Set the *Parent 1* for *Constraint 1* to EOP.

173.Set the *Parent 1* for *Constraint 2* to NB_POSS.

174.Key in the -0.1667 for the Value of Constraint 1.

175.Key in the *0.1000* for the *Value* of *Constraint 2*.

176.<D> Apply.

177.<D> Next to select the NB_POSS point.

178.Set the *Constraint 1 Type* to Horizontal.

179.Set the *Constraint 2 Type* to Slope.

180.Set the *Parent 1* for both constraints to **NB_EOP**.

- 181.Key in the *12.00* for the *Value* of *Constraint 1*.
- 182.Key in the *0.1667* for the *Value* of *Constraint 2*.
- 183.**<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.

- 184.<D> <D> on the line forming the ditch to display the *Component Properties* for the *NB_EOP_HIGH* component.
- 185.In the Component Properties dialog box, <D> the Edit button. This displays the Component Display Conditional Expression dialog box.
- 186.In the Component Display Conditional Expression dialog box, <D> the Add button. This displays the Display Rule dialog box.
- 187.In the *Display Rule* dialog box, key in *NB_EOP_HIGHWidth* for the *Name*.
- 188.Key in *Sets width for ditch* for the *Description*.
- 189.Set the *Type* to Absolute Horizontal.
- 190.Set *Between* to EOP.
- 191.Set *And* to **Median_Ditch-Bottom**.
- 192.Set the operator to < and key in **12.00** for the value. The dialog box with completed entries is illustrated below:

ኵ Display R	ule		X
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		

193.<D> OK. This dismisses the *Display Rule* dialog box.

194.In the *Component Display Conditional Expression* dialog box, **<D>** the **Add** button.

195.In the *Display Rule* dialog box, key in *NB_EOP_HIGHVertical* for the *Name*.

196.Key in *Sets height for the ditch* for the *Description*.

197.Set the *Type* to **Vertical**.

198.Set *Between* to NB_POSS.

199.Set And to Median_Ditch-Bottom.

200.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:	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		

- 201.<D> OK. This dismisses the *Display Rule* dialog box.
- 202.In the *Component Display Conditional Expression* dialog box, highlight NB_EOP_HIGHWidth in the *Template Display Rules* area.
- 203. **<D>** the **Selected Rule** button.
- 204.**<D>** the **AND** button.
- 205.Highlight NB_EOP_HIGHVerfical in the Template Display Rules area.
- 206.<D> the Selected Rule button. The dialog box with completed entries is illustrated below:

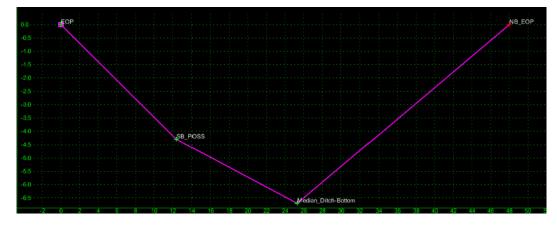
CompoundVertical NB_POSS - Median_Ditch-Bottom > 0.00 True		Expression for NB_EOP-Hig I_NB_EOP-HighWidth AND	h Component Compound_NB_EOP-HighVertical		^ _		OK Cancel Help
CompoundVertical NB_POSS - Median_Ditch-Bottom > 0.00 True) Selected Rule				
	Name	Туре	Expression	Test	Value	Result]

- 207.<D> OK. This dismisses the *Component Display Conditional Expression* dialog box and adds the rule to the component properties of *NB_EOP High*.
- 208.<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. Next the final component is built.

- 209.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*.
- 210.<**R>** in the template view and select **Add New Component > End Condition** from the right click menu.
- 211.In the *Current Component* area, key in *Ditch_Width* for the *Name*.
- 212.Set the *Style* to **Breakline**.
- 213.Set the *Target Type* to Feature XYZ.
- 214.Set the *Surface* to **12345DES_Northbound**.
- 215.Set the *Feature* to Northbound-Conc_EOP-Top.
- 216.In the *Dynamic Settings* dialog box, select **EOP** for the *Point Name*.
- 217. Move the cursor to the template origin (0.00, 0.00) and **<D>** to place the point.
- 218.In the *Dynamic Settings* dialog box, key in *NB_EOP* for the *Point Name*.
- 219.Toggle on End Condition is Infinite and Do Not Construct.
- 220.Set the key in mode to **hs=**.
- 221.Key in 48,0 in the precision key in field and press Enter.
- 222.<**R>** and select **Finish** from the right click menu.
- 223.Add a new unconstrained component.
- 224.Key in SB_EOP-High for the Name.
- 225.Select **D_Shoulder** for the *Style*.
- 226.**<D>** on the **EOP** point to start the component at the origin.
- 227. In the *Dynamic Settings* dialog box, key in *SB_POSS* in the *Point Name* field.
- 228.Select **D_POSS** for the *Point Style*.
- 229.<**D**> between and below the *EOP* and *NB_EOP* points.
- 230.In the *Dynamic Settings* dialog box, key in *Median_Ditch-Bottom* in the *Point Name* field.
- 231.Select **D_DITCH-Bottom** for the *Point Style*.
- 232.<D> between and below the *SB_POSS* and *NB_EOP* points.
- 233.**<D>** on the **NB_EOP** point.

234.<**R>** and select **Finish** from the right click menu. The illustration below shows the component as it appears at this point.



235.<D> <D> the **SB_POSS** point.

236.Set the *Constraint 1 Type* to Horizontal.

237.Set the *Constraint 2 Type* to Slope.

238.Set the *Parent 1* for both constraints to EOP.

239.Key in the *12.00* for the *Value* of *Constraint 1*.

240.Key in the -*O. 1667* for the *Value* of *Constraint 2*.

241.**<D> Apply** to accept the changes.

242.<D> Next to select the Median_Ditch-Bottom point.

243.In the *Point Properties* dialog box, set the *Type* to **Slope** on both constraints.

244.Set the *Parent 1* for *Constraint 1* to **SB_POSS**.

245.Set the *Parent 1* for *Constraint 2* to NB_EOP.

246.Key in the -0. 1000 for the Value of Constraint 1.

247.Key in the *0.1667* for the *Value* of *Constraint 2*.

248.<D> Apply.

The shape of the ditch is now fixed. Now display Rules must be added to control when this component is displayed.

- 249.<D> <D> on the line forming the ditch to display the *Component Properties* for the *SB_EOP-High* component.
- 250.In the *Component Properties* dialog box, **<D>** the **Edit** button. This displays the *Component Display Conditional Expression* dialog box.
- 251.In the *Component Display Conditional Expression* dialog box, **<D>** the **Add** button. This displays the *Display Rule* dialog box.

252.In the *Display Rule* dialog box, key in *SB_EOP_HIGHWidth-Max* for the *Name*.

253.Key in Sets maximum width for ditch for the Description.

254.Set the *Type* to Absolute Horizontal.

- 255.Set Between to Median_Ditch-Bottom.
- 256.Set And to NB_EOP.
- 257.Set the operator to < and key in **12.00** for the value. The dialog box with completed entries is illustrated below:

🕌 Display R	ıle		×
Name:	SB_EOP_HIGHWidth-Max		ОК
Description:	Sets maximum width for ditch		Cancel
Type:	Absolute Horizontal		Help
Between:	Median_Ditch-Bottom	+	
And:	NB_EOP	÷	
	< ▼ 12.00		

258.<D> OK. This dismisses the *Display Rule* dialog box.

259.In the *Component Display Conditional Expression* dialog box, **<D>** the **Add** button.

- 260.In the *Display Rule* dialog box, key in *SB_EOP_HIGHWidth-Min* for the *Name*.
- 261.Key in Sets minimum width for ditch for the Description.
- 262.Set the *Type* to Horizontal.
- 263.Set *Between* to SB_POSS.
- 264.Set And to Median_Ditch-Bottom.
- 265.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:	SB_EOP_HIGHWidth-Min		ОК
Description:	Sets minimum width for ditch		Cancel
Type:	Horizontal		Help
Between:	SB_POSS	-	
And:	Median_Ditch-Bottom	+	
	< .00		

266.<D> OK. This dismisses the *Display Rule* dialog box.

- 267.In the *Component Display Conditional Expression* dialog box, highlight **SB_EOP_HIGHWidth-Max** in the *Template Display Rules* area.
- 268. **<D>** the **Selected Rule** button.

269.**<D>** the **AND** button.

270.Highlight SB_EOP_HIGHWidth-Min in the Template Display Rules area.

271.<D> the Selected Rule button. The dialog box with completed entries is illustrated below:

Komponent Display Conditional E	rpression				- • •
Conditional Expression for SB_EOP-Hig	h Component				ОК
SB_EOP_HIGHWidth-Max AND SB_E0	DP_HIGHWidth-Min		-	[]	Cancel Help
AND OR NOT () Selected Rule				
Name Type	Expression	Test	Value	Result	
SB_EOP_HAbsolute Horizontal	Median_Ditch-Bottom - NB_EOP	<	12.00	False	
SB_EOP_HHorizontal	SB_POSS - Median_Ditch-Bottom	<	0.00	True	
		Add	Edit	Delete]

- 272.<D> OK. This dismisses the *Component Display Conditional Expression* dialog box and adds the rule to the component properties of *SB_EOP High*.
- 273.<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 25.2 - 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.

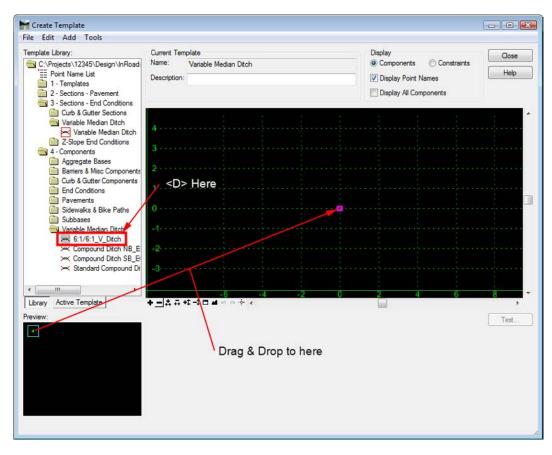
- Delete the redundant end condition components.
- Add additional display rules so that only one component is displayed at a time.

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.

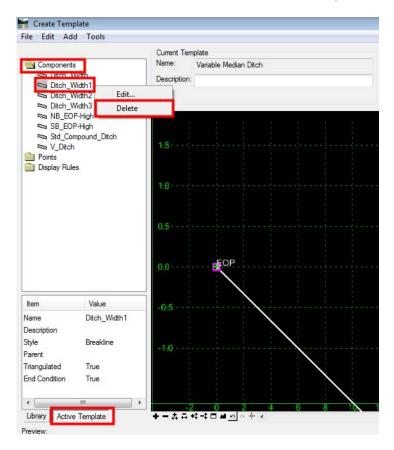
- 6. **<D>** on the **6:1/6:1_V_Ditch** component so that it is displayed in the preview window.
- 7. Drag the component by its origin (the green dot in the upper left corner) and drop it on the origin in the template view.



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.

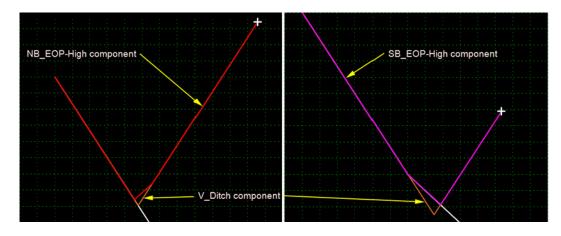


13. Repeat steps 10 through 12 for Ditch_Width2 and Ditch_Width3.

Next, test the section and see how each of the components behave.

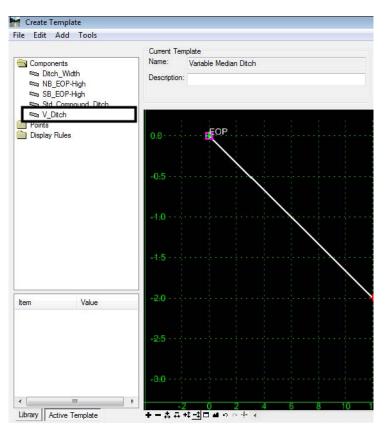
- 14. **<D>** the **Test** button.
- 15. In the *Test End Conditions* dialog box, **<D>** the **Draw** button.

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		X
Name:	NB_EOP-High-Displayed		ОК
Description:	NB_EOP-High is displayed		Cancel
Type:	Component is Displayed 🔹		Help
Component:	NB_EOP-High	+	

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.

Conditional Expression for V_Ditch Comp	onent 		^ 			ОК
	D> Here		Â	_		
			*			Cance Help
AND OR NOT () Selected Rule					
Name Type	Expression	Test	Value	Result	*	
CompoundVertical	NB_POSS - Median_Ditch-Bottom1	>	0.00	True		
CompoundAbsolute Horizontal	EOP - Median_Ditch-Bottom1	<	12.00	False		
NB_EOP-HiComponent is Displayed	NB_EOP-High			True	=	
SB_EOP_HAbsolute Horizontal	Median_Ditch-Bottom2 - NB_EOP	<	12.00	False		
SB_EOP_HHorizontal	SB_POSS - Median_Ditch-Bottom2	<	0.00	True		
SB_EOP-Hi Component is Displayed	 SB_EOP-High			False		
StandardCoHorizontal	SB_POSS1 - NB_POSS1	<	0.00	True		
Std_Compo Vertical	NB_POSS1 - Median_Ditch-Bottom3	>	0.00	True	-	

- 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 Compo	Displayed AND NOT SB_EOP-High-Displayed					ОК
	onpublica nino non ob_con nigir onpublica					Cance Help
AND OR NOT () Selected Rule					
Template Display Rules 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	•	
	NB_POSS - Median_Ditch-Bottom1 EOP - Median_Ditch-Bottom1	>	0.00	True False		
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.HComponent is Displayed SB_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		
Name Type CompoundVertical CompoundAbsolute Horizontal NB_EOP-HiComponent is Displayed SB_EOP_HAbsolute Horizontal SB_EOP_HAbsolute Horizontal SB_EOP_HBorizontal SB_EOP_HBorizontal SB_EOP_HBorizontal	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	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		

- 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 triang	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:

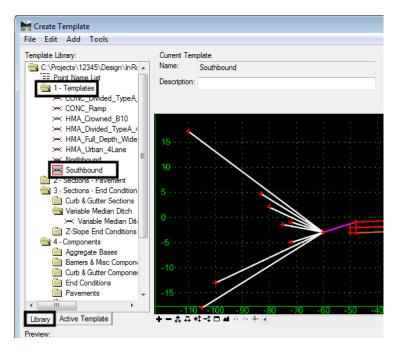
- As components were added to the section, common points were merged but common components (like the end conditions) are not.
- Use the Active Template tree view to access components that are not displayed.
- Additional display rules can be used to turn off a component when two are displayed at the same time.

Lab 25.3 - Adding the Section to a Template and Reviewing the Corridor

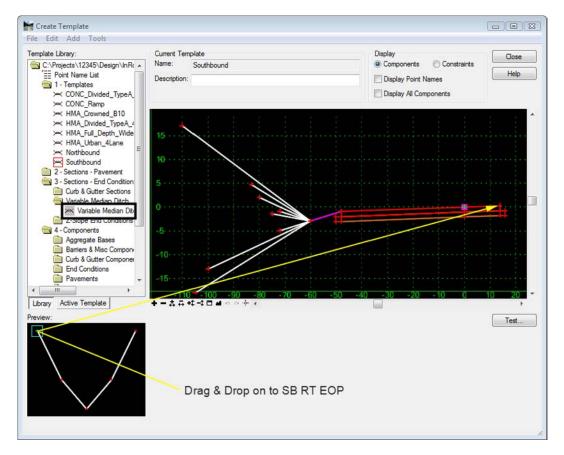
The variable median ditch section can now be added to the template and used in the design corridor.

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 area.
- 5. In the Preview area, **<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.

- 9. 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.

+-44+		+_0	1 (
Corridor:	Southbound -	Station:	<u>k</u> <	1360+19.10	→ ×
Active Surface:	12345SURV_Existing_Ground	Interval:		25.00	
		Template:		SB CONC 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.

in the second	ate Drop	os			
Corridor:	Southb	ound	-		Add
Station:	1397+0	0.00		+	Close
Interval:	25.00			+	Change
Library Te	mplates:				
		C_Divided_Type/ C_Ramp _Crowned_B10 _Divided_TypeA _Full_Depth_Wid _Urban_4Lane	_4L _		Copy Help
	← North ← South	bound	-		
	✓ North South	bound bound Payamant			
Current Te	✓ North South	bound bound props:	Revi	Library	
Current Te	North	bound bound props:	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 26 - 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

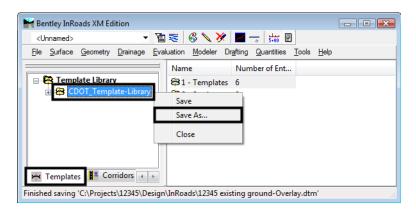
Each of these walls are applied to the same corridor. The wall component that is currently in the library is used on the right side of the template. The new wall component, that is built as part of the lab, is used on the left side.

Lab 26.1 - 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.
- 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.



- 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_Walls-Lab*.
- 5. **<D> Save** then **<D> Cancel**.
- 6. From 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 **CONC_Ramp** template and select **Copy** from the right click menu.

Create Template File Edit Add Tools			
Template Library: \Projects\12345\Design\InF Point Name List 1 - Templates		Current Template Name: Description:	
	Set Activ	/e	
🛏 HMA_Divided_Typ	Cut		Ctrl-X
HMA_Full_Depth_	Сору		Ctrl-C
→ HMA_Urban_4Lan 2 - Sections - Pavemen	Paste		Ctrl-V
3 - Sections - End Conc 4 - Components	Delete		Del
1 4 - components	Rename	1	F2
	Templat	te Documentation Link	
	Display.		

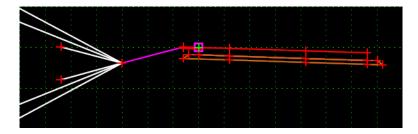
9. **<R>** on the **1** - **Templates** folder and select **Paste** from the right click menu. This creates the *CONC_Ramp1* template.

🐂 Create Template			
File Edit Add Tools			
Template Library:	n\lnRoad:	Current Template Name: Description:	
→ 5th_Ave_A >→ 5th_Ave_A	New	+	
CONC_Divi	Cut	Ctrl-X	
→ CONC_Ran	Сору	Ctrl-C	
→ Federal Blv → HMA Crow	Paste	Ctrl-V	
HMA_Divid	Delete	Del	
	Rename	F2	

- 10. **<R>** on the **CONC_Ramp1** template and select **Rename** from the right click menu.
- 11. 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.
- 13. In the *Dynamic Settings* dialog box, set the *Steps* to *O. 10*.
- 14. 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 Dyn	amic Origin					

15. Delete the POSS and end condition components from the right side of the template. The illustration below show 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 overlay into the wall base.

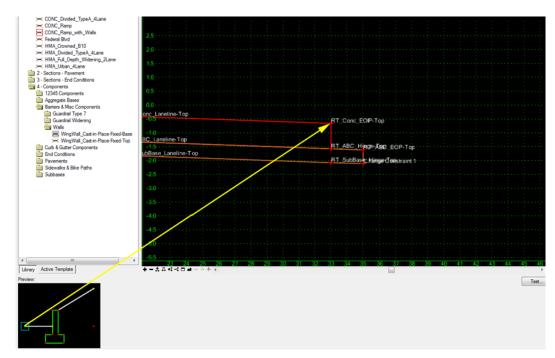
- <D> <D> on the RT_SubBase_EOP-Top point to display the *Point Properties* dialog box.
- 17. Change the *Constraint 1 Type* from *Slope* to Horizontal.

