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Workshop - X13 Advanced Geometric Design for InRoads V8i

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1. 1. LESSON NAME: SETUP GEOMETRY OPTIONS

LESSON OBJECTIVE:

This lesson will show how to setup the new Geometry Options during the design process.

1.1 EXERCISE: SETTING UP THE NEW GEOMETRY OPTIONS

This exercise will guide you through the steps to get started

- 1. Load the file **road_imperial.dgn**
- 2. Load the project file **Road.rwk**
- **3**. Go to Geometry > View Geometry > Options ...

Geometry Options	_ 🗆 🗙
Annotate Horizontal Elements	Apply
Annotate Vertical Elements	Close
Annotate Closed Areas	Preferences
Annotate Stationing	Help
Annotate Curve Sets	
🔲 Annotate Vertical Change in Plan	
Annotate Regression Points	

As create or edit alignments the software updates most annotation. Specifically the software updates the following:

- Horizontal Elements
- Vertical Elements
- Closed Areas
- Stationing
- Curve Sets
- Vertical Change in Plan
- View Horizontal & Vertical Regression Points

Whether or not annotation is updated during edits is based on the following:

• You must have an option to update the annotation that you want to annotate.

• You must have a means to control the annotation. In other words, while it may be appropriate to annotate an alignment with stationing, it may be inappropriate to annotate a boundary/parcel with stationing.

Check on the following check boxes to specify to update the associated annotation.

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Note:

The appearance of the annotation is controlled by each Geometry > View commands preferences by using the alignment's style and view commands preference. Example, you have an alignment with a style called DESIGN CENTERLINE. If you checked on that you want to annotate the stationing then you must save a View Station preference called DESIGN CENTERLINE. If such a preference is defined then the software displays and annotates the stationing based upon the settings for DESIGN CENTERLINE. The software does not look at the settings for View Stationing that are in memory. The preference must exist on disk or the software silently skips the stationing annotation.

4. View the Perimeter Surface > View Surface > Perimeter ...

2. LESSON NAME: USING THE NEW GEOMETRY VIEW OPTIONS

LESSON OBJECTIVE:

This lesson will show how to use the new Geometry Options

2.1 EXERCISE: USING GEOMETRY > VIEW OPTIONS

This exercise will guide you through the steps to use the new options

1. Create a new horizontal & vertical alignment

Mew			
Surface Geometry	Site Modeler		
<u>Т</u> уре:	Horizontal Alignment	•	Apply
<u>N</u> ame:	A1		Help
Description:		_	
Style:	DESIGN CENTERLIN		
<u>C</u> urve Definition:	Arc	-	
Name	Description	Style	
	Close		

New		
Surface Geometry	Site Modeler	
<u>T</u> ype:	Vertical Alignment	Apply
<u>N</u> ame:	A1	
Description:		
Style:	DESIGN CENTERLIN	E
<u>C</u> urve Definition:	Parabolic	
	·	
Name	Description	Style
A1		DESIGN CENT
	Close	

Close the dialog box

2. Use the horiz. PI – Method or Element Method and design a simple horiz. alignment

Horizontal Curve	: Set		×
1 10 10 10	🟹 🛄 🐻	A0+0 B2+0	8

Insert a horizontal curve

3. Check Geometry > View Geometry > Stationing > Preference ...

Preferences	×
<u>N</u> ame:	Close
Default DESIGN CENTERLINE	Load
	<u>S</u> ave
	Save <u>A</u> s
	<u>D</u> elete
	<u>H</u> elp
Preference 'Default' loaded	

Default

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¥iew Stationing								_ 🗆 ×
🔄 View Stationing	Data:							
General	Object	Placement	Prefix	Suffix	Precision	Format	Name	
	Station	In			0.12	SS+SS.SS		
	Northing				0.12			
PIs	Easting				0.12			
Event Points								
Radius + A								
Transition Radii								
Vertical Stations	🔲 Omit POB and PO	DE	🔲 Swa	p Point A	bbreviation	and Station		
	Display On: 💿 Mi	Itiple Lines	O Sing	le Line				
	Leaders:							
	Object Le	ngth Ang	le	Relativ	e To Name	e		
	Leader Line				Prop	Horizontal		
	Segment 1 3.0	00 901	00'00.000) Alignm	ent			
	Segment 2 10	0.000 0^	00'00.000	(Alignm	ent			
			Apply	Prefe	erences)	Close		<u>H</u> elp

There 2 preferences with different annotation settings.

