LAB 5 - Horizontal Alignments

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

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

Chapter Objectives:

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

The following files are used in this lab:

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

A typical workflow is:

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

Lab 5.1 - Name Alignment Points

Section Objectives:

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

Tolerances	Factors Abb	reviations	Rail	Sight Distance
Precision	General	Units and	d Format	Geometry
Plotting Heigh	nt:	0.00		Help
Seed Alignme	nt Name:	1		
Seed Point N	ame:	1		
Curve Defin	ition			
Horizontal:	Arc	•	📃 Alway	s Confirm
Vertical:	Parabolic	•	🔲 Alway	s Confirm
Measure:	Along Arc	Along C	hord	
Degree of C	urve Length:	100.00		
Unit Station	Length:	100.00		
Define Transit	tions By:	Length	Co	nstant
Spiral Definition	on:	Clothoid		-
Cubic Parabo	la Definition Is:	New Sout	h Wales	•
ICS Coordina	te Sequence:	Northing/	Easting	-
Vertical Angle	Reference:	Zenith		•
Angular Mode		Bearings		•
Point Names	During Edits:	Do Not As	sian	•
On Horizor	ntal Edits Recor	npute Vertic	al Alignmer	nts
⊂ Default Acc	ess Modes			
	Re	ead-Only	Read-Writ	te
Horizontal A	lignments:		۲	
Cogo Buffer	:	\odot	۲	

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

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

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

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

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

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Eile Surface Geometry Drainage Eva <unnamed></unnamed>	luation <u>M</u> odel ≅ & ∖	er Site Modeler Drafting Quan	tities <u>T</u> ools <u>H</u> elp
Geometry Projects	Name Cogo Bu Default SH 86 SH 86_V Side Ro	Description ffer New Set Active Copy Delete Empty View Fit	By Whom cferree cmfriesen cferree Ron Brys
	I	Edit Review Check Integrity Hilite	1



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

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

efine By:	Single P	oint	8			A	oply
Add As				by			1000
O Station ar	nd Offset		Name:				1056
O Northing	and Easting		Northing	0.00	+		Help
Cogo Poi	nt		Easting:	0.00			
Alignment	t Point to Co	go		8		_	
Seed Nar	me: 200		Station		Offse	ts	
Descriptio	n: Propose	d Alianm	Start		First:		
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Style: AL	.G_PRO	~	Stop:		Seco	nd:	
Add Verti	cal Event Po	ints	366+60	50	+ 0.00		+
Compute E	levation from	Active \	/ertical Alignme	ent			
N Statio	n (Offset	Northing	Easting	Elevation	Style	
						47.	

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

Results			
1000 200 201 202 203 204 205 206 207 208 209 210 	1558417.74 1558450.09 1537339.09 1558458.63 1558467.52 1558467.58 1558467.58 1558117.51 1547356.90 1557965.30 1557961.57 1585933.56	3267409.40 3268517.55 3269133.91 3268994.82 3270345.09 3270364.85 3270987.32 3272329.96 3270047.57 3272956.51 3276471.06 3284404.53	Close Save As Append Display Print Help

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

Lab 5.2 - Create New Geometry

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

Section Objectives:

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

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

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

Mew 🗧		
Surface Geometry	/ Site Modeler	_
Туре:	Geometry Project 🔹	Apply
Name:	12345_Geometry Training	Help
Description:	Geometry Training class	
Style:		
Curve Definition:		
Name	Description	
Default		
12345_Design	SH 86 Design Alig	
	Close	

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

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



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

🚔 New		- • ×
Surface Geometry	/ Site Modeler	
Туре:	Horizontal Alignment 👻	Apply
Name:	Design Alt 1	Help
Description:	Alignment by PI method	
Style:	ALG_PRO -	
Curve Definition:	Arc 👻	
		•
Name	Description Sty	e
	Close	

• Curve Definition: ARC

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

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Image: Second try Projects Image: Cogo Buffer Image: Second try Projects Image: Second try Projects Ima	-1	. 1	Line of the second second
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E Default Design Alt 1 Alignment by PI method E 12345_Design I2345_Geometry Training Cogo Buffer Design Alt 1	Geometry Projects	Cogo Buffer	
	Cogo Buffer Cogo Alt 1	Design Alt 1	Alignment by PI method