- 18. Key in **0.00** for the Value.
- 19. **<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:	U_EOF	•	< Previous
			Next >
			Help
	Membe	er of:	
Constraints			
Constraints	int 1	Constraint	2
Type: Horizontal	-	Vector-Offset	•
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.

- 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.
- 21. **<D>** on the **WingWall_Cast-in-Place-Fixed-Base** component to display it in the *Preview* window.
- 22. **<D> and hold** on the wall component's origin (the far left point).



23. 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.

- 24. **<D> <D>** on the **RT_Wall_Top-Back** point to display the Point Properties dialog box.
- 25. In the *Point Properties* dialog box, Change the *Value* of *Constraint 2* (the Horizontal constraint) to *5.83*.

🖌 Point Pr	operties				×
Name:		RT_Wall_To	p-Back	+ +	Apply
Feature Nar	me Override:	RT_Wall_To	p-Back		Close
Surface Fea	ture Style:	D_Wall-Wing	,	•	< Previous
Alternate	Surface:			-	Next >
		Me	ember of:		Help
		R R R	T_Fill T_WingW T_WingW T_WingW T_WingW T_WingW	'all-h11 'all-h2 'all-h3	▲ E
Constraint	s Constra	int 1		Constraint	2
Type:	Slope	•	Hor	zontal	•
Parent 1:	RT_Height	_Determir 👻	+ RT.	_Conc_EO	P-Top 🔻 🕂
Parent 2:	Rollov	rer Values			
Value:	50.00%		5.83	}	
Label:		•			•
Style C	onstraint:			-	
⊚ He Rang	orizontal (e: 0.00	Vertical	O Both		

26. **<D> Apply** then **<D> Close** to dismiss the dialog box.

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.

- 27. **<D> <D>** on the **RT_SwaleToe** point.
- 28. In the *Point Properties* dialog box, Set the *Constraint 2 Type* to Vector-Offset.
- 29. Set the *Constraint 2 Parent 1* to **RT_Wall_Top-Front**.
- 30. Set the *Constraint 2 Parent 2* to **RT_Wall_Base-Front**.
- 31. Key in **0.00** for the **Constraint 2 Value**.

e		
Point Properties		×
Name:	RT_SwaleToe 👻 🕈	Apply
Feature Name Override:	RT_SwaleToe	Close
Surface Feature Style:	D_Top-of-Cut	< Previous
Alternate Surface:		
		Next >
	Member of:	Help
	RT_Base_Elevation	Control
Constraints		
Constra Type: Stope		
Siope	▼ Vector-Offset	
Parent 1: RT_Conc_	EOP-Top 🔻 🕂 RT_Wall_To	p-Front 🔻 🕂
Parent 2: 🔲 Rollov	rer Values RT_Wall_Ba	se-Fron' ▼ 🕂
Value: 0.00%	0.00	
Label:	• [•
Style Constraint:		
Horizontal	Vertical 💿 Both	
Range: 0.00		

32. **<D> Apply** then **<D> Close** to dismiss the dialog box.

33. **<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 I
RT ABC Hin 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_Projet_FormBack Place the new point here RT_Conc_EOP-Top RT_SwaleToe RT_ABC_H=rueABOP_EQP=VRan_Projet_VEBAGeABaackTop RT_ABC_H=rueABOP_EQP=VRan_Projet_VEBAGeABaackTop RT_SubBacehakiggeeToeBtraint 1 RT_Wall_Toe-Projet_VEBAGeABaackTop
- 34. Place the point between and below the RT_Conc_EOP-Top and RT_SwaleToe points.

- 35. **<D> <D>** on the new point to display the *Point Properties* dialog box.
- 36. In the *Point Properties* dialog box *Name* field, key in **RT_Ditch-Bottom**.
- 37. Set the *Surface Feature Style* to **D_Ditch-Bottom**.
- 38. Set the *Type* for both constraints to **Slope**.
- 39. Set the *Parent 1* for *Constraint 1* to **RT_Conc_EOP-Top**.
- 40. Set the *Parent 1* for *Constraint 2* to **RT_SwaleToe**.
- 41. Key in -8.33% for the Value of Constraint 1.
- 42. Key in **8.33%** for the *Value* of *Constraint 2*.

Point Properties		×
Name: Feature Name Override: Surface Feature Style: Alternate Surface:	RT_Ditch-Bottom	Close < Previous Next > Help
	Slope Slope RT_Swale RT_Swale RT_Swale RT_Swale RT_Swale RT_Swale RT_Swale Rollov R33%	-

43. **<D> Apply** then **<D> Close** to dismiss the dialog box. The illustration below shows the dialog box as completed

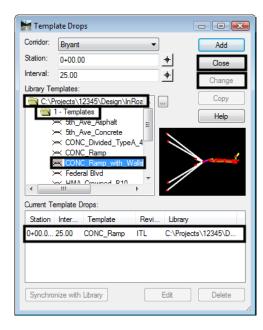
This completes the edits to the template.

44. Select **File > Save** from the *Create Template* menu bar.

45. **<D>** the **Close** button on the *Create Template* dialog box to dismiss it.

Now, examine how the template behaves in Roadway Designer.

- 46. Select **Modeler > Roadway Designer** from the InRoads menu bar.
- 47. From the *Roadway Designer* menu bar, select Corridor > Template Drops.
- 48. In the *Template Drops* dialog box, highlight the entry in the *Current Template Drops* area.
- 49. Expand the Template library folder to show the contents of the *1 Templates* folder.
- 50. Highlight the CONC_Ramp_with_Walls template from the *Library Templates* list.



51. **<D> Change** then **<D> Close** to dismiss the dialog box.

- 52. Scroll through the template drops in the Cross Section view of the Roadway Designer dialog box.
- 53. Verify that the wall is expanding and contracting to meet the existing ground.
- 54. Select File > Save from the *Roadway Desgner* dialog box.
- 55. **<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 26.2 - 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.

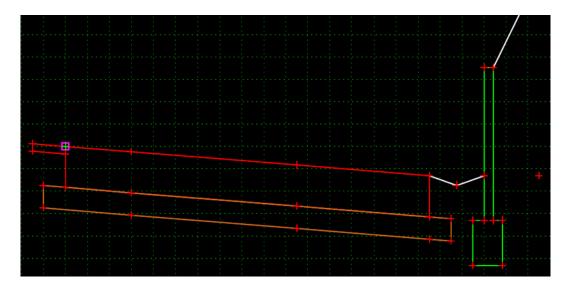
First, a copy of the CONC_Ramp_with_Walls template is made. This template is used for the first 150' of the project.

- 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-Lt 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*.

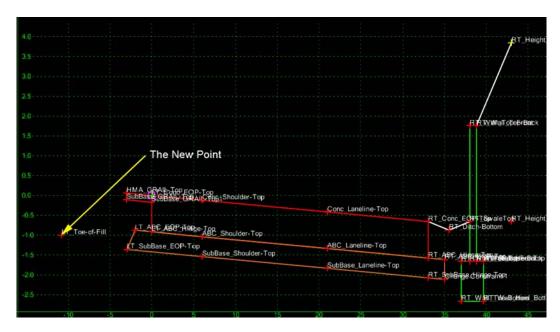
+ - ☆ ↔ + □ ▲ ⇔ ⇔ ∲ + Current Component						
Name: 1	Name: 10:1 Fill			Style:	D_Toe	⊷of-Fill 🔻
Target Ty	pe:	Featu	re XYZ 🛛 🔻	Priority:		1
Surface			345_Walls-Lab	Benching	Count:	0
Feature:		▼ 03	101311	From D	latum:	0.00
	Horizon	tal	Vertical	Step Elev	ation:	0.00
Offsets:	0.00		0.00	Rounding Ler	ngth	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 Settin	gs				
X: 0.90	Step:	0.10			
Y: 1.10	Step:	0.10			
Check for In	terception				
V Place Point	at Intercept	tion			
End Condition	on is Infinite				
Do Not Con	struct				
Point Name: Toe-of-Fill 👻					
Point Style:					
Apply Affixes					
hs=	•				
Set D	ynamic Orig	in			

- 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 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 -0.0	HMA_GRAIL-TPPConc_EOP-Top SubBase_GRAU-Base_GRAIL-Top1	Conc_Shoulder-Top	
-0:4	T_Toe-at-Wall		
-0.8 -1.0 -1.7 Toe-of-Fill	LT_ABC_EOSBC04Hinge-Top	. ABC_Shoulder-Top	
-1:6 -1:8	LT_SubBase_EOP-Top	SubBase_Shoulder-Top	

- 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.

0.2 · · ·	Finish	Enter						
√.2	Closed Shape	Ctrl-L	LT_	Tankat Chenat		:		
-0:0 · ·	Mirror	Ctrl-M		SubBasa Ci	L Top TConc_EO	P-Top	0	dan se da s
-0:2 · ·	Undo Last	ESC		Subbase_G	RAIL-Top SubBase_GR	AIL-Top1	Conc_S	houlder-Top
-0.2	Cancel							
-0:4	Set Dynamic Origin	Ctrl-D	TTOP	at-Wall				
0.0								
-0:0	· · · /							
-0:8				LT ABO	C FOR-Lon			
-0:8 · · · ·	Toe-of-Fill			LT_ABC		ge-Top		oulder Ten
-0:8 · · · · -0:8 · · · ·	Toe-of-Fill					ge-Top	ABC_SI	noulder-Top
-0:8 · · · · -0:8 · · · ·	Toe-of-Fill		LT	LT_ABC		ge-Top	ABC_SI	noulder-Top
-0:8 · · · · -1:0 · · · · ·	Toe-of-Fill		LT	\V∑āllWBalseBl			ABC_SI	noulder-Top
-0:8 · · · · -1:0 · · · · · -1:2 · · · ·	Toe-of-Fill		LT	\V∑āllWBalseBl	āsenBack			noulder-Top e Shoulder-T
-0:8 · · · · -1:0 -	Toe-of-Fill		LT.	\V∑āllWBalseBl	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-Bac	ck 🔻 🕈 🛛 Apply
Feature Name Override:	LT_Wall_Base-Bac	ck Close
Surface Feature Style:	D_Wall-Retaining	Previous
Alternate Surface:		Next >
	Member	of:
	LT_Wa	1
Constraints		
Constra	aint 1	Constraint 2
Type: Horizontal	-	Vertical 👻
Parent 1: HMA_GRA	IL-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.

1.00			
Point Properties			×
Name:	LT_Wall_Base-Fro	nt 🔻 🕂 📔	Apply
Feature Name Override:	LT_Wall_Base-From	nt 🔲	Close
Surface Feature Style:	D_Wall-Retaining	•	< Previous
Alternate Surface:			
			Next >
	Member		Help
	LT Wa		
	LI_VVa		
Constraints			
Constraints	int 1	Constraint 2	
Type: Slope	•	Vertical	•
Parent 1: LT_Toe-at-	Wall 🔻 🕂	LT_Toe-at-Wall	-+
Parent 2: Rollov	ver Values		
Value: 10000.00%		-1.50	
Label:	•		•
Style Constraint:		-	
Horizontal	Vertical	Both	
Range: 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
Alternate Surface:	Next >
	Member of:
	LT_D_Toe-of-Fill
Constraints	
Constraints	nt 1 Constraint 2
Constrain Type: Slope	tt 1 Constraint 2 ▼ Slope ▼
Constrain Type: Slope Parent 1: LT_Toe-of-Fi	▼ Slope ▼
Constrain Type: Slope Parent 1: LT_Toe-of-Fi	▼ Slope ▼
Constrain Type: Slope Parent 1: LT_Toe-of-Fi	▼ Slope ill ▼ ↓ LT_Toe-at-Wall3
Constrain Type: Slope Parent 1: LT_Toe-of-F Parent 2: Rollove	Slope I + I T I Rollover Values
Constrain Type: Slope Parent 1: LT_Toe-of-F Parent 2: Rollove Value: 10.00%	Slope I + I T I Rollover Values
Constrair Type: Slope Parent 1: LT_Toe-of-F Parent 2: Rollove Value: 10.00% Label: Style Constraint:	Slope I + I T I Rollover Values
Constrair Type: Slope Parent 1: LT_Toe-of-F Parent 2: Rollove Value: 10.00% Label: Style Constraint:	Image: Slope Image: Slope

- 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.

Here 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 >
	Member of: LT Wall	Help
	LI_VVaii	
Constraints Constra Type: Horizontal		onstraint 2
Parent 1: HMA_GRA	▼ Vertio	_GRAIL-Top ▼ _+
Value: -1.00	0.00	
	•	•
Style Constraint:		*
Horizontal	Vertical OBoth	
Range: 0.00		

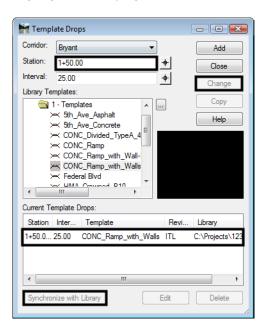
- 73. **<D> Apply** then **<D> Close** to dismiss the dialog box.
- 74. In the Template Library explorer, expand the folders to show the contents of the C:\Projects\12345\Design\InRoads\DE\$12345_Walls-Lab.itl > 4 Components > Barriers & Misc Components > Guardrail Type 7 folder.
- 75. **<D>** on the **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*.

and temp	ate Dro	ps			- • •
Corridor:	Bryant		•		Add
Station:	1+49.9	9		+	Close
Interval:	25.00			÷	Change
Library Ter	nplates:				
	⊶ 5th_	lates Ave_Asphalt Ave_Concrete IC Divided Ty			Copy Help
	← CON ← CON ← Fede	Conumed D	_Walls		>
Current Te					
	Inter	Template		Revi	Library
					ubidiy
0+00.0	25.00	CONC_Ram			C:\Projects\123
0+00.0 1+49.9	25.00 25.00	CONC_Ram CONC_Ram			
0+00.0	25.00 25.00		p_with_Wall-	ITL	C:\Projects\123
0+00.0 1+49.9	25.00 25.00	CONC_Ram CONC_Ram	p_with_Wall-	ITL	C:\Projects\123 C:\Projects\123

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 Desgner* 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 occuring in areas where they are not wanted or not occuring 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 27 - 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 27.1 - 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.

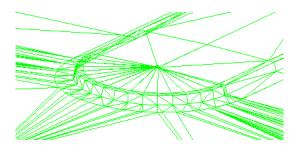
- 1. Open MicroStation and InRoads using the *12345DES_Model-Create Raised Median.dgn* file.
- 2. Select **File> Open** from the InRoads menu bar.
- 3. Select the file C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\ Preferences\CDOT_Civil.xin
- 4. Continue to select the following files from *C*:*Projects**12345**Design**InRoads*\ and the **<D> Open** button.
 - ◆ 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 27.2 - Workflow

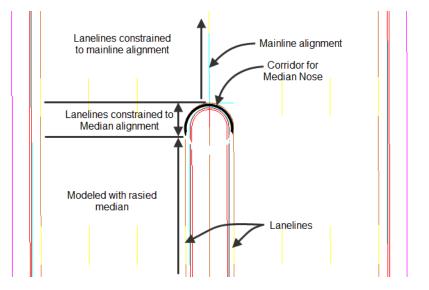
A summary of the overall process

- 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.



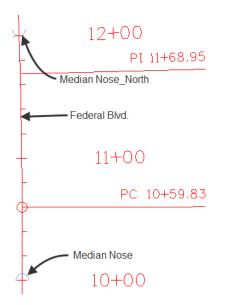
Modeling Schematic



Lab 27.3 - Review The Alignments

In this exercise three alignments are used. *Federal CL* for the main corridor and *Median Nose* & *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 & Median Nose_North
- 3. View stationing for horizontal alignment Federal CL

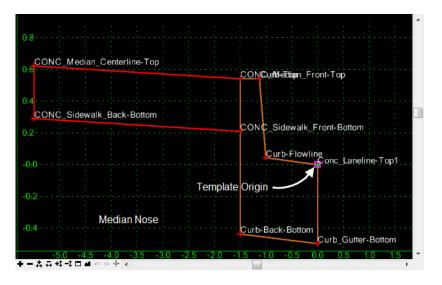


Lab 27.4 - Review Data

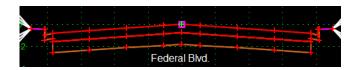
An initial model of the roadway was created using a crowned roadway section (without the raised median). This is done for the purpose of extracting the vertical profile of the median noses which is accomplished by using the command **File > Import > Geometry [Vertical From Surface].** This step has already been completed.

🔣 Import Geon	netry				
From Graphics	ICS	Vertical from Surface			
Surface: Federal_Crowned					
	Vertical Alignment				
Name:	Mediar	n NoseV			
Description:	Vertica	I from crowned DTM			
Style:	ALG_(OTHER_Vert ▼	Help		
Target					
Horizontal Alig	nment:	Median Nose 🔹			
Station Lin	nits				
Start:		0+00.00 +			
Stop:		0+17.28 +			
Horizontal	Horizontal Offset: 0.00				
 Points of Vert 	ical Inte	rsection			
Interval:		0.00			
Tolerance	:	0.00			
		Close			

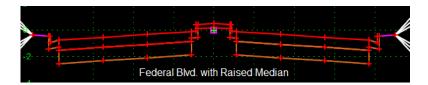
- 1. Select **Modeler > Create Template** from the InRoads menu bar.
- 2. In the *Create Template* dialog review the template for *Median Nose* in the *1-Templates* folder.



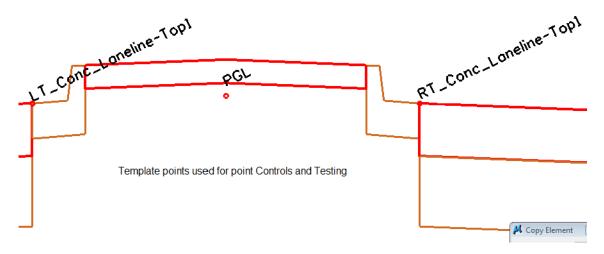
3. Also in the *Create Template* dialog review the template for *Federal Blvd* in the *1-Templates* folder. This template was use to create a preliminary model. This model was used to extract vertical alignments for the median alignments.



4. The template *Federal Blvd with Raised Median*. Display rules control if the median is modeled.



5. 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 27.5 - Add Display Rules

Display rules can be associated with components to test if the component should be displayed or not.

- 1. Copy the template *Federal Blvd with Raised Median* to *Federal Blvd with Raised Median_DR*
- 2. Open Federal Blvd with Raised Median_DR for editing
- 3. The goal is to eliminate the construction of the median components if the distance between either lanelines and the PGL is less than 5.50'.
 - **Note:** 5.50 feet represents the distance from the mainline alignment to the PC or PT of the alignments for the median noses.