DEFINE CENTERLINE

🛐 View Stationi	ng Da	ata:							
General		Object	Place	ment Prefix	Suffix	Precision	Format	Name	
Regular S	Stations 🛛 🗵	Station	In			0.12	\$+\$\$\$.\$\$		
💠 Cardinal 🖗	Stations	Northing				0.12			
Pls		Easting				0.12			
Radius+	A								
Transition Vertical S	itations Di	aders:	Multiple Li	ines OSir	gle Line	Abbreviation		-1	
	itations Di	splay On:			gle Line	Abbreviation		_	
	itations Di Di	splay On: 🛛 🕢	Multiple Li	ines OSir	gle Line	ve To Nam			

Close the dialog box.

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Go to Geometry > View Geometry > View Options > ...

Geometry Options	
Annotate Horizontal Elements	Apply
Annotate Vertical Elements	Close
Annotate Closed Areas	Preferences
Annotate Stationing	Help
Annotate Curve Sets	
Annotate Vertical Change in Plan	
Annotate Regression Points	

By Default all annotation is turned off.

Load a preference called DESIGN CENTERLINE

Preferences	×
Name:	Close
Default DESIGN CENTERLINE	
	<u>S</u> ave
	Save <u>A</u> s
	<u>D</u> elete
	<u>H</u> elp
Preference 'DESIGN CENTERLINE	' loaded

Geometry Options	_ 🗆 🗵
🔽 Annotate Horizontal Elements	Apply
Annotate Vertical Elements	Close
🔽 Annotate Closed Areas	Preferences
🔽 Annotate Stationing	
🔽 Annotate Curve Sets	<u>H</u> elp
🔽 Annotate Vertical Change in Plan	
Annotate Regression Points	

All Annotation is turned on for the design process.

Move on with the alignment creation

The software annotates during the design process all stationing values from the View Stationing settings.

4. Create a profile turn the dtm on

Create Profile		
Create Profile General Source Include Offsets Controls Axes Grid Details ASCII	Set Name: A1 Direction Exaggeration Image: Constraint of the second se	
	All Properties	
	Apply Pre <u>f</u> erences Close	<u>H</u> elp

5. Use the vert. PI – Method or Element Method and design a simple vert. alignment

Vertic	al Curve :	Set		×
1	e 🕑 🌶	· 🚰	💷	8

Yiew Vertical Annotat	ion	_ 🗆 🗡
Main Points Curves	Tangents Affixes	
Point Type: PVI		Help
Justification: Left	•	
P	osition Precision	Format
✓ Station: 1	0.12	▼ SS+SS.SS ▼
Elevation: -1	0.12	•
Curve Data		
Leaders		
	Minimum Length	Deflection Angle
Segment <u>1</u> :	25.000	90^00'00.00000''
Segment <u>2</u> :	0.000	90^00'00.00000''
Point Annotation Locatio		1
_		
Drop Station Equation	Name	
Rotate Symbol with G	rade	
	ology with Point's Style	
Symbology:		
Object	Name	
PVC Text	Prop Vertical	
PVI Text	Prop Vertical	
PVT Text	Prop Vertical Prop Vertical	
⊠ PVT Text ⊠ PVCC Text ⊠ PVRC Text	Prop Vertical Prop Vertical	
X Event Point Text	Prop Vertical	
High Point Text	Prop Vertical	
Apply	Preferences	Close

6. Annotate the vertical alignment Geometry > View Geometry > Vertical Annotation

There 2 different preferences for different annotation

Preferences	×
Name:	Close
Default DESIGN CENTERLINE	Load
	<u>S</u> ave
	Save <u>A</u> s
	<u>D</u> elete
	<u>H</u> elp
Preference 'DESIGN CENTERLINE	'loaded



Yiew Vertical Annotation	n	_ 🗆 🗙
Main Points Curves Ta	angents Affixes]	,
Point Type: PVI	T	<u>H</u> elp
Justification: Left	•	
Posit	ion Precision	Format
✓ Station: 1	0.12	▼ SS+SS.SS ▼
Elevation:	0.12	■
🔲 <u>C</u> urve Data		
Leaders		
Segment <u>1</u> :	Minimum Length	Deflection Angle
Segment <u>2</u> :	0.000	90^00'00.00000''
Point <u>Annotation Location</u> :	Concave 💌	
Drop Station Equation N	ame	
Botate Symbol with Grad	e	
🔲 Override Point's Symbolo	gy with Point's Style	
Symbology:		
Object	Name	
PVC Text	Default_1	
⊠ PVIText ⊠ PVTText	Default_1 Default_1	
PVCC Text	Prop Vertical	
PVRC Text	Prop Vertical	
Event Point Text	Prop Vertical Prop Vertical	
Apply	Preferences	Close

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7. Use the different View Geometry Options by loading the different preferences and view the results during the design process

3. LESSON NAME: USING THE DESIGN CALCULATOR

LESSON OBJECTIVE:

This lesson will show how to work with the design calculator during the horizontal alignment creation.

