Labs for Bridge Essential Using InRoads XM

Colorado Department of Transportation

CADD and Engineering Innovation Updated November, 2009 Version XM



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Software Versions

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MicroStation® version 08.09.04.51 InRoads® version 08.09.02.16 0209 – Version 04.00.00 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:

ltem	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 hyper linked	
Emphasis	style used when referring to important word or phrases	
Hyperlink	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	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	

Table of Contents

LAB 1 - Getting Started in InRoads for Bridge	7
Lab 1.1 - Purpose of Bridge Essentials Labs	7
Lab 1.2 - Review of the Project Directory Structure	8
Lab 1.3 - InRoads Terminology	
Lab 1.4 - Understanding How Project Design Data is Stored	10
Lab 1.5 - Requesting InRoads Design Data	13
Lab 1.6 - Using the Bridge Toolbar to follow a Workflow	13
LAB 2 - Reviewing Roadway Design Data	19
Lab 2.1 - Requesting InRoads Design Data	19
Lab 2.2 - Using InRoads Surface and Geometry Tools	19
Lab 2.3 - Using InRoads Evaluation Tools	48
LAB 3 - Working With Alignments	69
Lab 3.1 - Draw Graphic Elements for the Horizontal Alignment	69
Lab 3.2 - Create a Geometry Project and Import a Horizontal Alignment	75
Lab 3.3 - Creating a Vertical Alignment	83
LAB 4 - Templates and Corridors	89
Lab 4.1 - Construct the Channel Liner	90
Lab 4.2 - Create the Excavation Components	102
Lab 4.3 - Adding Backfill Components	108
Lab 4.4 - Creating the Corridor for the Channel	110
LAB 5 - Evaluating Clearances and Conflicts	119
Lab 5.1 - Open Data Files	119
Lab 5.2 - Intersecting Alignment Reports	119
Lab 5.3 - MicroStation Measurements	125
Lab 5.4 - Isopach Surface	130
LAB 6 - Working with Surfaces	135
Lab 6.1 - Open Project Data	135
Lab 6.2 - Create Skewed Cross Sections from Graphics	135
Lab 6.3 - Update and Annotate Cross Sections	147
Lab 6.4 - Creating Profiles from Graphics	155
LAB 7 - Feature Based Modeling	159
Lab 7.1 - Open Project Data	159
Lab 7.2 - Create an Excavation Surface for a Pier Footer	160
Lab 7.3 - Create a Backfill surface for a Pier	170
Lab 7.4 - Create Pier Features	175
LAB 8 - Evaluating Bridge Design Surfaces	191
Lab 8.1 - Open Data Files	191
Lab 8.2 - Compute the Pier Excavation Volume	192
Lab 8.3 - Compute the Pier Backfill Volume	196
Lab 8.4 - Compute End Area Volumes	198
LAB 9 - Plan Production for Bridge	207
Lab 9.1 - Under Development	207

LAB 1 - Getting Started in InRoads for Bridge

Chapter Objectives:

- Setup a project with the correct resources including the creation and maintenance of an InRoads project file
- Identify and load the correct resources and files needed for bridge design
- Develop an understanding of what InRoads tools to use as they relate to real world design processes
- **Note:** The *.zip file of the data set for these labs can be downloaded from the website <u>Labs for Bridge Essentials</u>. The zip file should be extracted to the C:\Projects\ directory. If the labs will not be worked through sequentially, the data for each lab is also found in the Miscellaneous directory of the data set. To use the files from theMiscellaneous directory, copy the files in each specific lab folder following the instructions found in the *.doc file.

Lab 1.1 - Purpose of Bridge Essentials Labs

The Bridge Essential labs have been developed to demonstrate how InRoads tools can be used to facilitate the design and detailing processes of bridges and structures. These labs are intended as a supplement to the reference material and labs developed for the standard MicroStation and InRoads courses.

The labs are based on students having a basic understanding of MicroStation. A basic understanding of InRoads is preferable, but not required. Some of the basic InRoads concepts are covered in these labs only to explain more specific details as they relate to the Bridge workflow. However, for concepts that are not specific to the Bridge workflow, refer to the reference material for MicroStation and InRoads to gain a fundamental understanding of the CDOT engineering software environment.

For those with little or no experience with InRoads, use the links below to access standard MicroStation and InRoads reference material related to this lab.

From A Practical Guide for Using MicroStation XM

- <u>Chapter 1 Introduction to CDOT</u> This chapter documents helpful CADD resources available to the student and links to those resources.
- <u>Chapter 2 Getting Started in MicroStation</u>- This chapter documents the basics of the MicroStation interface including mouse mechanics, the MicroStation Manager window, and description of the toolbars.
- Another important chapter for the student to understand is <u>Chapter 3 Levels</u>. Use this link if you are not familiar with how levels are organized and how to use them.

From A Practical Guide for Using InRoads XM

- <u>Chapter 1 Getting Started in InRoads</u> describes where to find and store files used in InRoads, how to setup a project directory, and best practices for setting up InRoads to automatically use the correct InRoads files and point to the correct InRoads folders.
- <u>Chapter 2 InRoads Options</u> provides instruction on what Locks are and how to use them in addition to setting up the display precision for reports and setting the scale factors for how InRoads displays text, cells, and line styles.
- 1. Use the following link to see what other training material, including reference material and labs, is available for your use: <u>Manuals, Training Materials, and Resources</u>.

Lab 1.2 - Review of the Project Directory Structure

Project Setup

Setting up a project directory is generally performed by the Project Manager. However, a standard project directory structure can also be used to store data that is not part of a formal project. Benefits of setting up a standard project directory in these cases include:

- Ensures that predictable MicroStation and InRoads resources are being used to develop the data
- Facilitates the transfer of data to/from other project participants, entities, or storage areas
- Reduces need for support and associated downtime

The standard project directory structure is suitable for small and large projects, projects in a network environment or stand alone projects, and even projects in the ProjectWise environment. By using this standard directory structure, Bridge users will be able to find the data they need from other specialty groups and in return specialty groups will be able to find the data supplied by bridge.

The next few steps will illustrate how to create a project directory for a stand alone project.

- *Note:* Because a stand alone project does not have a project code use a project code of *00001* as the project number.
- Follow the steps outlined in the section "Creating the Project Directory" found in <u>Chapter</u> <u>1 - Getting Started in InRoads</u> of A Practical Guide for Using InRoads XM to create the project folder.

🖃 🚞 Projects
🖃 🚞 00001
🕀 🚞 Bridge
🕀 🚞 Construction
🛅 Consultants
🕀 🚞 Design
🕀 🚞 Hydraulics
🗉 🚞 Landscape_Environmental
🗉 🚞 Materials_Geotechnical
🚞 Miscellaneous
🗉 🚞 Planning
🕀 🚞 Plot_Sets
🚞 Project_Configuration
표 🚞 Project_Manager
🚞 Redline
🗉 🚞 ROW_Survey
C Specifications
🕀 🚞 Traffic_ITS
🗉 🚞 Utilities

2. Open *Windows Explorer* and navigate to the new 00001 project folder.

3. Expand the *Bridge* folder.



The folders highlighted in the image above are the folders that will be most often used during this course and the normal design process.

In addition to these folders, files in the **ROW_Survey**|**InRoads** and **Design**|**InRoads** folders will be used as a basis for bridge and structure design.

- The topographic survey file will be found in the ROW_Survey\InRoads folder.
- The proposed roadway alignment and surfaces will be found in the Design\InRoads folder.

Lab 1.3 - InRoads Terminology

The following steps will show how the user how to use the Help system that comes with the product to find definitions to unfamiliar terminology.

- 1. Launch *InRoads Help* by going to Help > Contents in the InRoads application window.
- 2. On the *Contents* tab, click on Supplemental Information > Glossary.
- 3. Look up the following terms in the **Glossary**:
 - a. Original Surface and Design Surface
 - b. Digital Terrain Model
 - c. Perimeter
 - d. Geometry Project
 - e. Alignment
 - f. Corridor
 - g. Project and RWK

Lab 1.4 - Understanding How Project Design Data is Stored

This section will help you understand how the different design features, such as surfaces, alignments, and typical sections, relate to InRoads file types. Managing InRoads data will be a lot easier if you have a good understanding of this relationship. The following table shows how InRoads file types relate to design elements.

Design Element	InRoads File
Surfaces - Topographic (existing) or proposed design	*
Alignments	*.alg
Typical sections (templates)	*.itl
Modeling (corridors)	*.ird
Control how graphics look (preferences)	*.xin
InRoads project	*.rwk

Additional information on how these file types in the section "InRoads XM Resource Locations" found in <u>Chapter 1 - Getting Started in InRoads</u> of A Practical Guide for Using InRoads XM.

The next few steps illustrate a practical application of how to manage InRoads data in the project directory structure. There are several files located in the \Miscellaneous directory of project 12345 that need to be moved to the project 00001.



4. Open *Window Explorer* and navigate to the directory **\12345\Miscellaneous**.

5. Move all the files that begin with *00001* to the correct folders in the \00001 project directory.

🗆 🚞 Projects
🖃 🧰 00001
🖃 🚞 Bridge
🕀 🚞 Calculations
🕀 🚞 Correspondence
🕀 🚞 Drawings
🚞 Geometry
🚞 InRoads
🚞 Photos
🕀 🚞 Reports
🚞 Working
🗉 🚞 Construction
Consultants
🕀 🚞 Design
🖾 🦳 Hudeoulica

- **Note:** Each discipline has a standard acronym. Use this acronym to determine the folder the file should be placed in (e.g. BRDG is the acronym used for the bridge group).
- **Note:** The contents of these files are irrelevant. Only the filenames are important in this exercise.
- 6. Identify the one file that should not be used from the project directory structure because it is not a standard file.
 - **Note:** Notice that there is only one geometry (*.alg) file for bridge. A good practice is to store all alignments in one geometry file. There are only a few situations that would require using more than one geometry file.

Using Project Defaults

InRoads *Project Defaults* are a way to improve the process of loading and saving InRoads files by setting a default path to the project folder where the resource should be located. This is accomplish by using another file type with the extension *.reg.

1. Launch MicroStation and set the *Project Workspace* to 00001.

Note: You will need to revisit the MicroStation Manager window to set the project workspace to 12345 for subsequent labs.

User:	CDOT User 🔹
Project:	00001 -
Interface:	CDOT 👻

- 2. Open the file **00001BRDG_Model.dgn** from the directory *C:\Projects\00001\Bridge\Drawings\Reference_Files*.
- 3. Launch InRoads by clicking on the Field icon.
- Follow the steps in the workflow <u>CDOT InRoads XM Project Defaults Management</u> to import the standard CDOT project defaults and set the *Configuration Name* to CDOT Bridge Discipline.
- 5. Click Apply and then Close the Project Defaults dialog box.

🕌 Set Project Defaults		×
Configuration Name:	CDOT Bridge Discipline	Apply
Default Preferences		Close New
Preferences (* xin):	\$(CDOT_PREF)\CDOT_Civil.xin	Copy
Tumouts (*.bt):		Rename
Drainage Structures (*.dat):		Delete
Rainfall Data (*.idf):		Browse
Bridge Sections (*.txt):		
Drafting Notes (*.dft):	\$(CDOT_WKSP)\Standards-Global\InRoads\Notes\CDOT-Notes.d	Event
Pay Items (*.mdb):		
Default Directory Paths		Help
ProjectWise Directory:		
Project Default Directory:	\$(MS_DEF)Bridge\	
Report Directory:	\$(MS_DEF)Bridge\InRoads\	
Projects (*.rwk):	\$(MS_DEF)Bridge\InRoads\	
Surfaces (*.dtm):	\$(MS_DEF)Bridge\InRoads\	
Geometry Projects (*.alg):	\$(MS_DEF)Bridge\Geometry\	
Template Libraries (*.itl):	\$(MS_DEF)Bridge\InRoads\	
Roadway Design (*.ird):	\$(MS_DEF)Bridge\InRoads\	
Survey Data (*.fwd):	S/MS DED	

6. From the InRoads interface, select File > Open. Notice how InRoads now defaults to the Bridge folder of the project.

🙀 Open		
Look in:	🐌 Bridge	- 🧐 🤌 📴
(Ha	Name	Date modified
Recent Places	Calculations	10/2/2009 12:49 PM
	Correspondence	10/2/2009 12:49 PM
	퉬 Drawings	10/2/2009 12:49 PM
	퉬 Geometry	10/2/2009 12:49 PM
Desktop	퉬 InRoads	10/2/2009 12:49 PM

There are two keys to getting project defaults to work correctly:

- Load the correct pcf file by choosing the correct project workspace in the MicroStation Manager window
- Set the project default configuration name to CDOT Bridge Discipline

Lab 1.5 - Requesting InRoads Design Data

Before starting a Bridge project, you will need to load InRoads data files that have been created by other groups. The following is a list of these InRoads data files. Request the files from the appropriate contact person in each group.

Design Element	InRoads File	Responsible Group
Existing surface	*	Survey
Proposed (design) surface	*	Roadway Design
Proposed (design) alignments	*.alg	Roadway Design
Roadway Typical Sections (if needed)	*.itl	Roadway Design

The files should be copied into the *Bridge**InRoads* folder. The responsible group should update the Bridge group if any changes are made to these files, including:

- Additional/new survey data
- Revised alignments (horizontal and vertical)
- Revised typical sections
- Additional work at approach to structures

Lab 1.6 - Using the Bridge Toolbar to follow a Workflow



Not all InRoads tools are relevant to Bridge design and detailing processes. In addition, some tools are used more often than others. The purpose of the Bridge toolbar is to organize the most commonly used InRoads tools in a concise, sequential order and make them easily accessible.

The toolbar is not intended to be complete at this time but has been created to introduce bridge designers to the toolbar concept. With input from the bridge group, it is expected that the toolbar will change over time according to the needs of the group.

The toolbar needs to be loaded manually. Once loaded, the toolbar resides in the registry of the computer and only needs to be loaded again if it changes.

1. Load the *Bridge Design* toolbar by selecting **Tools** > **Customize**. The *Customize* dialog box will appear.

🚔 Customize			
Toolbars Commands Key	board Macros Export Import		
Toolbars: Cogo Points Cross Section Design Pad Design Roadway Design Surface Drafting Drainage Profile Drainage Structures Drainage Tools Drainage Utilities Drainage View Edit Surface Feature Pra-	Show Tool Tips With Shortcut Keys	Reset All New Rename Delete Help	
Close			

- 2. Click n the *Import* tab and choose Browse.
- 3. Select the CDOT Bridge.tbr file from the C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Interface directory.

4. Click on **Import**.

Tustomize	- • •
Toolbars Commands Keyboard Macros Export Import File Name: C:\Workspace\Workspace-CDOT_XM\Standar Import Import	Import
	Browse
	Help
Close	

- 5. Click on the *Toolbars* tab
- 6. Check on **CDOT Bridge** in the *Toolbars:* area. The CDOT Bridge toolbar will appear on the screen

🕌 Customize		- • •	
Toolbars Commands Keybo	ard Macros Export Import		
Toolbars: CDOT Bridge Cogo Points Cross Section Design Pad Design Roadway Design Surface Drainage Profile Drainage Structures Drainage Structures Drainage Utilities Drainage View Edit Surface	. Show Tool Tips ♥ With Shortcut Keys	Reset All New Rename Delete Help	
Close			

7. Close the Customize dialog box.

- 8. Click on the title bar of the CDOT Bridge menu to make it active.
- 9. Hover over the *Project Defaults* icon. A *tool tip* appears to indicate what tool the icon represents.



10. An explanation of what the tool does also appears in the lower left of the InRoads application window.

😽 Bentley InRoads XM Edition	
<u>F</u> ile <u>S</u> urface <u>G</u> eometry <u>D</u> rainage <u>E</u> val	uation <u>M</u> odeler Dr <u>a</u> fting <u>T</u> ools
<u>H</u> elp	
	File Name Type
Preferences	CDOT_Civil XIN
4 <u> </u>	
Preferences 😡 Drainage 🕢 🛌	< <u> </u>
Sets the default directory paths for a project	ct

For now, the toolbar is divided into the following sections:

CDO	T Bridge			
ß	%	9 - 1 - 1	🗠 🛗 🛱	🗠 🗠 🏪

- a. Project Defaults Used to set the default paths to InRoads files
- b. View Surface Used to evaluate a surface including displaying the contours or surface features
- c. Review Horizontal Alignments Used to display and annotate horizontal alignments and generate alignment reports
- d. Profiles and Vertical Alignments Used to generate and annotate profiles
- e. Cross Sections Used to generate and annotate cross sections

The Project Defaults tool was explained in this lab. The other tools on this toolbar will be explained in the next lab.

11. Now that you understand how to create a project and manage the data within a project directory structure, **Delete** the project *00001*.

Chapter Summary:

- Using the standard project directory structure will make it easier to manage project data and facilitate the correct usage of InRoads resources.
- Using Project Defaults will make it easier to save and retrieve InRoads files to/from the correct project folders.
- Using the Bridge Toolbar will reduce the amount of time looking for the correct InRoads tool. In addition, the toolbar is workflow based, allowing the user to quickly find the correct tool based on the design stage being worked on.

LAB 2 - Reviewing Roadway Design Data

Chapter Objectives:

- Develop an understanding of the roadway design data.
- Learn InRoads' tools that are used to display and evaluate surfaces.
- Learn InRoads' tools that are used to display and evaluate alignments.

The following files are used in this lab:

- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Preferences\ CDOT_Civil.xin
- C:\Projects\12345\Bridge\Working\12345BRDG_Model-Drain.dgn
- C:\Projects\12345\Design\InRoads\12345 SH52
- C:\Projects\12345\Design\InRoads\12345 SH119 SH52 interchange.alg
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange

Lab 2.1 - Requesting InRoads Design Data

See Section 1.5 *Requesting InRoads Design Data* to determine which InRoads data files are needed to start your work. The labs assume that you have been provided the appropriate InRoads data files from the responsible groups noted in Section 1.5.

Lab 2.2 - Using InRoads Surface and Geometry Tools

This section covers how to use surface and geometry viewing, annotation, tracking, and reporting tools to review InRoads data that is provided to the Bridge group by the Roadway Design group. A "working" file will be used to view geometry, cross sections, and profiles.

- 1. Open MicroStation and InRoads using the *C:\Projects\12345\Bridge\Working* *CU12345BRDG_Model.dgn* file.
 - **Note:** The standard filename for working files includes the user's initials in front of the filename. In this case, "CU" stands for CDOT User.
- 2. Delete any MicroStation graphics currently in the design file.
- 3. Verify the correct *.*xin* file is loaded.
- 4. Select **File > Open** from the InRoads menu.
- 5. Open C:\Projects\12345\Design\InRoads\12345 SH52 and 12345 SH119 SH52 interchange.alg.
- 6. Open C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange.

Review the surfaces

- 1. Select Surface > View Surface > Contours.
- 2. Select Preferences.

Freferences	×
Name:	Close
CDOT Default Existing	Load
Existing 1' Mir - 0.2 Minor Existing 10' Mir - 2' Minor	<u>S</u> ave
Existing 100' Mir - 20' Minor Existing 5' Mir - 1' Minor	Save <u>A</u> s
Proposed Proposed 1' Mjr - 0.2' Minor	<u>D</u> elete
Proposed 10' Mir - 2' Minor	<u>H</u> elp
Active Preference: CDOT	

3. Highlight the *Existing 5' Mjr – 1' Minor* preference.

Note: The *Preference* controls the interval of the contours, number of minors per major contour, labeling, levels the contours are displayed on, etc.

- 4. <D> Load, then Close.
- 5. Set the *Surface* to *12345 existing ground for interchange*.
- 6. **<D> Apply**.

🦌 View Contours			• 🗙
Main Advanced	abels		
S <u>u</u> rface:	12345 existing grour 👻 Help		
Fence <u>M</u> ode:	Ignore	-	
Interval:	1.00		
Min <u>o</u> rs per Major:	4	<u>*</u>	
Symbology:			
Object		Name	
Major Contours Minor Contours Major Labels Minor Labels Major Depression Minor Depression	n Co	DTM_Ex_Contour_Major DTM_Ex_Contour_Minor DTM_Ex_Contour_Text DTM_Ex_Contour_Text DTM_Ex_Contour_Major DTM_Ex_Contour_Minor	BYL BYL BYL BYL BYL
Apply Preferences Close			



7. Review the contours and zoom into the proposed bridge area.

8. Use MicroStation to **Delete** the contours when done reviewing.

Note: The contours are a graphic group, so make certain graphic group lock is on.

- 9. Select Preferences from the View > Contours dialog.
- 10. Highlight the *Proposed 5' Mjr 1' Minor* preference.



- 11. **<D> Load**.
- 12. Switch the surface to *12345 SH52*.

🕌 View Contours			
Main Advanced I	Labels		
Surface:	12345 S	H52 🔹	Help
Fence Mode:	Ignore	Ŧ	
Interval:	1.00		
Minors per Major:	4	×	
Symbology:			
Object		Name	
Major Contours		DTM_Prop_Con	tour_Maj BYL
Major Labels		DTM_Prop_Con	tour Te BYL
Minor Labels		DTM Prop Con	tour Te BYL
Major Depression	n Co	DTM_Prop_Con	tour_DeBYL
Minor Depression	n Co	DTM_Prop_Con	tour_De BYL
Apply	Prefer	ences	Close

- 13. **<D> Apply**.
- 14. Close the *Preferences* dialog.
 - **Note:** Loading the preference changes the contour settings so this display uses the proposed symbology.
- 15. Review the contours and window in as shown.



- **Note:** In this case, the design model does not have sideslopes in the area where the proposed bridge will be located.
- 16. Close the View Contours dialog.
- 17. Use MicroStation to **Delete** the contours when done reviewing.
- 18. Select Surface > Update 3D/Plan Surface Display.
 - **Note:** This command is useful since it provides access to most surface viewing commands in one dialog, and it allows you do delete the displays without using the MicroStation Delete command.
- 19. Toggle *Display On* and highlight the *existing ground* surface.
- 20. Toggle on *Perimeter*.

🚔 Update 3-I	D/Plan Surface Display				- • •
Mode:	◉ Display <u>O</u> n		Γ	Apply	
Fence <u>M</u> ode:	Ignore	-			Close
S <u>u</u> rfaces:				- Î	Filter
Name		Descrip	otion	- r	E dit Stule
Default 12345 existing	g ground for interchange	SH119 9	SH52 existing gr		<u>H</u> elp
12345 5H52		Lreated	from roadway de		
Perimeter	Surface <u>E</u> levations	📃 Colo	r-Coded A <u>s</u> pects		
Triangles	Slope <u>V</u> ectors	Colo	r-Coded Elevations		
Contours	Profiled Model	📃 Colo	r-Coded <u>S</u> lopes		
Eeatures:	🔲 <u>G</u> ridded Model				
Name			Style	[+ -
			_		
•	III			P.	

- 21. <D> Apply.
- 22. Fit the MicroStation view to see the perimeter of the surface.



Note: The perimeter of the existing ground is useful to review the limits of the survey.

23. Repeat for the SH52 surface.



- **Note:** You can highlight more than one surface at a time. These were done separately to more easily tell which surface is which.
- 24. Toggle Display Off.

25. Highlight both surfaces.

opuate 5-	o, rian burrace bispiay		
Mode:	🔘 Display <u>O</u> n 🔘 <u>D</u> is	splay Off	Apply
Fence <u>M</u> ode:	Ignore	r]	Close
S <u>u</u> rfaces:			Filter
Name		Description	
Default			Edit Style
12345 existing 12345 SH52	g ground for interchange	SH119 SH52 existing gr Created from roadway de	<u>H</u> elp
		the second processing sources	
V <u>P</u> erimeter	Surface <u>E</u> levations	Color-Coded Aspects	
<u> </u>	Slope <u>V</u> ectors	Color-Coded Elevations	
Contours	Profiled Model	Color-Coded Slopes	
Eeatures:	C Gridded Model		
Name		Style	(<u>+</u>
<	111		P

- 26. **<D> Apply**.
- 27. Toggle Display On.
- 28. Toggle on *Contours*.
- 29. Toggle off *Perimeter*.
- 30. Highlight the *existing ground* surface.



- 31. **<D> Apply**.
- 32. Review the contour display.

- 33. Toggle Display Off.
- 34. **<D> Apply**.
 - **Note:** You are not given a choice on the preference when using this command for displays, but you were able to delete the perimeter and contours without using the MicroStation delete command.
- 35. <D> Close.

Review alignments using Viewing, Tracking and Stationing

The following InRoads tools will be used in this lab to review alignments that are created by the Roadway Design group.

- Geometry > View Geometry > All Horizontals which displays all horizontal alignments in the active geometry project with no annotation.
- **Tools** > **Tracking** > **Tracking** which displays the Station and Offset for a specific point, along with surface data.
- ◆ Tools > Tracking > Horizontal Alignments which provides a readout of the Station, Offset and Curve radius (if applicable) for a specific point, along with elevation of the active vertical alignment.
- Geometry > View Geometry > Active Horizontal which displays only the active horizontal with no annotation.
- Geometry > View Geometry > Horizontal Annotation which displays the specified alignment or alignments along with annotation of the tangent and curve data.
- **Geometry > View Geometry > Stationing** which displays station for the specified horizontal alignment.
- 1. Select Geometry > View Geometry > All Horizontals.
- 2. Fit the MicroStation view.

Note: This geometry file contains horizontal and vertical alignments for *SH119 NB* and *SB*, *SH52*, *Ramps A-D*, and several walls.



3. In the *Explorer* part of the InRoads menu, <**D**> on the *Geometry* tab and <**D**> on the '+' next to the geometry project to expand the list of alignments.

Bentley InRoads XM Edition		
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Toggles the Report Lock		

Note: You may need to use the arrows to scroll across to see the Geometry tab.

4. Right-click on *SH52-H* and select *Set Active* if it's not already.

Bentley InRoads XM Edition				
<u>File</u> <u>Surface</u> <u>Geometry</u> <u>Drainage</u> <u>Evaluation</u> <u>Modeler</u> Dr <u>afting</u> <u>T</u> ools <u>H</u> elp				
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Note: The active alignment has a red box around its icon.

5. Select Tools > Tracking > Tracking.

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Easting:	Settings
Elevation:	Close
Slope:	
Aspect:	<u>H</u> elp
Station:	
Offset:	
Dual Dimension:	

- 6. <D> Activate.
- 7. Move your cursor in the vicinity of the wall alignments as shown.



Note: The readout of *Station*, *Offset*, etc is shown in the dialog box. Using this command gives you a readout of the stationing on the alignment, the perpendicular offset to your cursor location the coordinates of your cursor location, and the *Elevation* (along with other data) of the *active surface* at your cursor location.

8. Snap to the end point of the wall alignment as shown.



Note: You may snap using <**T**> <**D**> just as you would in MicroStation or if you want to use *AccuSnap*, hold down your <**Ctrl**> and <**Shift**> keys on your keyboard. This is true whenever you need to use *AccuSnap* within an InRoads command.



Note: The readouts are written to the design file. The text is written perpendicular to the alignment being tracked and is top-left justified on the point where you snapped.

In the next series of steps you'll attach a reference file containing the SH52 bridge pier and abutment graphics and then use these graphics to obtain additional tracking information.

- 9. Select File > Reference from the MicroStation menu.
- 10. Select Tools > Attach.

11. Select C:\Projects\12345\Bridge\Drawings\Reference_Files\12345BRDG_Model_D-16-DU.dgn.

Reference Attachment	Settings for 12345BRDG_Model_D-16-DU.dgn
Eile Name: 1234 Full Path:NR Model: CDOT Logical Name: Description: Globa	58RDG_Model_D-16-DU.dgn sference_Files\123458RDG_Model_D-16-DU.dgn Default all Origin aligned with Master File
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	<u>O</u> K Cancel

- 12. **<D> OK** to accept the default reference settings.
- 13. Close the *Reference* dialog box.
 - Note: Abutment and Pier centerlines are shown in the file.