4. Select the median curb and gutter component named *LT_C/G_Type2-1B* for editing.

Component Prop	erties	X
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
Exclude from triang	ulation	Help

5. Select Edit

Componer	it Display Conditi	ional Expression				
Conditional E	pression for LT_C.	/G_Type2-IB Component				ОК
						Cancel Help
AND	OR NOT	() Select	ed Rule			
Template Displa	-				-	
Name	Туре	Expression	Test	Value	Re	
•		m			4	
		Add	Edit	Delet	e	

- 6. Select Add
- 7. **Create** a Display Rule that tests the distance between the Left Laneline and the PGL.
 - ♦ Name: LeftC/G
 - Description: test distance between LT laneline and PGL
 - Type: Absolute Horizontal
 - Between: LT_Conc_Laneline-Top1 and PGL
 - Test: $\geq =$
 - ◆ Value: 5.50

🔛 Display R	ule		×
Name:	LeftC/G	C	ОК
Description:	test distance between LT laneline and PGL	ſ	Cancel
Туре:	Absolute Horizontal		Help
Between:	LT_Conc_Laneline-Top1	+	
And:	PGL •	₽ -	
	>= • 5.50		

Compo	onent Display Conditio	nal Expression					
Condition	al Expression for LT_C/0	G_Type2-IB Compone	ent				ОК
LeftC/G				*	=		Cancel Help
AND Template [OR NOT	()	Selected Rule				
Name	Туре	Expression		Test	Value	Result	1
	Absolute Horizontal	LT_Conc_Laneline-	Fop 1 - PGL	>=	5.50	True	-
			Add	Edi	t	Delete	

8. Select **Rule** for the LT Laneline, **OK & Apply**

- 9. Select the component *RT_C/G_Type2-1B* for editing.
- 10. Build and apply a similar rule for the RT Laneline.
 - ♦ Name: RightC/G
 - Test 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")
 - Name: MedianPavt
 - Description: Test width between lanelines
 - Type: Absolute Horizontal
 - Between: LT_Conc_Laneline-Top1 and RT_Conc_Laneline-Top1
 - Test: $\geq =$
 - ♦ Value: 11.00

🔛 Display R	ule		83
Name:	MedianPavt		ОК
Description:	Test width between lanelines		Cancel
Туре:	Absolute Horizontal		Help
Between:	LT_Conc_Laneline-Top1	+	
And:	RT_Conc_Laneline-Top1	+	
	>= • 11.00		

13. Save and Close the Create Template dialog.

Lab 27.6 - Create Corridors

Corridors contain definitions for which alignments, templates, point controls, etc. to incorporate when modeling the roadway. In this exercise, three corridors are defined, one for each median nose and one for the mainline.

- 1. Select Modeler > Roadway Designer
- 2. Select **Corridor > Corridor Management** from the Roadway Designer menu bar or

<D> the Manage Corridors button **1**.

- 3. Add corridors for both median openings.
 - Name: Median Nose
 - Type: Alignment
 - Horizontal Alignment: Median Nose
 - Vertical Alignment: Median NoseV

Name: Median No:	se		Limits Station		Add
Туре:	Alignment	•	Start:		Close
Horizontal Alignment	t: Median No	se 🔹 🕈	0+00.00		Change
/ertical Alignment:	Median No	seV 💌	Stop:		Сору
⁹ Rounding Tange	nt: 0.00		0+17.28	+	Copy From
Comidors: Name	Туре	Source Name	Start Station	Stop	Help
Federal	Alignment	Federal CL	8+00.00	19+00	
Median Nose	Alignment	Median Nose	0+00.00	0+17.	28

- 4. Add corridor definition for corridor Median Nose North
 - Name: Median Nose North
 - Type: Alignment
 - Horizontal Alignment: Median Nose_North
 - Vertical Alignment: Median Nose_NorthV
- 5. Add and Close

Lab 27.7 - Add Template Assignments

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 alignment so setting the interval and selecting the desired template is all of the input that is required.

- Select Corridor > Template Drops from the Roadway Designer menu bar or <D> the template drops button X
- 2. Add template assignment to *Median Nose*
 - Template: Median Nose
 - ♦ Interval of 1'

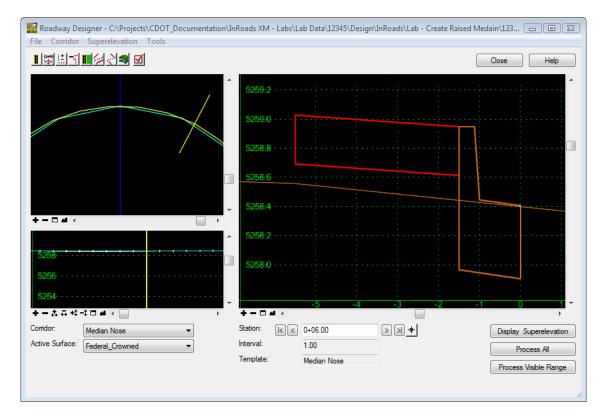
🔣 Templa	ate Drops			
Corridor:	Median No	se	•	Add
Station:	0+00.00		+	Close
Interval:	1.00		+	Change
Library Ten				
	≺ Federal B ≺ HMA_Cro	lvd with Raised I wored B10	V 🔺 📖	Сору
		ided_TypeA_4La	3	Help
	 ≺ HMA_Urb ✓ Median N - Sections - 	lose Pavement End Conditions	• •	
Station	Inter	Template	Revi	Library
0+00.00	1.00	Median Nose	ITL	C:\Projects\CDOT_D.
< Synchron	ize with Libr	III ary	Ed	it Delete

3. **<D> Add** then **Close**.

- 4. Add template assignment to *Median Nose_North*
 - Template: Median Nose_North
 - ♦ Interval of 1'

M Templa	ate Drops					
Corridor:	Median N	ose_North	•	Add		
Station:	0+00.00	0+00.00 + Close				
Interval:	1.00		+	Change		
Library Ter	nplates:					
	✓ Federal ✓ Federal ✓ HMA_C ✓ HMA_D ✓ HMA_Fit ✓ HMA_U ✓ HMA_U ✓ Median	Doucomont		Copy Help		
Station	Interval	Template	Revised In	Library		
0+00.00	1.00	Median Nose	ITL	C:\Projects\12345		
•				•		
Synchron	iize with Lib	orary	Edit	Delete		

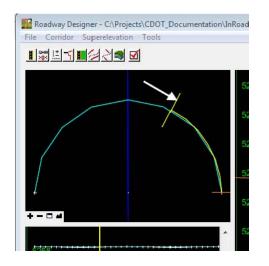
- 5. **<D> Add** then **Close**.
- 6. Roadway Designer can be used to evaluate the two median corridors.



- **Note:** The template data is displayed in the template view. There are two options for scrolling through the design, using the station arrows below the template view and using the station line in the plan view.
- 7. **<D>** on the station arrows to scroll through the design.

+	4		
Station:	K <	0+00.00	<u>+</u> < <
Interval:		1.00	
Template:		Median Nose	

8. **<D> and Hold** on the yellow station line. Move the pointer back and forth to scroll through the design.



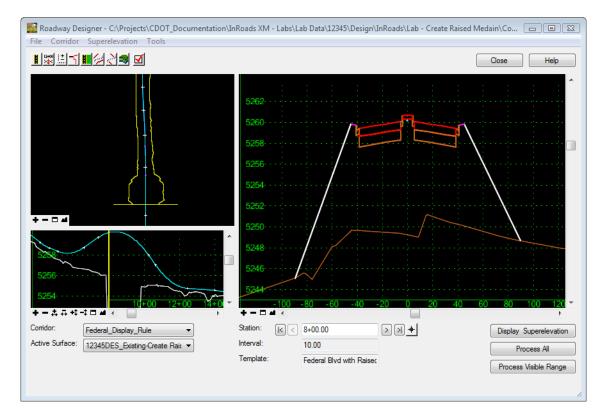
The median models are now ready to be evaluated.

- 9. From the pull down menu in the Roadway Designer dialog **Corridor > Corridor Management**.
- 10. Create a corridor for the Mainline.
 - Name: Federal_Display_Rule
 - Type: Alignment
 - Horizontal Alignment: Federal CL
 - Vertical Alignment: Federal CL_V
 - ♦ Start Station: 8+00
 - ♦ Stop Station: 19+00
- 11. **<D> Add**

12. **<D> Close**

- 13. From the Roadway Designer dialog **Corridor > Template Drops**
- 14. Add template assignments to the corridor Federal_Display_Rule.
 - ♦ Station: 8+00

- ♦ Interval of 10'
- Template:Federal Blvd with Raised Median_DR
- 15. **<D> Add**
- 16. **<D> Close**
- 17. Evaluate the *Federal_Display_Rule* corridor.



Lab 27.8 - 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, horizontal cardinal and event points are processed, cut and fill information is added to the template view, and component and point information is added to the processing report.

The first series of steps tell the Roadway Designer to process the horizontal cardinal and event points.

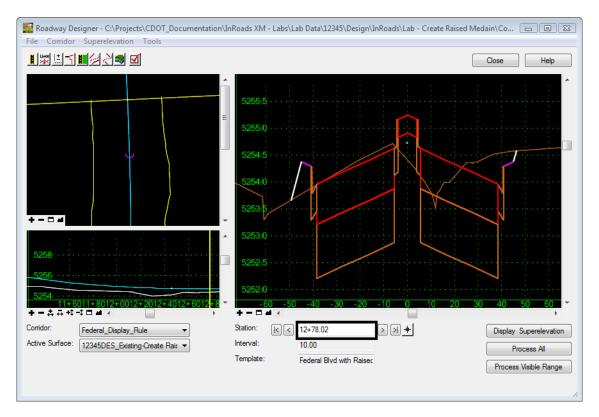
1. From the Roadway Designer menu bar, select **Tools > Options**.

2. In the *Roadway Designer Options* dialog box, toggle on Horizontal Cardinal Points, Vertical Cardinal Points, External Control Points, Reference Graphics, and Transition Graphics.

Include Critical Sections Include Critical Sections Image: Ima	OK Cancel Preferences Help
Display Carlot Reference Graphics Transition Graphics Triangulated Surface Cut and Fill Graphics Cut and Fill Values Net Volume Net Volume Null Points	Superelevation Display Key Station Lines Station Result Reporting Options Find Condition Failures Find Condition Failures Find Control Usage Component Information Point Information
Curve Set ID Cardinal Points Cross Section Tracking	Process Aliases Automatically

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 27.9 - Point Controls

This series of steps adds Point Controls (overrides) to the corridor definition previously defined in Roadway Designer.

1. Select **Corridor > Point Controls** from the Roadway Designer menu bar or **<D>** the

Point Control button

- 2. The roadway will model 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). The first control instructs the laneline to follow a feature created by the *Median Nose* corridor. The second control instructs the laneline to follow a feature created by the *Median Nose*. The third control instructs the laneline to follow a feature created by the *Median Nose*. North corridor.
- 3. Verify the corridor Federal_Display_Rule is the active corridor.

Point Control	S		
Corridor: Federal	_Display_Rule		
Point:	RT_Conc_	Laneline- 💌	+
Mode Morizontal	Vertical	Both	5

- 4. Create the following Point Control entries to instruct the template point RT_Conc_Laneline-Top1 to follow a feature (by the same name) created by the Median Nose corridor.
- 5. First Point Control
 - Point: RT_Conc_Laneline-Top1
 - ♦ Mode: Both
 - Control Type: Corridor Point
 - Corridor: Median Nose
 - Reference Point: Conc Laneline-Top 1
 - Station Start: 10+00.00 (begin of median radius)
 - Station Stop: 10+05.50 (end of median radius/nose)

6. **<D> ADD**

Horizonta	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

- 7. Second Point Control
 - Point: RT_Conc_Laneline-Top1
 - ♦ Mode: Both
 - Control Type: Alignment

- Horizontal Alignment: Federal CL
- Vertical Alignment: Federal CL_V
- Station Start: 10+05.51 (end of median radius/nose beginning of median opening)
- Station Stop: 12+00.00 (beginning of north median/radius nose)

8. **<D> ADD**

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

- 9. Third Point Control
 - Point: RT_Conc_Laneline-Top1
 - Mode: Both
 - Control Type: Corridor Point
 - Corridor: Median Nose_North
 - Reference Point: Conc_Laneline-Top 1
 - Station Start: 12+00.00 (begin of median radius/nose)
 - Station Stop: 12+05.00 (end of median radius)

10. **<D> ADD**

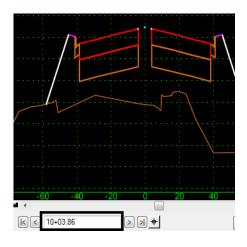
Horizontal and Vertical Controls:							
Enab	Priority	Name	Start Station	Stop Station	Mode	Туре	Control
x	1	RT_Conc_Laneline-Top1	10+00.00	10+05.50	Both	Corridor Point	Median Nose:Conc_Laneline-Top1
х	1	RT_Conc_Laneline-Top1	10+05.51	12+00.00	Both	Alignment	Federal CL:Federal CL_V
Х	1	RT_Conc_Laneline-Top1	12+00.00	12+05.00	Both	Corridor Point	Median Nose_North:Conc_Laneline-Top1

11. Add 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.

Horizontal and Vertical Controls:								
Enabled	Priority	Name	Start Sta	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	
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> ADD**
- 13. **<D> Close**

14. Review the results graphically in Roadway Designer. You should see the raised median disappear between stations 10+00.00 and 10+05.00 and again between 12+00.00 and 12+05.00. Between these station limits, the corridors for the medians will complete the model.



15. You should also see the left and right pavement edges running together between stations 10+05.51 and 12+00.00. This represents the median opening.

Lab 27.10 - 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 or in the case of this exercise, just prior to and after the application of point controls. This ensures the roadway models 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 Point

Control button .

- 2. **Key-in** the station values immediately before and after the point controls. Select **Add** after each entry.
 - ♦ 9+99.99
 - ♦ 10+05.51
 - ♦ 11+99.99

♦ 12+05.51

Comdor:	Federal_Dis	play_Rule		Add
Station:	8+00.00		<u>+</u>	Close
Selected:				Help
9+99.99				Thoip
10+05.5				
11+99.99)			
12+05.5				

- 3. D > Close
- 4. Select **File > Save** from the Roadway Designer menu.

Lab 27.11 - Creating the Model

With all the corridors, template applications, 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

Point Control button

- 2. Select the following corridors for modeling:
 - Federal_Display_Rule
 - ♦ Median Nose
 - ♦ Median Nose_North
- 3. **<D>** on *Clipping Options*

Corridor	Clipping Corridor	Clipping Option	ОК
Median Nose	Federal_Display_Rule	Clip None	Cancel
Median Nose_North	Federal_Display_Rule	Clip None	Help
			Thep

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:

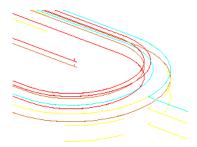
Create Surface			23
Name:	Design Model		Apply
Default Preference:	Proposed	•	Close
New Surface for	Each Corridor		Preferences
Empty Design Su	iface		Help
🔲 Include Null Poin	ts		<u> </u>
Add Exterior Bou	ndlary - Style:	Exterior Bo	undary 👻
Densify Horizonta	al Curves using Cho	ord Height To	plerance
Densify Vertical (Curves using Chord	Height Tole	rance
Triangulate			
Federal Federal_Display_Ri Median Nose Median Nose_North			All None
Clipping Optio	ns		
Features Duplicate Names:			
Append	Replace	Rename	Modify
Add Transverse	e Features		
Style:	Default		
Create Alternate	Surfaces		
Process Visible F	Range Only		
Remove Loops			
Display Features	in Plan View		

Lab 27.12 - Review the Design

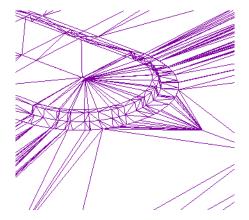
Use you knowledge of InRoads to review your model.

Some methods may include:

• A 3D isometric view of DTM features



• DTM triangles



Contours, profiles and cross sections are additional options.

Chapter Summary:

- In *Lab 27.5 -Add Display Rules* were created and associated with template components.
- In *Lab* 27.9 -*Point Controls* were defined to modify the application of the defined template
- In *Lab 27.10 Adding Key Stations* are used to define supplemental template application stations.
- In *Lab 27.11 Creating the Model* multiple corridors are modeled simultaneously and corridor clipping option are defined.

LAB 28 - 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 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 and tie a ramp vertical alignment into the edge of lane of the mainline taper using the Vertical Gore Tool.
- Create a freeway entrance ramp (tapered type) model and the infield, gore and taper area segment of the the mainline model.
- Create a ramp and mainline surfaces from the Roadway Designer, display cross sections and examine the results.

Lab 28.1 - Open InRoads Data Files

- 1. Open MicroStation and InRoads uing 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.

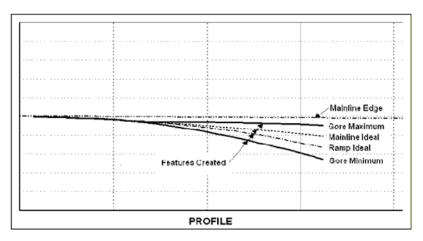
- 3. Select **File> Open** from the InRoads menu bar.
- 4. Select the following files from C:\Projects\12345\Design\InRoads\ and <D> Open them.
 - ♦ 12345DES_Geometry-Create Ramp Model.alg
 - ◆ 12345DES_Template-Create Ramp Model.itl
 - ◆ 12345DES_Roadway-Create Ramp Model.ird
 - ◆ 12345DES_Existing-Create Ramp Model.dtm
- 5. **<D> Cancel** the *Open* dialog box to close.

Lab 28.2 - Set the Global Scale Factors

- 1. Select **Tools> Options** from the InRoads menu bar.
- 2. In the *Options* dialog box:
 - Select *Factors* tab.
 - Key in **200** in the Factor fields.
 - <D> Apply and <D> Close.

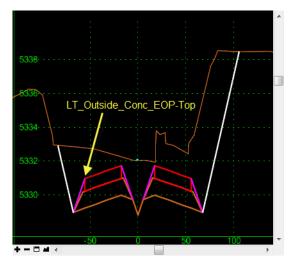
Lab 28.3 - Create Ramp Vertical Alignment Guide with Vertical Gore Tool

Use the Vertical Gore Tool to create a guide for revising the ramp vertical alignment. This command is used to create a surface feature envelope of a ramp that merges into a mainline corridor. The output from this command includes a surface with four linear features which are designed to be plotted on 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.

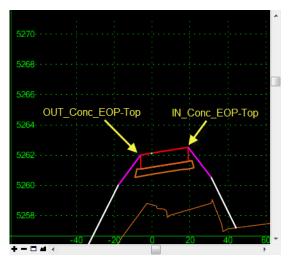


- 1. Select **Modeler> Roadway Designer** from the InRoads menu bar.
- 2. Select Tools> Vertical Gore Tool from the Roadway Designer menu bar.
- 3. In the *Vertical Gore Design Tool* dialog box:
 - Select *IH 39* in the Mainline Corridor field

 Select *LT_Outside_Conc_EOP-Top* for the Mainlined Edge field, using the dropdown list or the selector button and <D> on the template point in the Roadway Designer dialog box.



- 4. Set *NW Ramp* as the ramp corridor field.
- 5. Select *IN_Conc_EOP-Top* for the Ramp Inside Edge field, using the selector button and **<D>** on the template point in the Roadway Designer dialog box.
 - Select *OUT_Conc_EOP-Top* for the Ramp Outside Edge field, using the selector button and <D> on the template point in the Roadway Designer dialog box.



- Key in **8%** in the Maximum Difference field.
- Key in *30+50* in the Mainline Start field.
- ♦ Key in *32+00* in the Mainline Stop field.
- Key in *Gore Design* in the Surface Name field.
- Select *D_GORE_Max_Vertical* for the Maximum Style.
- Select *D_GORE_Mainline_Ideal* for the Mainline Ideal Style.
- Select *D_GORE_Ramp_Ideal* for the Ramp Ideal Style.