3.1 EXERCISE: SETTING UP THE NEW SIMPLIFIED GEOMETRY TOOLS

This exercise will guide you through the steps to get started with the Design Calculator

- 1. You need to have an active horizontal alignment
- 2. Go to Geometry > Horizontal Curve Set > Define Horizontal Curve ...

🗽 Define Horizontal C	urve Set	20	Currently 9	inaring	
Horizontal Pl Define By:				Apply	,
Direction Back:	PI Coordina		_ _]	Close	.
Length Back:		566093		Undo	,
Point Name:	698.7	761424	_	Rate Ca	
_				_	_
E <u>a</u> sting:		252.561183	_ +	<u>D</u> esign C	
Nor <u>t</u> hing:	5671	247.929351		Cur <u>v</u> e Ca	alc
Direction Ahead:	144.6	689707	- ф-	Report	t
Length Ahead:	944.0	071143	+	<u>H</u> elp	
Horizontal Curve Curve Set Type:	⊙ s <u>c</u> s	⊙ <u>s</u> cscs			
Leading Transition:	Clothoid	•	60.00000	0	+
Radius <u>1</u> :	10.61033	0	600.0000	00	+
Compound Transition:	Clothoid	7	0.000000		- ф-
Radius <u>2</u> :	0.000000		0.000000		- ф-
Trailing Transition:	Clothoid	•	60.00000	0	+
Define By: 💿 <u>R</u> adius					
O Tangen	t to Spiral	Point Name:			
🔿 Spjral to	Tangent	Easting:	4501011.	189097	
C Point on	Curve	Northing:	5671253.	868335	
C Angle up	o to PCC (P	C to PCC)	0.000000		-
C Angle af	ter PCC (PC	CC to PT)			_
<u> </u>	ous	<u>N</u> ext >	Last	<u>Se</u> le	ect

- **3**. Use the Design Calculator
- 4. Use the Table Lookups

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Design Calculators		[🔄 💁 Curren	tly Sharing 💶 🗖 🗙
Cant Calculator Table	Lookups		
Method: Lookup	Speed		ОК
Curve Design <u>S</u> peed: Maximum <u>e</u> : Maximum <u>f</u> : <u>R</u> adius:	4.000000% 15.000000% 573.000000	_	Help
- Select Table Entry-			
1			
	Preferences	Cancel	

- 5. Select the Table name
- 6. You will find the table name in the product directory under ... \data\imperial\Horizontal Design Checks.txt or ...\data\metric\Horizontal Design Checks.txt

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Design Calculato	rs		_ 🗆 🗡
Cant Calculator Ta	ble Lookups		
Method: Look	up Speed	•	ок
Curve Desig Comp Speed: Look			<u>H</u> elp
indianidin <u>o</u> .	14.0000		
Maximum <u>f</u> :	15.000		
<u>R</u> adius:	573.00	0000	
Select Table Entry	J		
Speed	Maximum e	Maximum f	Radius
40	4.000000	15.000000	573.000000
40	6.000000	15.000000	509.000000
40	8.000000	15.000000	468.000000
40	10.000000	15.000000	432.000000
40	12.000000	15.000000	395.000000
Table Name: Itey\Bentley Rail 1	rack V8.11\data\	imperial\Horizontal	Design Checks.txt
	Pre <u>f</u> erences.	Cancel	

The user can now look for different design checks

Or can select different speeds.