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

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

Lab 5.3 - Create Alignment Tangents

Section Objectives:

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

Saved Views - View 1	-	- • -
😤 Active File 🔻 🏷 🖵 🏹	🚰 🗙 🌮 📭 🕞	
Type Show Status Name	Description	🕵 Clip V
SH 86 Alt 1	Alternate Layout	
•	"	•

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

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

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



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

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<u>File Surface Geometry Drainage Eva</u>	luation <u>M</u> odeler Site M	odeler Dr <u>a</u> fting <u>Q</u> uantities	<u>T</u> ools <u>H</u> elp
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5			
	Name	Description	By Whom
□ Geometry Projects □ □	Cogo Buffer	Alignment by PI method	cferree cferree
몶 Geometry 😭 Preference 4 🔸	۰ III		۰.
Toggles Locate Features/Locate Graphics	mode		.đ

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

🗈 References (1 of 1 unique, 0 displayed)
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Slot 🕅 File Name Model Description Log Orientation Presentation 💽 🦪 🍾 💪
1 12345SURV_Topo 100.dgn CDOT Default Global Ori Coincident - World Wireframe 🗾 🗸 🗸
• • • • • • • • • • • • • • • • • • •
Ne <u>w</u> Level Display: Config Variable Georeferenced: No

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

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

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



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



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

eometry Project: 12345_Geometry Tra v orizontal Alignment: Design Alt 1 v	Mode O Curve Sets	Alignment 🔿 Eleme	nt	Close Save As
Project Name: 1234 Description: Geom Horizontal Alignment Name: Desi Description: Alig Style: ALG	5_Geometry Traini etry Training cla gn Alt 1 nment by PI metho EXISTING	ng ss d		Append Display
Style: ALC_	STATION	NORTHING	EASTING	Print
Element: Linear POB () PI () Tangent Direction: Tangent Length:	0+00.00 13+47.31 N 88^19'40" E 1347.31	1558417.74 1558457.06	3267409.40 3268756.14	Help Select First
Element: Linear PI () PI () Tangent Direction: Tangent Length:	13+47.31 32+60.94 N 89^37'22" E 1913.63	1558457.06 1558469.66	3268756.14 3270669173	< Previous Next >
c]	1		>	Last

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

Following is a summary of the PI locations

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

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

Lab 5.4 - Define Alignment Curves

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

Section Objectives:

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

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

🐂 Define Horizontal	Curve S	Set		
Horizontal PI				Apply
Define By: Known P	I Coordina	tes	~	Close
Direction Back:	N 88	^19'40'' E		
Length Back:	1347	.31	+	Undo
Point Name:				Rate Calc
Northing:	1558	457.06	-	Design Calc
Easting:	3268	756.14		Curve Calc
Direction Ahead:	N 89	^37'22'' E	+	Report
Length Ahead:	1913	.63	-	Help
				Пор
Curve Set Type: (SCS	⊖ scscs		
Define Transitions By: (Length 	O Constant		
Leading Transition:	Clothoid	~	0.00	+
Radius 1:			21120.00) +
Compound Transition:	Clothoid	~	0.00	-+-
Radius 2:			0.00	+
Trailing Transition:	Clothoid	~	0.00	+
Define By: 💿 Radius				
◯ Tangent t	o Spiral	Point Name:		
🔿 Spiral to T	angent	Northing:	1558457	.06 +
O Point on C	Curve	Easting:	3268756	.14
O Angle up t	to PCC (PC	C to PCC)	0^00'00)'' -
◯ Angle afte	er PCC (PC	C to PT)		
First < Previo	us	Next >	Last	Select

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

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

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

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

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

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

13. **<D> Compute**.