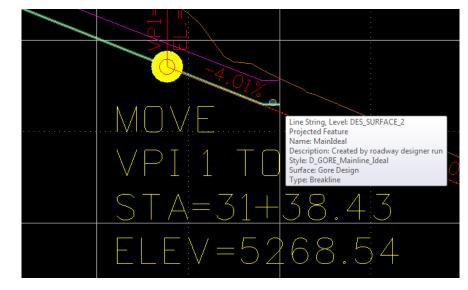
Kertical Gore Design Tool		<u> </u>
Mainline Comidor: IH 39 -	Plan View	Apply
Mainline Edge: LT_Outside_Conc_E	+ Start Gara Stop Gore Station -	Close
Ramp Corridor: NW Ramp -	Start Gore Stop Gole Station	Preferences
Ramp Inside Edge: IN_Conc_EOP-Top 💌	+	
Ramp Outside Edge: OUT_Conc_EOP-Tc 💌	+ Mainline Edge	Help
Maximum Difference: 8.00%		
Limits		
Mainline Start: 30+50.00	+ Ramp Outside Edge	
Mainline Stop: 32+00.00	+ Ramp Inside Edge	
	Cross Section View	
	Maximum Vertical —	Ramp
Output	Mainline	
Surface Name: Gore Design	RampIde	eal 🔪
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_Verti		

• Select *D_GORE_Min_Vertical* for the Mimimum Style.

- <D> Apply and <D> Close
- 6. In the *Roadway Designer* dialog box:
 - **<D> Close** and select *No* to save changes

Lab 28.4 - Update NW Ramp profile view to display Projected Features from the Gore Design surface

- 1. Select Evaluation> Profile> Update Profile from the InRoads menu bar.
- 2. In the *Update Profile* dialog box:
 - Verify *NW Ramp* for the Profile Set.
 - Select *Projected Features* in the Update Profile area.
 - Select *Display On* for the Mode.
 - Select *Gore Design* in the Surfaces area.
 - Select All features in the Projected Features area.



<D> Apply and <D> Close.

The vertical alignment displayed in the profile view does not tie into the mainline and was created to model the NW Ramp corridor for use in the Vertical Gore design Tool. The NW Ramp vertical alignment needs to be revised to tie into the edge of lane of the mainline taper. Revise VPI #1 to begin at Sta. 31+38.43 and the slope of feature D_GORE_Mainline Ideal is extended to the revised VPI #2 location of the proposed sag vertical curve at Sta. 35+75.00. The ramp vertical alignment is lowered to better tie into the mainline ditch in the infield area.

- 3. Set alignment *NW Ramp* as the *Active* alignment
- 4. Select Geometry> Vertical Curve Set> Move PI from the InRoads menu bar.
- 5. **Move** VPI #1 to Station 31+38.43, Elev. 5268.54
- 6. **Move** VPI #2 to Station 35+75.00, Elev. 5251.04

Note: The keyin *se=station, elevation* can be used to move the PI's

- 7. Select Geometry> View Geometry> Vertical Annotation from the InRoads menu bar.
 - <D> Apply and <D> Close.

Revise NW Ramp corridor to start at the beginning of the ramp's revised vertical alignment.

- 8. Select Modeler> Roadway Designer from the InRoads menu bar.
- 9. In the *Roadway Designer* dialog box:
 - Select *NW Ramp* in the Coordiors field.
 - Select **Corridor > Corridor** Management from the Roadway Designer menu bar.
 - ◆ **<D>** on cooridor NW Ramp
 - ♦ Key in *31+38.43* in the Start field.

<D> Change.

Define End Condition Exceptions for the IH 39 corridor. Apply Left Override, Backbone Only to left side of IH 39 along the NW Ramp gore and infield area.

- 10. In the *Roadway Designer* dialog box:
- 11. Select *IH 39* in the Corridor field and select **Corridor> End Condition Exceptions** in the Roadway designer menu bar.
 - ♦ Key in *31+38.43* in the Start field.
 - Key in *40+50* in the Stop field.
 - Select *Left Override* in the Apply To area.
 - Select *Backbone* Only
 - <D> Add and <D> Close

Lab 28.5 - Define End Condition Exceptions for NW Ramp corridor

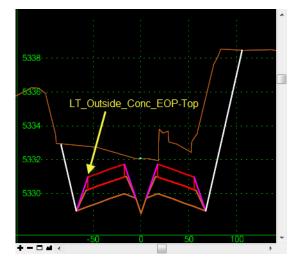
Apply Right Override, Backbone Only to right side of NW Ramp along the gore and infield area.

- 1. In the *Roadway Designer* dialog box:
- Select *NW Ramp* in the Corridor field and select Corridor> End Condition Exceptions in the Roadway designer menu bar.
 - ♦ Key in *31+38.43* in the Start field.
 - ♦ Key in *40+50* in the Stop field.
 - Select *Right Override* in the Apply To area.
 - Select *Backbone* Only
 - <D> Add and <D> Close

Define Point Controls for the IH 39 corridor. Stretch westbound roadway's left edge of pavement to create the ramp taper.

- 3. In the *Roadway Designer* dialog box:
- 4. Select *IH 39* in the Corridor field and select **Corridor> Point Controls** in the Roadway designer menu bar.
- 5. In the *Point Controls* dialog box:

Select *LT_Outside_Conc_EOP-Top* for the Point field, using the selector button and
 on the template point in the Roadway Designer dialog box.

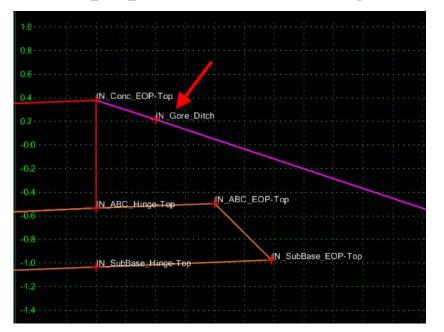


- Select *Horizontal* for the Mode.
- Select *Alignment* in the Control Type field.
- Select *Outside Edge of Pavement* in the Horizontal Alignment field.
- Select Use as a Secondary Alignment.
- ♦ Key in *31+38.43* in the Stop field.
- <D> Add and <D> Close

Lab 28.6 - Define Point Controls for the NW Ramp corridor

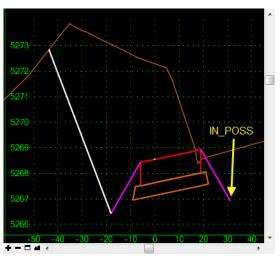
Create a special ditch between the ramp and mainline shoulders pavements from the gore nose to a station where the mainline ditch starts (when the ramp fore slope is flatter than the 3:1 maximum) and tie the inside (right) fore slope of the ramp to the mainline ditch along the infield area when the mainline ditch starts.

- 1. In the *Roadway Designer* dialog box:
- 2. Select *NW Ramp* in the Corridor field and select **Corridor> Point Controls** in the Roadway designer menu bar.
- 3. In the *Point Controls* dialog box:

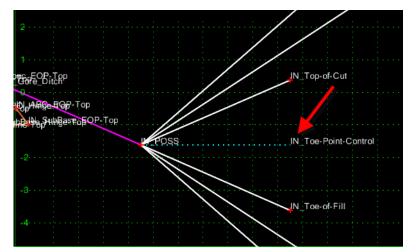


• Select *IN_Gore_Ditch* for the Point field, from the drop-down list.

- Select *Both* for the Mode.
- Select *Alignment* in the Control Type field.
- Select *Special_Ditch_NW_Ramp* in the Horizontal Alignment field.
- Unselect *Use as a Secondary Alignment.*
- ♦ Key in *31+38.43* in the Start field.
- Key in *35+99.90* in the Stop field.
- ♦ <D> Add
- 4. In the *Point Controls* dialog box:
 - Select *IN_POSS* for the Point field, using the selector button and <D> on the template point in the Roadway Designer dialog box.



- Select *Both* for the Mode.
- Select *Corridor Point* in the Control Type field.
- Select *IH 39* in the Corridor field.
- Select *LT_Outside_Conc_EOP-Top* in the Reference Point field.
- ♦ Key in *31+38.43* in the Start field.
- ♦ Key in *35+99.90* in the Stop field.
- ♦ <D> Add
- 5. In the *Point Controls* dialog box:
 - Select *IN_Toe-Point-Control* for the Point field, from the drop-down list.. Note: This component has a display rule.



- Select *Both* for the Mode.
- Select *Corridor Point* in the Control Type field.
- Select *IH 39* in the Corridor field.
- Select *LT_POSS* in the Reference Point field.
- Key in *36+00* in the Start field.
- ♦ Key in *40+50* in the Stop field.
- <D> Add and <D> Close

Lab 28.7 - Define Key station for IH 39 corridor

- 1. In the *Roadway Designer* dialog box:
- 2. Select *IH 39* in the Corridor field and select **Corridor> Key Stations** in the Roadway designer menu bar.
 - ♦ Key in *31+38.42* in the Station field.
 - <D> Add and <D> Close

Define Key station for NW Ramp corridor.

- 3. In the *Roadway Designer* dialog box:
- 4. Select *NW Ramp* in the Corridor field and select **Corridor> Key Stations** in the Roadway designer menu bar.
 - Key in *3599.90* in the Station field.
 - <D> Add and <D> Close

Lab 28.8 - Create Surfaces to display in cross sections to examine design models

- 1. In the *Roadway Designer* dialog box:
- Select *Existing_Ground* in the Active Surface field and select Corridor> Create Surface in the Roadway designer menu bar.
 - Select the following options and <D> Appy and <D> Close

Create Surface Zs Name: Apply Default Preference: Default Image: Image:		23					
Default Preference: Default Close Ø New Surface for Each Comidor Preferences Ø Empty Design Surface Help Include Null Points Ø Ø Add Exterior Boundary - Style: Exterior Boundary Densify Horizortal Curves using Chord Height Tolerance Ø Triangulate Create Surface(s) from: H 39 NW Ramp Ouplicate Names: Ø Append Replace Rename Modify Add Transverse Features Style: Default © Create Altemate Surfaces Process Visible Range Only Ø Remove Loops	Create Surface	25					
Image: Cost of the second s	Name:	Apply					
 New Surface for Each Comidor Preferences Empty Design Surface Help Include Null Points Add Exterior Boundary - Style: Densify Horizontal Curves using Chord Height Tolerance Densify Vertical Curves using Chord Height Tolerance Triangulate Create Surface(s) from: H 39 NW Ramp All None Clipping Options Features Duplicate Names: Append Replace Rename Modify Add Transverse Features Style: Default Create Attemate Surfaces Process Visible Range Only Remove Loops 	Default Preference: Default	Close					
 Empty Design Surface Help Include Null Points Add Exterior Boundary - Style: Exterior Boundary Densify Horizontal Curves using Chord Height Tolerance Densify Vertical Curves using Chord Height Tolerance Triangulate Create Surface(s) from: H 39 NW Ramp All None Clipping Options Features Duplicate Names: @ Append Replace Rename Modify Add Transverse Features Style: Default Create Alternate Surfaces Process Visible Range Only W Remove Loops 							
Include Null Points ✓ Add Exterior Boundary - Style: Exterior Boundary - Style: Densify Horizontal Curves using Chord Height Tolerance ⑦ Densify Vertical Curves using Chord Height Tolerance ⑦ Triangulate Create Surface(s) from: [H 39] NW Ramp ② Opping Options Features ⑦ uplicate Names: ③ Append Replace Rename Modify Add Transverse Features Style: □ efault ♥ Remove Loops		references					
 Add Exterior Boundary - Style: Exterior Boundary ▼ Densify Horizontal Curves using Chord Height Tolerance Densify Vertical Curves using Chord Height Tolerance ✓ Triangulate Create Surface(s) from: H 39 NW Ramp All None Clipping Options Features Duplicate Names: ③ Append		Help					
Densify Horizontal Curves using Chord Height Tolerance Densify Vertical Curves using Chord Height Tolerance Triangulate Create Surface(s) from: It 39 NW Ramp All None Clipping Options Features Duplicate Names: © Append © Replace © Rename © Modify Add Transverse Features Style: Default ♥ Create Alternate Surfaces Process Visible Range Only ♥ Remove Loops							
Densify Vertical Curves using Chord Height Tolerance Triangulate Create Surface(s) from: H 39 NW Ramp Al None Clipping Options Features Duplicate Names: @ Append @ Replace @ Rename @ Modify @ Add Transverse Features Style: Default		•					
✓ Triangulate Create Surface(s) from: H 39 NW Ramp All None Olipping Options Features Duplicate Names: ③ Append Replace Rename Modify All None Clipping Options Features Duplicate Names: ③ Append Replace Rename Modify Add Transverse Features Style: Default Create Alternate Surfaces Process Visible Range Only Y Remove Loops	Densify Horizontal Curves using Chord Height Tolerance						
Create Surface(s) from: H 39 WW Ramp All None Clipping Options Features Duplicate Names:	Densify Vertical Curves using Chord Height Tolerance	e					
IH 39 NW Ramp All None Clipping Options Features Duplicate Names: @ Append @ Replace @ Rename @ Modify Add Transverse Features Style: Default © Create Attemate Surfaces @ Process Visible Range Only @ Remove Loops	✓ Triangulate						
NW Ramp All None Olpping Options Features Duplicate Names:							
Clipping Options Features Duplicate Names:							
Clipping Options Features Duplicate Names:							
Clipping Options Features Duplicate Names: Add Transverse Features Style: Default Create Alternate Surfaces Process Visible Range Only Remove Loops		All					
Features Duplicate Names:		None					
Features Duplicate Names:	Clipping Options						
Append Replace Rename Modify Add Transverse Features Style: Default Create Alternate Surfaces Process Visible Range Only Remove Loops							
Add Transverse Features Style: Default Create Alternate Surfaces Process Visible Range Only Remove Loops							
Style: Default Create Alternate Surfaces Process Visible Range Only Remove Loops		Modify					
Create Alternate Surfaces Process Visible Range Only Remove Loops	Add Transverse Features						
Process Visible Range Only Premove Loops	Style: Default -						
Process Visible Range Only Premove Loops							
Remove Loops							
Display Features in Plan View	Remove Loops						
	Display Features in Plan View						

- 3. In the *Roadway Designer* dialog box:
 - Select **File> Save** in the Roadway designer menu bar.

Lab 28.9 - Display cross sections and use cross section viewer to examine mainline and ramp design models together

1. Make IH 39 the active alignment

- 2. Select Evaluation> Cross Section> Create Cross Sections from the InRoads menu bar.
- 3. **<D> Preferences** and select 40H 20V 320' Wide
- 4. Uncheck Gore design surface

Create Cross Section				
Create Cross Section Create Cross Section General Source Include Controls Custom Layout Axes Grid Details ASCII	Set Name: Create: Interval: Left Offset: Right Offset: Vertical Exaggeration: Show Data Outside Surfaces:		+ + +	
	Object Default Existing_Ground Gore Design NW Ramp H 39	Name Default Default Default Default Default	BYL BYL BYL BYL BYL BYL	All
		Apply Preference	Properties Properties Close	Help

- Display cross sections in an area to the right of the design data.
- 5. **<D> Apply** and **<D>** in the drawing view to display the cross section set
- 6. **<D> Close** and
- 7. Select **Evaluation> Cross Section> Cross section Viewer** from the InRoads menu bar.
- 8. Select 24+00.00 in the Cross Sections area and **<D> Run**.
- 9. Examine the ramp and westbound mainline sections as the viewer moves along the taper, gore, and infield areas.

LAB 29 - Forcing Toes Inside of the Right Of Way

There are numerous reasons why it may not be possible to aquire 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 29.1 - 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.

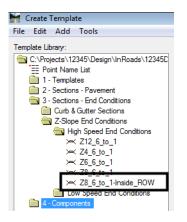
Three NULL points are used to modify the end condition. Two are used to locate the maximum length of the 6 to 1 and 4 to 1. The third locates the right of way. The constraints are changed on the toe of slope points to extend to the NULL point closest to the centerline.

- 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
Z6 6 to 1 Z8 6 to 1 Cow Speed Enc 4 - Components	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 ╋ = क़ क़ +1 =1 ■ ० ० 🔅	•

13. **<R>** in the template view and select **Add New Component > Null Point** from the right click menu.

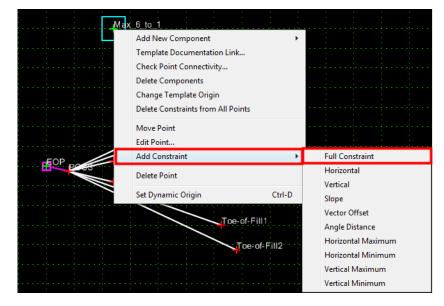
Add New Component	×	Simple
Template Documentation Link		Constrained
Check Point Connectivity		Unconstrained
Delete Components		Null Point
Change Template Origin		End Condition
Delete Constraints from All Points		
Set Dynamic Origin	Ctrl-D	

- 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.

Dynan	nic Setting	IS	
X:	68.80	Step: 0.10	
Y:	-48.50	Step: 0.10	
Point	Name:	Max_6_to_1	•
Point Style:			
1 OIL	Style.	Default	-
	oply Affixes	Default	_
		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.

<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.

20. **<D> OK** to accept the constraints and dismiss the dialog box.



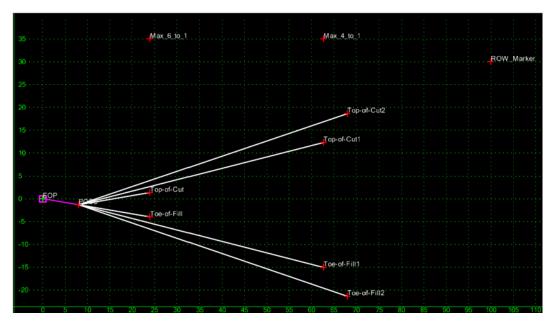
- 21. **<R>** in the template view and select **Add New Component > Null Point** from the right click menu.
- 22. In the *Dynamic Settings* dialog box, key in *Max_4_to_1* in the *Point Name* field.
- 23. In the precision key in field, key in *62.67,35* and press the *Enter* key.
- 24. **<R>** on the *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 O.OO.

Point Properties			×
Name:	Toe-of-Fill	▼ +	Apply
Feature Name Override:	Toe-of-Fill		Close
Surface Feature Style:	D_Toe-of-Fill	•	< Previous
Alternate Surface:			
			Next >
End Condition Propertie			Help
Check for Interception	on Membe Fill-6/		
Place Point at Interce	ception	1	
End Condition is Infin	nite		
Do Not Construct			
Do Not Construct			
Constraints			
Constra		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-Slop	e 🔻
Style Constraint:		T	
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 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*.

📅 Point Prope	rties					X
Name:	Toe-of-	Fill 1	•	+	Appl	y –
Feature Name O	verride: Toe-of-	Fill 1			Clos	•
Surface Feature	Style: D_Toe	-of-Fill	•	•	< Previ	0115
Alternate Sur	face:			-	Next	
- End Condition	Properties				Help	,
Check for Ir	nterception	Membe			<u> </u>	
V Place Point	at Interception	Fill-4/1	I			
End Conditi	on is Infinite					
Do Not Cor	astruct					
Constraints	Constraint 1		6	nstraint	2	
Туре: но	rizontal Minimum	-	Slope	nstraint .	2 •	
	ex_4_to_1	- +	POSS			+
)W_Marker	→ +		ollover	Values	<u> </u>
Value: -0.0	00		-25.00%	6		
Label: To	e-of-Fill-Horiz	•	Toe-of-	Fill-Slop	e 🔻	
Style Const	raint:			-		
Horizon	ntal 💿 Vertica	al ©	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.