Design Calculat	ors		_ 🗆 🗙
Cant Calculator T	able Lookups		
Method: Loc	kup Speed	•	ок
Curve Design Speed: Maximum <u>e</u> : Maximum <u>f</u> : <u>R</u> adius: Select Table Enl	40 20 30 40 50 55 60 65 70	40	<u>H</u> elp
Speed	Maximum e	Maximum f	Radius
40 40 40 40 40	4.000000 6.000000 8.000000 10.000000 12.000000	15.00000 15.00000 15.00000 15.00000 15.000000	573.000000 509.000000 468.000000 432.000000 395.000000
, Table Name: tley\Bentley Rail	Track V8.11\data	\imperial\Horizontal	Design Checks.txt
	Preferences	s Cancel]

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Upon these values the software will calculate the required radius.

Note:

Clicking the Design Calc button on the Define Horizontal Curve Set dialog box activates this dialog.

The Table Lookups tab works as follows: After you have specified the Method field, key in any of the relevant values, then press the tab key to see the results of the computation. As you change the data in the dialog, the software automatically recomputes all parameters. Once you have settled on a calculation, click OK to post the Radius back to the parent dialog.

Tab Options

Method

defines the method for calculating the horizontal curve.

Compute Radius – computes the radius for horizontal curves using the following equations:

<u>English</u> - $R=V^2/[15(e+f)]$, where R is the radius (ft), V is the vehicle speed (mph), e is the rate of roadway superelevation (ft/ft), and f is the side friction factor

<u>Metric</u> - $R=V^2/[127(e/100+f)]$, where R is the radius (m), V is the vehicle speed (kmh), e is the rate of roadway superelevation (m/m), and f is the side friction factor

Compute Speed – computes the speed using the equations for the compute radius method for imperial and metric units.

Lookup Radius – reads the values for radius, maximum f and speed values varying the rate of superelevation. These values are read from an ASCII file specified under Table Name and contains information from "A Policy on Geometric Design of Highways and Streets 1994" for imperial and metric units.

Lookup Speed – reads in the values for radius, maximum f and maximum e varying the vehicle speed. These values are read from an ASCII file specified under Table Name and contains information from "A Policy on Geometric Design of Highways and Streets 1994" for imperial and metric units.

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	Design Calcula	ators			
Curve Design Help Speed: 40 Maximum g: 4.000% Maximum f: 15.000% Badius: 573.000 Select Table Entry 573.000 Select Table Entry 573.000 40 4.000 40 5.000 40 6.000 40 5.000 40 15.000 40 10.000 40 12.000 40 12.000 15.000 395.000 Iable Name: Iable Name:	Cant Calculator	Table Lookups			
Speed: 40 Maximum g: 4.000% Maximum f: 15.000% Badius: 573.000 Select Table Entry Speed Maximum e Maximum f Radius: 573.000 40 6.000 15.000 40 6.000 15.000 40 8.000 15.000 40 10.000 15.000 40 12.000 15.000 40 12.000 15.000 40 12.000 15.000 Jable Name:	Method:	ookup Speed	•		ок
Speed: 40 Maximum g: 4.000% Maximum f: 15.000% Badius: 573.000 Select Table Entry 573.000 Speed Maximum e 40 4.000 40 6.000 40 6.000 40 8.000 40 10.000 40 12.000 40 12.000 40 395.000	_				Help (
Maximum f: 15.000% Badius: 573.000 Select Table Entry Maximum e Maximum f Radius 40 4.000 15.000 573.000 40 6.000 15.000 509.000 40 8.000 15.000 468.000 40 10.000 15.000 432.000 40 12.000 15.000 395.000 Iable Name: Iable Name: Iable Name: Iable Name:	<u>S</u> peed:	40			
Badius: 573.000 Select Table Entry Maximum e Maximum f Radius 40 4.000 15.000 573.000 40 6.000 15.000 509.000 40 8.000 15.000 468.000 40 10.000 15.000 432.000 40 12.000 15.000 395.000	Maximum <u>e</u> :	4.000	8		
Badius: 573.000 Select Table Entry Maximum e Maximum f Radius 40 4.000 15.000 573.000 40 6.000 15.000 509.000 40 8.000 15.000 468.000 40 10.000 15.000 432.000 40 12.000 15.000 395.000	Maximum <u>f</u> :	15.000)%		
Speed Maximum e Maximum f Radius 40 4.000 15.000 573.000 40 6.000 15.000 509.000 40 8.000 15.000 468.000 40 10.000 15.000 432.000 40 12.000 15.000 395.000	<u>R</u> adius:	573.00	00		
40 4.000 15.000 573.000 40 6.000 15.000 509.000 40 8.000 15.000 468.000 40 10.000 15.000 432.000 40 12.000 15.000 395.000 Lable Name:	Select Table E	ntry			
40 6.000 15.000 509.000 40 8.000 15.000 468.000 40 10.000 15.000 432.000 40 12.000 15.000 395.000 Iable Name:					
40 8.000 15.000 468.000 40 10.000 15.000 432.000 40 12.000 15.000 395.000 Iable Name:					
40 10.000 15.000 432.000 40 12.000 15.000 395.000 <u>Iable Name:</u>					
40 12.000 15.000 395.000 <u>I</u> able Name:					
Iable Name:					
D:\Program Files\Bentley\Bentley Rail Track V8.11\data\imperial\Horizo	 Table Name:				
	D:\Program File	es\Bentley\Bentley F	Rail Track V8.11\c	lata\imperial\Hor	izo
	, ,			•	
		Preferences	s Cancel		
Preferences Cancel					