14. Window in on the area shown to see the abutment centerline.

15. Select Tools > Tracking > Tracking.

🕌 Tracking	—
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Easting:	Settings
Elevation:	
Slope:	
Aspect:	<u>H</u> elp
Station:	
Offset:	
Dual Dimension:	

16. <D> Activate.



17. Move your cursor in the vicinity of the abutment graphic as shown.

18. Select MicroStation's Intersection snap mode.





19. Snap to the intersection of the abutment centerline and the SH52 centerline alignment.

Note: The readouts are written to the design file. Note that the abutment centerline is located at station 108+73.63 on the SH52 alignment. Tracking is a convenient tool for obtaining station locations of abutment centerlines or backfaces.



- 20. **<D> Close** to exit the *Tracking* command.
- 21. Delete the readout with MicroStation.
- 22. Turn off the display of the bridge reference file.

References (1 of 1 unique, 0 displayed)	1			
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	🖌 Wall D-16-J	Wall D-16-J	CDOT User	
	🖌 Wall D-16-K	Wall D-16-K	CDOT User	
	🖌 Wall D-16-L	Wall D-16-L	CDOT User	
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Station: 1+92.00 Offset: 0.00 Elevation: 5183.70 R	adius: 0.00"			

23. Select Tools > Tracking > Horizontal Alignments.

- **Note:** The *Station*, *Offset*, *Elevation* and curve *Radius* is shown in both the InRoads and MicroStation message fields. Using this command gives you a readout of the stationing on the alignment, the perpendicular offset to your cursor location and the elevation of the *active vertical alignment* associated with the horizontal you're tracking (as opposed to the DTM elevation in the Tracking command).
- 24. Make *Wall D-16-L* active.

"Station: 1+92.00 Offset: 0.00 Elevation: 5183.70 Radius: 0.00"

- 25. Track the Alignment with Horizontal Alignment Tracking.
- 26. Toggle *Point Snap* on.



27. Track the alignment and note that the cursor only tracks from the beginning, ending and angle points or PIs of the alignment.
Note: This can be used to easily check the stationing of the angle points for the wall to see if the wall segments are of even lengths.



28. Toggle *Point Snap* back to *No Snap*.



Next, you will station an alignment. The *Text Scale Factor* is applied to all text, ticks and offsets created by InRoads and may be changed at any time.

29. Choose Tools > Options > Factors.

Note the default settings.

30. **<D>** the lock icon to unlock the three settings so they can be set individually.

31. Change the *Text Scale Factor* to 50.

🐂 Options		- • ×
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Cell <u>S</u> cale Factor:	100.0000	
Line Style Scale Factor:	100.0000	
Apply	Preferences	Close

- 32. **<D> Apply**.
- 33. **<D> Close**.

Note: If you **Apply** without saving a preference, the change only remains active until you exit InRoads.

- 34. Select Geometry > View Geometry > Stationing.
- 35. Toggle the *Horizontal Alignment* to SH52-H.
 - **Note:** The Horizontal Alignment defaults to the active alignment. Changing it here also changes the active alignment.

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36. Load the preference *PROPOSED-100 Ft Interval*.

37. **<D> Apply**.



38. Select Tools > Options > Factors and set the Text Scale Factor to 100. (Don't forget to Apply.)

39. **<D> Apply** on the *Stationing* dialog, then **Close**.



- Note: Since you are in Pencil mode, the second set of stationing replaces the first set.
- **Note:** The display of the stationing on the alignment honors the *Text Factor* as you can see. In general, you use a text factor equal to the scale you plan to plot. When reviewing data that you do not plan to plot, as you are here, you may choose a different text scale to make the text more legible in the file.
- 40. Use MicroStation to **Delete** the Stationing.

Note: The stationing is made up of graphic groups, making it easier to delete.

- 41. Choose Geometry > View Geometry > Horizontal Annotation.
- 42. In the Horizontal Alignments Include field, select the SH52-H alignment.

You may either:

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• Use the target button next to the *Include* field and graphically pick the alignment,

• Type the alignment name in the *Include* field (wildcards are allowed), or

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<D> in the *Include* field and choose *Filter* to pick the alignment from a list and select Add and then OK.

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- 43. **<D> Apply** and the alignment is annotated.
- 44. Window in and review the annotation.

9° 41'35''E 11.89 Δc =22° 31'1 Τc =198.11' Lc =391.10' Rc =995.00'

- **Note:** You may also <D> Interactive and then choose one piece of any alignment at a time to annotate (whether or not it is currently active or displayed).
- 45. Choose Geometry > Review Horizontal.
 - **Note:** You can also right-click on the horizontal in the *Explorer* portion of the menu and choose **Review**.

🚔 Review Horizontal Alignment	(- • •
Geometry Project: 12345 SH119 SH52 Horizontal Alignment: SH52:H		Close Save As
Project Name: 12345 SH119 SH52 Interchange Description: Alignments for SH119 SH52 interchange Horizontal Alignment Name: SH52-H Description: State Highway 52 Proposed Horizontal Alignment Style: ALG_PRO STATION NORTHING EASTING	•	Append Display Print
Element: Linear POB (1) 99+84.26 291556.35 133707.22 PC () 99+96.14 291556.41 133719.11 Tangent Direction: N 89^41'35" E Tangent Length: 11.89	Ш	Help Select
Element: Circular PC () PI () PI () PI () PT () Pelta: 22^31'16" Right Degree of Curvature(Arc): 5^45'30" Length: 391.10 Tangent: 198.11 Chord: 388.59 Middle Ordinate: 19.15 External: 19.53 Tangent Direction: N 89^41'35" E Radial Direction: S 79'02'47" E Radial Direction: S 22^12'51" W Tangent Direction: S 67'47'09" E	_	<pre>Pirst </pre> Next > Last
<		

- **Note:** The *Review* lists all the information about the *active* horizontal alignment. This report can be saved as a text file, displayed in the design file or printed if necessary. You can also switch to a different alignment using the drop-down list at the top of the dialog.
- *Important!* The *Print* command allows the report to be printed to any printer that can be accessed on the current machine.
- 46. **<D> Close** when you are finished evaluating the alignment.
- 47. Choose Geometry > Review Vertical.

Note: You can change Geometry Projects, Horizontal Alignments, or Vertical Alignments using the drop-down list at the top of the *Review* dialog. You can also use the target buttons to graphically identify alignments.

🐂 Review Vertical Alignment			
Geometry Project: 12345 SH119 SH52 -	Mode		Close
Horizontal Alignment: SH52-H 🗸 🕂	 Alignment 		Save As
Vertical Alignment: SH52-V 🗸 🔶	 Element 		Append
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Description: Alig Horizontal Alignment Name: SH52	nments for SH119 SH	152 interchange	
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Vertical Alignment Name: SH52	-V		Help
Description: 5H52 Style: ALG_	PRO_Vert		
	STATION	ELEVATION	Select
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PVC Tangent, Grade:	99+97.00 -0.18	5161.59	< Previous
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PVI	100+12.00	5161.55	
- VION FAI	100+27.00	5161.59	
Length: Entrance Grade:	30.00 -0.18		
Exit Grade: r = (g2 - g1) / L:	0.23 1.36		
K = 1 / (g2 - g1): Middle Ordinate:	73.72 0.02		
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- **Note:** The *Review* lists all the information about the active vertical alignment. In this case, the vertical is the top of wall elevation.
- 48. **<D> Close** when you are finished evaluating the alignment.
- 49. Continue to review other alignments as desired.
- 50. Select Tools > XML Reports > Geometry.
- 51. Select the SH52-H alignment.

As described earlier, you may either:

- Use the target button next to the *Include* field and graphically pick the alignment,
- Type the alignment name in the *Include* field (wildcards are allowed), or
- **<D>** in the *Include* field and choose *Filter* to pick the alignment from a list.
- 52. Toggle on *Include Vertical Alignments*.
- 53. Toggle on Active.

54. Toggle all other options off.

🕌 Geometry Report			
Horizontal Alignments Include: -+-	Cogo Points Include:		+ Apply
Selected:	Selected:		Close
Name Description Styl	Name D	escription 9	Styl Filter
SH52-H State Highway 5 ALG			Preferences
			Help
	())))))))))) ()) ())] []]]]]]]]]]]		► +

55. **<D> Apply**.

- **Note:** When you create a report using one of the XML Report commands, an *.*xml* data file with the results is created in the user's *Local Settings**Temp* folder. This XML file is formatted in the Report Browser using an XSL style sheet, or format. Most reports have a default format, but you can choose between other formats as desired.
- 56. In the *Report Browser* that appears, available formats are listed on the left side. Choose the format: *Geometry > HorizontalAndVerticalAlignmentReview.xsl*.
 - **Note:** All XML reports use this same browser, so the folder structure at left lists all different types of reports. Here, you are looking at an alignment, so you choose a report format from the *Geometry* folder. If you are reporting on Stations and Offset, you would use formats from the *StationOffsets* folder, and so on.

57. Review the report.

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\Program Files\Bentley\InRoads Group V8.9\XML Data\		$\times \times \times \times$	(\mathbf{X})	XXXX	XXX	$X \times X X$	XX
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All HorizontalAlignmentReview.xsl	2	S. <u>A.</u> A. A.					
A HorizontalAlignmentHeviewASUII.xsl		Element: Linear					
A: HorizontalAndVerticalAlignmentBeview vol		POB	(1)	99+84.26	291556.35	133707.22	
A: Horizontal-lements able.xsl		PC	()	99+96.14	291556.41	133719.11	
A HorizontalElementsXYZ.xsl		Tangential Di	rection	N 89°41'34 86" F			
HorizontalE vents.xsl		Tanacatial	Longth:	11 007			
A HorizontalInterpolatedSlews.xsl		rangential	Length:	11.00/			
A ListCoordinates.xsl							
All ListCoordinatesStation.xsl		Element: Circular					
A: ProfileStationElevation.xsl		PC	()	99+96.14	291556.41	133719.11	
Projectálianmenti istina vsl	-	PI	0	101+94.25	291557.48	133917.21	
All Project-Alignment istingDetails xsl		00	0		290561 43	133724 44	
A] SettingOutTable.xsl		DT	~	102:07.24	201402.50	124100.62	
SlewDiagram.xsl			~ 0	103+01.24	231402.50	134100.02	
Ag SlewDiagramLegacyFormat.xsl			Radius:	995.000			
A Traverse.xsl	1		Delta:	22°31'16" Rig	ght		
A TraverseCurveASCII.xsl		Degree of Cu	Invature	53451D01			
TraverseCurveASCII2.xsi			(Arc):	5*45'30"			
Al TraversePoints vol			ength:	391 101			
AT VerticalAlignment3PercentGrade.xsl	2		angent	109 109			
VerticalAlignmentAndEvents.xsl		X X X X	anyent.	190.100			
VerticalAlignmentReview.xsl			Chord:	388.588			
VerticalAlignmentReviewASCII.xsl		Middle Or	rdinate:	19.154			
A VerticalAlignmentSightDistanceReview.xsl		XXXE	xternal:	19.530			
All Verticals vents xsl		Tangent Di	rection	N 89°41'34 86" F			
All VerticalSlewDiagram vsl		Dedi-L Di	rection:	C 0º10'05 14" F			
ICS	K	Radial Di	rection.	5 0 1025.14 E			
Images		Chord Di	rection:	S 79°02'47.31" E			
IntersectingAlignmentStations	K	Radial Di	rection:	S 22°12'50.52" W			
LegalDescription		Tangent Di	rection:	S 67°47'09.48" E			
LightRailManufacturing		XXXX					
MapLheck	-	Element: Linear					

- **Note:** If you right-click a format and choose *Style Sheet Help*, a dialog will pop up describing the data required to complete that particular format.
- *Important!* Just like in the *Review* command, reports may be printed directly from this dialog. Select File > Print to access this function.
- 58. Choose Tools > Format Options.

Format Options					
Northing/Easting:	Mode		Precision 0.12	Format	Close
Elevation:			0.123 💌		
Angular:	Degrees	▼	0 💌	ddd^mm'ss.s" 💌	🔲 Include Angular Suffix
Slope:			0.12 💌	50% 💌	
Use Alternate Slope if	Slope Exceeds:		0.00%		
Alternate Slope:			0.12 💌	2.0:1	
Linear:			0.123 💌		
Station:			0.12 💌	SS+SS.SS 💌	
Acres/Hectares:			0.1 💌		
Area Units:			0.1 💌		
Cubic Units:			0 💌	Convert to Cubic	Yards
Direction:	Bearings	•	0.12 💌	ddd^mm'ss.s" 💌	
Face:	Right Face	•			
Vertical Observation:	Zenith	•			

Note: Much of the formatting of the report can be modified on the fly by changing the settings in this dialog box.

Format Options				×
	Mode	Precision	Format	Close
Northing/Easting:		0.1234 💌		
Elevation:		0.123 💌	•	Help
Angular:	Degrees 💌	0 💌	ddd^mm'ss.s" 💌 🗖 Include	Angular Suffix
Slope:		0.12 💌	50%	
Use Alternate Slope if	Slope Exceeds:	0.00%		
Alternate Slope:		0.12 💌	2.0:1	
Linear:		0.123 💌		
Station:		0.12 💌	\$\$+\$\$.\$\$ •	
Acres/Hectares:		0.1 💌		
Area Units:		0.1 💌		
Cubic Units:		0 💌	Convert to Cubic Yards	
Direction:	Bearings 💌	0.12 💌	ddd^mm'ss.s"	
Face:	Right Face 💌			
Vertical Observation:	Zenith			

59. Change the *Northing Easting Precision* to show four decimals.

Area vel	Horizontal Alignment:	SH52-H		
A: ControlLineData.xsl	Horizontal Description:	State Highway 52 Pro	posed Horizontal A	dignment
A) HorizontalAlignmentCurveSetReview.xsl	Horizontal Style:	ALC PRO		
A HorizontalAlignmentData.xsl	Tionzontar style.	ALOTINO		
For isonal Alignment Lengths.xsl		Station	Northing	Easting
A HorizontalAlignmentReview.xsl				
A HorizontalAlignmentHeviewASUII.xsl	Element: Linear			XXXX
A: HorizontalAugnmentSuperelevationHeview.xsi	POB (1)	99+84.26	291556.3503	133707.2214
All Horizontal-lements Lable xsl	PC ()	99+96.14	291556.4140	133719.1081
HorizontalElementsXYZ.xsl	Tangential Direction:	N 89°41'34 86" F		
HorizontalEvents.xsl	Tangential Direction.	14 007		
A HorizontalInterpolatedSlews.xsl	Tangential Length:	11.887		
ListCoordinates.xsl				
All ListCoordinatesStation.xsl	Element: Circular			
A ProfileStationElevation.xsl	PC ()	99+96.14	291556.4140	133719.1081
A ProfilestationElevationASUI.xsi	E PI ()	101+94.25	291557,4754	133917.2128
All Project/AlignmentListingDatails vol	0 22		200561 4282	133724 4302
All SettingDutTable vi			250501.4202	133124.4332
Ari SlewDiagram.xsl		103+87.24	291482.5774	134100.6164
A) SlewDiagramLegacyFormat.xsl	Radius:	995.000		
AT Traverse.xsl	Delta:	22°31'16" R	ight	
TraverseCurveASCII.xsl	Degree of Curvature		3XXX	
TraverseCurveASCII2.xsl	(Arc)	5°45'30"		
All TraverseCurveASCII3.xsl	(ad).	201 101		
A: I raverserronts.xsi	Length:	391.101		
Al Vertical@lignment&ndEvents.vsl	Tangent:	198.108		
All Vertica/AlignmentReview.xsl	Chord:	388.588		
VerticalAlignmentReviewASCII.xsl	Middle Ordinate:	19.154		
Ki VerticalAlignmentSightDistanceReview.xsl	Evtamal	19 530		
VerticalEvents.xsl	External.	13.330		
A VerticalInterpolatedSlews.xsl	Tangent Direction:	N 89-4134.86" E		
A: Vertical5lewDiagram.xsl	Radial Direction:	S 0°18'25.14" E		
ILS	Chord Direction:	S 79°02'47.31" E		
Intersection/LignmentStations	Radial Direction	S 22°12'50 52" W		
LegaDescription	Trapart Direction:	0.07847900.40		
LightRailManufacturing	langent Direction:	3 01 41 09.40 E		
MapCheck				
Obsolete	 Element: Linear 			

60. **<D> Close** on the *Format Options* dialog.

61. Close the Report.

62. Back in the *Geometry Report* dialog, <D> in the *Include* field and key in *Wall** to select all the Wall alignments.

🕌 Geometry Re	port					- • •
Horizontal Align Include: Wal	ments I [×]	+	Cogo Points Include:		+	Apply
Selected:			Selected:			
Name Wall D-16-E Wall D-16-F Wall D-16-G Wall D-16-H Wall D-16-I Wall D-16-J	Description Wall D-16-E Wall D-16-F Wall D-16-G Wall D-16-H Wall D-16-I Wall D-16-J		Name	Description	Styl	Filter Preferences Help
Include Vertica All All Act Include Cant A All Act Include Vertica Include Vertica Include Horizo	r Lignments Mignments tive al Event Points Intal Event Points	4	Interval: 50.00 Limits Station Static 0+00. Stop: 0+00.	00	+ +	

63. **<D> Apply**.

In the Report Browser, note the reports now shows each of the wall alignments.

ogram Files\Bentley\InRoads Group V8.9\XML Data\	Alianment 1	lame: W	Vall D-16-F		
Area.xsl	Alig	nment W	Vall D-16-E		
-All ControlLineData.xsl	Descri	ption:			
-A: HorizontalAlignmentAndEvents.xsi	Alignment	Style: A	LG_OTHER		
All HorizontalAlignmentCurveSetheview.xsi			Station	Northing	Easting
A HorizontalAlignment engths yel	$ \times \times \times \times \times$				
All HorizontalAlignmentBeview xsl	Element: Linear				
All HorizontalAlignmentBeviewASCILxsl	POB	()	0+00.0	291347 3836	134243 5728
A HorizontalAlignmentSuperelevationReview.xsl	PC	V OV	0+19.5	2013/0 0112	134261 6255
A HorizontalAndVerticalAlignmentReview.xsl	T-constict Di		0 0713.5	231340.0112	134201.0233
A HorizontalElementsTable.xsl	rangential Di	ection:	561-4109 E		
- All HorizontalElementsXYZ.xsl	Tangential I	ength:	19.5		
A HorizontalEvents.xsl					
-A] HorizontalInterpolatedSlews.xsl	Element: Circular				
- All ListCoordinates.xsl	PC	()	0+19.5	291340.0112	134261.6255
All ListCoordinatesStation.xsl	PI	0	0+33.5	291334 7020	134274 6262
-A] ProfileStationElevation.xsl	00	1		201255 7101	124269 4496
A ProfileStationElevationASCILxsl		~ !!		231330.7131	134200.4400
A: ProjectAlignmentListing.xsl	P	0	0+43.4	291345.9994	134282.9674
A Setting Out Table us		Radius:	18.0		
A SlowDisgrom val		Delta:	75°46'28" L	eft 🔨 🖄	
All SlewDiagram enacyFormative	Degree of Cu	rvature			
All Traverse xsl		(Arc):	31/*28'31"		
	$\mathbf{X} \times \mathbf{X}$	ength:	23.9		
AT TraverseCurveASCII2.xsl	XXXX	angont:	14.0		
A: TraverseCurveASCII3.xsl		ingent.	14.0		
TraversePoints.xsl		Chord:	22.2		
VerticalAlignment3PercentGrade.xsl	Middle Or	dinate:	3.8		
VerticalAlignmentAndEvents.xsl	E CONTRACTOR	ternal:	4.8		
VerticalAlignmentReview.xsl	Tangent Dir	ection:	S 67°47'09" E		
A VerticalAlignmentReviewASCII.xsl	Radial Di	ection:	S 22º12'51" W		
VerticalAlignmentSightDistanceReview.xsl	Charles Di	ection.	N 74940'27" F		
A VerticalEvents.xsl	Chord Di	ection:	N (4-1931 E		
A: VerticalInterpolatedSlews.xsl	Radial Di	ection:	S 53°33'38" E		
A VerticalSlewDiagram.xsl	Tangent Dir	ection:	N 36°26'22" E		

64. Close the Report Browser when you're done reviewing the report.

Lab 2.3 - Using InRoads Evaluation Tools

Next, you will be creating profiles and cross sections to analyze geometry and surface data provided by Roadway Design. This includes annotating information on the profiles and cross sections. For this annotation the text scale factor is applied to all the text, ticks and offsets for the cross sections as well as profiles.

- **Note:** Each time you create profiles or cross sections, you create a new set and it is given a name, which by default is derived from the alignment name with a counter on the end. Later, you will use this set name when identifying the profile or section set to view, annotate, etc.
- 1. For this example, set the *Text Scale Factor* to 40.



- 2. Choose Evaluation > Profile > Create Profile.
- 3. **<D> Preferences** and **Load** the *2x Vertical* preference.

Freferences	X
<u>N</u> ame:	Close
10x Vertical 10xVert_Drain 1x Vertical	Load
1xVert_Drain 2x Vertical	<u>S</u> ave
2xVert_Drain 5x Vertical	Save <u>A</u> s
5xVert_Drain CDOT	<u>D</u> elete
SS Drain	<u>H</u> elp
Preference '2x Vertical' loaded	

4. **<D> Close** on the *Preferences* dialog.

5. In the *Surfaces* area, toggle on both the *existing ground* and *SH52*.

🕌 Create Profile							X
Create Profile General Source Include Gfsets Controls Axes	Set Name: Direction O Left to Righ Right to Le	Wall D-16-L nt ft	Exaggeratio Vertical: Horizontal:	2.0000 1.0000			
Grid Cetails Cetails ASCII	Object Default 12345 exist 12345 SH5	N De ting ground T_ i2 D_ 111	ame fault Existing_Ground Finished-Grade	B, B, B,	All]	
			Pro	perties			
		Appl	Pre <u>f</u> ere	nces	Close	<u>H</u> elp	

- 6. **<D>** on the *Source* branch on the left of the dialog.
- 7. Make certain Alignment is toggled on and set to *Wall D-16-L*.

🕌 Create Profile		
Create Profile General Source Include Controls Axes Grid Details ASCII	Create: Alignment: Graphics Alignment: Alignment: ASCII File	Window and Data
		Apply Preferences Close <u>H</u> elp

8. **<D>** on the *Include* branch.

🕌 Create Profile		- • 💌
Create Profile General Source Unsets Controls Axes Grid Details ASCII	Crossing Features Projected Features Bandwidt Left Offset: 0.00 Right Offset: 0.00 Include Features: Inside Band Clip Features Display Planimetrics Show Data Outside Elevation	
	Apply Preferences Close	<u>H</u> elp

- **Note:** If you want to display crossing features on your profile like pipes or utilities, toggle on *Crossing Features*. These features must first exist in the surface(s) you're profiling. The feature's style controls if the feature can be shown on the profile.
- **Note:** If you want to show features that fall outside the profile window, toggle on *Projected Features*. This will show the orthogonal projection of the features onto the profile. You also have the option of specifying a *Bandwidth* to either side of the profile to project the features.
- 9. For this exercise, leave these options toggled off.
- 10. **<D>** on the *Controls* branch and toggle off all Controls.

🕌 Create Profile		
Create Profile General Source Include Offsets Controls Over	Elevation Use High: 1000.00 Low: 0.00 From Cogo Points From Regression Points	Example
Grid Grid Details	Station □ Use Start: 0+00.00 Stop: 2+68.00	
	Window Clearance Apply Top: 0.00 Bottom 50.00	
	Apply Preferences	s) Close <u>H</u> elp

- **Note:** The *Elevation* option is used to set absolute values for the left axis. With it off, the left axis elevations are determined by the high and low elevations of the surfaces. The *Station* option allows you to create a partial profile. With it off, the entire alignment is profiled. The *Window Clearance* option is used when you want to add grid to the top or bottom of the profile for annotation, which we do not need here.
- 11. **<D> Apply** and **<D>** a clear area in your design file when prompted to *Identify Location*.
 - **Note:** This is the location of the lower left corner of the profile grid, so make certain there is room above and to the right of the point you select. You do not need to click near the horizontal alignment.



The profile is displayed with the two surfaces showing. Offsets can also be shown on the profile.

- 12. Use MicroStation to delete the profile.
- 13. Under *General*, highlight the existing ground surface and choose Properties.

🕌 Surfa	ce Properties						- • ×
Main	Advanced						
<u>S</u> urfa	ice: 12345	i existing grour 🔻					
Cros	s Sections						Help
Symb	ology: T_Exi	sting_Ground		•	🔲 <u>U</u> se F	eatures Only	
- Profil	les						
Sy <u>m</u> b	ology: T_Exi	sting_Ground		•	Lock	Symbologies	
Offse	t Distance	Symbology	Color	Offset	Distance	Symbology	Color
<u>1</u> :	-1.50	D_SURFACE_1	-	<u>9</u> :	0.00	Default	•]
<u>2</u> :	0.00	Default		1 <u>0</u> :	0.00	Default	•
<u>3</u> :	0.00	Default	-	1 <u>1</u> :	0.00	Default	•
<u>4</u> :	0.00	Default	-	1 <u>2</u> :	0.00	Default	•
<u>5</u> :	0.00	Default	-	1 <u>3</u> :	0.00	Default	•
<u>6</u> :	0.00	Default	-	1 <u>4</u> :	0.00	Default	•
Z:	0.00	Default	-	1 <u>5</u> :	0.00	Default	-
<u>8</u> :	0.00	Default	-	1 <u>6</u> :	0.00	Default	•
		Ap	ply	Clo	se		

14. On the *Advanced* tab of *Surface Properties*, set *Offset 1* to *-1.50* and the *Symbology* to *D_Surface1*.

Note: A negative offset is to the left of the alignment.

15. **<D> Apply**.

16.	Toggle th	ne Surface to	12345 SH52	and select I	Properties.
	22	•/			

Main	ce Properties Advanced						
<u>S</u> urfa Cros: Symb	ce: 12345 s Sections iology: D_Fin	i SH52 ▼ ished-Grade		•	Use F	eatures Only	<u>H</u> elp
Profil Sy <u>m</u> b	es rology: D_Fin	ished-Grade		•	Lock !	Symbologies	
Offse 1:	t Distance 1.00	Symbology D_SURFACE_3	Color	Offset <u>9</u> :	Distance 0.00	Symbolog Default	, Color
<u>2</u> :	0.00	Default	•	1 <u>0</u> :	0.00	Default	•
<u>3</u> :	0.00	Default	•	1 <u>1</u> :	0.00	Default	•
<u>4</u> :	0.00	Default	•	1 <u>2</u> :	0.00	Default	•
<u>5</u> :	0.00	Default		1 <u>3</u> :	0.00	Default	•
<u>6</u> :	0.00	Default	•	1 <u>4</u> :	0.00	Default	•
<u>Z</u> :	0.00	Default		1 <u>5</u> :	0.00	Default	•
<u>8</u> :	0.00	Default	-	1 <u>6</u> :	0.00	Default	•
			Apply	Clo	se		

- 17. On the *Advanced* tab, Set *Offset 1* to *1.00* and the *Symbology* to *D-Surface3*.
- 18. **<D> Apply** then **Close**.
- 19. Choose Offsets on the Profile dialog.