H Point Properties			×
Name:	Toe-of-Fill2	→ + Г	Apply
Feature Name Override:	Toe-of-Fill2		Close
Surface Feature Style:	D_Toe-of-Fill		< Previous
Alternate Surface:			Next >
End Condition Propertie Check for Interception Place Point at Interception End Condition is Infinite Do Not Construct	on Memb ception Fill-3/		Help
Constraints	int 1	Constraint 2	
Type: Horizontal		Slope	•
Parent 1: ROW_Man	ker 🔻 🕈	POSS	• +
Value: 0.00		-33.33%	
Label: Toe-of-Fill-H	loriz 👻	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.

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 Pr	operties					—
Name:		LT_Toe+	of-Fill		+	Apply
Feature Nan	ne Override:	LT_Toe+	of-Fill			Close
Surface Fea	ture Style:	D_Toe-o	f-Fill		•	< Previous
Alternate	Surface:				Ŧ	Next >
Check	ition Propertie for Interceptie Point at Interc Indition is Infii Construct	on eption	Membe			Help
Constraint	s Constra	int 1		I	Constraint 2	2
Type:	Horizontal I	Maximum	•	Slop	e	•
Parent 1:	LT_Max_6	_to_1	• +	LT_	POSS	•
Parent 2:	LT_ROW_	Marker	• +		Rollover V	alues
Value:	-0.00			16.6	7%	
Label:	Toe-of-Fill-H	loriz-Mirra	•	Toe	of-Fill-Slope	e-Mim ▼
C Style C	onstraint:				-	
⊚ Ho	orizontal 🤅) Vertical		Both		
Rang	e: 0.00					

63. Select **File > Save** from the *Create Template* menu bar.

64. Close the Create Template dialog box.

This completes the workdone 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 29.2 - 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.

Manage Corrido	rs			
Name: SH 86			Limits Station	Add
Туре:	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
Corridors:				Help
Name	Туре	Source Name	Start Station	Stop Station
				Delete
				1.

- 10. Select **Corridor > Template Drops** from the Roadway Designer menu bar.
- 11. Key in *25* for the *Interval*.
- 12. 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.

M Temp	late Drop	os			- • •
Corridor:	SH 86				Add
Station:	203+80).28		÷	Close
Interval:	25.00			+	Change
Library Te	mplates:			_	
		2345\Design\In	nRoa 🔺 🤅		Сору
	1 - Templ	ates C_Divided_Type			Help
			-4 E		
		Crowned B10		\	/
	\prec HMA	_Crowned_B10-	4 La		
5		_Divided_Type/	_		E
		_Full_Depth_Wi	deni 🚽	1	
•			•	/	
Current Te	emplate D)rops:			
Station	Inter	Template	Revi	Library	
203+80	25.00	HMA_Crowned	IITL	C:\Projec	ts\12345\D
	nize with	Library		Edit	Delete

14. **<D> Add** then **<D> Close** to dismiss the Template Drops dialog box.

- 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.

Froint Controls	
Corridor: SH 86	Add
Point: RT_ROW_Marker +	Station Limits Start: 203+80.28 + Close
Mode Horizontal Vertical Both	Stop: 260+43.16 + Change
Control Type: Alignment	Horizontal Offsets
Horizontal Alignment: RT_ROW -+	Start: 0.00
	Stop: 0.00 +
Use as Secondary Alignment	Vertical Offsets Start: 0.00
Priority: 1	
Horizontal and Vertical Controls:	
En Pri Name Start Stati Stop Sta	ati Mode Type Control
X 1 RT_HMA_U203+80.28 260+43.1	6 Horizontal Alignment RT_ROW
	Delete

- 21. Set the *Point* to LT_ROW_Marker.
- 22. Select LT_ROW for the *Horizontal Alignment*.
- 23. **<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**.
- 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.

0000.						
	🐂 Display References					
0055	Corridor: SH 86	Add				
6655	Display Reference	Close				
	Alignment: RT_ROW ▼ +					
6650 · ·	Surface: 12345 existing groun V	Change				
00000	○ Feature: Centerline Profile	Help				
	◎ Filter:					
6645	Display as Right of Way					
			RT_ROW	line 🔪		
	Station					
6640	Start: 203+80.28 +			÷		· · · · .
	Stop: 260+43.16 +					
6635	Display References:					
	Name Right of Start St	Stop Sta				
6630	Alignment RT_ROW True					
0000						
6625 · ·						
		Delete				
6620 ·		1.				
6 6 15· ·			\mathbf{X}			
		\sim			· · ·	
66 10···				1		
0010						
	120 100 90 60 40 20	: : :	: :	: :	1 1	:
	-120 -100 -80 -60 -40 -20	0 20 40	60 80 1	00 120	140 160) 180

- 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 hekps 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 then show areas that need further consideration.

LAB 30 - 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 depth 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 30.1 - End Conditions that Require Multiple Solutions

- 1. Open MicroStation and InRoads uing the 12345DES_Model-End Cond Mult Sol.dgn file.
- 2. Select **File> Open** from the InRoads menu bar.
- 3. Select the *C:\Projects\12345\Design\InRoads\ 12345DES_Template-End Cond Mult Sol.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.
- 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 *0.10*.

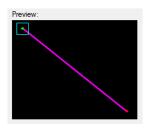
Naming Options Components Seed Name:		OK Cancel Preferences Help
Points Seed Name:		
Apply Affixes Left: Right:	Prefix Suffix LT	
Step Options		
X: 0.10	Y: 0.10 Slop	pe: 0.00%

- 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.

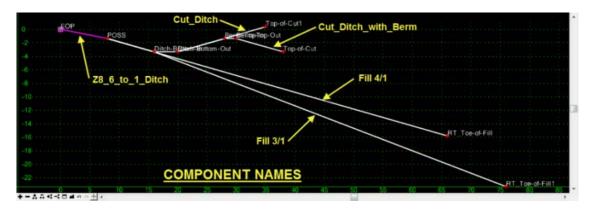


- 16. Expand 4 Components> End Conditions> Cut Slope Components folder.
- 17. **<D>** on the *Cut_Ditch_with_Berm* component.

- 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.

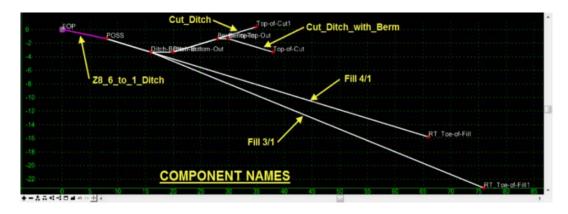


22. **<D> <D>** on the *Cut_Ditch_with_Berm* component.

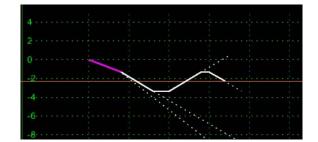
23. Verify that the **Priority** is set to **1**.

Name:		Cut_Dite	ch_with_Bem	ı		+	Apply
Description:						⋪	Close
Style:		D_Top-	of-Cut	•	Locate		< Previous
Parent Compo	onent:			• +	Button		
Display Rules							Next >
						Edit	
Exclude fr	om triangu	ulation				Edit	Help
Exclude fr	-					Edit	Help
End Condition	on Propert		•	▼ Priorit	y:	Edit	Help
End Conditi	on Propert	ties			y: enching Count:	Edit	Help
End Condition Target Type	on Propert	ties Surface				1	Help
End Condition Target Type	on Propert	ties Surface <ac< td=""><td></td><td>Be</td><td>enching Count:</td><td>1</td><td>Help</td></ac<>		Be	enching 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.
- 30. **<D>** the **Test** Button.



31. In the *Test End Conditions* dialog box, **<D> Draw** and notice how end conditions behave.

32. **<D> Close**.

LAB 31 - 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

Lab 31.1 - Create End Conditions to Search a Surface

1. Open MicroStation and InRoads using the *12345DES_Create End Cond Search Surf.dgn* file.

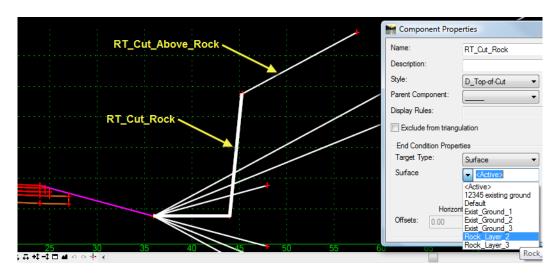
In the MicroStation drawing, notice the three perimeters displayed for each existing ground surface

- 2. Select **File> Open** from the InRoads menu bar.
- 3. Select the following files from *C:\Projects\12345\Design\InRoads* and **<D> Open** them.
 - ♦ 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 *Open* dialog box to close.

Lab 31.2 - 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

- 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
- 8. On the left side of the template, **<D>** on the *LT_Cut_Rock* component.

LT_Cut Above Rock		
10Name: LT_Cut_Rock		+ Apply
8 LT_Cut_Rock Description:		Close
6 Style: D_Top-of-Cut	•	< Previous
4 · · · · Parent Component:	▼ +	Next >
2 Display Rules:		Edit Help
Exclude from triangulation		
End Condition Properties Target Type: Surface	Priority:	
Iarget Type: Surface Surface Surface	Benching Count:	0
· nuck_Laye_2	From Datum:	0.00
-6	Step Elevation:	0.00
Offsets: 0.00 0.00	Rounding Length	0.00
-50 -45 -40 -35 -30 -25 -20 ╪╾╪╤╪╡┙╝╧┊┥	-15 -10	-5 U 7

9. In the *Component Properties* dialog box, Change the Surface to *Rock_Layer_2*, then
 Apply and Close.

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 or

<D> the corridor management button

- 12. In the *Manage Corridors* dialog box:
 - Key in *Centerline* in the Name field.
 - Select Centerline Horizontal Alignment.
 - Select **Centerline V** Vertical Alignment.
- 13. **<D> Add** then **<D> Close**.

Name: Cente	erline		Limits Station		Add
Гуре:	Align	ment 🔻	Start		Close
Horizontal Alig	nment: Cent	erline 👻 🕂	4+00.00	-	Change
		1	Stop:		r
/ertical Alignm	Cent	erline V 🔻			Copy
-	Con	edine V 🔻	706+00.00	+	Copy Copy From
PI Rounding T Corridors:	Tangent: 0.00		706+00.00		Copy From Help
/ertical Alignm Pl Rounding 1 Comidors: Name	Con	erline V			Copy From
PI Rounding T Corridors:	Tangent: 0.00		706+00.00		Copy From Help Station

Lab 31.3 - Define template drop for the corridor

- Select Corridor> Template Drops from the Roadway Designer menu bar or <D> the template drops button
- 2. In the *Template Drops* dialog box:
 - Select *Centerline* for the *Corridor* name.
 - Key in *50* for the *Interval*.
 - Expand *1 Templates* folder in *Library Templates* area.
 - **<D>** on the **12345_HMA_2Lane_Rock** template.

♦ <D> Add.

🐂 Template	e Drops			
	Centerline	+		Add
Interval: 5	i0.00	+		Change
Library Temp	lates:			
	Templates 12345_HM 12345_HM 12345_HM 12345_HM CONC_4La CONC_Div CONC_Ra HMA_Crow	IA_2Lane_Rock IA_zLaneLeft Side IA_4Lane ane_Right-Side_Only ided_TypeA_4Lane mp uned_R10	_Template-Libra	ary.itl
Station	Interval	Template	Revised In	Library
4+00.00	50.00	12345_HMA_2Lane_Rock	ITL	C:\Projects\12345\Design\InRoads\1
•		III		•
Synchroniz	e with Libra	ry		Edit Delete

<D> Close

Lab 31.4 - Define target aliasing

- 3. Select Tools> Target Aliasing from the Roadway Designer menu bar.
- 4. In the *Target Aliasing* dialog box:
 - ♦ Select *<Active Surface>* for the *Target*.
 - Select Surface Exist_Ground_1, Surface Exist_Ground_2 and Surface -Exist_Ground_3 in the Surface or Corridor area.
 - ♦ <D> Add ->.

Target Aliasing		X
Target: Surface or Contidor	→ Aliases:	ОК
Surface - Default Surface - Rock Layer_2 Surface - Rock_Layer_3	Add -> Surface - Exist_Grr Surface - Exist_Grr Move Up Move Down	pund_2
	Use Closest	

- Select *Rock_Layer_2* for the *Target*.
- Select Surface Rock_Layer_2 and Surface Rock_Layer_3 in the Surface or Corridor area.

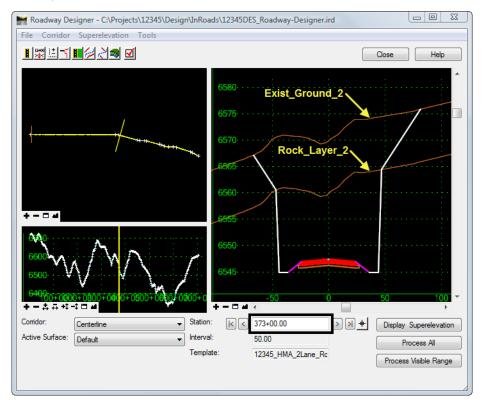
♦ <D> Add ->.

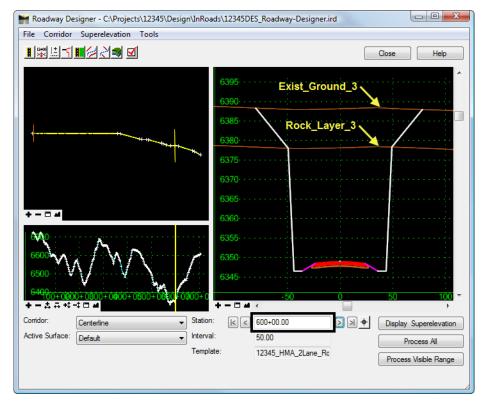
Target Aliasing		23
Target: Surface or Conidor Surface - Default Surface - Exist_Ground_1 Surface - Exist_Ground_2 Surface - Exist_Ground_3	Aliases: Add -> Suface - Rock_Layer_2 Surface - Rock_Layer_3 Move Up Move Down	OK Cancel Help
	Use Closest	

5. **<D>OK**

Lab 31.5 - 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*.





• Key in *600+00* for the *Station*.

Note: Notice the end conditions target the multiple existing ground and rock layer surfaces in both of the above Roadway Designer dialog's cross- section viewer. Both of the station locations shown are in deep rock cut sections in the profile.

Chapter Summary:

- In this lab an existing template was modified to target a rock layer.
- In this lab a corridor was built to use target aliasing to target multiple existing ground and rock layer surfaces along three segments of the project.
- In this lab the corridor was examined at the end condition to determine if templates and target aliasing were working properly.

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 Ave. 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 template 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.
- **16628**.xin This file controls the preferences

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 mainline design surface to include curb returns
- 6. Update corridor
- 7. Create the final intersection Surface

Initial Modeling

Chapter 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 5^{th} Ave., the intersecting street. Using the new vertical alignment and the predefined template for 5^{th} 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 north of 5th Ave to south 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.

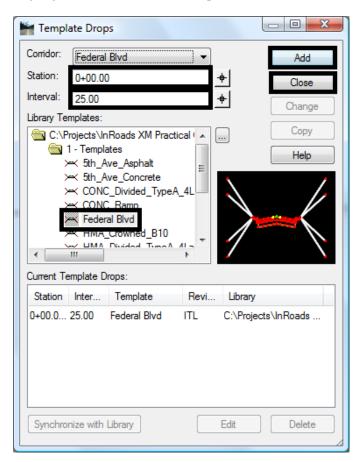
- 3. In the *Manage Corridors* dialog box, key in *Federal Blvd* for the *Name*.
- 4. Set the *Type* to Alignment.
- 5. Select Federal CL as the Horizontal Alignment.
- 6. Select **Federal CL_V** as the *Vertical Alignment*.
- 7. Toggle on **Station** in the *Limits* area.
- 8. Key in *0+00.00* for the *Start* station.
- 9. Key in *3+00.00* for the *Stop* station.
- 10. **<D> Add** to complete the corridor.
- 11. **<D> Close** to dismiss the *Manage Corridors* dialog box.

🖌 Manage Cor	ridors			
Name: Federal Type: Horizontal Alignme Vertical Alignmer PI Rounding Tar Corridors:	Alignment Federal CL		Limits Station Start: 0+00.00 Stop: 3+00.00	Add Close Change Copy Copy From
Name	Туре	Source Name	Start Station	Stop Station
	Alignment			
				Delete

Add Federal Blvd. Template Drops

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.



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 slopewith 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.

🚔 Create Surface			
Name:	Federal Blvd		Apply
Default Preference	Proposed	•	Close
New Surface fo	r Each Comidor		Preferences
V Empty Design S	urface		Help
🔲 Include Null Poi	nts		
Add Exterior Bo	undary - Style:	Exterior Bo	undary 👻
Densify Horizon	tal Curves using	Chord Height T	olerance
Densify Vertical	Curves using Ch	ord Height Tole	rance
🔽 Triangulate			
Create Surface(s) fr	rom:		
			All
Clipping Opt	ions		
Features Duplicate Names Append Add Transvers	Replace	Rename	Modify
Style:	Default	v	
Create Alternate	Surfaces		
Process Visible	Range Only		
Remove Loops			
Display Feature	s in Plan View		

4. Verify the remaining settings match the illustration below.

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 deferintiate between surfaces.

- 10. From the InRoads menu bar, select **Surface > Surface Properties**. This displays the *Surface Properties* dialog box.
- 11. In the Surface Properties dialog box on the Main tab, select the Federal Blvd surface.

Main Advance	ed						
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	d Data Checks	;	Random:	0	0	2	2
Lock Triangu	lation		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
	952622.69	952755.52	Exterior:	53	1	0	53
Easting:			All Points:	396	52	2	398
Easting: Elevation:	5258.15	5263.46					

- 12. Select the *Advanced* tab.
- 13. Select **D_Finished-Grade** for *Cross Sections Symbology*.

	_	I		Help
	_			Help
	•	Use F	eatures Only	
	•	Lock S	Symbologies	
Color		Distance	Symbology	Col
•	9:	0.00	Default	
•	10:	0.00	Default	•
•	11:	0.00	Default	•
•	12:	0.00	Default	•
	13:	0.00	Default	
•	14:	0.00	Default	•
•	15:	0.00	Default	•
		• 9: • 10: • 11: • 12: • 13: • 14:	Color Offset Distance ♥ 9: 0.00 ♥ 10: 0.00 ♥ 11: 0.00 ♥ 12: 0.00 ♥ 13: 0.00 ♥ 14: 0.00	▼ 9: 0.00 Default ▼ 10: 0.00 Default ▼ 11: 0.00 Default ▼ 12: 0.00 Default ▼ 13: 0.00 Default ▼ 14: 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. surfaceare 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.

Create Profile	Set Name: 5th_Ave Direction		Exaggeratio	n		
- Source Include	 Left to Right Right to Left 	1	Vertical: Horizontal:	1.0000		
Controls	Surfaces:			1.0000		
- Grid - 🛅 Details	Object	Name				
ASCII	Default	Default		BYI		
	X 16628_Existing X Federal Blvd	T_Existin D_Finishe	g_Ground sd-Grade	BYL BYL	Al	
		0_11444			None	
			Pro	perties		
		Apply	Prefere		Close	Help

4. On the *General* leaf, enter **5th_Ave** for the *Set Name*.

The 5x Vertical preference is used here so that the slopes are easier to see.