You can save the settings as a preference.

Hit OK. The software will take the required radius into the Define Horizontal Curve dialog box.

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🐺 Define Horizontal Curve Set 📃 📃				
Horizontal Pl Define By: Known F			Apply	
Direction Back:	PI Coordinates S 88^35'25.85818''	E +	Close	
Length <u>B</u> ack:	698.761	с ф	Undo	
Point Na <u>m</u> e:			Rate Calo	
Northing:	5671247.9294		(<u>D</u> esign Ca	lc)
Easting:	4501252.5612		Cur <u>v</u> e Cal	c
Direction Ahead:	S 49^46'45.34895''	E 🕂	Report.	
Length Ahead:	944.071	+	<u>H</u> elp	
Horizontal Curve Curve Set Type: Leading Transition:		0.000		-∔ 1
	Clothoid	0.000		+
Radius <u>1</u> :	9^59'57.34839''	573.000		+
Compound Transition:	Clothoid 🔽	0.000	·	+
Radius 2: 0^00'00.00000'' 0.000				
Trailing Tra <u>n</u> sition:	Clothoid	0.000		+
Define By: <u>R</u> adius				
C Tangent	•	<u> </u>		
C Spiral to	-	5671253.8		+
○ P <u>o</u> int on		4501011.1	891	
C Angle up	o to PCC (PC to PCC)	0^00'00.0	. ''00000	
C Angle af	ter PCC (PCC to PT)			
<u> </u>	ous <u>N</u> ext >	Last	S <u>e</u> leo	ot

Apply will save the curve value to the alignment. Close the dialog box.

4. Lesson Name: Simplified Geometry Tools

LESSON OBJECTIVE:

This lesson will show how to setup the new simplified geometry tools.

4.1 EXERCISE: SETTING UP THE NEW SIMPLIFIED GEOMETRY TOOLS

4.2 HORIZONTAL DESIGN

This exercise will guide you through the steps to get started with the Simplified Geometry Tools

- 1. Create a new horizontal alignment
- 2. Setup your horizontal geometry settings



Leading Transition

defines the leading transition spiral's length or constant. This field honors Tools > Options > Geometry and Define Transitions by Length or Constant.

Radius

defines the circular arc's radius.

Trailing Transition

defines the trailing transition spiral's length or constant. This field honors Tools > Options > Geometry and Define Transitions by Length or Constant.

Design Calculator

invokes the design calculator to define the transition lengths and radius from design criteria.

Note: This dialog should remain active while using the Simplified Horizontal Elements commands. As you change settings on this dialog, commands that use these settings instantly reflect these settings.

3. Do the following settings:

Settings	
Leading Transition: 60.000	Close
Radi <u>u</u> s: 300.000	Design <u>C</u> alc
Trailing Transition: 60.000	<u>H</u> elp

4. Start the design process with Add Fixed Line:



The command works a little bit different then the Horizontal Element Method.

5. Fill the gaps with the Add Free Curve command.

Simplified Horizontal Element				×	
112	100	~	\square	1 📉	æ
	A	dd Free	e Curi	ve	

The software takes the values from the settings.