🔁 Create Profile	Surface:	12345 SH52	•	
General	Offsets:			
Source	Object	Offset	Name	
Include Include	🛛 Offset 1	1.00	D_SURFACE_3	
	Dffset 2	0.00	Default	
	Dffset 3	0.00	Default	
Grid	Offset 4	0.00	Default	
	C Offset 5	0.00	Default	
	Dffset 6	0.00	Default	
	Offset 7	0.00	Default	
	Dffset 8	0.00	Default	
	Dffset 9	0.00	Default	
	Offset 10	0.00	Default	
	Offset 11	0.00	Default	
	Offset 12	0.00	Default	
	Diffset 13	0.00	Default	
	Offset 14	0.00	Default	
	Diffset 15	0.00	Default	
	Diffset 16	0.00	Default	
		1		

20. Set the Surface to 12345 SH52 and toggle on Offset 1.

Create Profile	Surface:	12345 existing	g grour 💌	
General	Offsets:			
Source	Object	Offset	Name	
Include	Offset 1	-1.50	D SURFACE 1	
	Dffset 2	0.00	Default	
	Offset 3	0.00	Default	
Grid	Offset 4	0.00	Default	
Details	C Offset 5	0.00	Default	
	C Offset 6	0.00	Default	
	Offset 7	0.00	Default	
	C Offset 8	0.00	Default	
	C Offset 9	0.00	Default	
	Offset 10	0.00	Default	
	Offset 11	0.00	Default	
	Offset 12	0.00	Default	
	Offset 13	0.00	Default	
	Offset 14	0.00	Default	
	Offset 15	0.00	Default	
	Offset 16	0.00	Default	

21. Set the *Surface* to *12345 existing ground for interchange* and toggle on *Offset 1*.

22. **<D> Apply** and **<D>** a clear area in your design file when prompted to *Identify Location*.



23. Window in close to the ground surface on the profile.



- **Note:** The profile now shows two lines for the existing ground and two lines for the proposed. The existing ground is shown at the wall centerline and 1.5' in front of the wall. The proposed ground is shown at the wall centerline and 1.0' behind the wall. You can use profile offsets to set the bottom of wall elevations (e.g. if the toe of wall is 1.5 feet in front of the wall face, you can copy that offset line down by 1.5' (or whatever the vertical exaggeration requires) to get the top of the footing. Dropping it 3 feet will provide the minimum bottom of footing).
- 24. **<D> Close** on the *Profile* dialog.

25. Select Geometry > View Geometry > Active Vertical.



You may instead want to display and annotate the vertical alignment.

- 26. Select Geometry > View Geometry > Vertical Annotation.
- 27. Load the *Other* preference.

Freferences	X
Name:	Close
Default Existing	Load
Other	Save
Secondary	Save As
	Delete
	Help
Preference 'Other' loaded	

🕌 View Vertical Anno	tation	- • 🗙
Main Points Curv	es Tangents Affixes	
Horizontal Alignment:	Wall D-16-L 🔹 🕈	Help
⊻ertical Alignment:	Wall D-16-L • +	
<u>P</u> rofile Set:	Wall D-16-L 🔹 🕈	
Limits Station Start: 0+00.00 Stop: 2+68.00		
	pply Preferences Close	

28. **<D> Apply**.



- 29. Review the annotation on the profile. You may need to change the *Text Scale Factor* using **Tools > Options > Factors**. If you **<D>** Apply again, the original annotation is deleted and the new annotation is placed.
- 30. **<D> Close** when done.
- 31. Right-click on the *SH52-H* alignment in the *Explorer* part of the InRoads menu and choose *Set Active*.
- 32. Create a profile for this alignment using the same steps as shown above, except only toggle on the *existing ground* surface.



33. View the vertical annotation, using the *Proposed* preference.

🚼 View Vertical Anno	tation	- • ×
Main Points Curv	es Tangents Affixes	
Horizontal Alignment:	SH52-H 🔹 🛨	Help
Vertical Alignment:	SH52-V 👻 🛨	
Profile Set:	SH52-H 🔻 🛨	
Limits		
Station		
Start: 99+84.26		
Stop: 134+90.00	-#-	
	Preferences Close	

Note: When more than one profile exist in the MicroStation file, you can tell InRoads which one to use for annotation by selecting it from the drop-down list or by using the target button and selecting it graphically.



The vertical alignment for *SH52* does not currently show the location of the bridges. This can be accomplished using *Event Points* as shown below.

- 34. Verify SH52-H is still active.
- 35. Select Geometry > Horizontal Curve Set > Events.
- 36. Toggle on Add Vertical Event Points.

Horizontal Events		- • •
Define <u>By:</u> Single Point	▼	Apply
Add As Station and <u>O</u> ffset	Locate By Name:	Close
Northing and Easting	Northing: 0.00	+ <u>H</u> elp
© <u>C</u> ogo Point	Easting: 0.00	
Alignment Point to Cogo		
Seed Name:	Station	Offsets
Description:	<u>Start:</u> 99+84.26	Eirst: 0.00 +
Style: Default ▼	Stop:	Second:
Add Vertical Event Points	135+00.00 +	0.00 +

Important! Adding event points results in a modification to the *.alg file. In order to make this type of edit, you will need write access to the alignment file being used in the geometry project. This file is typically located in the Design group's InRoads folder and often has restricted access. If direct access is not granted, someone fron the Design group will need to add the event points for you. Either way, communication with the Design group is critical.

- B<u>u</u>tton Bar <u>A</u>ccuSnap Multi-snaps <u>N</u>earest Keypoint <u>M</u>idpoint <u>C</u>enter <u>O</u>rigin Bisector Intersection <u>T</u>angent Tangent Point Perp P<u>e</u>rp Point Parallel Point T<u>h</u>rough <u>P</u>oint On Multi-snap<u>1</u> Multi-snap<u>2</u> Multi-snap<u>3</u>
- 37. **<D>** the Snap icon on the MicroStation Status bar and choose *Intersection*.

38. **<D>** the Target button in the *Locate By* field on the dialog.

1.50		
Horizontal Events		- • •
Define By: Single Point	•	Apply
Add As Station and <u>O</u> ffset	Locate By Name:	Close
Northing and Easting	Northing: 0.00	+ Help
○ <u>C</u> ogo Point	Eagting: 0.00	
Alignment Point to Cogo		
Seed Name:	Station	Offsets
Description:	Start	<u>First</u>
Chiles	99+84.26 +	0.00 +
St⊈le. Default ▼	Stop:	Second:
Add Vertical Event Points	135+00.00 +	0.00 +

- 39. Hold down your *<Ctrl>* and *<Shift>* keys on your keyboard and move your cursor to the intersection of the *SH52* and *Wall D-16-K* alignment.
 - **Note:** <*Ctrl*> and <*Shift*> can be held down any time you want to use *AccuSnap* within an InRoads command.



40. When the two alignments highlight with a yellow X at the intersection, **<D>** to select the location.

The coordinates of the intersection are entered in the dialog.

Horizontal Events		- • •
Define <u>By:</u>		Apply
Add As Station and <u>Offset</u> 	Locate By Name:	Close
Northing and Easting	Northing: 291246.41	+ <u>H</u> elp
© <u>C</u> ogo Point	Easting: 134678.92	
Alignment Point to Cogo		
Seed Name:	Station	Offsets
Description:	Start:	Eirst:
Style: Defeult	99+84.26	0.00
• ···· Delault ▼	Stop:	Second:
☑ Add Vertical Event Points	135+00.00	0.00

41. **<D> Apply** to add the event point.

🐂 Horizontal E	vents					. • 💌
Define By:	Single Point		•			Apply
Add As Station and	Offset		Locate By Name:			Close
Northing an	d Easting	1	Northing:	291246.41	+	Help
🔘 Cogo Point		1	Easting:	134678.92		
🔘 Alignment P	oint to Cogo					
Seed Name Description: Style: Defa	: [Station Start: 99+84.26 Stop:	+	Offsets First: 0.00 Second:	-+-
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Compute Elev	vation from Activ	e Vertica	l Alignmen	t]
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na Horizontal Even	ts	
- Add As	ngle Point	Apply Apply
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Northing and Ea	asting	Northing: 291246.41 + Help
💿 Cogo Point		Easting: 134678.92
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🛛 📝 Add Vertical Ev	ent Points	
	on from Active	Vertical Alignment
Compute Elevation		
Compute Elevation		Northing Easting Elevation Style
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Compute Elevation Events M Station S 110+11.91	Offset 0.00	291246.41 134678.92 0.00 Default
Compute Elevation Events M Station S 110+11.91 S 111+29.96	Offset 0.00 0.00	291246.41 134678.92 0.00 Default 291201.78 134788.21 0.00 Default

42. Repeat this process for the location of the intersection of SH52 and Wall D-16-L.

- 43. **<D> Close** when you have both Event Points located.
- 44. View the vertical annotation for SH52, again using the Proposed preference.
 - **Note:** The last used preference remains active in a dialog until another one is selected or you close InRoads, so you should not need to load it this time.



The locations of the intersecting alignments are annotated on the profile as Event Points.

Next, you will create cross sections.

45. For this example, set the *Text Scale Factor* to *40*.

🕌 Options		
Precision Genera Tolerances Factors	I Units and Format Abbreviations Rail	Geometry Sight Distance
Text Scale Factor:	40.0000	Help
Cell Scale Factor:	100.0000	
Line Style Scale Factor:	100.0000	
Apply	Preferences	llose

46. Choose Evaluation > Cross Section > Create Cross Section.

47. Load the Stacked 20 per column preference.



- 48. Set the Offsets to -200 and 200.
- 49. Toggle on both surfaces.

🐂 Create Cross Section				- • •
Create Cross Section General Source Include	<u>S</u> et Name: Crea <u>t</u> e: Inter <u>v</u> al:	SH52-H Window and Data ▼ 50.00	- +	
Controls	<u>L</u> eft Offset: <u>R</u> ight Offset:	-200.00 200.00	+	
Grid 	Vertical Exaggeration: Show Data Outside Surfaces: Object Default 12345 existing gro 12345 SH52	2.0000 Elevation Range Name Default un T_Existing_Grou D_Finished-Grad	BYL Ind BYL Ie BYL	
		[Properties	None
		Apply Preference	s) Close	<u>H</u> elp

50. **<D>** on the *Include* branch at left.

51. Toggle on *Components*.

Projected Structures Ahead Band: 10.00 Back Band: 10.00
Back Band: 10.00

- 52. **<D>** on *Controls > Plan Display*.
- 53. Toggle on the *Planimetric* option in the *Symbology* branch.

in Create Cross Section				- 0 💌
Create Cross Section Create Cross Section General Controls Critical Sections Critical Sections Critical Sections Critical Sections Critical Sections Grid Grid Grid Grid Controls Critical Sections Critical S	Planarize Elevatjon: 0.00			
	Symbology: Dbject Planimetric Planimetric Station Feature Band Structure Band	Name InRoads_Misc InRoads_Misc InRoads_Misc	BYL BYL BYL BYL	
	Ap	Preferences	Close	<u>H</u> elp

- **Note:** The planimetric option displays a MicroStation element showing where each cross section is cut.
- 54. **<D> Apply**.

55. **<D>** in a clear area in the design file. Like the profile, you are identifying the lower left corner for the display, so make certain you are in an area that is clear above and to the right of your **<D>**.



56. Fit your MicroStation view and notice the planimetric lines. You can see that by default, cross sections are cut perpendicular to the active alignment. In a later section, you will learn to cut the cross sections on a skew.



- 57. Use MicroStation to delete the cross sections and the planimetric lines in the plan view.
- 58. **<D>** on *Controls > Limits*.
- 59. Toggle on Station.
- 60. Set the *Start Station* to **116+00.00**.
- 61. Set the *End Station* to **111+50.00**.
- 62. **<D> Apply**.

63. **<D>** in a clear area in the design file.



64. Fit your MicroStation view and notice the planimetric lines.



Note: Using the Station Limits allows you to cut sections for just a portion of the alignment.

You can zoom in and out of the cross sections to review them, or you can use a viewer that will automatically zoom into a selected cross section.

Kross Section Viewer			- • •
Cross Section Set: SH52:H Horizontal Alignment: SH52:H Zoom Factor: 1:000 View: 1 Movie Mode Iime: 1.00 sec. Bun	Cross Sections: 106+00.00 106+50.00 107+00.00 107+50.00 108+00.00 108+50.00 109+50.00 110+50.00 110+50.00 111+00.00	4 III >	Close Preferences) Help

65. Choose Evaluation > Cross Section > Cross Section Viewer.

The viewer allows you to view cross sections by set. If you have more than one set of sections in the file, you can use the drop-down to choose the set you want to view, or you can use the target and $\langle D \rangle$ inside one of the sections. If you are zoomed out far enough, you will see a box drawn around the set of sections currently shown in the Viewer.

- 66. $\langle D \rangle$ on any one of the sections in the list.
- 67. With only one MicroStation view open, the Viewer automatically uses it to zoom into the section selected. If you have more than one MicroStation view open, you are prompted to select the view with a <D>.



- 68. Change the *Zoom factor* to *1.0000* and choose another section.
- 69. **<D> Run**.

Just as before, with only one MicroStation view open, the Viewer automatically uses it to zoom into the sections, but this time it automatically scrolls through the entire set. If you have more than one MicroStation view open, you are prompted to select the view with a **<D>**.

Note: <Esc> on your keyboard stops the viewing process.

- 70. <D> Close on the Cross Section Viewer.
- 71. Window in to any one of the sections.



- **Note:** The lifts, curb and gutter, etc. are *components*, which were turned on before cutting sections. Design surfaces are made up of these components, as well as features and triangles.
- 72. Select Evaluation > Cross Section > Update Cross Section.
- 73. Set the Cross Section Set to SH52-H.
- 74. Set the Mode to Display Off.
- 75. Select the *Components* branch at left.
- 76. Highlight the 12345 SH52 surface.
- 77. Right-click in the component list and *<D> Select All*.
- 78. **<D> Apply**, then **Close**.

Cross Section Sec	Mode: 🔘 Refresh 💿 Display On 💿 Display Off	
SH52-H	Start: 99+84.26 Stop: 135+00.00	
Update Cross Section General	Surface: Name Description	
— Surfaces —	12345 SH52 Created from roadw	
 Crossing Features Projected Features 		
Storm and Sanitary		
	Camponent	
	Name Style	
	LT Select All Ctrl+A nt	
	LT Select None Ctrl+N	
	Styles	
	Apply Close Help	
5180 1100		

Note: The cross sections now show only the triangulated surface for SH52. Components may be turned on and off as desired using this procedure.

79. Use MicroStation to **Delete** the cross section set and the planimetric lines.

Note: Sections can be cut along any alignment, not just a highway alignment.

80. Using what you have learned, cut 25' sections along Wall-16-L that are 20' wide on either side.



- 81. Review the sections.
- 82. Use MicroStation to **Delete** the cross section set and the planimetric lines.

Chapter Summary::

- Surfaces may be reviewed graphically by viewing the perimeter, triangles and/or contours among other surface displays.
- Horizontal alignments may be viewed graphically along with their stationing and annotation.
- Horizontal alignments may also be tracked as a review tool.
- Reports for horizontal alignment can be generated with the Review commands or with the XML Report command.
- With a horizontal alignment and surface, you can generate a profile and annotate a vertical alignment.
- With a horizontal alignment and surface, you can generate a set of cross sections to review the data.

LAB 3 - Working With Alignments

Alignments are reference points that are used to relate the design world to the real world. The coordinates that make up the alignment are located at the construction site and measurements for design elements are taken from these coordinates.

In this lab, a horizontal and vertical alignment is created that represents the new flowline for a drainage channel. The new flowline must match the existing flowline horizontally and vertically at the beginning and end of the alignment as well as at an inlet structure in the middle.

Chapter Objectives:

- Import a horizontal alignment from a graphic element.
- Add a horizontal curve to the alignment.
- Create a profile.
- Define a vertical alignment.

The following files are used in this lab:

- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Preferences\ CDOT_Civil.xin
- C:\Projects\12345\Bridge\Drawings\Reference Files\12345BRDG_Model-Drain.dgn
- C:\Projects\12345\Bridge\Drawings\Reference Files\12345BRDG_Prof.dgn
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345_Drain

Lab 3.1 - Draw Graphic Elements for the Horizontal Alignment

There are numerous methods for entering horizontal alignment data into InRoads. Most of these methods are designed for survey and roadway geometry. Because this lab is not concerned with roadway geometric design criteria, the alignment can be laid out graphically then imported into inRoads.

Section Objectives:

- Create MicroStation graphic elements that represent the alignment.
- Create a complex chain from those elements.
- Import the graphic as a horizontal alignment.
- Change the direction of the alignment, if needed.
- 1. Start MicroStation and InRoads using the 12345BRDG_Model-Drain.dgn file.
- 2. In the main InRoads dialog box, verify that the *CDOT_Civil.xin* is loaded.
- 3. From the InRoads menu bar, select **File > Open**.
- 4. Navigate to the C:\Projects\12345\ROW_Survey\InRoads\DTM\ directory and open the 12345_Drain file

5. Using the MicroStation view controls, zoom into the area shown in the illustration below.



- 6. From the *CDOT Menu*, select the **Geometry** group.
- 7. **<D>** the **Proposed** button.
- 8. Verify that the *Type* is set to Horizontal.
- 9. Highlight Alignment from the item list. This activates the Place SmartLine command.





10. $\langle T \rangle$ then $\langle D \rangle$ on the points shown in the illustration below.

Points 1 and 2 are on the flowline of the existing channel. Point 3 is in the center of the top side of the inlet structure.

11. **<R>** to exit the **Place SmartLine** command. The result is a linestring placed as shown below.



12. Zoom out to see the channel below the inlet.
13. **<T>** then **<D>** on the points shown in the illustration below.



This line will match the new channel to the existing channel below the inlet.

14. **<R>** to exit the **Place SmartLine** command. The result is a linestring placed as shown below.



In order to create an alignment from these elements must match up end to end. The MicroStation Extend Elements to Intersection is used to accomplish this.

15. From the MicroStation Main toolbar select the **Extend Elements to Intersection** command.



- 16. **<D>** on the first linestring near the inlet.
- 17. $\langle D \rangle$ the second linestring near the end closest to the inlet.



Note: If you are having trouble selecting the correct lines, the green terrain lines can be deleted to get them out of the way.

The MicroStation Create Complex Chain command is used to join the two linestrings into a single element which can be imported into InRoads as a horizontal alignment.

18. From the MicroStation Main toolbar select the Create Complex Chain command.

	· · · · · · · · · · · · · · · · · · ·	8	
1	<u>بري</u>	1	Drop Element
00	5	<u>2</u>	Create Complex Chain
8	Z	<u>3</u>	Create Complex Shape
×	ᢓ	<u>4</u>	Create Region
	₩	<u>5</u>	Add To Graphic Group
	₩	<u>6</u>	Drop From Graphic Group
	6	7	Group Hole
	S	÷.	

19. **<D>** on each line, then **<D>** in a blank area to accept the elements.

20. <**R**> to exit the **Create Complex Chain** command.

This completes the linestring that will be used for the alignment. Next, the linestring is imported into InRoads.

Section Summary:

- MicroStation graphic elements can be used to create InRoads alignments.
- Multiple elements can be joined to create a single element which is easier to import into a single alignment.

Lab 3.2 - Create a Geometry Project and Import a Horizontal Alignment

Section Objectives:

- Create a new InRoads geometry project.
- Import the chain into InRoads.

The first step is to create a Geometry Project. This is the file that holds the horizontal and vertical alignment data.

- 1. Start MicroStation and InRoads (if they are not already started) and open the *12345BRDG_Model-Drain.dgn* file.
- 2. If InRoads was already opened, save and close any InRoads data files that are open.
- 3. From the inRoads menu, open the C:\Projects\12345\ROW_Survey\InRoads\DTM\ 12345_Drain file.

4. From the InRoads main menu, select **File > New**.

1	В	entley InRo	oads XM Ed	lition						• 🗙
	<u>F</u> ile	e <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	Tools	<u>H</u> elp
Г	Ĉ	<u>N</u> ew						Ctrl+N		
3	• • •	Open Save Save <u>A</u> s Close Project De	faults					Ctrl+O		Type XIN
5	闺	Text Import Import Export Translators	t <u>W</u> izard					1		• 11

- 5. In the *New* dialog box, **<D>** the **Geometry** tab.
- 6. Set the *Type* to Geometry Project.
- 7. Key in *12345-Drain* for the *Name*.
- 8. Key in *New channel project* for the *Description*.
- 9. **<D> Apply** then **<D> Close** to dismiss the dialog box.

Type:	Geometry Project	Apply
Description:	12345-Drain New Channel Project	Help
Style:		
News	Deserver	
Default	Description	

- 10. On the InRoads Explorer, **<D>** the **Geometry** tab.
- 11. **<R>** on the **12345-Drain** geometry project and select **Save** from the right click menu.

🚔 Bentley InRoads XM Edition	on	[- • ×
<u>File</u> <u>Surface</u> <u>G</u> eometry <u>D</u>	rainage <u>E</u> valuation <u>M</u> odeler	Drafting Quantities	<u>T</u> ools <u>H</u> elp
<unnamed></unnamed>	- 🚡 🗟 🔪 🤇	🐓 📕 🛶 📴	
	Name	Description	By Whom
⊕ j≟ Default	* 🚺 12345-Drain	n New Channel	cferree
E 12345-Drain	New		ree
⊡ 🚺 12345-Dra	Save		
12345-	Save As		
🖁 Geometry 🖄 Pref	Set Active		F.
Toggles Locate Features/Lo	Сору		

- 12. In the *Save As* dialog box, navigate to the C:\Projects\12345\Bridge\InRoads\ folder.
- 13. At the bottom of the dialog box, use the *Active* drop down menu to reselect the **12345**-**Drain** geometry project. This will automatically fill in the name field so that the name on the hard drive matches what is shown in InRoads.
- 14. **<D> Save** then **<D> Cancel** to dismiss the dialog box.

🙀 Save As									X
Save in:	📗 InRoads			-	G 🖠	Þ	 ~		
Ca.	Name	Date modif	Туре	Size					
Recent Places									
Desktop									
Chris Ferree									
Computer									
Network	File name:	12345-Drain	.alg			Ŧ		Save	•
	Save as type:	Geometry Pr	ojects (*.alg)			•		Cano	el
								Help	
	Active:	12345-Drain				•		Option	s

Next, the horizontal alignment is created from the graphic element drawn above.

- 15. From the InRoads menu bar, select File > Import > Geometry.
- 16. In the *Import Geometry* dialog box, verify that the From Graphics tab is selected.
- 17. Set the *Type* to Horizontal Alignment.
- 18. Key in *Channel_Flowline* for the *Name*.
- 19. Key in *Channel alignment for project 12345* for the *Description*.
- 20. Set the *Style* to ALG_PRO.

- 🚔 Import Geometry - - - -From Graphics ICS Vertical from Surface Type: Horizontal Alignment Apply Geometry Name nnel Flowline Description Channel alignment for project 12345 Help Style: ALG PRO Horizontal Curve Definition Arc Vertical Curve Definition: Paraboli Target Geometry Project: 12345-Drain Horizontal Alignment: 12345-Drain Use Fence Resolve Gaps and Nontangencies Join Elements No Duplicate Cogo Points All Selected Elements Added to Single Alignment Attribute Tags 📃 Use Tag Data Project: Active Name Conflicts: No Overwrite Close
- 21. **<D> Apply**. The *Import Geometry* dialog box minimizes.

- 22. **<D>** on the linestring then **<D>** in a blank area to accept the element.
- 23. **<R>** to end the command. The *Import Geometry* dialog box is redisplayed.
- 24. **<D>** the **Close** button to dismiss the dialog box.

The linestring has now been added to the 12345-Drain geometry project. Next, the direction of the alignment must be determined. The alignment should run from north to south. The direction of the alignment is determined by the direction of the linestring (or complex chain). To check the direction of the alignment use the review command.

- 25. In the InRoads explorer, expand the **12345-Drain** geometry project to show the **Channel_Flowline** alignment.
- 26. <R> on the Channel_Flowline alignment and select Review from the right click menu.
- 27. Move the **Review Horizontal Alignment** dialog box so that the **Channel_Flowline** alignment is visible.

28. In the *Review Horizontal Alignment* dialog box, toggle the mode to Element. This causes the first element of the alignment to highlight.



29. **<D> Close** to dismiss the Review Horizontal Alignment dialog box.

If the element highlights as shown in the image above, the alignment is running the wrong way. To change the direction of the alignment:

Important! Complete steps 30 through 33 only if your alignment starts at the south end, as illustrated above.

- • Rentley InRoads XM Edition <u>File</u> <u>Surface</u> <u>Geometry</u> <u>Drainage</u> <u>Evaluation</u> <u>Modeler</u> <u>Drafting</u> <u>Quantities</u> <u>Tools</u> <u>Help</u> <Unnamed> View Geometry • 🔪 🎽 📩 🛃 🗐 Eit Alignment Descripti Type ⊡⊸⊒ Geom Horizontal Curve Set Vertical Curve Set 📄 🧮 12 Create/Edit Alignment by Cogo Points... Horizontal Element • 🗩 <u>J</u>oin... Vertical Element 🗄 崖 De. → <u>7</u> <u>T</u>rim Alignment → <u>7</u> Extend Alignment Superelevation 🖁 Geometry 🖌 💉 Pa<u>r</u>tial Delete Alignment Lot Layout Modifies geome Review Horizontal... Multicenter Curve. <u>Cul-de-sac...</u>

 <u>Cul-de-sac...</u>

 <u>Create Right-of-Way...</u> Review Vertical... Review Geometry Points... 😤 Parallel Horizontal Alignment.. Cogo <u>P</u>oints Parallel Vertical Alignment. Locate 之 Transpose. Active Geometry... Inverse Direction ... VI Transform. X Delete Geometry... Assign <u>N</u>ames. Rename Geometry. Assign Elevations. <u>U</u>tilities
- 30. From the InRoads main menu bar, select Geometry > Utilities > Transpose.

31. In the Transpose dialog box, <D> the "target" button then <D> on the alignment. <D> in a blank area to accept.



- 32. The alignment name appears in the Selected list. **<D>** the **Apply** button. **<D>** Close to dismiss the *Transpose* dialog box.
- 33. Review the alignment again. The north most element highlights indicating the alignment now runs in the desired direction.

	The highlighted element	
· · · · · · · · · · · · · · · · · · ·	🕌 Review Horizontal Alignment	
	Geometry Project: 12345-Drain Horizontal Alignment: Channel_Rowline Horizontal Alignment Bement	Close Save As
· · · · · · · · · · · · · · · · · · ·	STATION NORTHING EASTING	Append
с/	POBLO 287107.78 227082.68 PI () 0+07.37 387101.19 227085.98 Tangent Direction: S 26^36'00" E Tangent Length: 7.37	Display Print Help Select
		First < Previous Next > Last

34. **<D> Close** to dismiss the Review Horizontal Alignment dialog box.

To smooth the intersection between the last two segments of the alignment, a horizontal curve is added to the alignment.

35. From the InRoads menu bar, select Geometry > Horizontal Curve Set > Define Curve.

🙀 Bentley InRe	oads XM Edition	E	_ • •
<u>File</u> Surface	Geometry Drainage Evaluation	<u>M</u> odeler Dr <u>a</u> fting <u>Q</u> uantities <u>T</u>	ools <u>H</u> elp
<unnamed></unnamed>	View <u>G</u> eometry ∐rt Alignment	Proi Description	File Name
⊟… 🖧 Geon	Horizontal Curve <u>S</u> et	• / <u>A</u> dd PI	C:\Projects\12
🕀 崖 De	Vertical Curve Set	▶ <u>Î</u> ≫ Insert Pl	
	Hori <u>z</u> ontal Element Vertical Ele <u>m</u> ent	<u>I</u> ≫ <u>D</u> elete PI	
	Superelevation	Define Curve	
	Lot La <u>v</u> out		
	Review Horizontal	<u>v</u> <u>Events</u>	
🖁 🔚 Geometry	Geometry Points		+
Adds a horizont		•	.H

36. The first PI highlighted does not need a curve because that segment of the alignment is there to match the existing flowline. **<D>** the **Next** button to move to the next PI.