- 5. **<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 be used to 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.
- 6. Toggle on Right to Left in the Direction area.
 - *Important!* Stationing of alignments normally increase from left to right. In this case, the 5th Ave. alignment increases in stationing from Right to Left so the direction of the profile needs to be changed to fit this circumstance.
- 7. **<D> Load** to load the preference and then **<D> Close**.

Name:		Close
10x Vertical 10xVert Drain		Load
1x Vertical		LOad
1xVert_Drain		Save
2x Vertical 2xVert_Drain	=	
5x Vertical		Save As
DXVert_Drain		Delete
Default		
SS Drain	-	Help

- 8. Toggle on Right to Left in the Direction area.
 - *Important!* Stationing of alignments normally increase from left to right. In this case, the 5th Ave. alignment increases in stationing from Right to Left so the direction of the profile needs to be changed to fit this circumstance. The direction should be set after loading a preference; otherwise it will be overwritten by the setting in the preference.
- 9. Toggle on the 16628_Existing and Federal Blvd surfaces.
- 10. **<D>** on the **Controls** leaf.

Create Profile Create Profile Create Profile General Cource Controls Controls Controls Controls Axes Controls Axes Axes Axes Axes Axes Axes Axes Axe	Set Name: 5th_Ave Direction © Left to Right © Right to Left	Exaggerati Vertical: Horizontal:	on 5.0000	
	Surfaces: Object Default 16628-EG-JRY Federal Blvd	Name Default D_Finished-Grade	BYL BYL BYL None	
		Apply Prefer	ences) Close	Help

11. Toggle on **Use** in the *Station* area.

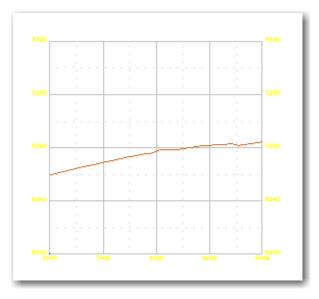
Because this lab is concerned with just the intersection, the vertical alignment (and the profile) is constructed to cover just the area of the intersection.

- 12. Key in *6+00.00* for the *Start* station.
- 13. Key in *9+98.50* for the *Stop* station.
- 14. Toggle on **Apply** in the *Window Clearance* area.

15. Key in *25* for both the Top: and Bottom.

🐂 Create Profile		
Create Profile General Source Include Offsets Controls Limits Axes Grid Details ASCII	Elevation Use High: 1000.00 Low: 0.00 From Cogo Points From Regression Points Station Image: State in the st	Example
	Apply	s) Close Help

- 16. **<D> Apply**.
- 17. <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.
- 18. The profile should look similar to the following:



19. **<D> Close** on the *Create Profile* dialog box to dismiss it.

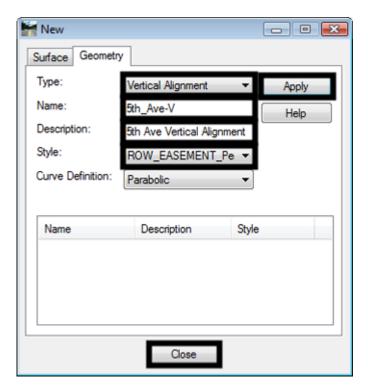
Define the 5th Ave Vertical Alignment

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.



- 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)
- 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.
- 11. In the *Add Vertical PI* dialog box, **<D> Apply**.

🕌 Add Vertica	I PI	- • •
Dynamics		Apply
Station:	0.00	Close
Elevation:	0.00	Help
Grade:	0.00%	

12. In the MicroStation Key in window, key in *se=6+00.00, 5249.77* and press Enter.

🖌 Key-in			×
€+00.00,5249.77 ▼	₽	ন্দ	•

- 13. Key in *se=7+87.03, 5258.98* and press Enter.
- 14. Key in *se=9+57.06, 5262.00* 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.
- 15. Key in *se=9+98.49, 5262.82* and press Enter.
- 16. **<R>** to stop placing PI's.
- 17. In the *Add Vertical PI* dialog box, **<D> Close** to dismiss the dialog box.
- 18. Select Geometry > Vertical Curve Set > Define Curve from the InRoads main menu.
- 19. In the *Define Vertical Curve Set* dialog box, verify that the *Station* is **7+87.03**.
- 20. Verify that the *Elevation* is *5258.98*.

🕌 Define Vertical	Curve Set	- • •
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 Calculate By: Length:	Length of Curve 200.00	Help
Adjacent Curves Update By: Distance:	Length of Curve 0.00	
First < Pr	evious Next > Last	Select

21. In the *Vertical Curve* area, key in *200.00* in the *Length* field.

22. **<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 Corrid	lors			
Name: 5th Ave			Limits	Add
Type: Horizontal Alignmen	our_/we	▼ ▼_+	Station Start: 6+00.00	Close + Change
Vertical Alignment:	5th_Ave-V	-	Stop: 9+98.50	the Copy
PI Rounding Tange	ent: 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
				Delete
				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 tmplate 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 with 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**.

🚟 Template Drops	
Comidor: 5th Ave	- Add
Station: 6+00.00	+ Close
Interval: 25.00	+ Change
Library Templates:	
← 1 - Templates	A Copy Help
CONC_Ramp CONC_Ramp Federal Blvd HMA_Crowned_B10 HMA_Divided_TypeA_4	
Current Template Drops:	
Station Inter Template	Revi Library
6+00.0 25.00 5th_Ave_Asph I	TL C:\Projects\InRoads
Synchronize with Library	Edit 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	ate Drops			- • •					
Corridor:	5th Ave	-]	Add					
Station:	6+00.00		+	Close					
Interval:	25.00		+	Change					
Library Ten	Library Templates:								
	- Template		Сору						
	≺ 5th_Ave ≥ 5th_Ave	-Asphalt Concrete		Help					
	<pre> < CONC_I < Federal < HMA_C < HMA_C < HMA_D < UMA_C </pre>	Blvd owned_B10 ivided_TypeA_4La II Dooth Widenin							
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\InRo					
8+30.00	25.00	5th_Ave_Concrete	ITL	C:\Projects\InRc					
•				4					
Synchron	iize with Lib	orary	Edit	Delete					

14. The template drops should appear in the dialog box as follows:

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 throught the corridor.

- In the *Roadway Designer* dialog box, select Corridor > Point Controls or <D> the button. This displays the *Point Controls* dialog box.
- 2. In the *Point Controls* dialog box, set the *Point* to **RT_HMA_Lift1_Laneline-Top** using the drop down menu or the # Button.
- 3. Toggle on **Horizontal** in the *Mode* area.
- 4. Set the *Control Type* to Alignment.
- 5. 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.
- 6. In the *Station Limits* area, key in *6+00.00* for the *Start* station.
- 7. Key in *8+29.99* for the *Stop* station.
- 8. In the *Horizontal Offsets* area, key in *23.89* for the *Start* and *Stop* offsets.
- 9. **<D> Add**.

Point Controls Comidor: 5th Ave						Add
Point: Mode Horizontal	HMA_Lift1_Lanelin	Stop: 0:40.00				Close Change
Control Type: Horizontal Alignment	Alignment 5th_Ave	 Horizontal Offs Start: 23.89 Stop: 23.89 	ets +			Help
🔲 Use as Secondar	y Alignment	Vertical Offsets Start: 0.00 Stop: 0.00	+ +			
Priority: Horizontal and Vertic	1 al Controls:					
Enabled Priority	Name	Start Station	Stop Station	Mode	Туре	Control
X 1	HMA_Lift1_Lane	line-T 6+00.00	8+49.99	Horizontal	Alignment	5th_Ave
•						4
						Delete

- 10. Advance the Station to 8+30.00 in the Roadway Designer plan view window.
- 11. Set the Point to **RT_Conc_Laneline-Top** using the drop down menu or the *button*.
- 12. In the *Station Limits* area, key in *8+30.00* for the *Start* station.
- 13. Key in *9+98.50* for the *Stop* station.
- 14. In the Horizontal Offsets area, key in 23.89 for the Start and Stop offsets.
- 15. **<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.

- 16. Set the Point to **LT_HMA_Lift1_Laneline-Top**.
- 17. In the *Station Limits* area, key in *6+00.00* for the *Start* station.
- 18. Key in *8+29.99* for the *Stop* station.
- 19. In the Horizontal Offsets area, key in -12.45 for the Start and Stop offsets.

20. **<D> Add**.

- 21. Set the Point to **LT_Conc_Laneline-Top**.
- 22. In the *Station Limits* area, key in *8+30.00* for the *Start* station.
- 23. Key in *9+00.48* for the *Stop* station.
- 24. In the Horizontal Offsets area, key in -12.45 for the Start offset.
- 25. Key in -15.87 for the Stop offset.
- 26. **<D> Add**.
- 27. In the *Station Limits* area, key in *9+00.48* for the *Start* station.
- 28. Key in *9+98.50* for the *Stop* station.
- 29. In the Horizontal Offsets area, key in -15.87 for the Start and Stop offsets.
- 30. **<D> Add**.
- 31. 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.

🐂 Po	int Cont	trols					- • •
Corrido Point: Mod		LT_Conc_Laneline-1 -	Station Lir Start: 9+(Stop: 9+9	0.48	+ +		Add Close Change
	ol Type: ontal Aligr	Alignment	Horizontal Start: 0.0 Stop: 0.0	0	+ +		Help
Priority		condary Alignment	Vertical O Start: 0.0 Stop: 0.0	0	+		
Horizo	intal and	Vertical Controls:					
Ena.	Prior	rity Name	Start Station	Stop Station	Mode	Туре	Control
x x	1 1	LT_HMA_Lift1_Laneline-Top RT_HMA_Lift1_Laneline-Top	6+00.00 6+00.00	8+29.99 8+29.99	Horizontal Horizontal	Alignment Alignment	5th_Ave 5th_Ave
X	1	RT_Conc_Laneline-Top	8+30.00	9+98.50	Horizontal	Alignment	5th_Ave
X	1	LT_Conc_Laneline-Top	8+30.00	9+00.48	Horizontal	Alignment	5th_Ave
X	1	LT_Conc_Laneline-Top	9+00.48	9+98.50	Horizontal	Alignment	5th_Ave
•							4
							Delete

32. **<D> Close**.

Create the Initial 5th Ave. Design Surface

This surface, along with the initial Federal Blvd. surface, we be used to determine the vertical alignments for the curb returns.

- 1. On the InRoads Surfaces tab, verify that **16628_Existing** is the active surface.
- 2. In the *Roadway Designer* dialog box, select **Corridor > Create Surface** or **<D>** the solution. 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.
- 6. The remaining settings should be correct. If not, set them to match the illustration below.

🕌 Create Surface		×
Name: 5th Ave		Apply
Default Preference: Proposed	-	Close
New Surface for Each Corridor		Preferences
Empty Design Surface		Help
Include Null Points		пар
Add Exterior Boundary - Style:	Exterior Bou	indary 🔻
Densify Horizontal Curves using Ch		
Densify Vertical Curves using Chord	Height Toler	ance
✓ Triangulate		
Create Surface(s) from: 5th Ave Federal Blvd Clipping Options		All
Duplicate Names: O Replace	Rename	Modify
Add Transverse Features		
Style: Default	-	
Create Alternate Surfaces		
Process Visible Range Only		
Remove Loops		
Display Features in Plan View		

- 7. **<D> Apply**.
- 8. **<D> Close**.

- 9. Select **File > Save** from the *Roadway Designer* menu bar.
- 10. Close the Roadway Designer dialog box.
- 11. 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**.
- **Chapter 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

Chapter Objectives:

• Create horizontal and vertical geometry for curb retuns.

In this section the two initial design surfaces are used to create a smooth vertical alignment transitions around the corners of the intersection. Horizontal and vertical geometry for each curb return is defined the InRoads *Create Multicenter Curves* tool, offset distances from the two corridor alignments, and the initial design surfaces. 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.

- Multicenter Curve - • • Main Advanced Curve Type: One Center Help Radii Radius 1: 75.00 ቀ Widths Radius 2: Width 1 + 23.89 40.00 **Badius** 3: 120.00 + Width 2 41.00 + Define By Offsets at Shifted PC/PT Offsets at PCC/PCC Length Use Second Set of Values Offset 1: 2.00 Length 1: 0.00 + Offset 2: 2.00 + Length 2: + Example Alignment 1 Width 1 Radius 1 Width 2 Preferences. Close Apply
- 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.

Multicenter Curve		_ 0 🔀
Main Advanced		
Alignment Name: 5th_Ave_ Description: NE Return Style: ALG_OTH		Help
Create Vertical Alignmer First Selected Alignmer Vertical Distance:	nt 0.00	
Gradient: Surface:	-2.00% 5th Ave	
Second Selected Align Vertical Distance: Gradient: Surface:	ment 0.00 -2.00% Federal Blvd ▼	
Length to Extend Ends:	10.00	
Арріу	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

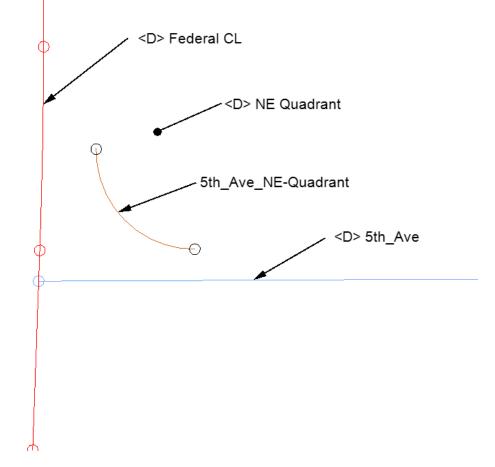
16. **<D>** on the **5th_Ave** alignment in the MicroStation view window. The following message is displayed:

> 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.

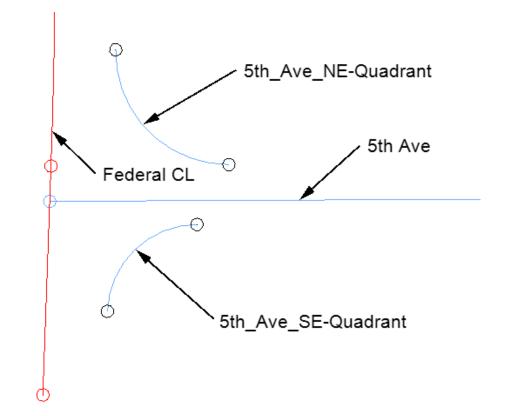


Create Southeast Curb Return

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. 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**.
- 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.



E A Geometry Projects
🖻 🛗 Default
Cogo Buffer
⊡∫ Default
E Federal@5thAve
Cogo Buffer
🚊 🖌 5th_Ave
== 5th_Ave-V.
⊡ / 5th Ave NE-Ouadrant.
5th_Ave_NE-Quadrant.
🖃 🖌 5th_Ave_SE-Quadrant
5th_Ave_SE-Quadrant
- I
Surfaces 📇 Geometry 🖄 Pri∢ ▶

10. Verify that the new alignments show up in the *Geometry* tab of InRoads as shown below.

Chapter 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 needed for the flowline.

Final Design Modeling

Chapter 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 fo 5th Ave.
- Update the 5th Ave surface
- Update Federal Blvd. template drops and add point controls
- Create a complete final combined surface

Create the Finial 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 occuring, The corridor for 5th Ave. is stopped before it reaches the edge of the Federal Blvd. template.

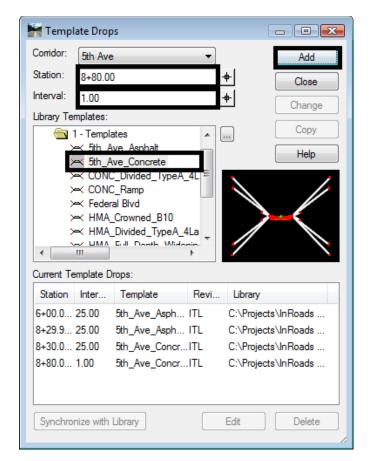
- In the *Roadway Designer* dialog box, select Corridor > Corridor Management or
 <D> the button. This displays the *Manage Corridors* dialog box.
- 2. Highlight **5th Ave** in the Corridors list.
- 3. Toggle on **Station** in the *Limits* area.
- 4. Key in *9+40.00* for the *Stop* station. This station was selected because it od about halfway through the curb returns and befor the edge of Federal Blvd.
- 5. **<D> Change**.
- 6. **<D> Close**.

🚔 Manage Cor	ridors			
Name: 5th Ave			Limits ▼ Station	Add
Туре:	Alignment	-	Start:	Close
Horizontal Alignm	ent: 5th_Ave	• +	6+00.00	+ Change
Vertical Alignmen	t: 5th_Ave-V	•	Stop:	Сору
PI Rounding Tan	igent: 0.00		9+40.00	+ Copy From
Corridors:				Help
Name	Туре	Source Name	Start Station	Stop Station
5th Ave	Alignment	5th_Ave	6+00.00	9+40.00
Federal Blvd	Alignment	Federal CL	0+00.00	3+00.00
L				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 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 retuns.
- 5. In the Library Templates area, expand the **1 Templates** folder.
- 6. Highlight the **5th_Ave_Concrete** template.
- 7. **<D> Add**.
- 8. **<D> Close**.



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. Select **Modeler > Roadway Designer** from the InRoads menu bar.
- 2. In the *Roadway Designer* dialog box, select **Corridor > Point Controls** or **<D>** the <u>button</u>.
- 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**.

🗑 Poi	nt Contro	ls					
Point: Mode The Horizon Vertica	orizontal Type: ntal Alignment I Alignment e as Secon	RT_Conc_La Vertical Alignment Sth_Ave_NE	Both Guadra	Station Limits Start: 8+79.07 Stop: 9+54.04 Horizontal Offse Start: 0.00 Stop: 0.00 Vertical Offsets Start: 0.00 Start: 0.00	+ + +		Add Close Change Help
Ena	. Priority	Name	Start Station	Stop Station	Mode	Туре	Control
x	1	LT_HMA_Lift1	. 6+00.00	8+29.99	Horizontal	Alignment	5th_Ave
х	1	RT_HMA_Lift1	6+00.00	8+29.99	Horizontal	Alignment	5th_Ave
х	1	RT_Conc_Lanel.	8+30.00	9+98.50	Horizontal	Alignment	5th_Ave
х	1	LT_Conc_Laneli.		9+00.48	Horizontal	Alignment	_ 5th_Ave
x	1	RT_Conc_Lanel.	8+79.07	9+54.04	Horizontal	Both	5th_Ave_NE-Qua
x	1	LT_Conc_Laneli.	9+00.48	9+98.50	Horizontal	Alignment	5th_Ave
							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**.