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

Turve Calculator	
Curve Lock	s: 1041.37
DOC:	5^30'07"
Ength	n: 281.81
Z Angle:	15^30'18"
Chord:	280.95
Tange	ent: 141.77
Extem	al: 9.61
Crdina Ordina	ste: 9.52
Compute: Curve Defir	Simple Curve The second secon
OK Compute	Results Help Cancel

					25
Horizontal PI Define By: Known R	Coordin	too		Apply	
Direction Back:	S 74	^//5'18" F	• •	Close	
Length Back:	2986	25		Undo	
Point Name:	2500			Rate Calc.	
Northing:	1555	931.76	-	Design Calc	
Easting:	3280	408.64	- 1	Curve Calc	
Direction Ahead:	N 89	^44'23'' E	+	Report	_
Length Ahead:	1726	6.67	+		_
				(nop	_
Horizontal Curve	@ ccc	@ ccccc			
Curve Set Type:	© SCS	© SUSUS			
Leading Transition:	Clothoid		0.00		₽
Radius 1:			1041.37	4	₽
Compound Transition:					
compound manadon.	Clothoid		0.00	-	₽
Radius 2:	Clothoid	· · · · · · · · · · · · · · · · · · ·	0.00	-	₽ ₽
Radius 2: Trailing Transition:	Clothoid		0.00 0.00 0.00		⊭ ⊭ ₽
Radius 2: Trailing Transition: Define By: Radius	Clothoid		0.00 0.00 0.00	4	⊭ ⊭ ₽
Radius 2: Trailing Transition: Define By: Radius	Clothoid Clothoid	Point Name:	0.00 0.00 0.00		±
Radius 2: Trailing Transition: Define By: Radius Tangent O Spiral to	Clothoid Clothoid to Spiral Tangent	Point Name: Northing:	0.00 0.00 0.00 1555969	4 4 4 4 4 4 04	↓ ↓
Radius 2: Trailing Transition: Define By: Radius Tangent Spiral to Point on	Clothoid Clothoid to Spiral Tangent Curve	Point Name: Northing: Easting:	0.00 0.00 0.00 1555969 3280271	.04 4	₽
Radius 2: Trailing Transition: Define By: Radius Tangent Spiral to Point on Angle up	Clothoid Clothoid to Spiral Tangent Curve to PCC (P	Point Name: Northing: Easting: C to PCC)	0.00 0.00 0.00 1555969 3280271 0^0000	.04	
Radius 2: Trailing Transition: Define By: Radius Tangent Spiral to Point on Angle up Angle aft	Clothoid Clothoid to Spiral Tangent Curve to PCC (PI er PCC (PC	Point Name: Northing: Easting: C to PCC) CC to PT)	0.00 0.00 0.00 1555969 3280271 0^00'00	.04 4 .86 9	
Radius 2: Trailing Transition: Define By: Radius Tangent Point on Angle up Angle aft	Clothoid Clothoid to Spiral Tangent Curve to PCC (PC	Point Name: Northing: Easting: C to PCC) CC to PT)	0.00 0.00 0.00 1555969 3280271 0^00'00	.04 4 .86 9	#- #- #-

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

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

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



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

					Apply	
Define By: K	nown PI Coo	rdinates		•		
Direction Back:	[N 89^44'23" E		+	Close	
Length Back:	[1726.67		+	Undo	
Point Name:					Rate Ca	c
Northing:	-	1555939.60		-	Design C	alc
Easting:		3282135.29			Curve Ca	lc
Direction Ahead:		S 78^45'12" E		+	Report	
Length Ahead:	[1232.01		-		_
Radius 1:				d 2-23-14		+
Compound Trans	ition: Cloth	oid	-	0.00		
Radius 2:				0.00		
Trailing Transition	n: Cloth	oid	•	0.00		+
Define By: 💿 Ra	adius					
🔘 Ta	ingent to Spi	ral Point N	ame:			
🔘 Sp	iral to Tange	nt Northin	g:	1555939.	60	-
Po	int on Curve	Easting		3282135.	29	
🔘 An	gle up to PC	C (PC to PCC)		0^00'00	"	
Ar	ole after PCO	C (PCC to PT)				

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

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

Lab 5.5 - Alignment Stationing

Section Objectives:

• Change the assigned stationing of an alignment.

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

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

🐂 Stationing				- • 💌
Horizontal Alignment:	Design Alt	1 🔹	ŧ	Apply
Starting Station:	100+00.00		Γ	Import
Name:			1	Report
Northing:	1558417.7	4	+	
Easting:	3267409.4	0		Close
○ Vertical and Superel ○ Do Not Update	levation Alig	nments		Help
 Synchronize Star Maintain Station 	ting Stations Difference	i		
Station Equations				
Back Station		Ahead Statio	n	
	New	Edit		Delete

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

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

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

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

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



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



Lab 5.6 - Annotating an Alignment

Section Objectives:

• Annotate an alignment.