Spiral to Tangent	Northing:	387101.19	- -
Point on Curve	Easting:	227085.98	
Angle up to PCC (Pl	C to PCC)	0^00'00''	+
Angle after PCC (PC)	C to PT)		
First < Previous	Next >	Last	Select

- 37. In the *Radius 1* field, key in *315*. This radius is a design decision made by the engineer.
- 38. **<D> Apply**. The MicroStation graphics are updated to show the radius.

\rightarrow	Define Horizontal Curve Set	
$\mathcal{A}_{\mathcal{A}}$	Horizontal PI	Apply
	Define By: Known PI Coordinates	
/	Direction Back: S 3^56'54" W	+ Close
	Length Back: 55.16	+ Undo
(0)	Point Name:	Rate Calc
T/	Northing: 387046.16	Design Calc
	Easting: 227082.18	Curve Calc
 /	Direction Ahead: S 13^42'28'' W	+ Report
<u> </u> /	Length Ahead: 55.33	+
		Нер
	Horizontal Curve Curve Set Type:	
	Define Transitions By: (a) Length (C) Constant	
\mathcal{P}	Leading Transition: Clothoid - 0.00	- +
	Radius 1: 315.0	0 +
	Compound Transition: Clothoid - 0.00	+
	Radius 2: 0.00	-+-
//0/	Trailing Transition: Clothoid - 0.00	+
	Define By:	
	C Tangent to Spiral Point Name:	
	Spiral to Tangent Northing: 38704	46.16 +
	Point on Curve Easting: 2270	82.18
	Angle up to PCC (PC to PCC)	0'00'' +
	Angle after PCC (PCC to PT)	
	First < Previous	Select

- 39. **<D> Close** to dismiss the *Define Horizontal Curve Set* dialog box.
- 40. In the InRoads explorer, <R> on the 12345-Drain geometry project and select Save from the right click menu.

Section Summary:

- The Geometry project holds horizontal and vertical alignment data.
- Use the same name for the geometry project when saving it as used when it was created.
- When importing a horizontal alignment from graphics, the direction of the element determines the direction of the alignment.

Lab 3.3 - Creating a Vertical Alignment

A vertical alignment controls the elevation of the template as it is placed along the corridor. Vertical alignments are typically built in a profile window.

Section Objectives:

- Create a profile along the new horizontal alignment.
- Create a vertical alignment placeholder.
- Add data to the vertical alignment

In order to add data to a vertical alignment, a profile window is required.

- 1. From the MicroStation menu bar, select File > Open.
- 2. Navigate to the C:\Projects\12345\Bridge\Drawings\Reference Files\ folder and select the 12345BRDG_Prof.dgn file.
- 3. From the InRoads menu bar, select Evaluation > Profile > Create Profile.



- 4. In the *Create Profile* dialog box, <D> the Preferences button.
- 5. In the *Preferences* dialog box, select **10x Vertical**.

6. **<D> Load** then **<D> Close** to dismiss the *Preferences* dialog box.

Create Profile Create Profile General Source Include Offsets Controls	Set Name: Channe Direction	el_Rowline	Exaggeration Vertical: 10.0000 Horizontal: 1.0000	
Gind Details ASCII	Surfaces: Object Default 12345_Drain	Name Default T_Existi	Preferences Name: 10x Vertical 1xVert_Drain 1xVert_Drain 2xVert_Drain 5x Vertical 5xVert_Drain 5xVert_Drain 5x Vertical 5x Drain * Preference '10x Vertical' loaded	Close Load Save Save As Delete Help
		Apply	Preferences Close	Help

Using the 10x vertical exaggeration makes it easier to see elevation changes in relatively flat terrain.

- 7. Verify that the **12345_Drain** surface is the only selected surface.
- 8. **<D> Apply** then **<D>** in the MicroStation view window. The profile is drawn in the dgn.

🐂 Create Profile						-	•	3
Create Profile	Set Name: Channel Direction	_Rowline	Exaggeratio Vertical: Horizontal:	n 10.0000 1.0000				
Grid 	Surfaces: Object Default 12345_Drain	Name Default T_Exist	ing_Ground Proj	BYL BYL Derties	All			
		Apply	Prefere	nces	Close		Help	

- 9. **<D> Close** to dismiss the *Create Profile* dialog box.
- 10. In MicroStation, zoom in on the profile so that the elevations between 4680 and 4700 are visible.

With the profile window created, the vertical alignment data can be entered. The first step in this process is to create a vertical alignment placeholder for the Channel_Flowline horizontal alignment.

- 11. On the InRoads menu bar, select **File > New**.
- 12. In the *New* dialog box, **<D>** the **Geometry** tab.
- 13. Set the *Type* to Vertical Alignment.
- 14. Key in *Channel_Flowline-V* for the *Name*.
- 15. Set the *Style* to ALG_PRO_Vert.
- 16. **<D> Apply** then **<D> Close** to dismiss the *New* dialog box.

🚼 New		
Surface Geometry	7	
Туре:	Vertical Alignment	 Apply
Name:	Channel_Flowline-V	Help
Description:		
Style:	ALG_PRO_Vert	-
Curve Definition:	Parabolic	
Name	Description	Style
Channel_Flowline		ALG_PRO_Vert
	Close	

17. On the InRoads menu bar, select Geometry > Vertical Curve Set > Add Pl.



18. In the *Add Vertical PI* dialog box, **<D>** the **Add** button.

Dynamics	Apply
	1 4 4 9
Station: 0.00	Close
Elevation: 0.00	Help
Grade: 0.00%	



19. <**T**> then <**D**> on each of the points indicated in the illustration below.

20. <R> <R> to exit the Add Vertical PI command. <D> the Close button to dismiss the *Add Vertical PI* dialog box.

The illustration below shows the completed vertical alignment.



21. In the InRoads explorer, <R> on the 12345-Drain geometry project and select Save from the right click menu.

Section Summary:

- A vertical alignments is a child of a horizontal alignment.
- Vertical alignment data is entered within a profile window.
- A profile window can be exaggerated vertically to emphasize elevation changes.
- Vertical PIs can be placed by tentative snapping to elements within the profile window. The SE=*station, elevation* key in can also be used to place vertical PIs.

Chapter Summary:

- Horizontal and vertical alignments are used to define the location or path of construction.
- Horizontal PIs can be placed by tentative snapping to elements within the drawing window. The xy=*easting coordinate,northing coordinate,elevation(optional)* key in can also be used to place horizontal PIs.

- A profile window displays the elevations of the existing ground under the horizontal alignment.
- Profiled are the entry point for vertical alignment data.
- Save the geometry project after data is entered. This file does not save automatically.

LAB 4 - Templates and Corridors

This lab demonstrates the use of templates and corridors to create a surface model (dtm) that can then be used to calculate earthwork and other quantities. This method of design is well suited for linear construction sites such as ditches/channels and walls.

In this exercise, a template is created that contains a cast-in-place reinforced concrete channel liner, the excavation required to build the liner, and backfill to complete the construction. Below is a sketch of the template.



TYPICAL SECTION

Note: The slope paving shown in the illustration above has been omitted for this lab.

Chapter Objectives:

- Build a template showing the excavation, channel liner, and slope paving.
- Create a corridor that follows an alignment.
- Review design data in Roadway Designer.
- Generate design surfaces from the template and corridor.

The following files are used in this lab:

- C:\Projects\12345\Bridge\Drawings\Reference Files\12345BRDG_Model-Drain.dgn
- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Preferences\ CDOT_Civil.xin
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345_Drain
- C:\Projects\12345\Bridge\InRoads\12345_Drain.alg
- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Templates\ CDOT_Template-Library.itl

Lab 4.1 - Construct the Channel Liner

The ditch liner is a closed shape component that defines the design channel. The wall of the channel liner are 4 inches thick and the bottom is 6 inches thick. The left side rises 6 inches above the existing ground, while the right side is flush with the existing ground. This component is not included as part of the triangulated surface model because it does not define the area of excavation.

Section Objectives:

- Copy the standard template library into the project folder.
- Create a new template in the project template library.
- Construct a new channel liner component for the template.
- Edit point properties to define the shape of the liner.
- Edit the component properties to exclude the line from triangluation.
- 1. Start MicroStation and InRoads opening the 12345BRDG_Model-Drain.dgn file.
- 2. In the main InRoads dialog box, verify that the *CDOT_Civil.xin* is loaded.
- 3. From the InRoads menu bar, select **File > Open**.

•	В	entley InRo	oads XM Ed	lition							x
	File	e <u>S</u> urface	Geometry	<u>D</u> rainage	<u>E</u> valuation	<u>M</u> odeler	Drafting	<u>Q</u> uantitie:	s <u>T</u> ool	s <u>H</u> elp	b
	٣	New						Ctrl+N		∀ #	*
	Ē	Open						Ctrl+O	Ву	Whon	n
	R	Save As						,	tra	antn	
	~	<u>Close</u>						•	cf	erree	
	ø	Project Def	faults								
	闺	Text Import	t <u>W</u> izard								
		Import						•			
		Export						•			
l		<u>T</u> ranslators	;					•			
_		1 C:\Projec	ts\12345-B	ridae \Bri\	Ditch Channe	l\iri85drain	law.dtm				•
C		2 C:\Work	space\Work	(space-CD	.\Templates\	CDOT_Te	mplate-Libr	rary.itl			н

- 4. Navigate to the C:\Projects\12345\ROW_Survey\InRoads\DTM\ directory and open the 12345_Drain file
- 5. Navigate to the C:\Projects\12345\Bridge\InRoads\ directory and open the 12345_Drain.alg file.

6. Navigate to C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Templates\ and open the CDOT_Template-Library.itl file.

📷 Open					×
Look in:	Templates		-	G 🤌 📂 🗉	·
9	Name D	ate modif Ty late-Library.itl	Network Chris Ferree Public		
Recent Places			Computer Local Disk Workspa	(C:) ice pace-CDOT_XM	
Chris Ferree)) Stan)) Ini	dards-Global Roads Templates	
Computer					
Network	File name: Files of type:	InRoads Files (*.n	wk;*.dtm;*.alg;*.itl;*.	▼ ird;*.sdb;*> ▼	Open Cancel Help

- 7. Navigate to C:\12345\ROW_Survey\InRoads\DTM\ and open 12345_Drain.
- 8. **<D> Cancel** to dismiss the Open dialog box.
- 9. In the InRoads Explorer pane, **<D>** the **Templates** tab.
- 10. <R> on CDOT _Template-Library and select Save As from the right click menu.



- 11. In the Save As dialog box, navigate to the C:\Projects\12345\Bridge\InRoads\ folder.
- 12. Key in *12345BDRG_Templates.it1* for the file name.

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

Nave As		
Save in:	📔 InRoads 🔹 😨 🎓 🖽 🗸	
Recent Places	Becent Items Desktop Network Chris Ferree	
Desktop Desktop Chris Ferree	Public Computer Local Disk (C:) Projects 12345 Bridge InRoads	
Computer		
Network	File name: 12345BRDG_Template-Library Save Save as type: Template Libraries (*.itl) Cancel Help Onlines	

14. From the InRoads menu bar, select **Modeler > Create Templates**. This displays the Create Template dialog box.

Hentley InRoads XM Edition	
File Surface Geometry Drainage Evaluation	Modeler Drafting Quantities Tools Help
<unnamed> 🔹 👔 😴</unnamed>	rreate <u>T</u> emplate
Nam	Roadway Designer By Whom Express Modeler
	Marker Cremee
Templates Corridors	4
Designs and manages roadway corridors	

- 15. From the Create Template menu bar, select **Tools > Dynamic Settings**.
- 16. In the *Dynamic Settings* dialog box, key in *O. 10* for both the "X" and "Y" Step.
- 17. 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 Dyna	amic Origin

The Dynamic Settings dialog box is used to enter data while constructing a component.

18. In the Template Library Explorer area of the *Create Template* dialog box, expand the folders to show the contents of the *1-Templates* folder.



19. **<R>** on the **1-Templates** folder and select **New > Template** from the right click menu.

File Edit Add Too	bls			
Template Library:	Bridge\InRoads\12	2345BF	Cun Nan Des	rent Template ne: cription:
	New		+	Folder
HMA_Crov HMA_Divic HMA_Full HMA_Urba	Cut Copy Paste	Ctrl-) Ctrl-(Ctrl-)	x c v	Template

20. Key in 12345_Channel-Liner for the template name.

Because the channel liner is a unique shape, there are no components in the library that can be used. Therefore, it will be built as a new component. The channel liner is first "sketched in" as an Unconstrained component. Then constraints are applied to the component points to define the proper shape.

21. <**R**> in the Template view and select **Add New Component** > **Unconstrained** from the right click menu.

Add New (Component	÷	Simple	
Set Dynam	nic Origin	Ctrl-D	Constrained	
oct bynan	ine origini	cur b	Unconstrained	ŀ
			Null Point	1
			End Condition	

22. In the lower center of the dialog box, data fields are displayed that apply to the new component. In the *Name* field, key in *Channel Liner*.

23. Select D_CONC_Pvmt from the *Style* drop down menu.

╡╴╴┇┇╡╡╡╗╗╔╺┊╸┥		
Current Component		
Name: Channel Liner	Style:	D_CONC_Pvmt

- 24. In the *Dynamic Settings* dialog box, <D> on the *Point Name* drop down arrow, and select Conc_Centerline-Top from the menu. This automatically sets the *Point Style* as well.
- 25. Move the cursor onto the *Template Origin* (the magenta square) so that the readout in the *Dynamic Settings* dialog box is *X*: 0.00 Y: 0.00, then <D>.

R		
	Dynamic Settir	ngs 🖾
	X: 0.00	Step: 0.10
	Y: 0.00	Step: 0.10
	Point Name:	Conc_Centerline 👻
	Point Style:	Centerline 🔻
	Point Style:	Centerline
	Point Style: Apply Affixe hs=	Centerline

- 26. In the *Dynamic Settings* dialog box, <D> in the *Point Name* field and key in *Ditch-Bottom*.
- 27. Set the *Point Style* to D-DITCH-Bottom.
- Move the cursor into the Template View to the right of the origin and <D> to place the *RT_Ditch-Bottom* point. The "*RT_*" is added to the name because *Apply Affixes* is on.
- 29. Key in *Wall_Inside-Top* for the next point.
- 30. Set the *Point Style* to D_CONC_Pvmt.
- 31. **<D>** above the *RT_Ditch-Bottom* point.



32. Use the diagram below to name and place the remaining points.

33. After the last point is placed, <**R**> in the Template View and select **Finish** from the right click menu.



This completes the basic outline of the channel liner. Next, constraints are assigned to the point to form the exact shape desired.

- 34. **<D><D>** on the **RT_Ditch-Bottom** point. This displays the Point Properties dialog box.
- 35. In the *Point Properties* dialog box, set the *Constraint 1 Type* to Horizontal.
- 36. Set the Constraint 2 Type to Vertical.

- 37. Set the *Parent 1* for both constraints to Conc_Centerline-Top.
- 38. Key in 2.00 for the Constraint 1 Value.
- 39. Key in **0.00** for the Constraint 2 Value.
- 40. **<D> Apply**.

Point Properties	
Name:	RT_Ditch-Bottom - + Apply
Feature Name Override:	RT_Ditch-Bottom
Surface Feature Style:	D_DITCH-Bottom
Alternate Surface:	Next >
	Member of: RT_D_CONC_Pvmt
Constraints Constra Type: Horizontal Parent 1: Conc_Cer	int 1 Constraint 2 Vertical interline-T() + Conc_Centerline-T() +
Value: 2.00	0.00
Label:	
Style Constraint:	
Horizontal Range: 0.00	Vertical O Both

The RT_Ditch-Bottom point symbol changes to red and the point move to be 2 feet to the right of the Conc_Centerline-Top point.

- 41. **<D> Next>** to move to the *RT_Wall_Inside-Top* point.
- 42. Set the *Constraint 1 Type* to Horizontal.
- 43. Set the *Constraint 2 Type* to Vertical.
- 44. Set the *Parent 1* for *Constraint 1* to *RT_Ditch-Bottom*.
- 45. Set the *Parent 2* for *Constraint 1* to *RT_Wall_Outside-Top*.
- 46. Key in **0.00** for the **Constraint 1 Value**.
- 47. Key in -0.04 for the Constraint 2 Value.

48. **<D> Apply**.

M Point Properties		X
Name:	RT_Wall_Inside-Top 👻 💠	Apply
Feature Name Override:	RT_Wall_Inside-Top	Close
Surface Feature Style:	D_CONC_Pvmt	< Previous
Alternate Surface:		Next >
	Member of:	Help
	RT_D_CONC_Pvmt	
Constraints Constra Type: Horizontal	int 1 Constraint Vertical	2
Parent 1: RT_Ditch-E	Bottom 🔻 🕈 RT_Wall_Out	side-T(▼ +
Parent 1: RT_Ditch-E	RT_Wall_Out	side-T(🔻 🕂
Parent 1: RT_Ditch-E	RT_Wall_Out	side-T(💌 🕂
Parent 1: RT_Ditch-E Value: 0.00 Label: Style Constraint:	Bottom RT_Wall_Out	side-T(▼ -+
Parent 1: RT_Ditch-E Value: 0.00 Label: Style Constraint: (a) Horizontal	Bottom + RT_Wall_Out -0.04 -0.04 Vertical Both	side-T(▼ +

- 49. **<D> Next>** to move to the *RT_Wall_Outside-Top* point.
- 50. Set the *Constraint 1 Type* to Horizontal.
- 51. Set the *Constraint 2 Type* to Vertical.
- 52. Set the *Parent 1* for both constraints to RT_Ditch-Bottom.
- 53. Key in **0.34** for the *Constraint 1 Value*.
- 54. Key in **0.04** for the Constraint 2 Value.

55. **<D> Apply**.

Doint Droportion			
Point Properties			
Name:	RT_Wall_Outside-Top	→ +	Apply
Feature Name Override:	RT_Wall_Outside-Top		Close
Surface Feature Style:	D_CONC_Pvmt	•	< Previous
Alternate Surface:		-	Maria 2
			ivext >
	Maarkanaf		Help
	INTERIOR	C. Durant	
Constraints Type: Horizontal Parent 1: RT_Ditch-E	int 1 Verti Nottom Verti	Constraint 2 cal Ditch-Botto	2 ▼ m ▼ +
Value: 0.34	0.04		
Label:	•		•
Style Constraint:		-	
Horizontal	Vertical OBoth		
Range: 0.00			

The Vertical constraint is temporary, in order to position the point. The final Constraint 2 is now set.

- 56. Set the *Constraint 2 Type* to Project to Surface.
- 57. Set the *Parent 1* for *Constraint 2* to Up.
- 58. Select **12345_Drain** for the *Constraint 2 Value*.

59. **<D> Apply**.

🕌 Point Properties		×
Name:	RT_Wall_Outside-Top -	+ Apply
Feature Name Override:	RT_Wall_Outside-Top	
Surface Feature Style:	D_CONC_Pvmt -	
Alternate Surface:		
		Next >
	Member of:	Help
	RT_D_CONC_F	vmt
Constraints	int 1 Con	straint 2
Type: Horizontal	 Project 	To Surface 🔻
Parent 1: RT_Ditch-E	Bottom 👻 🕂 Up	-
Value: 0.34	12345_[Drain 👻
Label:	-	
Style Constraint:		-
Horizontal	Vertical O Path	
Bange:		
U.00		

- 60. **<D> Next>** to constrain the *RT_Outside-Bottom* point.
- 61. Set the *Constraint 1 Type* to Horizontal.
- 62. Set the *Constraint 2 Type* to Vertical.
- 63. Set the *Parent 1* for *Constraint 1* to RT_Wall_Outside-Top.
- 64. Set the *Parent 1* for *Constraint 2* to RT_Ditch-Bottom.
- 65. Key in **0.00** for the **Constraint 1 Value**.
- 66. Key in -0.50 for the Constraint 2 Value.
- 67. **<D> Apply** then **<D> Next>** to constrain the *LT_Outside-Bottom* 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 LT_Ditch-Bottom.
- 71. Key in -0.34 for the Constraint 1 Value.
- 72. Key in -0.50 for the Constraint 2 Value.
- 73. **<D> Apply** then **<D> Next>** to constrain the *LT_FG* point.

This point will also have a temporary vertical constraint to position the point then it will be changed to a Project to Surface constraint.

74. Set the *Constraint 1 Type* to Horizontal.

- 75. Set the Constraint 2 Type to Vertical.
- 76. Set the Parent 1 for Constraint 1 to LT_Wall_Outside-Bottom.
- 77. Set the *Parent 1* for *Constraint 2* to LT_Ditch-Bottom.
- 78. Key in **0.00** for the Constraint 1 Value.
- 79. Key in **0.00** for the Constraint 2 Value.

80. <D> Apply

- 81. Set the Constraint 2 Type to Project to Surface.
- 82. Set the *Parent 1* for *Constraint 2* to Up.
- 83. Select 12345_Drain for the Constraint 2 Value.
- 84. **<D> Apply** then **<D> Next>** to constrain the *LT_Wall_Outside-Top* point.
- 85. Set the *Constraint 1 Type* to Horizontal.
- 86. Set the Constraint 2 Type to Vertical.
- 87. Set the *Parent 1* for both constraints to LT_FG.
- 88. Key in **0.00** for the Constraint 1 Value.
- 89. Key in **0.50** for the Constraint 2 Value.
- 90. <D> Apply then <D> Next> to constrain the LT_Wall_Inside-Top point.
- 91. Set the *Constraint 1 Type* to Horizontal.
- 92. Set the *Constraint 2 Type* to Vertical.
- 93. Set the *Parent 1* for *Constraint 1* to LT_Ditch-Bottom.
- 94. Set the *Parent 1* for *Constraint 2* to LT_Wall_Outside-Top.
- 95. Key in **0.00** for the Constraint 1 Value.
- 96. Key in -0.04 for the Constraint 2 Value.
- 97. <D> Apply then <D> Next> to constrain the *LT_Ditch-Bottom* point.
- 98. In the Point Properties dialog box, set the Constraint 1 Type to Horizontal.
- 99. Set the Constraint 2 Type to Vertical.
- 100.Set the *Parent 1* for both constraints to Conc_Centerline-Top.
- 101.Key in -2.00 for the Constraint 1 Value.
- 102.Key in **0.00** for the Constraint 2 Value.
- 103.<D> Apply.

This completes the point editing for the channel liner component. To complete the component properties are edited. The component property to exclude the channel liner from triangulation will be turned on. This will allow the design surface to triangulate properly so that it represents the actual area of excavation on this project.

- 104.<D><D> on the line that makes up the channel liner. This displays the *Component Properties* dialog box for the channel liner.
- 105.In the Component Properties dialog box, toggle on Exclude from triangulation.

106.<D> Apply then <D> Close.

🕌 Component Prop	erties		.
Name:	RT_Channel-Liner	+	Apply
Description:			Close
Style:	D_CONC_Pvmt Close Shape		< Previous
Parent Component:	+		Next
Display Rules:		Edit	
Exclude from triang	Julation		Help

The channel liner points and component is still included in the dtm created later. They can still be included in the cross section display and have volume data calculated. However, the channel liner component will not affect the earthwork volume calculations.

		. .	Outside Tar								
0.5 · · · ·			T_Wall_Inside-Top								
0.4											
0.3 · · · ·											
0.2											
0.2											
0.1 · · · · ·											
		LT EG LI	T Ditch-Bottom	÷	: Conc Cen	: terline-Top		RT Wab-F	_Wall_Outsid	e-Top	
-0:0					a contra a contante			Contrast, as	spreasing of p		
•0:1 · · · ·											
-0:1 · · · · · · · · · · · · · · · · · · ·											
•0:1 · · · · •0:2 · · · · •0:3 · · · · •0:4 · · · ·		T Wall (Outside-Bottorn					RT	Wall Outsid	e-Bottom	

107. Select **File > Save** from the Create Template menu bar.

New	•	urrent Tem	plate			
Open	Ctrl+O	lame:	12345_0	Channel-Line	er	
Save	Ctrl+S	escription:				
Save As						
Save As Import TML						

Section Summary:

• Copying the standard template library is necessary because the standard template library is overwritten at login if it has been changed.

- Templates store the information used to create design dtms.
- A dtm can contain triangulated and untriangulated data.
- Point constraints locate points in relation to other points.
- The Project to Surface constraint is used to make the point follow the "target" surface.

Lab 4.2 - Create the Excavation Components

The Excavation components comprise the triangulated part of the template which will be used to compute earthwork volumes in a later lab. Two end condition components are used, the left one has a 2 to1 slope, the right one has a 0.5 to 1 slope.

Section Objectives:

- Build the two end condition components.
- Move a component to a new location.
- Test the template.

The first end condition component to be added is the right side end condition. It begins at the center bottom of the channel liner, runs to the RT_Wall_Outside-Bottom point, then up at a 0.5 to 1 slope to intercept the existing ground surface (12345_Drain).

- 1. <R> in the Template View of the Create Template dialog box and select Add New Component > End Condition from the right click menu.
- 2. In the *Current Component* area, Key in *0.5_to_1-Cut* in the *Name* field.
- 3. Set the *Style* to **D_Top-of-Cut**.
- 4. Verify that the *Target Type* is set to **Surface** and set the *Surface* to **12345_Drain**.



5. In the *Dynamic Settings* dialog box *Point Name* field, select Conc_Centerline-Top. Then edit the name to read *Conc_Centerline-Bottom*.

6. Set the key in type to **XY**= and key in *O*, *-O.5* in the key in field. Then press the **Enter** key. This places the first point at the center bottom of the ditch liner.

Dynamic Sett	ings 🛛 🖂
X: 3.50	Step: 0.10
Y: -1.80	Step: 0.10
Point Name:	Centerline-Bottom 👻
Daint Chilay	
Forni Style.	Centerline -
Apply Affi	Centerline
V Apply Affi	Centerline ves ves ves

The next point is placed on top of the RT_Wall_Outside-Bottom point. The new point is merged with the existing point retaining the existing point's properties.

7. In the *Dynamic Settings* dialog box, toggle off Check for Interception.

Dynamic Setting	gs 🗵				
X: 7.30	Step: 0.10				
Y: 1.50	Step: 0.10				
Check for Interception					
✓ Place Point a	✓ Place Point at Interception				
End Condition	on is Infinite				
Do Not Cons	struct				
Point Name:	Conc_Centerline 👻				
Point Style:	Centerline -				
Apply Affixes	Apply Affixes				
xy=	•				
Set Dy	mamic Origin				

- 8. Move the cursor into the Template View and place it over the *RT_Wall_Outside-Bottom* point.
- 9. When the point symbol turns white, **<D>** to place the new point.
- 10. In the *Dynamic Settings* dialog box, toggle on Check fo Interception.
- 11. Toggle on End Condition is Infinite.
- 12. In the *Point Name* field, select **Top-of-Cut** from the drop down menu.

13. Set the key in type to HS= (horizontal distance and slope)and key in *1,1:0.5* in the key in field. Then press the Enter key.

Dynamic Settin	gs				
X: 5.30	Step: 0.10				
Y: 0.30	Step: 0.10				
Check for Interception					
Place Point	at Interception				
End Condition	on is Infinite				
Do Not Con	struct				
Point Name:	Top-of-Cut	-			
Point Style:	D_Top-of-Cut	•			
Apply Affixes	8				
hs=	 1,0.5:1 				
Set D	ynamic Origin				

- 14. **<R>** in the Template view and select **Finish** from the right click menu.
- 15. This completes the right end condition.

The left side end condition is added similarly to the right side. However, it cannot be placed directly on top of the existing points. If it were placed on to the existing points, the software would interpret them as part of a single end condition and the template would not function properly.

Therefore, the left end condition will be built in an open area then moved to its proper location.

- 16. <**R**> in the Template View of the Create Template dialog box and select **Add New Component** > **End Condition** from the right click menu.
- 17. In the *Current Component* area, Key in *2_to_1-Cut* in the *Name* field.
- 18. Set the *Style* to **D_Top-of-Cut**.
- 19. Verify that the *Target Type* is set to **Surface** and set the *Surface* to **12345_Drain**.
- 20. In the *Dynamic Settings* dialog box *Point Name* field, select Conc_Centerline-Top. Then edit the name to read *Conc_Centerline-Bottom*.