🗑 Poin	nt Control	ls					
Point: Mode	vrizontal	e RT_Conc_La O Vertical Alignment	Both	Station Limits Start: 8+30.00 Stop: 8+79.07 Horizontal Offse	+ +		Add Close Change Help
	tal Alignme		▼ ▼ +	Start: 23.89 Stop: 23.89	+ +		
Use 📃	as Secon	dary Alignment		Vertical Offsets Start: 0.00 Stop: 0.00	+		
Priority: Horizon		1 rtical Controls:					
Ena	Priority	Name	Start Station	Stop Station	Mode	Туре	Control
x	1	LT_HMA_Lift1	. 6+00.00	8+29.99	Horizontal	Alignment	5th_Ave
х	1	RT_HMA_Lift1	6+00.00	8+29.99	Horizontal	Alignment	5th_Ave
Х	1	RT_Conc_Lanel.	8+30.00	9+98.50	Horizontal	Alignment	5th_Ave
Х	1	LT_Conc_Laneli.	8+30.00	9+00.48	Horizontal	Alignment	5th_Ave
х	1	RT_Conc_Lanel.	8+79.07	9+54.04	Both	Alignment	5th_Ave_NE-Qua
x	1	LT_Conc_Laneli.	9+00.48	9+98.50	Horizontal	Alignment	5th_Ave
							Delete

- 12. Set the Point to LT_Conc_Laneline-Top using the drop down menu or the + button.
- 13. Toggle on **Both** in the *Mode* area.
- 14. Set the *Control Type* to Alignment.
- 15. Set the *Horizontal Alignment* to 5th_Ave_SE-Quadrant.
- 16. Toggle on **Use as Secondary Alignment**. This is so that the curb component is placed perpendicular to the curb return alignment.
- 17. In the Horizontal Offsets area, key in O for the Start and Stop offsets.

18. **<D> Add**.

Foint (Controls					- • ×
Corridor: Point: Mode	LT_Conc_Laneline-	• + Si	tation Limits art: 9+00.48 op: 9+40.00	+ +		Add Close Change Help
Vertical Ali	Alignment: 5th_Ave_SE-Quadra	v v v v v si v si v si v si v si v si v si v si v v si v v si v v v v v v v v v v v v v	orizontal Offsets art: 0.00 op: 0.00 entical Offsets art: 0.00 op: 0.00	+ + +		Thep
Priority: Horizontal	1 and Vertical Controls:					
Horizontal		Start Station	n Stop Station	Mode	Туре	Control
Horizontal	and Vertical Controls:	Start Station 6+00.00	h Stop Station 8+29.99	Mode Horizontal	Type Alignment	Control 5th_Ave
Horizontal Priority	and Vertical Controls: y Name					
Horizontal Priority 1	and Vertical Controls: y Name LT_HMA_Lift1_Laneline-Top	6+00.00	8+29.99	Horizontal	Alignment	5th_Ave
Horizontal Priority 1 1	and Vertical Controls: y Name LT_HMA_Lift1_Laneline-Top RT_HMA_Lift1_Laneline-Top	6+00.00 6+00.00	8+29.99 8+29.99	Horizontal Horizontal	Alignment Alignment	5th_Ave 5th_Ave
Horizontal Priority 1 1 1	and Vertical Controls: y Name LT_HMA_Lift1_Laneline-Top RT_HMA_Lift1_Laneline-Top LT_Conc_Laneline-Top	6+00.00 6+00.00 8+30.00	8+29.99 8+29.99 9+00.48	Horizontal Horizontal Horizontal	Alignment Alignment Alignment	5th_Ave 5th_Ave 5th_Ave
Horizontal Priority 1 1 1 1 1 1 1 1	and Vertical Controls: y Name LT_HMA_Lift1_Laneline-Top RT_HMA_Lift1_Laneline-Top LT_Conc_Laneline-Top RT_Conc_Laneline-Top	6+00.00 6+00.00 8+30.00 8+30.00	8+29.99 8+29.99 9+00.48 8+79.07	Horizontal Horizontal Horizontal Horizontal	Alignment Alignment Alignment Alignment	5th_Ave 5th_Ave 5th_Ave 5th_Ave
Horizontal Priority 1 1 1 1 1 1	and Vertical Controls: y Name LT_HMA_Lift1_Laneline-Top RT_HMA_Lift1_Laneline-Top LT_Conc_Laneline-Top RT_Conc_Laneline-Top RT_Conc_Laneline-Top	6+00.00 6+00.00 8+30.00 8+30.00 8+79.07	8+29.99 8+29.99 9+00.48 8+79.07 9+40.00	Horizontal Horizontal Horizontal Horizontal Both	Alignment Alignment Alignment Alignment Alignment	5th_Ave 5th_Ave 5th_Ave 5th_Ave 5th_Ave 5th_Ave_NE-C
Horizontal Priority 1 1 1 1 1 1 1	and Vertical Controls: Name LT_HMA_Lift1_Laneline-Top RT_HMA_Lift1_Laneline-Top LT_Conc_Laneline-Top RT_Conc_Laneline-Top LT_Conc_Laneline-Top	6+00.00 6+00.00 8+30.00 8+30.00 8+30.00 8+79.07 9+00.48	8+29.99 8+29.99 9+00.48 8+79.07 9+40.00 9+40.00	Horizontal Horizontal Horizontal Horizontal Both Both	Alignment Alignment Alignment Alignment Alignment	5th_Ave 5th_Ave 5th_Ave 5th_Ave 5th_Ave 5th_Ave_NE-C 5th_Ave_SE-C

19. 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.

20. **<D> Delete**.

Point Controls					- • ×
Corridor: 5th Ave Point: LT_Conc_Laneline- Mode Mode Horizontal Overtical Obt	• + Start:	n Limits 9+00.48 9+98.50	+ +		Add Close Change
Control Type: Alignment Horizontal Alignment: Sth_Ave	+ Horizo Start: Stop:		+ +		Help
Use as Secondary Alignment	Vertic: Start: Stop:		-+ -+		
Priority: 1 Horizontal and Vertical Controls:					
. Priority Name	Start Station	Stop Station	Mode	Туре	Control
1 LT_HMA_Lift1_Laneline-Top	6+00.00	8+29.99	Horizontal	Alignment	5th_Ave
1 RT_HMA_Lift1_Laneline-Top	6+00.00	8+29.99	Horizontal	Alignment	5th_Ave
1 LT_Conc_Laneline-Top	8+30.00	9+00.48	Horizontal	Alignment	5th_Ave
1 RT_Conc_Laneline-Top	8+30.00	8+79.07	Horizontal	Alignment	5th_Ave
1 RT_Conc_Laneline-Top	8+79.07	9+40.00	Both	Alignment	5th_Ave_NE-G
1 LT_Conc_Laneline-Top	9+00.48	9+40.00	Both	Alignment	5th_Ave_SE-G
1 LT_Conc_Laneline-Top	9+00.48	9+98.50	Horizontal	Alignment	5th_Ave
•					•
					Delete //

📲 Point C						
Corridor: Point: Mode () Horizo	LT_Curb-Back-Top	€ + Start	on Limits 9+00.48 9+98.50	+ +		Add Close Change
Control Typ Horizontal	Alignment Alignment Sth_Ave	▼ + Start	contal Offsets 0.00 0.00	_ + _		Help
Use as Secondary Alignment Vertical Offsets Start: 0.00 + Stop: 0.00 +						
^p riority: Horizontal	1 and Vertical Controls:					
. Priority	/ Name	Start Station	Stop Station	Mode	Туре	Control
1	LT_HMA_Lift1_Laneline-Top	6+00.00	8+29.99	Horizontal	Alignment	5th_Ave
1	RT_HMA_Lift1_Laneline-Top	6+00.00	8+29.99	Horizontal	Alignment	5th_Ave
1	LT_Conc_Laneline-Top	8+30.00	9+00.48	Horizontal	Alignment	5th_Ave
1	RT_Conc_Laneline-Top	8+30.00	8+79.07	Horizontal	Alignment	5th_Ave
1	RT_Conc_Laneline-Top	8+79.07	9+40.00	Both	Alignment	5th_Ave_NE-G
1	LT_Conc_Laneline-Top	9+00.48	9+40.00	Both	Alignment	5th_Ave_SE-G
•						•
						Delete

The illustration below shows the list of point controls used on the Final 5th Ave. corridor.

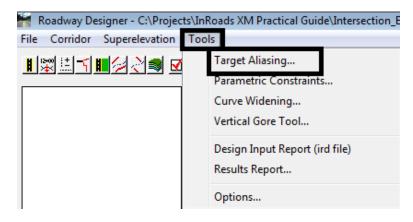
- 21. Close the Point Control dialog box.
- 22. Select **File > Save** from the *Roadway Designer* menu bar.

Create the Final 5th Ave. Design Surface

The 5th Ave. surface is remodeled to incorperate 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**.



- 2. 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		X
Target: <a>Active Surface>	•	ОК
Surface or Corridor	Aliases:	Cancel
Comidor - Federal Blvd Surface - 16628_Existing Surface - Default Surface - Federal Blvd :	Add -> <- Remove Move Up Move Down Use Closest	Help

- 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
New Surface for Each Corridor	Preferences
Empty Design Surface	Help
Include Null Points	
Add Exterior Boundary - Style: Exterior Bo	undary 🔻
Densify Horizontal Curves using Chord Height T	olerance
Densify Vertical Curves using Chord Height Tole	erance
✓ Triangulate	
Create Surface(s) from: 5th Ave Federal Bivo Clipping Options	All None
Features	
Duplicate Names: Append Replace Rename Add Transverse Features Style: DTM_Transverse •	Modify
Create Alternate Surfaces	
Process Visible Range Only	
Remove Loops	
Display Features in Plan View	

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 remainig parts of the curb returns and the intersection driving surface.

• Add template drops to tie into 5th Ave corridor

• Add point controls

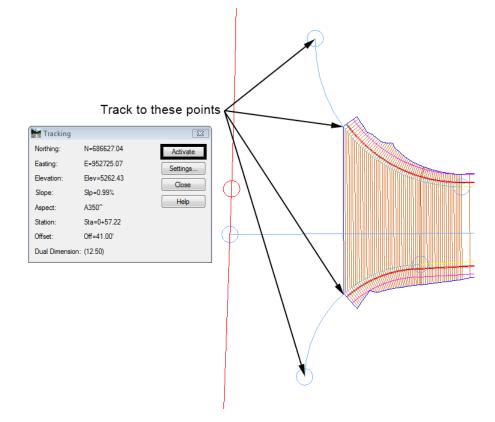
Collect Station Information for Template Drops

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 Geometry.
- 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.

Rentley InRoads XM Edition				
XS_Exluded from Triangulation	• 🛅 📚 🤞 🔪 🎽 💻 🚽	<u>ليل</u>		
<u>File S</u> urface <u>G</u> eometry <u>D</u> rainage	<u>E</u> valuation <u>M</u> odeler Dr <u>a</u> fting <u>Q</u> u	antities <u>T</u> ools <u>H</u> elp		
🗠 🗛 😬 🖫 🔛 🗟 🗠 🗒				
	Name	Description	By Whom	Las
Geometry Projects	🖌 5th_Ave	SH88 and 5th i	cferree	5/4
Default	✓ 5th_Ave_NE-Quadrant	NE Return for	cferree	5/5
Federal@5thAve	New		cferree	5/5
tan € 5th Ave			chengh	11/
5th_Ave_NE-Quac	Save		cferree	4/3
5th_Ave_SE-Quad	Save As			
🗄 🖌 Federal CL	Set Active			
🔚 Geometry 🔊 Preference	Сору			Þ
Toggles the Report Lock	Close			.đ
	Empty			
Г	View All Horizontals		1	
	View All Turnouts			
	View All Rails, Joints and Distar	ace 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. **<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 arond 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*.

🕌 Templ	ate Drops			- • •		
Corridor:	Federal Blv	ď	•	Add		
Station:	0+00.00		+	Close		
Interval:	50.00		+	Change		
Library Ter	nplates:					
	- Templates		·	Сору		
	≺5th_Ave_ ≺5th Ave			Help		
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 .		
1						
•						

16. **<D> Add**. The list of template drops is illustrated below.

17. **<D> Close**.

Federal Blvd. Point Controls for Curb Returns

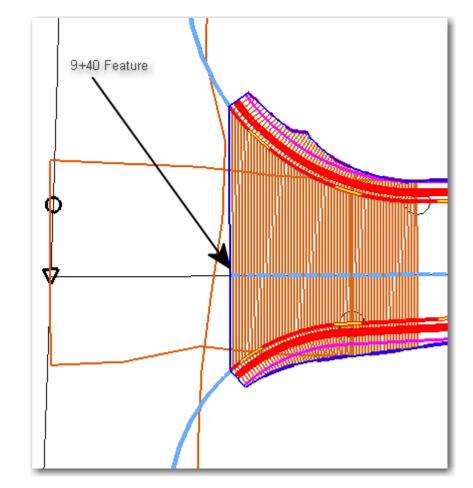
All four of the stations located above are used for point controls. The first and second stations create a control for the SE curb return. The second and third stations create a point control that follows the last transverse feature in the 5th Ave. surface. The third and fourth stations create a control for the NE curb return.

- 1. In the *Roadway Designer* dialog box, select **Corridor > Point Controls** or **<D>** the <u>t</u> button.
- 2. Set the Point to **RT_Conc_Laneline-Top6** using the drop down menu or the + button.
- 3. Toggle on **Both** in the *Mode* area.
- 4. Set the *Control Type* to Alignment.
- 5. Set the *Horizontal Alignment* to **5th_Ave_SE-Quadrant**.
- 6. Toggle on Use as Secondary Alignment.

- 7. In the Station Limits area, the Start station is set by the specified alignment. Key in 1+00.73 for the Stop station
- 8. **<D> Add**.

Foint Controls					- • •
Corridor: Federal Blvd Point: RT_Conc_Laneline- • Mode Horizontal Vertical Btth Control Type: Alignment • Horizontal Alignment: Sth_Ave_SE-Quadra • Vertical Alignment: Sth_Ave_SE-Quadra • Vertical Alignment: Sth_Ave_SE-Quadra • Priority: 1	Station Li Start: 0+ Stop: 1+ Horizonta Start: 0.0 Stop: 0.0 Vertical O Stop: 0.0 Stop: 0.0	57.22 00.73 I Offsets 10 00 IO IO IO	+ + + +		Add Close Change Help
Horizontal and Vertical Controls: Ena Priority Name	Start Station	Stop Station	Mode	Туре	Control
X 1 RT_Conc_Laneline-Top6	0+57.22	1+00.73	Both	Alignment	5th_Ave_S
•	m				Delete

- 9. Set the *Control Type* to **Feature**.
- 10. Select **5th Ave** for the *Surface*.



11. Select **5th Ave-9+40.00** for the *Feature*.

- 12. In the *Station Limits* area, key in *1+00.73* for the *Start* station.
- 13. Key in *1+86.15* for the *Stop* station.

14. **<D> Add**.

🕌 Point Contro	ls					- • •
Conidor: Federa Point: Mode O Horizontal	al Blvd 		mits 00.73 86.15	+ +		Add Close Change
Control Type: Surface: Feature: Vuse as Secon Priority: Horizontal and Ve	1	Horizonta Start: 0.(Stop: 0.0 Vertical C Start: 0.(Stop: 0.0	00 00 0ffsets 00	+ + +		Help
Ena Priority	Name	Start Station	Stop Station	Mode	Туре	Control
X 1 X 1	RT_Conc_Laneline-Top6 RT_Conc_Laneline-Top6	0+57.22 1+00.73	1+00.73 1+86.15	Both Both	Alignment Feature	5th_Ave_S 5th Ave:5th
•						•

- 15. Set the *Control Type* to Alignment.
- 16. Set the *Horizontal Alignment* to 5th_Ave_NE-Quadrant.

🗑 Point C	ontrols						, • 🔀
Corridor: Point: Mode O Horizo		Ivd RT_Conc_Laneline-	+ Station Lim Start: 1+80 Stop: 2+30	G.15	+		Add Close Change
Control Typ Horizontal / Vertical Alig	Alignment	Alignment 5th_Ave_NE-Quadra 5th_Ave_NE-Quadra	Horizontal Start: 0.00 Stop: 0.00		+ +		Help
V Use as	Secondar	ry Alignment	Vertical Off Start: 0.00		+		
			Stop: 0.00		+		
		1 al Controls:			+		
Horizontal a	Priority	al Controls: Name	Start Station	Stop Station	+ Mode	Туре	Control
Horizontal a Enabled X	Priority 1	al Controls: Name RT_Conc_Laneline-Top6	Start Station 0+57.22	Stop Station 1+00.73	Mode Both	Alignment	5th_Ave
Horizontal a Enabled X X	Priority 1 1	al Controls: Name RT_Conc_Laneline-Top6 RT_Conc_Laneline-Top6	Start Station 0+57.22 1+00.73	Stop Station 1+00.73 1+86.15	Mode Both Both	Alignment Feature	5th_Ave 5th Ave:
Horizontal a Enabled X	Priority 1	al Controls: Name RT_Conc_Laneline-Top6	Start Station 0+57.22 1+00.73 1+86.15	Stop Station 1+00.73	Mode Both	Alignment	5th_Ave
Horizontal a Enabled X X	Priority 1 1	al Controls: Name RT_Conc_Laneline-Top6 RT_Conc_Laneline-Top6	Start Station 0+57.22 1+00.73	Stop Station 1+00.73 1+86.15	Mode Both Both	Alignment Feature	5th_Ave 5th Ave:

17. In the *Station Limits* area, key in *1+86.15* for the *Start* station. The *Stop* station is set by the selected alignment.

18. **<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.

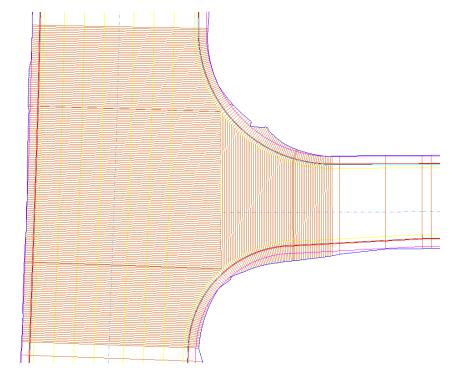
ptions		X
Clipping Corridor	Clipping Option	ОК
5th Ave	Clip All	Cancel
		Help
		Þ.
	Clipping Corridor 5th Ave	Clipping Corridor Clipping Option 5th Ave Clip All

- 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.

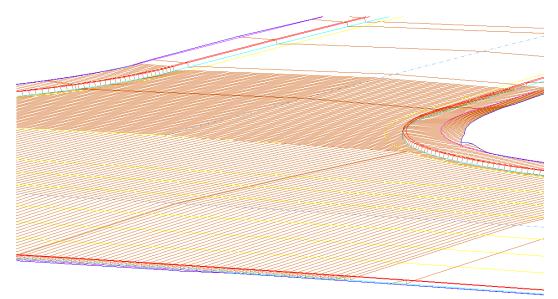
Kreate Surface	×
Name: Federal and 5th Intersection	Apply
Default Preference: Proposed -	Close
New Surface for Each Corridor	Preferences
Empty Design Surface	Help
Include Null Points	
Add Exterior Boundary - Style: Exterior Boundary	undary 🔻
Densify Horizontal Curves using Chord Height To	lerance
Densify Vertical Curves using Chord Height Toler	rance
Triangulate	
Create Surface(s) from:	
5th Ave Federal Blvd	
	All
	None
Clipping Options	
Features Duplicate Names;	
Append	Modify
Add Transverse Features	
Style: DTM_Transverse	
Create Alternate Surfaces	
Process Visible Range Only	
Remove Loops	
Display Features in Plan View	

- 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 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 Bivd. 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 6th 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 **l** button. This displays the *Manage Corridors* dialog box.

- 3. In the *Manage Corridors* dialog box, key in *SE Ramp* for the *Name*.
- 4. Set the *Type* to Alignment.
- 5. Select **SE Ramp** as the *Horizontal Alignment*.
- 6. Select **SE Ramp_V** as the *Vertical Alignment*.
- 7. **<D> Add** to complete the corridor.