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

Apply Style	S	
 Assigned 	Active Overwrite	Filter
Horizontal Alignment:	ALG_EXISTING	Help
Cogo Points:	Default	~
Horizontal Alignments		Points
Selected:	Sel	ected:
Name Descrip	tion Style Na	ame Descr Style
✓ Display As Comple	x Linestring	← Annotate
☑ Display As Comple Display ☑ Points —	x Linestring	← Annotate □ Points
✓ Display As Comple Display ✓ Points ✓ On-Alignment	x Linestring	← Annotate ☐ Points ☑ Elements
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 Display As Completed to the second second	x Linestring	 Annotate Points ✓ Elements Duplicates Dual Dimensions ✓ Try Altemate Styles Extend Beyond Element

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



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

Challenge Exercise:

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

Lab 5.7 - Horizontal Alignment from Graphics

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

Section Objectives:

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

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



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



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

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

Import Geo	ometry	
From Graphics	ICS Vertical from Surface	
Туре:	Horizontal Alignment	Apply
←Geometry — Name:	Holder Driveway	
Description:	Drive at Sta 190+80 RT	
Style:	ALG_SECONDARY	Help
Horizontal Cu	rve Definition: Arc	
Vertical Curve	e Definition: Parabolic 🗸	
Use Fence	Resolve Gaps and Nontangencies No Duplicate Cogo Points	
All Selected	Elements Added to Single Alignment	
Attribute Tag	s Data	
Project:	Active 🗸	
Name Cor	nflicts: No Overwrite	

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

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

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

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

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🖃 📇 Geometry Projects 🔺	Cogo Buffer		
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Changes the snap mode to Element/Point/None	2		

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

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rizontal Alignment	Holder Driveway	+ Curve Sets		n		Save As
	Project Name: 12 Description: Ge	345_Geometry Traini	ng			Append
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	PCC ()	1+58.77	1556886.81	3276324.15	_	14CM >
	Padina	75 00			V	

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

Lab 5.8 - Extend Alignment

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

Section Objectives:

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

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



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

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GENIO Translator Add-In								6		UN	_
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- 4. Once enabled, Select Geometry > Utilities > Extend Alignment.

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



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

Challenge Exercises:

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

Lab 5.9 - Saving Geometry

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

Section Objectives:

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



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

Lab 5.10 - Creating Parallel Horizontal Alignments

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

Section Objectives:

• Learn additional tools for creating alignments.

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



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

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

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

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Name Type	Description
□ □	
Ready	×

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

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

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



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

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

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

Multicen	ter Curve			_ D
Main Adva	anced			
Curve Type:	One Center	~		Help
Radii				
Radius 1:	15.00	+	~ Widths	
Radius 2:	40.00	+	Width 1: 30.00	+
Radius 3:	120.00	+	Width 2: 50.00	+
- Define By				
Offsets	at Shifted PC/PT	⊖ Offs	ets at PCC/PCC OL	ength
Use Se	cond Set of Values			
Offset 1:	2.00	+	Length 1: 0.00	+
Offset 2:	2.00	+	Length 2: 0.00	+
	1 uppin	Alignmen	t1 C) Hammeling Vidth 2	
L	Apply	Prefere	nces) Close]

16. Select **One Center**.

17. Input the following values:

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

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

> Identify first alignment/Reset

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

> Identify second alignment/Reset for new first alignment

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



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

> Accept/Reject

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

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

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



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Geometry M Preferences	<		>
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Note: Your stationing graphics may appear at a different location than shown above.

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

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

Key-in		X
	v 🛱 🕰	•

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

🚼 Key-in		
22400	te	•

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

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



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

Alignment 4 is created and displayed.





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

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

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

38. Select Geometry > Utilities > Join.

🕌 Join	_ 🗆 🗙
Delete Original Alignments	Apply
	Close
	Help

39. toggle on Delete Original Alignments.

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

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

> Identify initial alignment

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

> Identify alignment to parallel/Skip

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



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

> Accept/Reject

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



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

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

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



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

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

48. Select Geometry > Utilities > Parallel Horizontal Alignment.

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