Dynamic Setting	s		×
X: 0.50	Step:	0.10	
Y: -1.40	Step:	0.10	
Point Name:	Conc_Ce	enterline-	·
Point Style:	Centerlin	e	•
Apply Affixes			
hs= •			
Set Dyr	namic Orig	in	

- 21. Move the cursor into an open area of the Template View, to the left of the origin, and <D> to place the new point.
- 22. In the *Dynamic Settings* dialog box, toggle off Check for Interception and End Condition is Infinite.

- 23. Key in *Wall_Outside-Bottom* for the *Point Name*.
- 24. Select **D_Conc-Pvmt** for the *Point Style*.
- 25. Verify that the key in type is set to **HS**= and key in -*2.34,0* in the key in field. Then press the **Enter** key. This creates the bottom under the channel liner.

Dynamic Setting	IS 🗵
X: 6.50	Step: 0.10
Y: -0.60	Step: 0.10
Check for Int	erception
✓ Place Point a	t Interception
End Condition	n is Infinite
Do Not Cons	truct
Point Name:	Wall_Outside-Bot 👻
Point Style:	D_CONC_Pvmt -
Apply Affixes	
hs= •	-2.34,0
Set Dy	namic Origin

- 26. In the Dynamic Settings dialog box, toggle on Check for Interception.
- 27. Toggle on End Condition is Infinite.
- 28. In the *Point Name* field, select **Top-of-Cut** from the drop down menu.
- 29. Key in 1, -1:2 in the key in field. Then press the Enter key.

Dynamic Setting	js					
X: 6.30	Step: 0.10					
Y: 1.10	Step: 0.10					
Check for Int	Check for Interception					
V Place Point a	at Interception					
End Conditio	n is Infinite					
Do Not Cons	truct					
Point Name:	Top-of-Cut	•				
Point Style:	D_Top-of-Cut	•				
Apply Affixes						
hs=	· -1,-1:2					
Set Dy	namic Origin					

30. **<R>** in the Template view and select **Finish** from the right click menu.

This completes the left end condition. Now it is moved to its proper location.



31. <R> on the LT_Conc_Centerline-Bottom point and select Move Point from the right click menu.

32. Move the cursor (and the component) on to the *Conc_Centerline-Bottom* point and <D> to move the left end condition to its proper location.

This completes this portion of the template. The illustration below shows the template at this stage.



The template can now be tested to see how it will perform in a corridor.

 <D> the Test button under the right corner of the Template View. This displays the Test End Conditions dialog box. 34. **<D>** the **Draw** button.



35. Move the cursor up and down in the view area. Notice that the walls of the liner and the cut slopes extend up to meet the ground line so long as it is above the inside bottom of the liner.



- 36. **<D> Close** to dismiss the *Test End Conditions* dialog box.
- 37. Select **File > Save** from the Create Template menu bar.

Section Summary:

- End conditions are special components that do not use a constraint to intercept a surface.
- End conditions that share a common starting point are considered a single component and only one of the lines will be used.
- To create two end conditions that start at the same point, the second component must be created in a different location then moved to the correct spot.
- Test templates with end conditions to be sure they behave as expected prior to using them in a corridor.

Lab 4.3 - Adding Backfill Components

The final components for the template are the backfill components. These are used to calculate the the volume of embankment material used to fill in the trench excavation behind the channel liner. These components will not be used to create the triangulated surface, but can still be displayed in cross sections and have volumes calculated for them.

Section Objectives:

- Add Backfill components
- 1. <R> in the Template View of the Create Template dialog box and select Add New Component > Unconstrained from the right click menu.
- 2. In the *Current Component* area, key in *Backfill* for the *Name*.
- 3. Select D_SHOULDER-Embankment for the Style.

╪╼╬╬╪╧╗╗╔╬ <mark>╪</mark>		
Current_Component		
Name: Backfill	Style:	D_SHOULDER-Embankme 🔻

- 4. **<D>** on the *RT_Wall_Outside-Bottom* point.
- 5. In the *Dynamic Settings* dialog box, select **Top-of-Cut** for the *Point Name*.
- 6. **<D>** in an open area near the *RT_Top-of-Cut* point.
- 7. In the *Dynamic Settings* dialog box, key in *Wall_Outside-Top*.
- 8. Set the *Point Style* to D_CONC_Pvmt.
- 9. **<D>** in an open area near the *RT_Wall_Outside-Top* point.
- 10. **<R>** and select **Finish** from the right click menu.


11. <R> on the RT_Top-of-Cut1 point and select Add Constraint > Full Constraint from the right click menu.

- 12. **<D>** on the **RT_Top-of-Cut** point to identify it as the parent.
- 13. In the *Add Full Constraint* dialog box, key in *0.00* for the values of both the *Horizontal Offset* and *Vertical Offset*.
- 14. **<D> OK**.



 Repeat steps 11 through 14 for the RT_Wall_Outside-Top1 point, using *RT_Wall_Outside-Top* as the parent.

Placing the backfill points directly on top of the existing points would cause the line between RT_Wall_Outside-Top and RT_Top-of-Cut to match the existing ground instead of creating a single segment between the two points.

The steps to create the left side backfill are the same as those above.

16. Repeat steps 1 through 15 for the left side, using the corresponding points from the left of the existing template.

The final step to complete the template is to exclude the backfill components from triangulation.

- 17. <D><D> on the RT_Backfill component line. This displays the *Component Properties* dialog box.
- 18. Toggle on Exclude from triangulation.

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

🐂 Component Prop	perties		X
Name:	RT_Backfill	+	Apply
Description:			Close
Style:	D_SHOULDER-Emb 🔻 🗹 Close Shape		< Previous
Parent Component:	+		Nexts
Display Rules:		Edit	
Exclude from triang	gulation		Help

- 20. Repeat steps 11 through 13 for the LT_Backfill component.
- 21. Select File > Save from the Create Template menu bar.
- 22. **<D> Close** on the Create Template dialog dox to dismiss the window.

This completes the template. It is now ready to use to create a design surface model (dtm).

Section Summary:

- Points added on top of other points do not have to be defined in the dynamic Settings dialog box.
- Points added on top of other points are merged with the existing points and take on the properties already defined.

Lab 4.4 - Creating the Corridor for the Channel

With the completed template and the horizontal and vertical alignments from a previous lab, a corridor can be defined that is used to create the design surface model. A corridor contains two basic parts: a path over the existing terrain, and a typical section of the design. In this example, a horizontal and vertical alignment define the path of the corridor and the template built above defines the typical section.

Section Objectives:

- Create a corridor base on a horizontal and vertical alignment.
- Add a template drop to the corridor.
- Review the corridor in Roadway Designer.
- Create a design surface from the corridor.

The first step in creating a design surface is to create the corridor.

1. Select **Modeler > Roadway Designer** from the InRoads menu bar. This displays the *Roadway Designer* dialog box.



From the *Roadway Designer* menu bar, select Corridor > Corridor Management or select the corridor management button if from the button bar.



- 3. In the *Manage Corridors* dislog box, key in *12345BRDG_Channel* for the *Name*.
- 4. Verify that the *Type* is set to Alignment.
- 5. Verify that Channel _Flowline is set for the *Horizontal Alignment*.
- 6. **<D> Add** the **<D> Close** to dismiss the *Manage Corridors* dialog box.

🕌 Manage Corrido	rs			
Name: 12345BRDG	_Channel		nits	Add
Type: Horizontal Alignment: Vertical Alignment: PI Rounding Tangen	Alignment Channel_Flowli Channel_Flowli t: 0.00	ne v +	Start: 0+07.37 Stop: 1+33.99	Close Change Copy Copy From
Corridors:				Help
Name	Туре	Source Name	Start Station	Stop Station
12345BRDG_Ch /	Alignment	Channel_Flowline	0+07.37	1+33.99
				Delete

Next, the template drop is added to the corridor.

 Select Corridor > Template Drops from the *Roadway Designer* menu bar of <D> the Template Drops button from the button bar.



- 8. In the Template Drops dialog box, key in 5.00 for the Interval.
- 9. Expand the folder in the *Library Templates* area to show the contents of the 1-Templates folder.
- 10. Highlight the **12345_Channel-Liner** template then **<D> Add**.
- 11. **<D> Close** to dismiss the *Template Drops* dialog box.

🚼 Temp	late Drop)5			- • •
Corridor:	123458	RDG_Channel	•		Add
Station:	0+07.3	7		†	Close
Interval:	5.00			+	Change
Library Te	mplates:				
	1 - Templ	ates			Сору
	~ 1234	5_Channel-Liner			Help
			A_4		
		Camp	=		
		_Crowned_Bitu Divided_Type4			
		Full Depth Wi	deni		
	🛏 НМА	Urban_4Lane			
	2 Contin	na Powement			
Current Te	emplate D	rops:			
Station	Inter	Template	Revi	Library	
0+07.3	5.00	12345 Channe	LITL	C:\Project	s\12345\Br
		_			
Synchro	nize with	Library		Edit	Delete
					/

Notice that the template is now displayed in the template view of the Roadway Designer dialog box. The design can now be reviewed in Roadway Designer.

12. Use the station indicator arrows to move back and forth through the design corridor. The sideslopes should tie to the existing ground and the design channel flowline should be at or very near the existing flowline athe the beginning and end of the corridor.



- 13. Select **Tool > Options** from the Roadway Designer menu bar. The Roadway Designer Options dialog box is used to turn on or off various design data displays.
- 14. Toggle on Cut and Fill Values and Net Volume.
- 15. **<D> OK**.

🕌 Roadway Designer Options	
Include Critical Sections Horizontal Cardinal Points	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



16. Scroll through the corridor again. Notice the cut and fill volume data displayed at the bottom of the template view.

Finally, a surface (dtm) is created from the corridor. With a design surface, annotated cross sections can be created for plan sets and various volume reports can be generated.

17. Select Corridor > Create Surface from the Roadway Designer menu bar of <D> the create surface surface button from the button bar.



- 18. In the *Create Surface* dialog box, key in *12345_Channel-New* for the *Name*.
- 19. Select **Proposed** for the *Default Preference*.
- 20. Toggle on Empty Design Surface, Add Exterior Boundary, and Triangulate.
- 21. Select Exterior Boundary for the boundary's *Style*.

Carata Surfa			
Create Surra	.e		
Name:	12345_Chan	nel-New	Apply
Default Preference	e: Proposed	•	Close
New Surface	for Each Corridor		Preferences
Empty Design	Surface		
Include Null P	oints		пер
Add Exterior E	oundary - Style:	Exterior Bo	undan.
Densify Horizo	ntal Curves using	Chord Height T	
Densify Vertic	al Curves using C	hord Height Tole	arance
Triangulate	a carros dang c	nord noight for	
Create Surface/el	from		
12345BBDG_C	annel		1
			All
			None
Clipping O	ptions		
Peatures			
 Append 	Replace	Rename	Modify
Add Transve	erse Features		
Chilar			1
Style.	Default		ļ
Create Alterna	te Surfaces		
Process Visibl	e Range Only		
Remove Loop	s		
Dieplay Festure	nae in Plan View		
Display Featu	res in Fian view		

22. **<D> Apply**. This creates the design surface.

- 23. **<D> Close** to dismiss the *Create Surface* dialog bix.
- 24. Select File > Save from the *Roadway Designer* menu bar.
- 25. In the *Save As* dialog box, navigate to the C:\Projects\12345\Bridge\InRoads\ directory.

🙀 Save As										×
Save in:	🔒 Ditch Chan	📗 Ditch Channel			G	ø	Þ	-		
(Alia	Name	Date modif	Туре	Size						
Recent Places		N	o items match y	our s	earch	ı.				
Desktop										
Chris Ferree										
Computer										
Network	File name: Save as type:	12345_Chan Roadway De	nel sign (*.ird)	_	_		•		Sav Cano Help	re cel
									Option	IS

26. Key in *12345_Channel* for the *File name*.

- 27. <D> Close on the *Roadway Designer* dialog dox to dismiss the window.
- 28. In the InRoads Explorer, **<D>** the **Surfaces** tab at the bottom.
- 29. <R> on the 12345_Channel-New surface and select Save from the menu.

Hentley InRoads XM Edition		_ 0 🔀
<u>File Surface 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
<unnamed></unnamed>	12 😴 🚳 🔪 🏏	 5+00 E
	Data Type	Active F
Surfaces	Tr Breakline Fe	378
🕀 🐨 💭 Default	Scontour Fea	0
12345 Drain	Exterior Feat	61 🗉
12345_Channel-New	Save	0
	Save As	0
	burer lan	0
	Set Active	4 +
Surfaces 🚠 Geometry	Triangulate	
Ready	Copy	łi.

- 30. In the *Save As* dialog box, navigate to the C:\Projects\12345\Bridge\InRoads\ directory.
- 31. Use the *Active* drop down menu and select **12345_Channel-New**. This places the surface's name in the *File name* field.

🙀 Save As							×
Save in:	📗 InRoads			•	G 🤌	🔊 🥙	
9	Name	Date modif	Туре	Size			
Recent Places							
Desktop							
Chris Ferree							
Computer							
Network	File name:	12345_Chan	nnel-New.dtm			•	Save
	Save as type:	Surfaces (*.d	ltm)			•	Cancel
	Active:	12345_Chan	nel-New	_		-	Help Options

32. **<D> Save** then **<D> Cancel** to dismiss the dialog box.

The design surface is now ready for use generating cross sections, volumes, and reports.

Section Summary:

- Corridors are most commonly created along horizontal and vertical alignments.
- The origin of the template follows the corridor path (horizontal and vertical alignment or surface feature).
- Template Drops define which template is used and how often it is applied.
- Once the corridor and templated drops are defined, the design can be reviewed and edited in the Roadway Designer dialog box.
- A design surface (dtm), based on the corridor and templated drops, can be created from Roadway Designer.

Chapter Summary:

- Templates and corridors are used to create a design surface (dtm) of roughly parallel features.
- Templates define the "typical section" of the design surface.
- Templates are defined by points. Points are located using offsets from other points known as constraints.
- Acomponent is a series of related points that define the area of a specific material.
- Components are included in the design dtm, but do not have to make up the triangulated model.
- Corridors define the path, in relation to the existing ground, that the template will follow.
- The design model can be reviewed and edited in the Roadway Designer dialog box prior to creating a dtm.

LAB 5 - Evaluating Clearances and Conflicts

This section covers how to evaluate design data for minimum clearances. Alignments, Surfaces and Features will be used in the evaluation. Since the alignments and surfaces represent finished grade elevation, the depth of the bridge structure must be taken into account as well.

Chapter Objectives:

- Learn to find the minimum clearance between crossing vertical alignments.
- Learn some of the tools available for finding areas with potential clearance issues.
- Learn how to use MicroStation along with feature graphics to check clearances.

The following files are used in this lab:

- C:\Projects\12345\Bridge\Working \CU12345BRDG_Model.dgn
- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Preferences\ CDOT_Civil.xin
- C:\Projects\12345\Design\InRoads\12345 SH119
- C:\Projects\12345\Design\InRoads\12345 SH52
- C:\Projects\12345\Design\InRoads\12345 SH119 SH52 Interchange.alg
- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Templates\ CDOT_Template-Library.itl

Lab 5.1 - Open Data Files

- 1. Open MicroStation and InRoads using the *C:\Projects\12345\Bridge\Working \CU12345BRDG_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, 12345 SH52 and 12345 SH119 SH52 Interchange.alg.

Lab 5.2 - Intersecting Alignment Reports

1. Delete any MicroStation graphics currently in the design file.

2. Select Geometry > View Geometry > All Horizontals.



- 3. Select Tools > XML Reports > Intersecting Alignment Stations.
 - **Note:** This report returns the stationing of both intersecting alignments, along with the coordinates of the intersection and the elevation difference between the two active verticals.
- 4. For the *Horizontal Alignment*, select SH52-H.
- 5. For the *Intersecting Alignments*, key in *SH119** to select both NB and SB.

🖮 Intersecting A	lignment Stati	ons Report	(- • 💌
Horizontal Alignme	ent: SH52-H	•	+	Apply
Intersecting Alig	nments SH119*		+	Close Filter
Name	Description	Style		
SH119 NB-H SH119 SB-H	(10001011 C SH119 Southb.	. ALG_PRO ALG_PRO		

6. Select Apply.

7. If the default style sheet has not been set for this report, a Report Browser message will appear. Select **OK** if it does.



8. Select the *IntersectingAlignmentStations* > *IntersectingAlignmentStationsASCII* report format.

C:\Program Files\Bentley\InRoads Group V8.9\XML Data\			1
Pridae	1	SH52-H 107+16.50 SH119 SB-H 2295+75.20 134405.44 291358.09 -26.313	
Cant	Â.	SH52-H 107+81.57 SH119 NB-H 1295+94.39 134465.68 291333.49 -27.964	
Clearance			
Custom			
DataCollection			
Evaluation			
Geometry	E		
🗀 ICS			
Images			
Carl IntersectingAlignmentStations			
A: IntersectingAlignmentStationsASCII.xsl			
A IntersectingAlignmentStationsReview.xsl			
LegalDescription			
LightRailManufacturing			
MapLheck			
Ubsolete			
HoadwayDesign			
j schemas	*		

- **Note:** This report lists the stationing of each of the crossing alignments, along with the coordinates of the crossing point and the elevation difference. The report can be printed or saved as a text file if desired.
- *Important!* The last active vertical alignment under each horizontal is used to determine the vertical clearance. In this case, each horizontal has only one vertical, so it is not a concern.
- 9. Right-click on the format and select Set as Default Intersecting Alignment Stations.

2 D 1	SH5:	-H 107+16.50 SH119 SB-H 2295+75.20 134405.44 291358.09 -26.313	í.
Bridge Cark Cleatance Cuttom DataCollection Evaluation Geometry ICS IntersectingAlignmentStations All plansestingAlignmentStations All intersectingAlignmentStations All intersectingAlignmentStations LegaDescription LightRaiMandacturing MapCheck. Disolete RoadwayOesign	Style Sheet Help Set as Default Surfaces Set as Default Surface Check Set as Default Sturface Check Set as Default Stateout Set as Default Clearance Set as Default Clearance Set as Default Stakeout Set as Default Regal Description Set as Default Intersecting Alignmen Set as Default Horizontal Annotatio Set as Default Horizontal Annotatio	t Stations	1

10. Close the *Report* dialog.

If this report is needed at all feature intersections rather than only at the centerline intersections, the following steps may be used.

- 11. Close the Intersection Alignment Stations Report dialog.
- 12. **Delete** all the alignment graphics.
- 13. Toggle on the Feature Filter Lock.
- 14. Set the *Feature Filter* to *XS_Excluded from Triangulation*.



- **Note:** This filter allows only triangulated features to show in dialog boxes. In the next step, the features for SH52 are displayed and the non-triangulated features are not needed.
- 15. Select Surface > Update 3D Plan/Surface Display.
- 16. Toggle Display On.
- 17. Highlight the surfaces 12345 SH52 and 12345 SH119.
- 18. Toggle on Features.
- 19. In the feature list, right-click and Select All.
- 20. **<D>** on the *Style* header to sort by style name.
- Holding down your <*Ctrl*> key, <D> on all the *Cut* and *Fill* Features, the *Exterior* and the *3:1 Slope* features to de-select them. All other features should be highlighted.

🐂 Update 3-I	D/Plan Surface Display				•
Mode:	🖲 Display On 🔘 Dis	play Off			Apply
Fence Mode:	Ignore 🔻	•			Close
Surfaces:		1			ilter
Name		Description			
Default				Edi	t Style
12345 SH52		Created from r	oadway de		Help
12345 SH119					
Perimeter	Surface Elevations	Color-Code	ed Aspects		
🔲 Triangles	Slope Vectors	Color-Code	ed Elevations		
Contours	Profiled Model	Color-Code	ed Slopes		
🔽 Features:	🔲 Gridded Model				
Name		Style		▲	
SH52-LT_Toe	e-of-Fill	D_To	e-of-Fill		
SH52-RT_To	e-of-Fill	D_To	e-of-Fill	_	
SH52-RT_To	e-of-Fill1	D_To	e-of-Fill		
SH119 NB LT	_HMA_Lift1_Outside_Sh	oulder D_SH	OULDER		
SH119 SB RT	[_HMA_Lift1_Outside_Sh	oulder D_SH	OULDER		
SH52-RT_PO	SS	D_PO	ISS	-	
< □			4		

Note: Some of the features are de-selected because for the next series of steps, you only want the backbone features displayed.

22. **<D> Apply**.



- **Note:** The features should be displayed in the file as shown. If not, try the previous steps again.
- 23. Close Update 3D Plan/Surface Display.
- 24. Select MicroStation Place Fence and place a fence around all of the features.



- 25. Select File > Import > Geometry.
- 26. On the From Graphics tab, select Horizontal and Vertical Alignment for the Type.

- 27. Verify the Target Geometry Project is 12345 SH119 SH52 Interchange.
- 28. Toggle on Use Fence.
- 29. Toggle on Use Tag Data.

🐂 Import Geor	netry	- • 🗙
From Graphics	ICS Vertical from Surface	
Туре:	Horizontal and Vertical Alignment 💌	Apply
Geometry		
Name:	1	
Description:		
Style:	ALG_EXISTING -	Help
Horizontal Cu	rve Definition: 🛛 🗸	
Vertical Curv	Definition: Parabolic 🔹	
Target Geometry Pro Horizontal Ali	ject: 12345 SH119 SH52 Inter ▼ gnment: SH52-H ▼	
<u> U</u> se Fence	<u>R</u> esolve Gaps and Nontangencie	is in the second se
Join Elemen	its 🔄 No Duplicate Cogo Points	
All Selected	Elements Added to Single Alignment	
Vise Tag	s Data	
Project:	Active -	
Name Cor	flicts: No Overwrite 🔹	
	Close	

- 30. **<D> Apply**.
 - **Note:** All of the graphics in the fence are imported as alignment. Since they were displayed as features and have tags, the alignments are named the same as the feature names.
- 31. Select Tools > XML Reports > Intersection Alignment Stations.
- 32. For the Horizontal Alignment, select SH52-H.
- 33. For the *Intersecting Alignments*, key in *SH119** to select all of the crossing alignments.

	, Aigi	ment stat	ions Report		
lorizontal Align	ment	SH52-H	•	•	Apply
Intersecting A Include:	lignmet	nts sh119*]+	Close
Selected:					Filter
Name	De	scription	Style	-	Help
SH119 Media SH119 NB-H SH119 NB C SH119 NB L	a Med (10 e Crea T Crea	fian 00 1011 C. ated By Ro. ated by Ge.	D_MEDIAN ALG_PRO Centerline D_DITCH-B		

34. **<D> Apply**.

- **Note:** When an alignment is imported from graphics, the default stationing begins with 0+00.00, so the stations shown for the imported alignments do not correspond with the actual stationing.
- 35. Close the *Report* dialog when finished reviewing the data.

Jele John Jelep CProgram Files/Berefly/LPRoads Group V8 9004, Data Findge Cet Desarce Detaclobetion Evaluation Evaluation Evaluation Independent Station Alimetericity/Stations Jelepadent/Stations Jelepadent/Stations Lepadent/Stations Lepadent/Stations

- 36. Close the Intersection Alignment Stations Report dialog.
- 37. Select the MicroStation Place Fence command to clear the fence.

Lab 5.3 - MicroStation Measurements

1. Zoom into the bridge area.



- 2. On the MicroStation menu, select Measure Distance.
- 3. Set the *Distance* to *Minimum Between*.
- 4. Set the *Mode* to *True*.
- 5. **<D>** on one of the SH52 Features.

6. **<D>** on one of the SH119 Features.



Note: The Minimum Distance between the features is the vertical clearance.

If you want to check the minimum clearance between the shoulder and the edge of girder, you will need a MicroStation graphic representing the girder placed at the correct 3D location in the file. There are several methods for obtaining the girder element. One method is to use the *View 3D Alignment* command in InRoads. This command combines the horizontal and vertical alignment to create a 3D MicroStation element. You can use this command to view the centerline of SH52 and apply the correct offsets for any of the girders.

7. Turn off all levels except *DES_Roadway_Shoulder* (the SH119 shoulder lines) and *DRAFT_LC-Center_WT-3* (roadway centerlines).



- 8. Select Geometry > View Geometry > 3D Alignment.
- 9. Set Horizontal Alignment to SH52-H and Vertical Alignment to SH52-V.
- 10. In the *Limits* section, key in *106+00* for the *Start* station limit and *109+00* for the *Stop* station limit.

11. In the *Offsets* section, key in *52.92* for *Horizontal Start* and *Stop*. Key in *-6.92* for the *Vertical Start* and *Stop*.

🧮 View 3-D Alignm	ient			- • •
Apply Style:	Assigned	C Active	e:	Apply
	ALG_EXISTIN	G	-	Close
Horizontal Alignment:	SH52-H		→ +	Preferences
⊻ertical Alignment:	SH52-V		-	Hala
Limits V Statio <u>n</u>				Шеф
<u>Start:</u> 106+26.0	0 +			
Stop: 108+74.0	0 +			
In shude Caudinal Da		📃 Atta <u>c</u> ł	n Tag	
Horizontal	Vertical	<u>I</u> nterval:	10.00	-
Offsets				
Horizontal		Vertical		
Start: 52.92	+	Sta <u>r</u> t:	-6.92	
St <u>o</u> p: 52.92	+	Sto <u>p</u> :	-6.92	

- **Note:** For this bridge, there are 5 girders on each side of the centerline spaced at 10'-7" on center, making the outmost girder a horizontal offset of 52.92 feet from the centerline. The vertical offset to the bottom of the girder is 6.92 feet.
- 12. **<D> Apply**, then **Close**.



- **Note:** The red line represents the outermost girder on the right side of the SH52 and placed in the file at the correct horizontal and vertical offset from the centerline.
- 13. On the MicroStation menu, select Measure Distance.

- 14. Set the *Distance* to *Minimum Between*.
- 15. Set the *Mode* to *True*.
- 16. **<D>** on one of the SH52 girder (red line).
- 17. **<D>** on one of the SH119 left shoulder (left purple line).

Minimum Between 💌
True ▼ 18.313'

- **Note:** The minimum vertical distance from the girder to the shoulder is displayed in the tool settings box.
- 18. If you like, you can dynamically rotate your view to get a dynamic display (blue line) of where the minimum distance occurs.



- 19. If you rotated your view, rotate the view back to *Top*.
- 20. **Delete** the girder element (red line).

21. Turn on all levels to view all SH52 and SH119 roadway features.



Lab 5.4 - Isopach Surface

- 1. The surfaces can also be used for a more visual look at the clearances.
- 2. Select Tools > Options > Factors and set the *Text Scale Factor* to 5.

🐂 Options					×
Precision Tolerances	Genera Factors	I Units and Abbreviations	Format Rail	Geon Sight Dis	netry tance
Text Scale Fa	ictor:	5.0000		Help	
Cell Scale Fac	ctor:	100.0000			
Line Style Sca	ale Factor:	100.0000			
A	pply	Preferences		ose	

3. Place a MicroStation fence around the area where the bridge will be as shown.



- 4. Select Surface > Design Surface > Generate Isopach Surface.
- 5. Set the *First Surface* to *SH119*.
- 6. Set the *Second Surface* to *SH52*.
- Toggle on *Isopach Surface* and key in *12345 D-16-DU isopach* for the surface name.
 Note: This surface will be created when the command is applied.
- 8. Toggle on *Triangulate Surface*.
- 9. Set the Fence Mode to Inside.