Manage C Name: SE Ra Type: Horizontal Align Vertical Alignm PI Rounding Ti	Alignment Minnent: SE Ramp ent: SE Ramp_	▼ ▼ V ▼	Limits Station Start: 0+00.00 Stop: 16+52.23	
Corridors: Name SE Ramp	Type Alignment	Source Name SE Ramp	Start Station 0+00.00	Stop Station 16+52.23
				Delete

8. **<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**.

Template Drops									
Corridor:	SE Ramp		-		Add				
Station:	0+00.00			+	Close				
Interval:	25.00			+	Change				
Library Templates:									
Image: Conc_Divided_TypeA_4L Image: Copy Image: Conc_Off-Ramp Image: Copy Image: Conc_Ramp Image: Conc_Ramp Image: Conc_Ramp Image: Conconc_Ramp Image: Conc_Ramp									
Current Te	mplate Drop	15.	۲						
Station		emplate	Revi	Library					
0+00.0	25.00 SE	E_Ramp	ITL	C:\Project	s∖lnRoads				
Synchror	nize with Lib	rary		Edit	Delete //				

Create the Initial SE Ramp Design Surface

- In the *Roadway Designer* dialog box, select Corridor > Create Surface or <D> the solution. This displays the *Create Surface* dialog box.
- 2. Key in *SE Ramp* for the *Name*.
- 3. Select **Proposed** for the *Default Preference*.
- 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: SE Ramp	Apply
Default Preference: Proposed	▼ Close
New Surface for Each Comidor	Preferences
Empty Design Surface	Help
Include Null Points	Help
Add Exterior Boundary - Style:	r Boundary 👻
Densify Horizontal Curves using Chord Heigh)
Densify Vertical Curves using Chord Height	Tolerance
Triangulate	
Create Surface(s) from:	
SE Ramp	
	Al
	None
Clipping Options	
Features	
Duplicate Names: O Replace Rename	e 🔘 Modify
Add Transverse Features	
Style: Default	-
Create Alternate Surfaces	
Process Visible Range Only	
Remove Loops	
Display Features in Plan View	

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. Set the *Type* to Alignment.
- 4. Select Bryant Ramp as the Horizontal Alignment.
- 5. Select Bryant Ramp_V as the *Vertical Alignment*.
- 6. **<D> Add** to complete the corridor.
- 7. **<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			X
Name:	SE Ramp		Apply
Default Preference	Proposed	•	Close
New Surface fo	r Each Comidor		Preferences
🔽 Empty Design S	urface		Help
Include Null Poi	nts		
Add Exterior Bo	undary - Style:	Exterior Bou	undary 🔻
Densify Horizon	tal Curves using	Chord Height To	lerance
Densify Vertical	Curves using Cl	nord Height Tole	ance
Triangulate			
Bryant Ramp SE Ramp Clipping Opt	ions		All None
	Replace	Rename	O Modify
Add Transvers	se Features		
Style:	Default		
Create Alternate	Surfaces		
Process Visible	Range Only		
Remove Loops			
Display Feature	s in Plan View		

- 7. **<D> File > Save** from the Roadway Designer menu bar.
- 8. In the *Save As* dialog box, navigate to the ??? 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

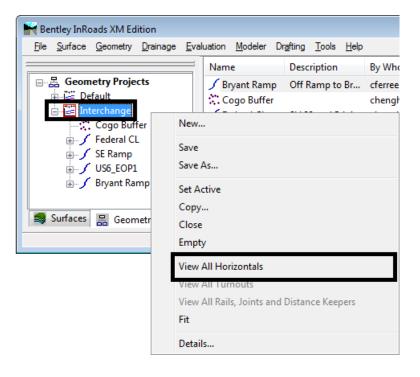
The relevant horizontal alignments are displayed in the dgn file give a reference location when determining the key stations.

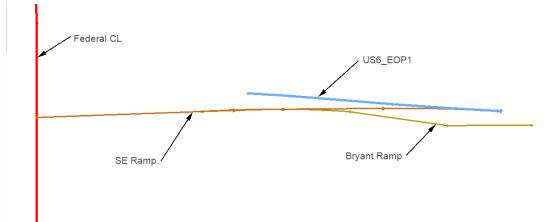
Section Objectives:

• 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 managible number.

1. On the InRoads Locks toolbar, set the *Feature Filter* to XS_Excluded from Triangulation.

<u>File Surface G</u> eometry <u>D</u> rainage <u>Eva</u>		<u>a</u> fting <u>T</u> ools <u>H</u> elp			
XS_Extuded from Triangulation 🛛 👻	🗟 💊 🏏	🖬 🛶 🕹 📳			
	Surface Name	Description	File Name	By Whom	Last Revis
	📑 Bryant Ramp	Created from r	C:\Projects\In	cferree	5/8/2009 1
🔒 🧠 🥮 Default	🤜 Default			cferree	5/11/2009
Existing_Ground	🗢 Existing_Gro		C:\Projects\In	jyourgules	2/19/2009
🖶 🥮 SE Ramp 🛓 🛃 Bryant Ramp	🥞 SE Ramp	Created from r	C:\Projects\In	cferree	5/8/2009
Surfaces 🖁 Geometry 🕢	•				

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 highlight the SE Ramp surface.
- 5. Toggle on the **Features** check box.
- 6. In the Features list, select the features with **EOP** or *POSS* in the name.
- 7. **<D> Apply**.

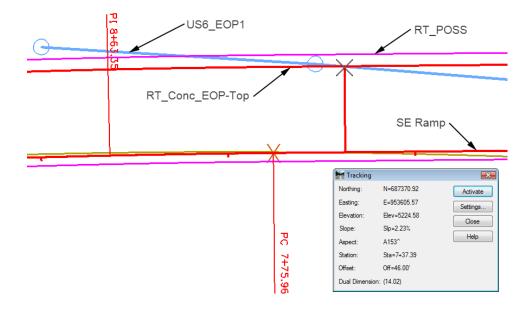
🕌 Update 3-I	D/Plan Surface Display		- • 💌
Mode:	💿 Display On 🛛 🔘 Dis	play Off	Apply
Fence Mode:	Ignore 🔻	-	Close
Surfaces:			Filter
Name		Description	
Default		E	Edit Style
Existing Group	nd	Created from roadway de	Help
Bryant Ramp		Created from roadway de	
Perimeter	Surface Elevations	Color-Coded Aspects	1
Triangles	Slope Vectors	Color-Coded Elevations	
Contours	Profiled Model	Color-Coded Slopes	
Features:	Gridded Model		
Name		Style	<u>+</u>
Exterior Bound	lary	Exterior Boundary	
LT_Conc_EO		D_EOP	
LT_Curb-Back LT_Curb-Flow		D_CONC_Sw	
LT_Curb-Flow	line	D_CURB_FL_Rt D_CURB_Top	
LT POSS		D_POSS	
177 (0)	111	* "O' T O	
		· · · · · · · · · · · · · · · · · · ·]

8. **<D> Close**.

After the features are displayed, tracking is used to determine the key stations for the SE Ramp along the 6th Ave. edge of pavement.

- 9. Using the MicroStation view controls, zoom in on the left end of the 6th Ave alignment.
- 10. Set the **SE Ramp** alignment active.
- 11. From the InRoads menu bar, select **Tools > Tracking > Tracking**.
- 12. **<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



13. **<T>** where the feature **RT_POSS** crosses the **US6_EOP1** alignment and note the station.

- RT_Conc_EOP-Top and US6_EOP1 7+37.39
- ♦ RT_POSS and US6_EOP1 8+23.46

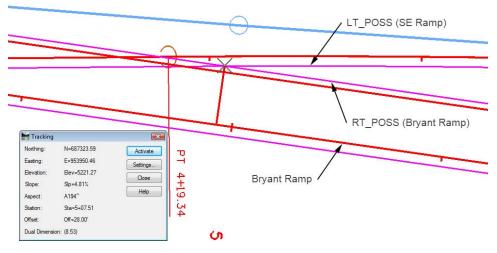
14. **<D> Close** on the *Tracking* dialog box.

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 highlight 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 *Bryant 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 *Bryant 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 Romp** template and select **Copy** from the menu.

Template Library:		Current Template	
C:\Projects\InRoads XM	Practical (Name:	
Point Name List		Description:	
☐ 1 - Templates			
HMA Crowned	B10		
HMA_Divided_T	ypeA_4Lar		
HMA_Full_Depth			
≻ HMA Urban_4La	ane		
2 - Sections - Pa	Set Activ	•	
3 - Sections - Er	Jer Activ	c	
4 - Components	Cut		Ctrl-X
	Сору		Ctrl-C
	Paste		Ctrl-V
	Delete		Del
	Rename		F2
	Templat	e Documentation Link	
	Display		

4. **<R>** on the **1 – Template** folder and select **Paste**.

Template Library: C:\Projects\InRoads XM Practical ([★]		Current Templ: Name: Description:	
→ Bryant Rar → CONC Div	New	۲	
CONC_Ra	Cut	Ctrl-X	
HMA_Crov	- Copy		
HMA_Divid	Paste	Ctrl-V	
→ HMA_Urba → SE_Ramp 2 - Sections - F	Delete Rename	Del 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.

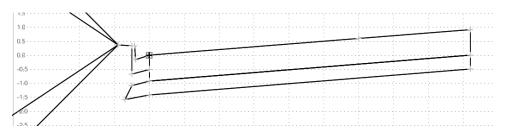
- 2. Zoom in on the right side of the template.
- 3. **<R>** in the Template view and select **Delete Components** from the menu.
- 4. Drag a line through the **RT_C/G_Type2-IIB** and the **RT_Benching** components.

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.

	LT_ABC_Hinge-Top	
	BC FOP-Ton	
	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	×
	Delete Point	
	Delete From Components (Make Null)	
5 4 3	Set Dynamic Origin Ctrl-D)

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 seperates 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_	Toe-of-Fill 🔹
Target Type:	Alignment XYZ 🔹 🔻	Priority:	1
Horizontal Alignment:	US6_EOP1 -	Benching Cou	int: 0
Vertical Alignment:	US6_EOP1 -	From Datur	n: 0.00
Horizon	tal Vertical	Step Elevation	n: 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.

	↓	
Conc Laneline Top	 B7 Conc_EOP-Top	
Conc_Lanenne-Top	RT_ABC_Hinge-Tan RT_SubBase_Hin	:
	 RT_SubBase Stress X: 56.10 Step: 0.10	
	Y: 3.50 Step: 0.10	ī
	Check for Interception	
	Place Point at Interception	
	End Condition is Infinite Do Not Construct	
	Point Name: Toe-of-Fill	Ţ
	Point Style: D_Toe-of-Fill	•
	Apply Affixes	
	hs= • 2,0.25	
	 Set Dynamic Origin	

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 seperate template is used here because using target aliasing and clipping options would resuld in the loss of the ABC component in the clipped template.

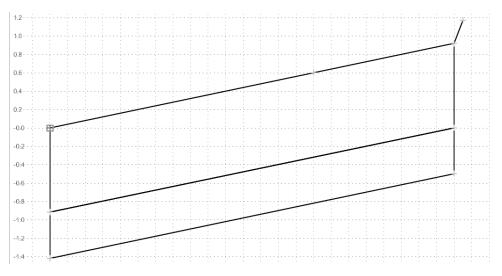
Section Objectives:

- 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 components an points on the left side of the template. The illustration below shows the completed template.



Bryant Ramp at the SE Ramp

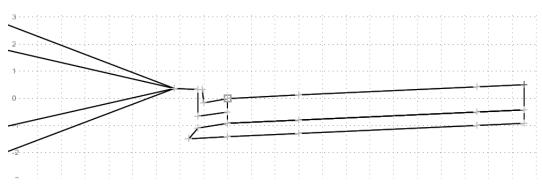
A copy of the Bryant Ramp template is also modified to work in the merger area.

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 teh 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**.

🚼 Templ	ate Drops			
Corridor:	SE Ramp		•	Add
Station:	0+00.00		+	Close
Interval:	25.00		+	Change
Library Ter				Сору
	_	ned_B10 ed_TypeA_4La	^	Help
	HMA_Full_L HMA_Litbar HMA_Litbar SE Ramp at SE Ramp at SE_Ramp SE_Ramp mplate Drops:	t 6th Ave t Bryant		
Station	Inter	Template	Revi	Library
0+00.00	25.00	SE_Ramp	ITL	C:\Projects\InRoads
<				
Synchro	nize with Library	/	Edit	Delete

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*.
- 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**.

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**.
- 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.

🐂 Templ	ate Drop	s		
Corridor:	SE Ram	p 🔻		Add
Station:	8+23.47	,	+	Close
Interval:	25.00		+	
Library Ter	mplates:			Change
	← CONC ← HMA_ ← HMA_ ← HMA_ ← HMA_ ← SE Ra ← SE_Ra ← SE_Ra	Crowned_B10 Divided_TypeA_4La Full_Depth_Widenin: Urban_4Lane mp at Bryant amp		Copy Help
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\InRo:
•				4
Synchron	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. Select **RT_Conc_EOP-Top** for the *Point*.
- 3. Toggle on **Both** for the *Mode*.
- 4. Set the *Control Type* to Alignment.
- 5. Select **US6_EOP1** for the *Horizontal Alignment*. The vertical alignment is automatically set.
- 6. In the *Station Limits* area, leave the *Start* at *0+00.00* and key in *8+23.46* for the *Stop* station.

7. **<D> Add** and **Close**.

Roint Controls	
Corridor: SE Ramp Point: RT_Conc_EOP-Top Mode Horizontal Vertical Both Control Type: Alignment Horizontal Alignment: US6_EOP1 Vertical Alignment: US6_EOP1 Use as Secondary Alignment	Station Limits Add Stat: 0+00.00 + Stop: 8+23.46 + Horizontal Offsets Change Horizontal Offsets + Stat: 0.00 + Stop: 0.00 + Vertical Offsets * Stat: 0.00 + Stop: 0.00 +
Priority: 1	<u></u>
Horizontal and Vertical Controls:	
En Pri Name Start Stati Stop Sta	ati Mode Type Control
X 1 RT_Conc_E0+00.00 8+23.46	Both Alignment US6_EOP1:
	Delete

Modify Side Slopes for SE Ramp

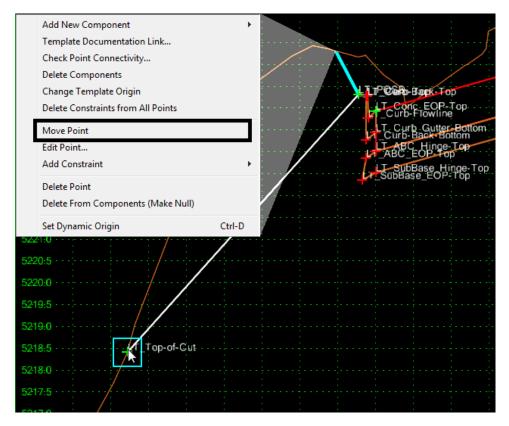
There is a area in this corridor where the computed end condition created an undesirable result. Because this area only covers two template drops, it is corrected by modifying the templates at those stations. If this area were larger, an end condition override or a new template should be used.

- 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**.

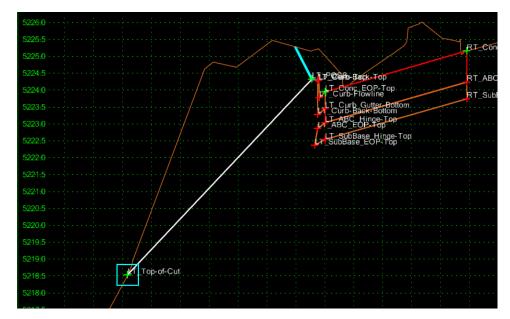
5. Key in **10.00%** for the slope **Step**.

Dynamic Settings	
X: 85.42 Step: 0.00	
Slope: 14751.28% Step: 10.00%	
Point Name:	•
Point Style:	•
Apply Affixes	
hs=	
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 as 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.

🎢 Manage Cor	ridors			
Name: Bryant R	lamp		imits V Station	Add
Type: Horizontal Alignm Vertical Alignmen PI Rounding Tan Corridors:	t: Bryant Raam		Start: 0+00.00 Stop: 8+85.00	Close Change Copy Copy From Help
Name	Туре	Source Name	Start Station	Stop Station
SE Ramp	Alignment	SE Ramp	0+00.00	16+52.23
Bryant Ramp	Alignment	Bryant Ramp	0+00.00	8+85.00

6. **<D> Change** and **Close**.

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.

📷 Templat	te Drops				• 🔀
Comidor:	Bryant Ramp	, -			Add
Station:	5+02.77		+		Close
Interval:	25.00		+		Change
Library Tem	plates:				change
	CONC_Div CONC_Off CONC_Ra CONC_Ra HMA_Crov	np at SE Ramp rided_TypeA_4L -Ramp mp			Copy Help
Current Tem Station	plate Drops: 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
•					•
Synchronia	ze with Libra	ry 🗌	Edit		Delete

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. Select **RT_Conc_EOP-Top** for the *Point*.
- 3. Toggle on **Both** for the *Mode*.
- 4. Set the *Control Type* to Corridor Point.
- 5. Select **SE Ramp** for the *Corridor*.
- 6. Select LT_Conc_EOP-Top for the *Reference Point*.
- In the Station Limits area, key in 5+02.77 for the Start station and key in 8+85.00 for the Stop station.

8. <d> Add</d>	d and Close.
-----------------------	--------------

Head Point Controls	
Conridor: Bryant Ramp Point: RT_Conc_EOP-Top ▼ ◆ Mode O Horizontal Vertical Control Type: Corridor Point ▼ Corridor: SE Ramp ▼ Reference Point: LT_Conc_EOP-Top ▼	Station Limits Add Start: 5+02.77 + Stop: 8+85.00 + Horizontal Offsets Change Help Help Stop: 0.00 + Vertical Offsets + Start: 0.00 +
Priority: 1 Horizontal and Vertical Controls: En Pri Name Start Stati Stop Sta X 1 RT_Conc_E5+02.77 8+85.00	Stop: 0.00
	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 befor 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 Comdor Comidor - SE Ramp Surface - Bryant Ramp Surface - Default Surface - Existing Ground Surface - SE Ramp	Aliases: Add -> <- Remove Move Up Move Down	Cancel
	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 Aliasing			X
Target: <a>Active Surface>	•		ОК
Surface or Corridor		Aliases:	Cancel
Corridor - SE Ramp Surface - Bryant Ramp Surface - Default	Add -> <- Remove Move Up Move Down	Surface - SE Ramp Surface - Existing_Ground	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 occured 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 combines 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 in 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 Comidor	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 Surfac	e		
Name:	SE-Bryant Ran	nps	Apply
Default Preference	e: Proposed	•	Close
New Surface f	or Each Comidor		Preferences
Empty Design	Surface		Help
Include Null Po	pints		
Add Exterior Bo	oundary · Style:	Exterior Bo	undary 👻
Densify Horizon	ntal Curves using	Chord Height T	olerance
Densify Vertica	I Curves using Ch	ord Height Tole	rance
🔽 Triangulate			
Create Surface(s)	from:		
Bryant Ramp SE Ramp			
			All
			None
Clipping Op	tions		
Features Duplicate Name:	~		
	Replace	Rename	Modify
Add Transver	rse Features		
Style:	Default	-	
Create Alternat			
Process Visible			
Remove Loops			
Display Featur	es in Plan View		

9. **<D> Apply** and **Close**. 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.

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. FM_BD_Body2