🦮 Generate Isopach S	Surface	- • ×
Main Staking		
First S <u>u</u> rface:	12345 SH119 🔹 👻	Help
Second Surface:	12345 SH52 🔹	
🔽 Isopach Surface:	12345 D-16-DU isop 🔻	
Iriangulate Sur	face	
Fence <u>M</u> ode:	[Inside 🔹 🔻	
Apply	Preferences	Close

10. Select the *Staking Tab*.

- 11. Set the Display Mode to Grid.
- 12. Set the Northing and Easting Intervals to 5.00.
- 13. <D> <D> on the *Fill Text Symbology* and set the *Rotation Angle* to *30^00'00"*, then <D> OK.

🖌 Generate Isopach Surface 👘 📼 💌	🖌 Text Symbology 🛛 🕰
Main Staking	Symbology Name:
Display Mode: Grid Help	Text Style:
Northing Interval: 5,00	Level: Default Help
Easting Interval: 5,00 -	Color: ByLevel
Cut Uninka Ell Uninka	Weight:(0)ByLevel -
Precision: 0.12	Font:
Prefix: C Prefix: F	Justification:
Suffix: Ft Suffix: Ft	Height: 0.14
	Width: 0.14
Planarize	Line Spacing: 0.10
Elevation: 0.00	View Independent
Symbology:	Rotation Offsets
Object Name	Angle Helative to Object Parter Hotation Absolute Angle Parter Detation
Cut Text InRoads Misc BYL	
	Angle. 30 0000" Holizorital. 0,00
Apply Preferences Close	veracar 0.00

- 14. **<D> Apply**, then **Close**.
- 15. Clear the fence.
- 16. Fit the MicroStation view, then window into the bridge area.



- **Note:** The text in the file denotes the difference between the two surfaces on a 5' grid interval. In addition, a surface was generated with points on a 5' grid, with each point's elevation being the difference. This surface can be used to help visualize any potential conflicts.
- 17. Delete all the graphics in the design file.
- 18. Select Surface > View Surface > Color Coded Elevations.
- 19. Set the Surface to 12345 D-16-DU isopach.

- 20. Set the *Color Mode* to *Automatic*.
- 21. Select the *Color Table* tab.
- 22. Set the *Initial Color* to 10.
- 23. Key in **1** for the *Color Step*.
- 24. Toggle on *Number of Colors* and key in 2.
- 25. Toggle on First and Last Elevation Options and set each to 26.00.
 - **Note:** The elevation is where the color will change on the display from color 10 to color 11, indicating that everything color 10 has a clearance of less than 26 feet, while everything color 11 has a clearance of more than 26 feet.
- 26. **<D> Generate**.

Main Legend	Color I a	ible Report			
- Generate Colors Initial Color:		10 🚔	Gener	ate	<u>H</u> elp
Color Step:		1			
Vumber of C	olors:	2			
🔽 First To Elev	ation:	26.00			
📝 Last From Ele	evation:	26.00			
				_	
Elevation Sta	p:	0.00			
Elevation Sta	ep: To	0.00 Elevation	Color		
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Elevation Ste From Elevation 24.14 26.00	ер: 26.0 31.6	Elevation 0 2	Color 10 11		E dit Insert

27. <D> Apply.

28. **<D>** in the design file for the location of the legend.



- 29. <D> Close
- 30. On the MicroStation menu, select **Utilities > Render > Smooth**.
- 31. $\langle D \rangle$ in the view.



32. Try other elevations to isolate potential areas of conflict.

Chapter Summary:

- The vertical clearance between InRoads alignments can be checked easily with an *XML Report*.
- Surface Features can be imported as alignments to run the same report.
- MicroStation measure commands are used to check the minimum distance between graphic elements.
- An *isopach* surface generated between two design surfaces will help determine areas of potential clearance issues.

LAB 6 - Working with Surfaces

This lab covers how to use additional cross section and profile tools to review surface data.

Chapter Objectives:

- Learn how to use cross section tools to cut sections on a skew to the alignment.
- Learn how to cut sections at specific locations based on graphic elements.
- Learn how to use level filters to find specific levels or groups of levels to turn on or off.
- Learn how to update components, features or surfaces on cross sections.
- Learn how to annotate points or features on cross sections.
- Learn how to use feature filters to find specific features for displaying or annotating.
- Learn how to cut profiles along graphic elements.

The following files are used in this lab:

- C:\Projects\12345\Bridge\Working \CU12345BRDG_Model.dgn
- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Preferences\ CDOT_Civil.xin
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange
- C:\Projects\12345\Design\InRoads\12345 SH52
- C:\Projects\12345\Design\InRoads\12345 SH119 SH52 Interchange.alg
- C:\Projects\12345\Bridge\Drawings\Reference_Files\12345BRDG_Model_D-16-DU.dgn
- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Templates\ CDOT_Template-Library.itl

Lab 6.1 - Open Project Data

- 1. Open MicroStation and InRoads using the C:\Projects\12345\Bridge\Working \CU12345BRDG_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 SH52 and 12345 SH119 SH52 interchange.alg.
- 5. Open C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange.

Lab 6.2 - Create Skewed Cross Sections from Graphics

In the previous lab, a cross section set was created based on SH52 at an even interval along the alignment and all sections were perpendicular. In this section, cross sections are created on a skew to the alignment for review purposes.

1. **Delete** any MicroStation graphics currently in the design file.

- 2. Select Geometry > View Geometry > All Horizontals.
- 3. **Fit** the MicroStation view.



4. **Zoom in** to the approximate area shown.



5. In MicroStation, select the **Element Selection** tool.



6. While holding down the *<Ctrl>* key on your keyboard, *<D>* on the four elements shown here.



Note: This makes a MicroStation selection set from the wall alignment graphics.

- 7. Select Tools > Options > Factors.
- 8. $\langle D \rangle$ the lock icon.

9. Set the *Text Scale Factor* to *40*.

Precision General Units and Format Geometry Tolerances Factors Abbreviations Rail Sight Distance Text Scale Factor: 40.0000 Help Cell Scale Factor: 100.0000 Image: Color Style Scale Factor: Line Style Scale Factor: 100.0000
Text Scale Factor: 40.0000 Help Cell Scale Factor: 100.0000 Internet Line Style Scale Factor: 100.0000
Cell Scale Factor: 100.0000
Line Style Scale Factor: 100.0000
Apply Preferences Close

- 10. **<D> Apply**, then **Close**.
- 11. Make *SH52-H* the active alignment.

🙀 Bentley InRoads XM Edition				
<u>File S</u> urface <u>G</u> eometry <u>D</u> rain	nage <u>E</u> valuation <u>M</u> odeler	Dr <u>a</u> fting <u>T</u> ools <u>H</u> elp		
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	Name	Туре	Description	By Whom
	Inter Inter SH52-V Set Active Copy Delete Empty View Fit	Vertical Alignment	SH52 Vertical	CDOT User
🔚 Geometry 🔊 Prefe	Edit Review	m		٨
Toggles Locate Features/Lo	Check Integrity			łt.

- 12. Select Evaluation > Cross Sections > Create Cross Sections.
- 13. Toggle on the two surfaces.
- 14. Select the **Custom > General** branch.
- 15. Set the *Type* to *Linestring*.
- 16. <D> Graphics.

Create Cross Section	Station Type	Type: Linestring -
General General Source Include Controls Custom General Layout Grid Grid Details ACCII	106+26.03 Skew 108+72.41 Skew 110+11.91 Skew 111+29.94 Skew	Details Station: 0+00.00 Left Offset: -100.00 Right Offset: 100.00
	Features Crossing	Storm and Sanitary Structures
	Projected	Projected
	Ahead Band: 0.00 + Back Band: 0.00 +	Ahead Band: 0.00 + Back Band: 0.00 +
	Add Update Graphics	Import Save Save As

Note: The list of stations where the graphics cross the alignment is shown in the dialog. If an entry is highlighted, the information on the right shows the offsets and the skew angle also.

🖌 Create Cross Section		×
Create Cross Section General Source Include Controls Custom General Layout Axes Grid Details ASCII	Station Type 106+26.03 Skew 108+72.41 Skew 110+11.91 Skew 111+29.94 Skew	T⊻pe: Skewed Details Station: 106+26.03 Left Offset: -60.35 Right Offset: 60.35 Skew Angle: 17^41'16''
	Features Crossing Projected Ahead Band: 0.00 Back Band: 0.00 Add Update Graphics	Storm and Sanitary Structures Crossing Projected Ahead Band: 0.00 Back Band: 0.00
	Apply	Preferences) Close <u>H</u> elp

17. **<D> Apply**.



18. **<D>** a clear area in the design file for the bottom left corner of the cross section set.

- 19. Review sections by zooming in or by using the Cross Section Viewer.
 - **Note:** The cross sections are created based on the graphic elements. In this case, they are graphical displays of alignments, but they can be graphics drawn in MicroStation as well. Next, elements representing bearing lines and the pier centerline are used to create sections.
- 20. Back in the *Cross Section* dialog, highlight the list of custom stations and choose **Delete** on the keyboard.
- 21. <D> Close.
- 22. Clear the selection set of graphics by selecting the **Element Select** tool and **<D>** in a clear area of your file.
 - **Note:** The graphics representing the centerline and bearing lines are currently in a reference file and on a level that is turned off.
- 23. Select File > Reference from the MicroStation menu.

24. Turn on the display of the *BRDG_Model_D_16-DU.dgn* reference.

_										
	References (1 of 1 uni	ique, 1 displayed)								×
To	ols <u>S</u> ettings									
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P	File Name		Model	Description	Logical	Presentation	0	ھ ا	K 🕒	
	12345BRDG_Model	_D-16-DU.dgn	CDOT Default	Aligned with Master File		Wireframe	0 🗸	· 🗸	$\sqrt{\sqrt{2}}$	
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Off	set 🔀 -178956.971	<u>Y</u> -178	956.971	∠ -178956.971	•	J 💦 🕒 🛄	<u>~</u> ~	٠ 🌐	8 💡 👰	
N	o Nesting 🔹 🗸	Allow Overrides 🔻] <u>D</u> epth: 1	New Level Display: Config	Variable	•				

- 25. Close the Reference dialog box.
 - **Note:** Bearing and Pier centerlines are shown in the file. This reference was attached in the previous lab.



- **Note:** It will be easier to see the new elements if the alignment levels are turned off. To facilitate finding the appropriate levels, level filters are used. Level filters allow the segregation of levels based on predefined criteria, such as all alignment levels, all bridge levels, etc. When a level filter is active, the dialogs listing levels only show those that pass the filter, making it easier to find specific ones.
- 26. In MicroStation, select Settings > Level > Display.
- 27. Toggle View Index 1 on and all others off.
- 28. Set the *Active Level* to *Default*.
- 29. Toggle Show Level Name or Filters to Levels.

30. Set the *List Filter* to *Alignment*

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P 🗄 🕨	(none) 🔻 Levels 💌 🛹	-			
E-M CU123 (none)) ed				
Alignn	nents				
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Default Bridge	- e+Draft		0		
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SHEET_Grid					
SHEET_Grid-Min			3		Ŧ
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- 31. Scroll through the list and notice only alignment levels are displayed.
- 32. Right-click in the level list and choose All Off.

✓ Level Display 2 3 4 5 6 7 8 View Display ✓ E > Alignme ▼ Levels ▼ ✓ E > Alignme ▼ Levels ▼ ✓ E > Alignme ▼ Levels ▼ ✓ CU12345DES_Model.dgn 12345BRDG_Model_D-16-DU.dg 12345BRDG_Model_D-16-DU.dg	▼ gn		
Name		Number	Description
ALG_*		19000-1999	99
ALG_OTHER_Hor-Alignment ALG_OTHER_Hor-Keypoints ALG_PROPOSED_Hor-Alignment ALG_PROPOSED_Hor-Keypoints ALG_COGO_Points ALG_EXISTING_Hor-Alignment-Sta-Minor ALG_EXISTING_Hor-Alignment-Sta-Minor ALG_EXISTING_Hor-Alignment-Text ALG_EXISTING_Hor-Cardinals ALG_EXISTING_Hor-Cardinals ALG_EXISTING Hor-Cardinals	Alignments Alignments Set <u>Active</u> All O <u>n</u> <u>All Off</u> <u>Invert On/O</u> Off By Elem All Except El <u>Save Filter</u>	19016 10021 fff ent lement	Other Horiz. Centerlin Other Horiz. Keypoint Proposed Horiz. Cent Proposed Horiz. Keyp COGO Points Event Points Existing Horiz. Centerline (i Existing Horiz. Alg Major St Existing Horiz. Alg Minor St Existing Horiz. CL Tangent Existing Horiz. Keypoint(s) Existing Horiz. Keypoint as

Note: In the MicroStation view, notice the alignments levels are now off and the bridge levels are still on.



33. Right-click in the level list and choose All On.

2 3 4 5 6 7 8 View Display Image: State of the s	_ ∠ ↓ Jgn		
Name		Number	Description
ALG_*		19000-1999	99
ALG_OTHER_Hor-Alignment	Alignments	19016	Other Horiz. Centerlin
ALG_OTHER_Hor-Keypoints	Set <u>A</u> ctiv	e	Other Horiz. Keypoint
ALG_PROPOSED_Hor-Alignment			Proposed Horiz. Cent
ALG_PROPOSED_Hor-Keypoints	All O <u>n</u>		Proposed Horiz. Keyp
ALG_COGO_Points	All Off		COGO Points
ALG_EVENT_Points	Invert Or	n/Off	Event Points
ALG_EXISTING_Hor-Alignment	-		Existing Horiz. Centerline (li
ALG_EXISTING_Hor-Alignment-Sta-Major	Off By El	ement	Existing Horiz. Alg Major St
ALG_EXISTING_Hor-Alignment-Sta-Minor	All Excep	t Element	Existing Horiz. Alg Minor St
			Existing Horiz. CL Tangent
ALG_EXISTING_Hor-Alignment-Text			
ALG_EXISTING_Hor-Alignment-Text ALG_EXISTING_Hor-Cardinals	<u>S</u> ave Filt	er	Existing Horiz. Keypoint(s)
ALG_EXISTING_Hor-Alignment-Text ALG_EXISTING_Hor-Cardinals ALG_EXISTING_Hor-Keypoints	<u>S</u> ave Filt	er	Existing Horiz. Keypoint(s) Existing Horiz. Keypoint as



- **Note:** Level filter are used in two ways. One, as described above, they are used to segregate the level lists to make it easier to find the necessary levels. They can also be used to turn on or off all associated levels.
- 34. Toggle the *Filter* to (*none*).
- 35. Toggle Show Level Name or Filters to Filters
- 36. Highlight Bridge-All.

📕 Level Display	
1 2 3 4 5 6 7 8 View Display 💌	
🖗 🔃 🗁 (none) 🔻 Filters 🗸 🕶	
CU12345DES_Model.dgn	
Name ^	<u>^</u>
Alignments	=
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Alignments. Utner	
Alignments Secondaru	
Alianments. Text	
Bidge	
Bridge-All	
TBridge+Drait	
Bridge+Draft+Sheet	
Construction	
GIS Banda	
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Hudraulies	
Hydraulics. Basins	
Hydraulics.Pipes	-
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37. Fit the MicroStation view and notice that the alignment levels are now off and only bridge levels are on.



38. Clear any previous selection set.
39. Make a selection set from the Pier and Bearing MicroStation graphics.



- 40. Select Evaluation > Cross Section > Create Cross Section.
- 41. In the *Cross Section* dialog on the *Custom* > *General* branch, set the *Type* to *Linestring*.
- 42. <D> Graphics.

Create Cross Section Create Cross Section Controls Controls Custom Custo	Station Type 106+24.63 Skew 107+49.13 Skew 108+73.63 Skew	Type: Linestring Details Station: 0+00.00 Left Offset: -100.00 Right Offset: 100.00
	Features Crossing Projected Ahead Band: 0.00 Back Band: 0.00 Add Update	Storm and Sanitary Structures Crossing Projected Ahead Band: 0.00 Back Band: 0.00 Import Save
	Apply	ierences) Close <u>H</u> elp

- 43. In the *Level Display* box, toggle off the *Bridge-All* filter to turn all levels back on.
- 44. In the *Create Cross Section* command, **<D> Apply** and then **<D>** in a clear area of the file.
- 45. **<D> Close**.

Note: Three cross sections are created for the three lines in the selection set.

46. *Do not* close out of the *Create Cross Section* command.

- 47. Close the *Level Display* box.
- 48. Review your new custom cross section set.

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49. In the Create Cross Section dialog box, select Save As.

K Create Cross Section					. • 💌
Create Cross Section General Source Include Controls Custom Layout Grid Grid Details	Station Type 106+24.63 Skew 107+49.13 Skew 108+73.63 Skew		Type: Line: Details Station: Left Offset: Right Offset:	0+00.00 -100.00 100.00	•
	Features Crossing Projected Ahead Band: 0.00 Back Band: 0.00 Add Update	+ +	Storm and Sa Crossing Projected Ahead B Back Ba Import	anitary Structure and: 0.00 nd: 0.00	s + + Save As
		Apply Prefe	erences	Close	<u>H</u> elp



50. Key in **12345BRDG_Model_D-16-DU** for the file name.

- 51. Select Save.
 - **Note:** In the future, these sections can be re-created by loading this text (*.*xsc*) file rather than selecting the graphic elements.
- 52. Zoom in to the second cross section.



Lab 6.3 - Update and Annotate Cross Sections

You can update a cross section set to turn on or off the display of components, crossing features, projected features or surfaces. You can also refresh the display of these items if changes have been after creating the cross sections.

Cross section points and segments can be annotated as well. If you want to annotate specific points, you can choose the corresponding features for annotation. However, the features must first be displayed on the cross section before they can be annotated.

In this section, you will use both the *Update Cross Section* and *Annotate Cross Section* commands. First, to more easily see the design surface, you will toggle off the components.

- 1. Select Evaluation > Cross Section > Update Cross Section.
- 2. Verify the *Section Set* is the current one.
- 3. Set the *Mode* to *Display Off*.
- 4. Highlight Components at left.

- 5. Highlight the SH52 Surface.
- 6. Right-click in the component list and *<D> Select All*.

- 7. **<D> Apply**, then **Close**.
- 8. Review the cross section to see that components have been turned off.

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- **Note:** To assist in evaluating the cross sections, it is often helpful to see the elevations, which can be annotated using *Annotate Cross Sections*.
- 9. Select Evaluation > Cross Section > Annotate Cross Section.
- 10. Load the preference Proposed Grades Only.

Name:	Close
Default Ereiting Cont Charach	Load
Proposed Grades Only	Save
	Save As
	Delete
	Help

- 11. Select the Set of skewed sections.
- 12. Toggle on the *SH52* surface.

Munotate Cross Section		- • •
Cross Section Set: SH52·H_1	Surfaces Preference 12345 existing group Proposed Grades Onl 12345 SH52 Proposed Grades Onl Limits Limits Station Bance	
	Station Hange Stat: 106+24.63	
	Apply Preferences Close	<u>H</u> elp

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

Note: The elevations are annotated for every point on the proposed grade.



- **Note:** Often, a more useful option is to annotate the elevations of only certain points. This is accomplished by first displaying the features in the proposed model on the cross sections.
- 14. Select Evaluation > Cross Sections > Update Cross Sections.
- 15. Select the set of skewed sections.
- 16. Set the *Mode* to *Display On*.
- 17. Select Crossing Features.

18. Highlight the SH52 Surface.

Hundate Cross Section			
Cross Section Set:	Mode: <u>R</u> efresh <u>Display</u> On Start: 106+24.63 Stop: 11	◯ Display O <u>f</u> f 08+73.63	
Update Cross Section General Surfaces Components Crossing Features Projected Features Storm and Sanitary	Name Default 12345 existing ground for interchange 12345 SH52	Description SH119 SH52 existing gro Created from roadway de	
	Feature: Name Exterior Boundary SH52:ABC_Centerline-Top SH52:HMA_Lift1_Centerline-Top SH52:HMA_Lift2_Centerline-Top	Style Exterior Bounc Centerline Centerline]
			Styles Filter

- **Note:** Look in the feature list and notice that there are several features. The surface contains features for each of the lifts seen on the cross sections earlier. The features on the finished grade, which are triangulated, are the ones typically annotated in this case. Rather than scrolling through this list and highlighting just those, a feature filter is used.
- 19. Select **Tools > Locks > Toolbar** to toggle on the locks toolbar if it is not on already.
- 20. On the Update Cross Section box, select Filter ...
- 21. In the feature filter list, select *XS_Excluded from Triangulation* and select OK.

🕌 Feature :	Selection Filter	- • •
Filter Na <u>m</u> e:	S_Exluded from Triangulation	• ОК
Start With: Build Seler		Cancel
Attri <u>b</u> ute:	Name	<u>Save</u>
<u>V</u> alue:		Save <u>A</u> s
Mode:	Include ○ Exclude	Delete
	Add <u>R</u> ule Replace Rule	<u>H</u> elp
Exclude All Include Do Include Atta	Features Not Triangulate = False ach Tag in 3-D/Plan = False	Move Up Move Down Delete Rule Clear All
Current Rest Exterior Bot SH52-HMA SH52-LT_C SH52-LT_C SH52-LT_C SH52-LT_F SH52-LT_F	ults: Lift]_Centerline-Top Lift_Centerline-Top 	

22. Toggle on the *Feature Filter* lock.



- *Note:* The feature filter has no effect unless the lock is on.
- 23. In the *Update Cross Section* box, scroll through the list of features and note the number is greatly reduced.

🐂 Update Cross Section			- • •
Cross Section Set: SH52H_1 ↓ ↓ Update Cross Section General Surfaces Components Crossing Features Projected Features Storm and Sanitary	Mode: Petresh Pisplay On Start: 106+24.63 Stop: 11 Surface: Name Default 12345 existing ground for interchange 12345 SH52 Feature: Name Exterior Boundary SH52-HMA_Litt1_Centerlime-Top SH52-LT_Curb-Back-Top SH52-LT_Curb-Flowline	© Display Off 08+73.63 Description SH119 SH52 existing gro Created from roadway de Exterior Bounc Centerline D_CURB_Bac D_CURB_FL V	*
		Apply Close	Styles Filter <u>H</u> elp

Note: The filter chosen, *XS_Excluded from Triangulation* eliminates non-triangulating features from any dialog box that lists features. While it is very handy, it can also be confusing when features that exist do not show up in the list. For that reason, the lock is toggled off after use. There are several pre-defined filters that can be used to segregate features. These filters are stored in the *XIN* file.

Cross Section Set:	Mode: <u>R</u> efresh <u>● D</u> isplay On <u>Display Off</u>	
Update Cross Section General Components Crossing Features Projected Features Storm and Sanitary	Start: 106+25.03 Stop: 111+29.94 Surface: Name Description Default 12345 existing ground for interchange SH119 SH52 existing gro 12345 SH52 Created from roadway de	
	Feature: Name Style SH52:RT_Curb_Gutter-top D_CURB_FL_ SH52:RT_HMA_Lift1_Laneline-Top D_LANELINE SH52:RT_HMA_Lift1_Laneline-Top1 D_LANELINE SH52:RT_POSS D_POSS	
		Styles Filter
	Apply Close	<u>H</u> elp

24. Highlight the *Centerline Top* and the *left* and *right Laneline-Top1* features.

25. **<D> Apply**.



- **Note:** Small '+' signs are shown on the cross sections. These mark the location of the features and can now be annotated.
- 26. **<D> Close**.
- 27. Toggle off *Feature Filter* lock.

Note: It is best to leave this lock off unless you need it.

28. Select Evaluation > Cross Section > Annotate Cross Section.

29. Load the preference *Proposed Grades Only*.

References	X	
Name:	Close	
CDOT Default Exsiting God CL only	Load	
Proposed Grades Only	Save	
	Save As	
	Delete	
	Help	
Preference 'Proposed Grades Only' loaded		

- 30. Select the set of skewed sections.
- 31. Toggle on the *SH52* surface.

Mannotate Cross Section		- • •
Cross Section Set: SH52:H_1	Surfaces Preference 12345 existing grout Proposed Grades Onl 12345 SH52 Proposed Grades Onl	
Frame	Limits Station Range Start: End: 106+24.63 • • 108+73.63 • • Location © Object © Agis © Frame	
	Apply Preferences) Close	<u>H</u> elp

32. Select *Points* and toggle off *Include Points*.

🕌 Annotate Cross Section								×
Cross Section Set:	🔲 Include Points							
SH52-H_1 +	Object	Position	Prefix	Suffix	Precision	Format	Name	
🔄 Annotate Cross Section	Leader							
General	Center	1	Gnd		0.1			
Points	Offset	1	Off =	·	0.1			
🚽 🗘 Öleneral	Elevation	0	PG =		0.12			
Segments	Station	1	Skew S		0.1	\$\$+\$\$.\$\$		
	🔲 Skew Offset	1	Skew C		0.1			
Erame	Description	1						
	Leader Length: Offset Tolerance: Points from ASCII: Drop Station Equatio	n Name	10	0.00				
			Apply	P	references	Close	e <u>H</u> elp	•

Mannotate Cross Section								×
Cross Section Set:	Include Features							
SH52-H_1 •	Object	Position	Prefix	Suffix	Precision	Format	Name	
🔄 Annotate Cross Section	Leader							
General	🛛 Offset	1 1	Off		0.12			
- Doints	Elevation	-1	Elev		0.12			
Seaments	Station	1 !	Skew S		0.1	\$\$+\$\$.\$\$		
	Skew Offset	1 :	Skew C		0.1			
🗣 General	Feature Station	1 1	Off:		0.12	8888.88		
Annotate	Feature Name	1						
	Feature Description	1						
	Feature Style	1						
	Leader Length: 10.00							
			Apply	P	references	Close	; <u>H</u> elp	,

33. Select *Features* and toggle on *Include Features*.

- 34. Select Annotate under Features.
- 35. Highlight the three features listed.

Manotate Cross Section				- 0 -
Cross Section Set:	Feature:			Styles
SH52-H_1 •	Name	Style	Des 🕂	
Annotate Cross Section General Points Segments General Peatures Frame	KH52-HMA_Lift1_Centerline-Top SH52-LT_HMA_Lift1_Laneline-Top1 SH52-RT_HMA_Lift1_Laneline-Top1	Centerline D_LANELINE D_LANELINE	Crea Crea Crea	<u>F</u> ilter
	Apply	Preferences	Close	<u>H</u> elp

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



Note: Offsets and elevations are annotated for only the three features on the proposed grade. The previous annotation was deleted since you displayed these graphics in *Pencil* mode.

Lab 6.4 - Creating Profiles from Graphics

In addition to cutting skewed sections based on graphic elements, profiles can also be generated from graphics. The main differences between the two options include:

- The bottom axis of Cross Sections list offsets from the reference line along which they are created (alignment, graphic, or multi-point).
- The bottom axis of a Profile lists stationing, even if the profile is cut from a graphic. For profiles cut from graphics or multi-points, the stationing begins at 0+00.

In this section, you will generate a profile showing existing and proposed surfaces along a the pier centerline graphic. Since the graphic is in a reference, you will first draw a new line the active file to use for profiling.

- 1. In MicroStation select the Place Line command.
- 2. Place a new line by snapping to the two end points of the pier centerline.
- 3. Select Evaluation > Profile > Create Profile.
- 4. Select *General*.

5. Toggle on both surfaces.

🕌 Create Profile			
Create Profile Create Profile Source Include Offsets Grid Axes Grid AXES ASCII	Set Name: SH52-H Direction © Left to Right © Right to Left Surfaces:	Exaggeration Vertical: Horizontal:	n 1.0000 1.0000
	Object Default 12345 existing groun 12345 SH52	Name Default T_Existing_Ground D_Finished-Grade Pro	BYL BYL BYL None perties
		Apply Prefere	nces) Close Help

- 6. Select *Source*.
- 7. Toggle on *Graphics Alignment*.
- 8. If you key in a name in the *Graphics Alignment* field, an alignment is created for the graphic element selected after choosing Apply.

🕌 Create Profile			
Create Profile General Source Include Offsets	Create:	Window and Data V SH52:H V	
	Graphics Alignment:		
Axes	Multipoint Alignment:		
Details ASCII	🔘 ASCII File		
		Apply Preferences Close	<u>H</u> elp

9. **<D>** on the Include Branch.

Carl Carl	Surface	
General	Crossing Features	
	Adjust Range	
Axes Grid Details ASCII	Back Band: 10.00	
	Storm and Sanitary Crossing Structures Projected Structures	
	Ahead Band: 10.00 Back Band: 10.00	
	Apply Preferences]	Close <u>H</u> elp

- **Note:** If you want to display crossing features on your cross section like pipes or utilities, toggle on *Crossing Features*. These features must first exist in the surface(s) you're showing on the sections. The feature's style controls if the feature can be shown on the cross section.
- **Note:** If you want to show features that fall outside the cross section, toggle on *Projected Features*. This will show the orthogonal projection of the features onto the cross section. You also have the option of specifying a *Bandwidth* to either side of the section to project the features.
- 10. For this exercise, leave Crossing Features and Projected Features turned off.
- 11. **<D> Apply**.
- 12. **<D>** on the line you drew over the pier centerline element.
- 13. **<D>** to accept the element.
- 14. $\langle D \rangle$ a clear area in the file.



Note: The profile is created showing both surfaces. Since there is not an alignment associated with this review profile, some of the post-processing commands for profiles, such as annotating and updating are not available. Profiles that need to be annotated and/or updates should be cut using an alignment, or an alignment should be created when the profile is cut by specifying an alignment name as noted above.

Chapter Summary:

- Custom cross sections are used to create sections that are not based on an interval or perpendicular to an alignment.
- The setup for custom cross section sets may be saved to a text file and loaded later to cut sections at the same location.
- Level filters can create a subset or group of levels to easily turn an entire group of levels on or off. They can also help you find individual levels more easily.
- Feature filters create a subset or group of surface features for displaying in plan, profile or cross section. They can also help you find individual features more easily.
- Profiles can be cut based on alignments or graphics.

LAB 7 - Feature Based Modeling

This section covers how to use Surface Modeling tools for excavation and backfills. You will also use these tools to create pier features.

Chapter Objectives:

- Learn how to create excavation and backfill surfaces for footers (piers, walls, etc.).
- Learn how to use the *Generate Sloped Surface* command to create proposed surfaces by intercepting existing or design surfaces.
- Learn how to profile excavation and backfill surfaces.
- Learn how to set the elevation of elements or features.
- Learn how to import MicroStation graphics into a surface.
- Learn how to create pier features and a pier surface for volume computations.

The following files are used in this lab:

- C:\Projects\12345\Bridge\Working \CU12345BRDG_Model.dgn
- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Preferences\CDOT_Civil.xin
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange
- C:\Projects\12345\Design\InRoads\12345 SH119
- C:\Projects\12345\Design\InRoads\12345 SH119 SH52 Interchange.alg
- C:\Projects\12345\Bridge\Drawings\Reference_Files\12345BRDG_Model_D-16-DU.dgn
- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Templates\ CDOT_Template-Library.itl

Lab 7.1 - Open Project Data

- 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. Select **File > Open** from the InRoads menu.
- 5. Open C:\Projects\12345\Design\InRoads\12345 SH119 and 12345 SH119 SH52 Interchange.alg.
- 6. Open C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange.

Lab 7.2 - Create an Excavation Surface for a Pier Footer

In this section, surfaces are created for the excavation and backfill for a pier footer for bridge D-16-DU. The primary commands used are *Generate Sloped Surface* and *Generate Longitudinal Feature*. For more information on either of these commands, please see the *Surface Editing* chapter of *A Practical Guide for Using InRoads XM*.

In a later lab, these surfaces will be used to calculate volumes.

- 1. In MicroStation, select Settings > Level > Display.
- 2. Toggle *View Index 1* on and all others off.
- 3. Toggle Show Level Name or Filters to Levels.
- 4. Highlight the *12345BRDG_Model_D-16-DU.dgn* file.
 - **Note:** This is the reference file that was attached in Lab 2. If it is not listed in this dialog, re-attach the reference file now.

5. Turn on the *BRDG_Outline-Foundation-Footer* level.





6. Select MicroStation's **Copy** tool.



7. Snap to a corner of the outline to choose it to copy.



- 8. Snap to the same corner to place it at the same location in the current working file.
- 9. In MicroStation, select File > Reference.
- 10. Highlight the *12345BRDG_Model_D-16-DU.dgn* file and toggle the *Display* off.

The new copy of the outline should still be showing in the current file.



- **Note:** The outline is currently at elevation 0. Next, the outline must be moved to the appropriate elevation.
- 11. Select Surface > Design Surface > Set Elevation.
- 12. Make certain the current *Locate Mode* is *Graphics*. If not, toggle it on your *Locks* toolbar.



- 13. In the Set Elevation dialog box, set the Input Mode to Single.
- 14. Toggle off the *Destination Level*.
- 15. Key in *5152* for the *Elevation*.

🚔 Set Elevation			- • ×
Current Locate Mode:	Graphics		Apply
Graphics Input Mode:	Single	-	Close
<u>S</u> ource Level:	ALG_COGO_Poir	nts 🔻	Filter
Destination Level:	ALG_COGO_Poir	its 👻	Preferences
••			<u>H</u> elp
Features			
Name	Style	Description	-+-

- 16. **<D> Apply**.
- 17. $\langle D \rangle$ the outline.
- 18. $\langle D \rangle$ to Accept.
 - **Note:** The outline may disappear because elevation 5152 is not within your display depth. If it does, Fit your view with MicroStation.
- 19. Select MicroStation's Move Parallel tool.



- 20. Toggle on *Distance* and key in *1.5*.
- 21. Toggle on *Make Copy*.
- 22. **<D>** on the outline.
- 23. $\langle D \rangle$ to Accept on the outside of the footer outline.



- 24. $\langle \mathbf{R} \rangle$ to stop copying.
- 25. Select Surface > Design Surface > Generate Sloped Surface.
- 26. Verify that the current *Locate Mode* is *Graphics*. If not, toggle *Locate Feature / Locate Graphics* to *Locate Graphics* on the *Locks* toolbar.
- 27. Verify that Generate Graphics Only is toggled off.
- 28. Set the Intercept Surface to 12345 existing ground for interchange.
- 29. Key in 12345 excavation for pier footer as the Destination Surface.
- 30. Set the *Cut Slope* to *1:1*.

Note: The ratio is automatically converted into a percentage.

- 31. Toggle on *Triangulate Surface*.
- 32. Toggle on *Source* and key in *Excavation break*.
- 33. Set the *Style* to *Breakline*.
- 34. Toggle on *Catch Point* and key in *Excavation Cut*.
- 35. Set the *Style* to *D_Top-of-Cut*.
- 36. Set the *Point Type* to *Breakline*.

📷 Generate Sloped Surface	- • •
Main Advanced	
Current Locate Mode: Graphics	Filter
Source Surface: 12345 existing grour V	New Style
Intercept	Help
Elevation: 0.00	
Destination Surface: 12345 excavation fo ▼	
Interval: 10.00 +	
Cut Slope: 1:1 To: 33.00%	
Eill Slope: -33.00%	
Apply to Both Sides	
Feature	
Transverse:	
Tick Marks	
Source: Excavation break ✓ Breakline	•
Catch Point: Excavation Cut	•
Point Typ <u>e</u> :	•
Point Density Interval: 0.00 +	
Duplicate Names:	
O Append O Repla <u>c</u> e O Rena <u>m</u> e	
Exclude from Triangulation Generate Graphics Only	
Apply Preferences Close	

37. <D> Apply.

- 38. **<D>** on the outer pier outline.
- 39. $\langle D \rangle$ to Accept.
- 40. **<R>** for Entire (the entire element).
 - *Important!* If you <D> again instead of <R>, that location is the starting point for the slope and the excavation will not be completed around the pier.
- 41. Move your cursor to the *outside* until the temporary graphic looks like shown here, then *<D>* to Accept the location.



<**R**> out of the command.

- **Note:** The *Generate Sloped Surface* command is very useful for creating sloped surfaces from features or graphical elements that intercept other surfaces. The intercepts can be existing ground surfaces, design surfaces or even surfaces previously created with this command.
- 42. Select Evaluation > Profile > Create Profile.
- 43. Toggle on *12345 existing ground for interchange*, *12345 SH119* and *12345 excavation for pier footer*.
- 44. Highlight 12345 excavation for pier footer and choose Properties.

Create Profile General Source Include Offsets Axes Grid Axes Ax	Set Name: SH52-H Direction © Left to Right © Right to Left	Exaggerati Vertical: Horizontal:	on 1.0000 1.0000	
	Surfaces: Object Default 12345 SH119 12345 existing groun 12345 excavation fo	Name Default D_Finished-Grade T_Existing_Ground Default	BYL BYL BYL BYL None]
		Apply Prefere	ences) Close	<u>H</u> elp

45. Set the *Profile Symbology* to *D_SURFACE_3*.

🗑 Sur	face Propertie	5				- 8 2
Main Advanced Surface: 12345 excavation fc ▼ Cross Sections						
⊂ Pri Syj	ofiles mbology: D_SL	JRFACE_3			🔲 Lock	Symbologies
UI	set Distance	Symbology	Loid	or Uniset	Distance	Symbology Color
1	0.00	Default	-	<u>9</u> :	0.00	Default 👻
2	0.00	Default	-] 1 <u>0</u> :	0.00	Default 👻
3	0.00	Default	•	1 <u>1</u> :	0.00	Default 👻
4	0.00	Default	•	1 <u>2</u> :	0.00	Default 👻
5	0.00	Default	•	1 <u>3</u> :	0.00	Default 🔻
6	0.00	Default	•	1 <u>4</u> :	0.00	Default 🔻
Z	0.00	Default	•	1 <u>5</u> :	0.00	Default 🔻
8	0.00	Default	•	1 <u>6</u> :	0.00	Default 🔻
				,		
			Apply	Cle	ose	

- 46. **<D> Apply**, then **Close**.
- 47. Back on the *Create Profile* dialog box, select the *Source* branch

48. Set *Alignment* to *SH52-H*

🚼 Create Profile		
Greate Profile General Visuace Include Offsets Controls Grid Details ASCII	Create: Alignment: Graphics Alignment: Multipoint Alignment: ASCII File 	Window and Data
		Apply Preferences Close Help

- 49. Select the *Controls* branch.
- 50. Set the *Station Limits* to *106+00* to *109+00*.

🚼 Create Profile		- • • ×
Create Profile General Source Include Offsets Controls The Controls	Elevation Use High: 1000.00 Low: 0.00 From Cogo Points From Regression Points	Example
Grid Grid Details	Station ✓ Use Start: 106+00.00 ◆ Stop: 103+00.00	
	Window Clearance Ø Apply Top: 0.00 Bottom 50.00	
	Apply Preferences	Close <u>H</u> elp

51. **<D> Apply**.



52. **<D>** a clear area in the design file for the location of the profile.

53. Window in to see the excavation surface.



54. Right-click on the *12345 excavation for pier footer* surface in the *Explorer* part of the menu and choose *Save*.

Hentley InRoads XM Edition				- • •
<u>File Surface Geometry Drainage Evaluation</u>	<u>M</u> od	eler Dr <u>a</u> fting <u>T</u> ools <u>H</u> elp		
<unnamed> 💌 🗃 😴 🛛</unnamed>	8 🔪	🗙 🏏 🗾 🛶 🔛		
	=	Data Type	Active	Features
🖃 📾 Surfaces		€ Breakline Features	130	2
🛓 🧠 🥮 Default		鯼 Contour Features	0	0
i 12345 SH119		Exterior Features	0	0
12345 existing ground for interchang	ge	🕅 Inferred Breaklines	0	0
12345 excavation for pier footer		Traterier Freetures	0	0
Si	ave	eatures	0	0
S	ave A	s nts	4	2
s	et Act	tive	154	0
Surfaces 🖁 Geometry 🔊 Pre T	riang	ulate		Þ
Ready	opy			н

Note: Verify the Active Surface is 12345 excavation for pier footer

55. If the *File name* is blank, use the *Active* drop-down to again choose *12345excavation for pier footer* and the name appears in the *File name* field as well.

🙀 Save As				
Save in:	📗 InRoads	•	· 🌀 💋	📂 🎞 -
An	Name	*		Date modified
Recent Places	📙 Lab - Intercl	hange Data		7/10/2009 3:34 PM
Recent Flaces	Lab - Interse	ections Data		7/10/2009 3:35 PM
	12345 existin	ng ground.dtm		8/11/2009 10:27 AM
Dealstein	12345 existin	ng ground for interchange.dtm		9/27/2009 6:23 PM
Desktop	12345 pond	.dtm		8/10/2009 5:54 PM
	12345 SH52	71st East of Bridge.dtm		9/25/2009 11:57 AM
	12345 SH52	9/23/2009 11:30 AM		
Todd	12345 SH52.dtm			9/27/2009 6:38 PM
	12345 SH119	9.dtm		10/7/2009 1:17 PM
	SH86 finished.dtm			9/4/2009 4:02 PM
Computer				
	•			4
	File name:	12345 excavation for pier footer	dtm	- Save
Network	The Hame.		dan	
	Save as type:	Surfaces (*.dtm)		▼ Cancel
				Help
	Active:	12345 excavation for pier foote	r	Options

- 56. Verify the Save In path is C:\Projects\12345\Bridge\InRoads.
- 57. <D> Save then Cancel.

Lab 7.3 - Create a Backfill surface for a Pier

Next, the surface for the backfill is created, using the same procedure.

- 1. Select Surface > Design Surface > Generate Sloped Surface if you previously closed it.
- 2. Verify that the current *Locate Mode* is *Graphics*. If not, toggle *Locate Feature / Locate Graphics* to *Locate Graphics* on the *Locks* toolbar.
- 3. Verify that Generate Graphics Only is toggled off.
- 4. Set the *Intercept Surface* to 12345 SH119.
- 5. Key in **12345 backfill for pier footer** as the **Destination Surface**.
- 6. Set the *Cut Slope* to *1:1*.

Note: The ratio is automatically converted into a percentage.

- 7. Toggle on *Triangulate Surface*.
- 8. Toggle on *Source* and key in *Backfill break*.
- 9. Set the *Style* to *Breakline*.
- 10. Toggle on *Catch Point* and key in *Backfill*.
- 11. Set the *Style* to *D_Top-of-Fill*.

🕌 Generate Sloped Surf	ace	
Main Advanced		
Current Locate Mode:	Graphics	Filter
S <u>o</u> urce Surface:	12345 SH119 👻	New Style
 Intercept Surface: 	12345 SH119 🔻	<u>H</u> elp
Elevation:	0.00	
Destination Surface:	12345 backfill for pie 👻	
Inter <u>v</u> al:	10.00 •	
C <u>u</u> t Slope: 1:1	To: 33.00%	
Eill Slope: .33.00%	G To: -33.00%	
Apply to <u>B</u> oth Sides	🔽 <u>T</u> riangulate Surface	
Feature	er Stuler]
Transverse:	e. Style.	-
Tic <u>k</u> Marks		
Source: Bac	kfill break 👻 🕈 Breakline	•
📝 Catch Point: 🛛 Bac	kfill 👻 🛨 D_Toe-of-Fill	•
Point Typ <u>e</u> :	Breakline 🔻	
Point <u>D</u> ensity Interval:	0.00	
Duplicate Names:	Poplace Rename	
Curclude form Trian		
	guiation denerate <u>d</u> raphics Univ	
	Apply Preferences Close	

12. Set the *Point Type* to *Breakline*.

13. **<D> Apply**.

- 14. **<D>** on the outer pier outline.
- 15. **<D>** to Accept.
- 16. **<R>** for Entire (the entire element).
 - *Important!* If you <D> again instead of <R>, that location is the starting point for the slope and the backfill will not be completed around the pier.

17. Move your cursor to the *outside* until the temporary graphic looks like shown here, then *<D>* to Accept the location.



- 18. **<R>**.
- 19. **<D> Close** on the *Generate Sloped Surface* dialog.
- 20. Right-click on the *12345 backfill for pier footer* surface in the *Explorer* part of the menu and choose *Save*.

Note: Verify the Active Surface is 12345 backfill for pier footer

21. If the *File name* is blank, use the *Active* drop-down to again choose *12345 backfill for pier footer* and the name appears in the *File name* field as well.



22. Verify the Save In path is C:\Projects\12345\Design\InRoads.

- 23. <D> Save then Cancel.
- 24. Select Evaluation > Profile > Update Profile.
- 25. Verify the *Profile Set* is the one used in the previous section if you have more than one in your file. A box is drawn around the Profile Set listed.



26. Toggle Mode to Display Off.

27. Highlight the *12345 excavation for pier footer*.

Wodate Profile Profile Set: Wodate Profile Wodate Profile Wodate Profile Wodate Profile Wodate Profile Workace Offsets Crossing Features Projected Features Projected Features Show Data Outside Elegation Range Apply	form.		
Profile Set: Mode: Befresh Display On Display Off Update Profile Surface: Surface: Name Description Offsets Crossing Features Projected Features Projected Features SH119 SH52 existing around for interchance SH119 SH52 existing around for interchance State Image: State Image: State Image: State Image: State Show Data Outside Elegation Range Show Data Outside Elegation Range Image: State Image: State Apply Close Help	🔚 Update Profile		
SH52:H Mode: Befresh Display On Display Off Update Profile Surface Surface Display On Description Offsets Crossing Features Name Description + 12345 SH119 12345 sexisting around for interchance SH119 SH52 ex 12345 excavation for pier footer 12345 sexisting around for interchance SH119 SH52 ex 12345 excavation for pier footer Image: Close Show Data Outside Eleyation Range Show Data Outside Eleyation Range Image: Close Help	<u>P</u> rofile Set:		
Update Profile Surface Offsets Crossing Features Projected Features Projected Features Show Data Outside Eleyation Range	SH52-H 👻 🛨	Mode: 🔘 <u>R</u> efresh 🛛 Display <u>O</u> n 💿 <u>D</u> isplay Off	
Surface Offsets Crossing Features 12345 SH119 Projected Features 12345 existing around for interchance Show Data Outside Eleyation Range	🔄 Update Profile	Surfaces:	
Offsets Crossing Features Projected Features I2345 SH119 I2345 existing around for interchance SH119 SH52 existing around for interchance I2345 excavation for pier footer IIII Show Data Outside Eleyation Range Apply Close Help	🚽 🌩 Surface	Name Descrip	tion 🔶
I2345 existing around for interchance SH119 SH52 existing around for interchance I2345 excavation for pier footer I2345 excavation for pier footer Image: Show Data Outside Elevation Range Apply	Offsets Crossing Features	12345 SH119	
12345 excavation for pier footer Image: Image Show Data Outside Eleyation Range Apply Close	Projected Features	12345 existing ground for interchange SH119 S	iH52 ex
Show Data Outside Eleyation Range		12345 excavation for pier footer	
Show Data Outside Eleyation Range		<	Þ
		Show Data Outside Elevation Range	
Apply Close Help			
Apply Close <u>H</u> elp			
		Apply Clo	se <u>H</u> elp

28. **<D> Apply**.



- *Note:* The excavation surface is no longer shown on the profile.
- 29. Toggle *Mode* to *Display On*.

🕌 Update Profile			- 0 🗾
Profile Set: SH52-H	Mode: <u>R</u> efresh <u>Display On</u> <u>Display Off</u> Surfaces: Name Default 12345 backfill for pier footer	Description	- + -
	III Show Data Dutside Ele <u>v</u> ation Range	Þ	
		Close	Help

30. Highlight the 12345 backfill for pier footer.

31. **<D> Apply**.



Note: The backfill surface is now shown on the profile.

32. <D> Close on the Update Profile dialog.

Lab 7.4 - Create Pier Features

The footer and pier must be excluded from the backfill quantities. This can be accomplished by manually calculating the quantity and deducting it from what will be calculated from the surface as it exists now. Or, features may be added to the surface that take the footer and pier into account when InRoads computes the quantity. In the next series of steps, the second option is shown, creating four breaklines: *bottom of footer*, *top of footer*, *bottom of pier*, and *top of pier*. Since DTMs do not support overhangs or true verticals, the footer and pier are represented as 'near' verticals.

1. Turn off the *BRDG_Outline-Foundation-Footer level*.



2. **Delete** all of the remaining plan graphics to make it easier to see the features as they are developed (do not delete the profile graphics).



- 3. Select Surface > View Surface > Features.
- 4. Set the *Surface* to *12345 backfill for pier footer*.

5. Highlight both features.

	res		×
S <u>u</u> rface:	12345 backfill for pie 🔻	Apply	,
Fence <u>M</u> ode:	Ignore 🔻	Close	
		Filter.	
		Edit Styl	e
_		<u>H</u> elp	
<u>F</u> eatures:			- h
Name		Style	Ψ.
Backfill Backfill break		D_Toe-of-Fill Breakline	

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



7. Turn on the *BRDG_Outline-Foundation-Footer level*.



8. Window in to the corner of the footer.

Window in to this area	

Note: This element represents the bottom of the footer. In the next series of steps, MicroStation is used to create 3 parallel copies of this element.



- 9. Select MicroStation's **Move Parallel** tool.
- 10. Toggle on *Distance* and key in *1.50*.
- 11. Toggle on *Make Copy*.



- 12. **<D>** on the footer outline.
- 13. **<D>** to Accept *inside* the footer outline.
- 14. **<R>** to end the copy.



Note: This is the bottom of the pier.

- 15. In the Move Parallel command, change the *Distance* to *0.01*.
- 16. Make a copy of each line, to the inside.



Note: These lines represent the top of the footer and the top of pier.


Note: There are now four concentric rectangles representing the footer and pier. In this

case, one monolithic pier is being used; for multiple piers this procedure would be

Each of these MicroStation shapes must now be made into a feature, then moved to the correct elevation.

- 17. Select File > Import > Surface.
- 18. Select the *From Graphics* tab.
- 19. Set the *Surface* to *12345 backfill for pier footer*.
- 20. Set *Load From* to *Single Element*.
- 21. Set *Elevations* to *Use Element Elevations*.
 - **Note:** All of these shapes are at the same elevations. After importing them, the proper elevations will be set.
- 22. Key in *Bottom of footer* for the *Seed Name*.
- 23. Set the *Feature Style* to *Breakline*.
- 24. Set the *Point Type* to *Breakline*.

S <u>u</u> rface:	12345 backfill	for pier foo 👻	Applu
Loa <u>d</u> From:	Single Elemen	t 👻	Filter
Level:	ALG_COGO_F	Points 👻	Beculto
Ele <u>v</u> ations:	Use Element B	levations 🔻	
Intercept Surface:	Default	-	Prejerences
Drape Vertices Or	nly		<u>H</u> elp
🔲 <u>T</u> hin Surface			
Toler <u>a</u> nce:	5.00		
Features Use Tagged <u>G</u> ra	aphics Informatio	n	
<u>S</u> eed Name:		Bottom of footer	→ +
Feature Style:		Breakline	•
P <u>o</u> int Type:		Breakline	•
Maximum Sej	gme <u>n</u> t Length:	0.00	
🔽 Point Density	Interval:	10.00	
Duplicate Names: Append Exclude from Tri	D Repla <u>c</u> e (angulation	Rename	

25. Toggle on *Point Density Interval* and key in *10.00* for the value.

- 26. **<D> Apply**.
- 27. **<D>** on the bottom of footer line.



28. **<D>** to Accept.

🝯 Import Surface				
From Graphics DEM	From Geom	etry		
S <u>u</u> rface:	12345 backfil	l for pier foo	•	Apply
Loa <u>d</u> From:	Single Elemen	nt	•	Filter
Level:	ALG_COGO_	Points	-	Besults
Ele <u>v</u> ations:	Use Element I	Elevations	•	Proferences
Intercept Surface:	Default		-	Frejerences
Drape Vertices On	ly .			<u>H</u> elp
🔲 <u>T</u> hin Surface				
Toler <u>a</u> nce:	5.00			
Features Use Tagged <u>G</u> rap	phics Informatio	on		
Seed Name:		Top of fo	oter	+
Feature Style:		Breakline		•
P <u>o</u> int Type:		Breakline		-
🔲 Maximum Seg	me <u>n</u> t Length:	0.00		
🔽 Point Density	Interval:	10.00		
Duplicate Names: O Append	Repla <u>c</u> e	◙ Rena <u>m</u> e		
Exclude from Tria	Ingulation			
		Close		

29. Key in *Top of footer* for the *Seed Name*

- 30. **<D> Apply**.
- 31. $\langle D \rangle$ on the top of footer line.



32. **<D>** to Accept.

33. Key in *Bottom of pier* for the *Seed Name*.

🚔 Import Surface			- • •	
From Graphics DEM	From Geome	etry		
S <u>u</u> rface:	12345 backfill	for pier foo 🔻	Apply	
Load From:	Single Elemen	it 🔻	Filter	
Level:	ALG_COGO_F	ALG_COGO_Points -		
Ele <u>v</u> ations:	Use Element F	Elevations 👻	Desferences	
Intercept Surface:	Default	-	Prejerences	
Drape Vertices On	ly .		<u>H</u> elp	
🔲 <u>T</u> hin Surface				
Toler <u>a</u> nce:	5.00			
Features	nhice Informatio	un.		
Seed Name:	Jillos mioma	D-H of size	-	
Feature Style:		Bottom or pier		
D 1 / T		Breakline	_	
Point Type:		Breakline	-	
📃 Maximum Seg	me <u>n</u> t Length:	0.00		
V Point Density	Įnterval:	10.00		
Duplicate Names: Append) Repla <u>c</u> e () Rena <u>m</u> e		
Exclude from Tria	ingulation			
		llose		

- 34. **<D> Apply**.
- 35. **<D>** on the bottom of pier line.



36. **<D>** to Accept.

🐂 Import Surface			- • ×
From Graphics DEM	From Geome	etry	
S <u>u</u> rface:	12345 backfill	for pier foo 👻	Apply
Loa <u>d</u> From:	Single Elemer	nt 🔻	Filter
Level:	ALG_COGO_I	Points 👻	Besults
Ele <u>v</u> ations:	Use Element I	Elevations 🔹 🔻	Preferences
Intercept Surface:	Default	Ŧ	
Drape Vertices Onl	y		Help
🔲 <u>T</u> hin Surface			
Toler <u>a</u> nce:	5.00		
Features Use Tagged <u>G</u> rap	phics Informatio	on	
<u>S</u> eed Name:		Top of pier	→ +
Feature Style:		Breakline	•
P <u>o</u> int Type:		Breakline	•
🥅 Maximum Segr	me <u>n</u> t Length:	0.00	
🔽 Point Density <u>I</u>	nterval:	10.00	
Duplicate Names:) Repla <u>c</u> e () Rena <u>m</u> e	
Exclude from Tria	ngulation		
		Close	

37. Key in *Top of pier* for the *Seed Name*.

- 38. **<D> Apply**.
- 39. $\langle D \rangle$ on the top of pier line.



- 40. <D> to Accept.
- 41. Select Surface > Design Surface > Set Elevation.

42. If the current *Locate Mode* is not set to *Features*, toggle *Locate Graphics/Locate Features* on the locks toolbar to *Locate Features*.



- **Note:** This command can set the elevation of either graphical elements or features. Since the shapes have already been loaded into the surface, they are already features.
- 43. Highlight the *Bottom of footer* feature.
- 44. Key in an *Elevation* of *5152*.

-			
Current Locate Mode:	Features		Apply
Graphics			Close
Input Mode:	Single	-	CIUSE
<u>S</u> ource Level:	ALG_COGO_F	Points 👻	Fil <u>t</u> er
Destination Level:	ALG_COGO_F	Points 👻	Preferences.
			Help
Features			<u></u> +
News	01. J		
1 10 2020	L S NUO	Description	
	Style	Description	
Backfill break	Breakline	Created by Ge	nerate
Name Backfill break Backfill break1 Bottom of footer	Style Breakline D Toe-of-Fill Breakline	Description Created by Ge Created by Ge	nerate
Name Backfill break Backfill break1 Bottom of footer Bottom of pier	Style Breakline D Toe-of-Fill Breakline Breakline	Description Created by Ge Created by Ge	nerate nerate
Name Backfill break Backfill break1 Bottom of footer Bottom of pier Top of footer	Style Breakline D Toe-of-Fill Breakline Breakline Breakline	Description Created by Ge Created by Ge	nerate nerate
Backfill break Backfill break Bottom of footer Bottom of pier Top of footer Top of pier	Style Breakline D Toe-of-Fill Breakline Breakline Breakline Breakline	Description Created by Ge Created by Ge	nerate nerate
Backfill break Backfill break Bottom of footer Bottom of pier Top of footer Top of pier	Style Breakline D Toe-of-Fill Breakline Breakline Breakline	Description Created by Ge Created by Ge	nerate nerate
Backfill break Backfill break Backfill break1 Bottom of footer Top of footer Top of footer Top of pier	Style Breakline D. Toe-of-Fill Breakline Breakline Breakline	Description Created by Ge Created by Ge	nerate nerate
Backfill break Backfill break1 Bottom of footer Bottom of pier Top of footer Top of pier	Style Breakline D Toe-of-Fill Breakline Breakline Breakline	Description Created by Ge Created by Ge	nerate

- 45. <D> Apply.
- 46. Highlight the *Top of footer* feature.
- 47. Key in an *Elevation* of *5153.5*.
- 48. **<D> Apply**.
- 49. Highlight the *Bottom of pier* feature.
- 50. Leave the *Elevation* set to 5153.5.
- 51. **<D> Apply**.
- 52. Highlight the *Top of pier* feature.
- 53. Key in an *Elevation* of *5180*.
- 54. **<D> Apply** then **Close**.

- **Note:** Alternately, you can set the MicroStation graphics to the correct elevation using the *Set Elevation* command prior to importing the graphics as features into InRoads. The *Set Elevation* command works on either graphics or features based on the *Locate mode*.
- 55. Select Surface > Triangulate Surface.
- 56. Verify the *Surface* is *12345 backfill for pier*.

🐂 Triangulate Surface	:		- • •
Surface:	45 backfill for pier fi	•	Apply
Description:		_	Close
Maximum Length: 0.00	-4	+	Help
Extended Data Check	:ks	Lock Triangulation	
Features	hics	Results Number of Points:	
Delete Surface Con	ntents	Number of Triangles:	
Eilter Tolerance: 0.	.00	Elapsed Time (Second	ds):
			<u>M</u> ore

- 57. **<D> Apply** then **Close**.
 - **Note:** This has basically created a footer and pier sitting in a trough. The triangles and/or contours may be displayed to review the surface if desired. This image shows a rotated view of the triangles that has been shaded using MicroStation's **Utilities** > **Render** > **Smooth**.



- 58. *Save* the *12345 backfill for pier footer* surface to the directory C:\Projects\12345\Bridge\InRoads.
- 59. Window in to the previously displayed profile.
- 60. Select Evaluation > Profile > Update Profile.
 - **Note:** If there is more than one profile in the design file, make certain the correct *Profile Set* is listed.
- 61. Set the *Mode* to *Refresh*.
- 62. Highlight the 12345 backfill for pier surface.

🕌 Update Profile			- 0 🔀
Profile Set:	Mode: @ Refresh @ Display On _ @ Display Off		
Update Profile	Surfaces:		
Surface	Name	Description	+
Crossing Features Projected Features	12345 SH119 12345 existing ground for interchange 12345 backfill for pier footer	SH119 SH52 ex	1
	<	۰.	
	Show Data Outside Elevation Range		
	Apply	Close	<u>H</u> elp

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



Note: This surface, along with the excavation surface will be used in a later lab to calculate volumes.

Chapter Summary:

- The *Generate Sloped Surface* command is very useful for creating sloped surfaces from features or graphical elements that intercept other surfaces.
- The intercepts can be existing ground surfaces, design surfaces or even surfaces previously created with this command.
- Features can be added to a proposed surface representing footers, piers, walls, etc.), which can be used for volume computations.
- MicroStation elements or surface features can be placed at the correct elevation using the *Set Elevation* command in InRoads.
- MicroStation elements can be imported as surface features using the *Import Surface* command in InRoads; if they are not at the correct elevation, the elevation can be set using the InRoads *Set Elevation* command.

LAB 8 - Evaluating Bridge Design Surfaces

In this lab you will evaluate the excavation and backfill surfaces you created in the previous lab by computing cut and fill volumes. InRoads provides different methods for computing volumes. In this lab, you will work with three different methods.

Chapter Objectives:

- Learn how to compute Triangle volumes.
- Learn how to set default XSL style sheets to format InRoads reports.
- Learn how to compute Grid volumes as a check for the triangle volumes.
- Learn how the grid interval affects grid volume results.
- Learn how to compute End Area Volumes from cross section graphics.

The following files are used in this lab:

- C:\Projects\12345\Bridge\Working \CU12345BRDG_Model.dgn
- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Preferences\ CDOT_Civil.xin
- C:\Projects\12345\Design\InRoads\12345 SH119
- C:\Projects\12345\Design\InRoads\12345 SH119 SH52 Interchange.alg
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange
- **Note:** The following files were created in the previous lab "*Feature Based Modeling*." If these files don't exist in the location identified below then they can also be copied from the directory *C:\Projects\12345\Miscellaneous\BRDG-08*
- C:\Projects\12345\Bridge\InRoads\12345 backfill for pier footer
- C:\Projects\12345\Bridge\InRoads\ 12345 excavation for pier footer

Lab 8.1 - Open Data Files

- 1. Open MicroStation and InRoads using the *C:\Projects\12345\Bridge\Working* *CU12345BRDG_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, 12345 backfill for pier footer, 12345 excavation for pier footer, and 12345 SH119 SH52 interchange.alg.
- 5. Open C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange.

Lab 8.2 - Compute the Pier Excavation Volume

The triangle is the most accurate method of computing volumes in InRoads. It compares existing and design surfaces to compute cut, fill and net volume between the surfaces. Since you have created an excavation surface for the pier footer, you can use the triangle method to compare this surface to the existing ground surface and compute the amount of cut needed for the excavation of the footer.

The grid method provides a quick check against other volume methods to ensure volume accuracy. The smaller you set the grid interval, the more accurate the volume results. You'll use the grid method to check your triangle volume.

- 1. **Delete** any MicroStation graphics currently in the design file.
- 2. Select Evaluation > Volumes > Triangle Volume.
- 3. Set *Mode* to *Entire Surface*.
 - **Note:** You have the option to compute volumes on a portion of the surface using a MicroStation fence or shape. Areas outside of the smaller of the two surfaces are ignored.
- 4. Set Original Surface to 12345 existing ground for interchange.
- 5. Set Design Surface to 12345 excavation for pier footer.

Note: *Cut* and *Fill Factors* are swell and shrinkage factors that you can apply to the volumes depending on the classification of material.

6. **<D> Add**.

🥌 Triangle Volume				
Mode: Er	ntire Surface 🔹 🔻			Apply
Surface Sets Original Surface: 12 Design Surface: 12	2345 existing grour ▼ 2345 excavation fc ▼	Cut Factor: Fill Factor:	1.0000	Close <u>H</u> elp
Original Surface 12345 existing grou.	Design Surface 12345 excavation f	Cut Factor 1.00	Fill Factor	
	Add	Change	Delete	

7. **<D> Apply**.

8. If you receive a warning message that a default style sheet has not been selected for the *Triangle Volume* report, select **OK** after receiving this message. You will set a default style sheet in this lab.



Note: The *Bentley InRoads Report Browser* automatically starts, allowing you to select a style sheet (i.e. a report template) to format the report. All available report style sheets are organized in folders and listed on the left-hand side of the report browser. The right-hand side shows the report *XML* data.

Tools Help Program Files/Bentley/UnRoads Group V8.9V/ML Data/ Bridge A sP-BuillEvations.xil BeamSeaElevations.xil BeamSeaElevations.xil BeamSeaElevations.xil BeamSeaElevations.xil Cearance2.xil Coarance2.xil Coarance2.xil Gridet_ayoutFormBeatral Gridet_ayoutFormBeatral Gridet_ayoutFormBeatral Gridet_ayoutFormBeatral Gridet_ayoutFormBeatral Gridet_ayoutFormBeatral Dearance2.xil Gridet_ayoutFormBeatral Gridet_ayoutFormBeatral Gridet_ayoutFormBeatral Gridet_ayoutFormBeatral Gridet_ayoutFormBeatral Gridet_ayoutFormBeatral Gridet_ayoutFormBeatral SubElevations.xil SubElevation3.congludinaLines.xil SubElevation3.congludinaLines.xil SubElevation3.congludinaLines.xil SubElevation3.congludinaLines.xil SubElevation3.congludinaLines.xil SubElevation1.congludinaLines.xil SubElevation1.congludinaLines.xil TransverseLines.xil TransverseLines.xil UBeamTubenthat	<pre></pre> xml version="1.0" encoding="iso-8859-1" ? < dnRoads productName="Bentley InRoads XM Edition" productVersion="08.09.02.16" outputcindScaleFactor="1.000000" inputCridScaleFactor="1.000000" inputGridScaleFactor="1.000000" infil#actor="1.000000" infil#actor="1.0
L Lant Delarance] Custom] Dat2Cillection] Evoluation] Geometry	

9. In the *Report Browser*, select the *Evaluation* folder.

10. Select the *TriangleVolumes.xsl* style sheet.

File Tools Help			
C.VProgram Files\Bentley\InRoads Group V8.9XML Data\ Bridge Cant Ceartace Custom DataCallection Evaluation All AverageTrossStopeArea.xsl All BasicEndAreaVolumeBalanceStation.xsl	Tria Mode: Entire Input Grid Factor: 1.00000	angle Volume Report Report Created: 10/9/2009 Time: 3:50pm Surface	
All Basic/Volume.xil A) CrossSectionAllFedures.xil A) CrossSectionGradebook.xil A) CrossSectionFradebook A)	Original Surface: 1234 Design Surface: 1234 Cut Factor: Fill Factor: Cut: Fill: Net: Cut: Fill: Net: Net:	5 existing ground for interchange 5 excavation for pier footer 1.000 1.000 1437 cu ft 0 cu ft 1437 cu ft 53 cu yd 0 cu yd 53 cu yd	

Note: The *XML* data is formatted using this report style sheet.

- 11. In the *Report Browser* window, select Tools > Format Options.
- 12. In the *Format Options* dialog box, set *Cubic Units* to 0.12 precision.

Format Options						×
Northing/Easting:	Mode		Precision	- 1	Format	Close
Elevation:			0.123	-		<u>H</u> elp
Angular:	Degrees	•	0	•	ddd^mm'ss.s'' 💌	Include Angular Suffix
Slope:			0.12	-	50% 💌	
Use Alternate Slope if	Slope Exceeds:		0.00%			
Alternate Slope:			0.12	-	2.0:1	
Linear:			0.123	-		
Station:			0.12	•	\$\$+\$\$.\$\$	
Acres/Hectares:			0.1	•		
Area Units:			0.1	-		
Cubic Units:			0.12	•	🔲 Convert to Cubi	c Yards
Direction:	Bearings	-	0.12	•	ddd^mm'ss.s'' 💌	
Face:	Right Face	•				
Vertical Observation:	Zenith	•				

13. **<D> Close**.

Program Files\Bentley\InRoads Group V8.9\XML Data\	Trian	de Volume Report	
Bridge	Indi	gie volume Report	
Cant			
Clearance	Rej	port Created: 10/9/2009	
Lustom		Time: 3:53pm	
DataLollection			
Evaluation	Mode: Entire Su	inface	
A Pavia Factor as Victor a Data as Chattan and	Input Grid Factor: 1.000000		
A Deviation well		\times \times \times \times \times \times \times	X
A CrossSection vol	Original Surface: 12345 e	existing ground for interchange	
All CrossSectionAllFeatures vol	Dosign Surface: 12345 c	sequation for plot footor	
CrossSectionASCIIInputFormat.xsl	Cut Easter	1.000	
A: CrossSectionASCIIInputFormatWithPencodes.xsl	Cut Factor:	1.000	
AT CrossSectionDesignSurfaceFeatures.xsl	Fill Factor:	1.000	
CrossSectionGradebook.xsl			
CrossSectionGradebookNE.xsl	Cut:	1437.14 cu ft	
CrossSectionGradebookWide.xsl	Fill	0.00 cu ft	
CrossSectionPoints.xsl		1127 14 B	
CrossSectionPointsList.xsl	Net.	1437.14 CU IL	
CrossSectionProfileList.xsl			
CrossSectionStaking.xsl	Cut:	53.23 cu yd	
CrossSectionStaking Lable.xsl	Fill:	0.00 cu yd	
All CrossSectionsToLSV.xsl	Net:	53.23 cu vd	
LiossSectionSurveyFormat.xsl			
A CrossSectionWite xst			
ClossoBolion 12. Xsi			
A EndAresVolume vel			
T EndAreaVolumePageTotals vel			
All Endéreal/olumeStationBange vsl			
All MultipleMateria/Volumes.xsl			
AT TriangleVolumes.xsl			
A: TriangleVolumesSumShapes.xsl			
All Volumes xsl			

Note: The report automatically updates with the new formatting.

14. Record your results:

Cut: ______ cu yd.

Note: Any fill that is listed should be negligible.

- 15. Right-click on the *TriangleVolumes.xsl* style sheet and select *Set Default Triangle Volume*.
 - **Note:** The next time you run the *Triangle Volume* command, InRoads will automatically use this style sheet without you having to select it. You can always select another style sheet from the *Report Browser* to change the report formatting at any time.
- 16. Close the *Triangle Volume Report* by select the *X* in the upper right corner of the *Report Browser*.
- 17. In the *Triangle Volume* command, <D> Close.

Next, you will check your triangle volumes by computing grid volumes.

- 18. Select Evaluation > Volumes > Grid Volume.
- 19. Set Original Surface to 12345 existing ground for interchange.
- 20. Set Design Surface to 12345 excavation for pier footer.

21. For *Grid Interval* Key in *2.0*.

🐂 Grid Volume				- • •
Fence <u>M</u> ode:	Ignore -]	Factors	Apply
Original Surface:	12345 existing grour 🔻]	<u>⊆</u> ut: 1.0000	Close
<u>D</u> esign Surface:	12345 excavation fc 🔻		Eill: 1.0000	Results
<u>G</u> rid Interval:	2.00	+		Help
Results			1	
Cut:				
Fill:				
Net				

22. <D> Apply.

Note: For this command, the volume results appear in the dialog box instead of a report.

- 23. Record your results in the table below.
- 24. For Grid Interval Key in 1.0.
- 25. <D> Apply.
- 26. Record your results in the table below.
- 27. For Grid Interval Key in O.5.
- 28. **<D> Apply**.
- 29. Record your results in the table below.

	Interval = 2.0	Interval = 1.0	Interval = 0.5
Cut Volume	cu yd.	cu yd.	cu yd.

- **Note:** As you decrease the size of the grid interval, your grid volume should approach the triangle volume results with increased accuracy. If your **0.5** grid interval volume does not compare favorably to your triangle volume, see your instructor.
- 30. **<D> Close** on the *Grid Volume* dialog box.

Lab 8.3 - Compute the Pier Backfill Volume

In this section, you will use the same volume commands to compute your backfill quantities.

- 1. Select Evaluation > Volumes > Triangle Volume.
- 2. Set *Mode* to *Entire Surface*.
- 3. Set Original Surface to 12345 backfill for pier footer.
- 4. Set Design Surface to 12345 SH119.

- **Note:** The backfill surface is set as the *original surface* in order for the results to display as a "fill" volume.
- 5. **<D> Add**.



- 6. **<D> Apply**.
 - **Note:** Since you previously selected a default style sheet for this command, you do not get the warning message and the report is automatically generated using the *TriangleVolumes.xsl* style sheet.

Program Files\Bentley\InRoads Group V8.9\XML Data\				
A verageCrossSlopeArea.xsl	*		riangle Volume Report	
BasicEndAreaVolumeBalanceStation.xsl				
Ag BasicVolume.xsl			Report Created: 10/9/2009	
CrossSection.xsl			Time: 7:00pm	
CrossSectionAllFeatures.xsl				
Ag CrossSectionASCIIInputFormat.xsl		Mode: E	Entire Surface	
CrossSectionASCIIInputFormatWithPencodes.xsl		Input Grid Factor:	000000	
CrossSectionDesignSurfaceFeatures.xsl				
CrossSectionGradebook.xsl		0	400451 15015 5 5 4	
CrossSectionLiradebookNE.xsl		Original Surface:	12343 backini for pier looter	
CrossSectionGradebookWide.xsl		Design Surface:	12345 SH119	
A: CrossSectionPoints.xsl		Cut Factor:	1.000	
LiossSectionPointsList.xsl		Fill Factor:	1.000	
LiossSectionProfileList.xsi	-			
CrossSectionStaking.xsi	-		00.02	
CrossSectionStakingTable.xsi		Cut	26.03 CU π	
T CrossSectionSurveyFormativel		Fill:	3984.17 cu ft	
All CrossSectionM/ide vsl		Net:	-3958.14 cu ft	
All CrossSection 07 xsl				
EarthworkQuantities.xsl		Cut	0.96 cu vd	
A EndAreaVolume.xsl		Eill-	147 E6 ou ud	
EndAreaVolumePageTotals.xsl			147.50 Cu yu	
🔄 EndAreaVolumeStationRange.xsl		Net:	-146.60 cu ya	
MultipleMaterialVolumes.xsl				
TriangleVolumes.xsl				
A TriangleVolumesSumShapes.xsl				
A: Volumes.xsl				
VolumesToCSV.xsl				
Geometry				
ICS				
Images				
IntersectingAlignmentStations				

7. Record your results:

Fill: _____ cu yd.

- 8. Close the *Triangle Volume Report* by select the *X* in the upper right corner of the *Report Browser*.
- 9. In the *Triangle Volume* dialog box, <D> Close.

Next, you will check your triangle volumes by computing grid volumes.

- 10. Select Evaluation > Volumes > Grid Volume.
- 11. Set Original Surface to 12345 backfill for pier footer.
- 12. Set Design Surface to 12345 SH119.
- 13. For Grid Interval key in O.25.
 - **Note:** An acceptable grid interval depends on the size of your surfaces, the variation and relief in your surfaces, whether or not your surfaces were surveyed, how they were surveyed, etc. You may need to try a few grid intervals based on these variables before converging on a good net number. For our two surfaces, an interval of **0.25** should provide accurate results.

🐂 Grid Volume			- 0 X
Fence <u>M</u> ode:	Ignore 👻	Factors	Apply
Original Surface:	12345 backfill for pie 🔻	<u>C</u> ut: 1.0000	Close
<u>D</u> esign Surface:	12345 SH119 👻	Eill: 1.0000	<u>R</u> esults
<u>G</u> rid Interval:	0.25	+	Help
Results			<u> </u>
Cut:			
Fill:			
Net:			

- 14. **<D> Apply**.
- 15. Record your results:

Fill: _____ cu yd.

Note: Your grid volume results should compare favorably to your triangle volume results. If not, see your instructor.

Lab 8.4 - Compute End Area Volumes

You may also want to use the *End Area Volumes* command as another check of your triangle volumes or if your contractor requires end area volumes for his work. The *End Area* method requires that you have a set of cross sections cut showing the surfaces from which you want to compute volumes. The volumes are calculated from the cross section graphics instead of comparing DTM data, as with the *Triangle* and *Grid* methods.

In this section you will compute the end area volume for your pier footer backfill. In order to do so, you must first cut a set of cross sections along the pier. You can either cut cross sections on a graphic or an alignment, so you will copy the pier centerline element from the reference file into the active bridge model file.

1. If your reference file is not turned on, select File > Reference and toggle on the display of the *12345BRDG_Model_D-16-DU* file.

References (1 of 1 unique, 1 displayed)									×
<u>T</u> ools <u>S</u> ettings									
🗄 - 陸 🔌 🎰 🕺 🏟 🖗 🖻	i i 🗗	70 🛱 🚰 📦	🗙 <u>H</u> ilite Mode:	Boundaries	•		-		
Slot 🎽 🏲 File Name	Model	Description	Logical	Presentation	0	•	لا	۲ 🕒	
1 12345BRDG_Model_D-16-DU.dgn	CDOT Default	Global Origin aligned v	vith	Wireframe	0	\checkmark	\checkmark	\checkmark	

2. Window in on the pier centerline.



3. Select MicroStation's Copy command.



4. Snap to the end of the line to identify it to copy.



5. Snap to the same end to copy it to the active file in the exact same location.

📕 Copy Element 🛛 💷 💌	
Copies: 1	
Use <u>F</u> ence: Inside 🔻	1.
	u

6. Turn off the display of the reference file.

Note: Only the pier centerline element is now shown in the view.

- 7. Before cutting cross sections, set the text scale factor to be used for the cross section text. Select **Tools > Options**.
- 8. Select the *Factors* tab.
- 9. Unlock the three factors and for *Text Scale Factor* key in *40*.

🖌 Options		- • •
Precision Genera Tolerances Factors	I Units and Format Abbreviations Rail	Geometry Sight Distance
Text Scale Factor:	40.0000	<u>H</u> elp
Cell <u>S</u> cale Factor:	100.0000	1
Line Style Scale Factor:	100.0000	-
Apply	Pre <u>f</u> erences	lose

- 10. **<D> Apply**, then **<D> Close**.
- 11. Select Evaluation > Cross Section > Create Cross Section.
- 12. Select *Preferences* and select the *Stacked 20 per column* preference.

Freferences	
Name:	Close
10H 5V 120' Wide 20H 10V 120' Wide 20H 10V 200' Wide	Load
40H 20V 160' Wide	Save
40H 20V 320' Wide CDOT	Save As
Stacked 20 per column	Delete
	Help
Active Preference: Default	

- 13. **<D> Load**, then **<D> Close**.
- 14. On the *General* branch, toggle off the *12345 excavation for pier footer* and *Default* surfaces. Make sure all other surfaces are toggled on.
- 15. For Set Name, key in Pier.
- 16. For *Interval*, key in *10*.

in Create Cross Section					- • •	3
Create Cross Section	<u>S</u> et Name:	Pier				
General	Crea <u>t</u> e:	Window a	and Data 🛛 🔻	1		
	Inter <u>v</u> al:	10.00		+		
Controls	Left Offset:	-80.00		+		
Layout	<u>R</u> ight Offset:	80.00		-		
Axes	Vertical Exaggeration:	2.0000				
Details	🔲 Sho <u>w</u> Data Outside	Elevation F	Range			
ASCII	Surfaces:					
	Object		Name	_	<u>~</u>	
	12345 existing gro	und f	T_Existing_(Ground Grade	_	
	12345 excavation	for pi	Default	anduc		
	12345 backfill for	pier fo	Default		▼	
				•	None	
			ĺ	Properties.		
		Apply	Preference	es) (Close <u>H</u> elp	

17. On the *Source* branch, toggle on *Graphics* and in the *Alignment* field, key in *Pier centerline*.

🐂 Create Cross Section				- • • ×
🚔 Create Cross Section	O Alignment:	SH52-H	* +	
General	Single St.	ati <u>o</u> n: 0+00.00	-#-	
Include	Graphics			
Controls	Alignment:	Pier centerline		
Lustom	Multipoint			
- Axes	Alianment			
Grid				
	C ASCITTIE			
		Apply Pref	erences	Close <u>H</u> elp

- **Note:** The *End Area Volume* command requires an alignment in order to compute volumes. Specifying a name here will automatically create an alignment along the pier centerline element.
- 18. **<D> Apply**.
- 19. **<D>** the pier centerline.



- 20. **<D>** to Accept.
- 21. $\langle D \rangle$ in a clear area for the lower left corner of the cross section set.





Note: Since you added the pier features to the backfill surface in the last lab, the pier and footer will be excluded from the backfill quantities, but the area of the pier that falls above the SH119 surface will be shown as cut and should be ignored.

- 23. Select the *InRoads Explorer Geometry* tab and note that you now have an active *Pier centerline* alignment created by the *Cross Section* command.
 - □□器 Geometry Projects 🗉 🧮 Default 📄 🧱 12345 SH119 SH52 Intercha 🕂 Cogo Buffer 🗄 🖌 🖌 Ramp A-H 🛓 🖌 🖌 Ramp B-H 🗄 🖌 Ramp C-H 🗄 🖌 Ramp D-H 🗄 🖉 SH119 NB-H 🗄 📝 SH119 SB-H 🛓 🖌 SH52-H 🛓 🖌 Wall D-16-E 🗄 🖌 🖌 Wall D-16-F 🗄 🖉 🖌 Wall D-16-G 🖶 🖌 Wall D-16-H 🗄 🗸 🖌 Wall D-16-I 🗄 🗸 🖌 Wall D-16-J 🚋 🖌 Wall D-16-K 🖌 Wall D-16-L 📝 Pier centerline

You're now ready to compute the end area volumes from the cross section graphics and new pier centerline alignment.

- 24. Select Evaluation > Volumes > End Area Volumes.
- 25. On the *General* branch, toggle off the *12345 existing ground for interchange surface* and make sure the *12345 SH119* and *12345 backfill for pier footer surfaces* are toggled on.
- 26. Set Cross Section Set to Pier.
- 27. Set Imperial Units to Cubic Yards.
- 28. Toggle on Create XML Report.

🐂 End-Area Volumes			
<u>F</u> ile			
Cross Section Set: Pier ▼ End-Area Volumes → General	Surface 12345 existing ground for interc 12345 SH119 12345 backfill for pier footer	Type Existing Design Existing	Method Standard Correct for Curvature Station Limits
Unsuitable Materials by Feature Unsuitable Materials by Station Classifications Compaction/Expansion Volume Exceptions Added Quantities Forced Balance As Built Annotation	Imperial Units Cubic Yards Cubic Feet Create XML Report	Þ	Use Station Limits Start Station: 0+00.00 Stop Stati
		Apply	Preferences) Close <u>H</u> elp

- 29. **<D>** Apply.
- 30. If you receive the *Report Browser* warning message, select OK since the *End Area Volume* command does not yet have a default style sheet set.

31. In the *Report Browser*, select the *EndAreaVolume.xsl* style sheet under the *Evaluation* folder to format the report.

ram Files\Bentley\InRoads Group V8.9\0ML Data\	$\nabla \nabla^{\alpha}$						<u></u>	\sim	$\sim \sim$	\sim	\sim	$\sim \sim$	\sim	∇		
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VolumesToCSV.xsl	$K \times X$															
an alieu	1 X - X -															

Note: If your report lists cubic feet, select **Tools > Format** options and toggle on *Convert to Cubic Yards*.

32. Read your fill volume from the Grand Total line of the report and record your results:

Fill: _____ cu yd.

- **Note:** The *End Area Volume* results should compare favorably to your *Triangle Volume* results for backfill (within a few cubic yards). If not, see your instructor.
- 33. Close the *End Area Volume* report (click the X in the upper right corner).
- 34. <D> Close on the *End Area Volume* dialog box.

Chapter Summary:

- *Triangle* volumes provide accurate cut and fill quantities.
- The *Triangle Volumes* command compares surfaces to compute volumes.
- The *Grid* method is useful to check triangle volumes.
- The accuracy of the *Grid Volumes* is controlled by the grid interval.
- Many factors affect the selection of an appropriate grid interval. Select an interval that converges on a net number favorable to the triangle results.
- The smaller the grid interval, the more accurate the grid volumes.
- End Area Volumes are computed from cross section graphics instead of comparing DTMs.
- The *End Area Volume* results should compare favorably to the *Triangle* volume results.

LAB 9 - Plan Production for Bridge

Chapter Objectives:

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Lab 9.1 - Under Development

Index