6. Add a Floating Curve and use these settings:

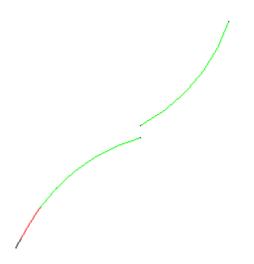
Settings		_ 🗆 X					
Leading Transition:	60.000	Close					
Radi <u>u</u> s:	300.000	Design <u>C</u> alc					
Trailing Transition:	0.000	Help					
Simplified Horizontal Element							
	Add Floating Curve						

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7. Add a Fixed Curve with the following settings

Settings		_ 🗆 🗙					
Leading Transition:	0.000	Close					
Radi <u>u</u> s:	-300.000	Design <u>C</u> alc					
Trailing Transition:	0.000	<u>H</u> elp					
Simplified Horizontal Element							
1122	$ \cap \frown \land \land \land \land $	nt 🗙 🖉					
A	dd Fixed Curve						

If you have a solution like shown



you can fill a reverse spiral between reverse arcs.

8. Use Define Spiral

Simplified Horizontal Element	×
/ / / / / / / / / * / *	-
Define Spiral	

The reverse spirals have the same parameter.

9. Check the Integrity.

Туре	Station	Northing	Easting @	Direction @ Start Northing	Easting @	Direction @ End Length	Radius	Constant	Integrity	Integrity	Element I	Apply
inear	0.000	3063.3654	3299.3248	N 26^49'01.6855 3237.5272	3387.3657	N 26^49'01.6855 195.150				OK	OK	
lothoid	195.150	3237.5272	3387.3657	N 26^49'01.6855 3290.1191	3416.1909	N 32^32'48.1661 60.000		134.164	OK	OK	OK	Close
ircular	255.150	3290.1191	3416.1909	N 32^32'48.1661 3409.5326	3563.5024	N 69^23'43.8907 192.940	300.000		OK	OK	OK	
lothoid	448.090	3409.5326	3563.5024	N 69^23'43.8907 3426.8513	3620.9207	N 75^07'30.3714 60.000		134.164	OK	OK	OK	Help
inear	508.090	3426.8513	3620.9207	N 75^07'30.3714 3504.1720	3912.0265	N 75^07'30.3714 301.199			OK	OK	OK	
Clothoid	809.289	3504.1720	3912.0265	N 75^07'30.3714 3521.4908	3969.4448	N 69^23'43.8907 60.000		134.164	OK	OK	OK	
Circular	869.289	3521.4908	3969.4448	N 69^23'43.8907 3627.5913	4107.7489	N 35^37'01.0439 176.864	-300.000		OK	OK	OK	
Clothoid	1046.154	3627.5913	4107.7489	N 35^37'01.0439 3678.5639	4139.3496	N 29^53'14.5632 60.000		134.164	OK	OK	OK	
inear	1106.154	3678.5639	4139.3496	N 29^53'14.5632 3738.8423	4173.9936	N 29^53'14.5632 69.525			OK	OK	OK	
Clothoid	1175.678	3738.8423	4173.9936	N 29^53'14.5632 3789.8148	4205.5943	N 35^37'01.0439 60.000		134.164	OK	OK	OK	
Circular	1235.678	3789.8148	4205.5943	N 35^37'01.0439 3834.0037	4244.3298	N 46^51'28.4258 58.857	300.000		OK	OK	OK	
lothoid	1294.536	3834.0037	4244.3298	N 46^51'28.4258 3902.3977	4339.6531	N 58^04'49.3429 117.522		187.767	OK	OK	OK	
lothoid	1412.057	3902.3977	4339.6531	N 58^04'49.3429 3970.7917	4434.9764	N 46^51'28.4258117.522		187.767	OK	OK	OK	
ircular	1529.579	3970.7917	4434.9764	N 46^51'28.4258 4094.6189	4514.3708	N 18^28'32.5720 148.609	-300.000		OK		OK	

If you move an element all radii will be hold as they are designed.

4.3 VERTICAL DESIGN

- 1. Create a vertical alignment
- 2. Create a profile
- 3. Setup your vertical geometry settings



Define Curve by

Length of Curve, Rate of Change and K or Radius, depending upon whether the vertical alignment is defined with parabolas or vertical circles. The text input field defines the parabola's length, rate of change or K or a circular's radius in the Add Fixed Curve, Add Floating Curve and Add Free Curve.

Note: This dialog should remain active while using the Simplified Horizontal Elements commands. As you change settings on this dialog, commands that use these settings instantly reflect these settings

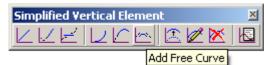
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Settings		_ 🗆 🗙
Dynamics		Close
Station:	0.000	Help
Elevation:	0.0000	
🔲 <u>G</u> rade:	0.000%	
Define Curve by	200.000	

4. Create a Fixed Vertical Line

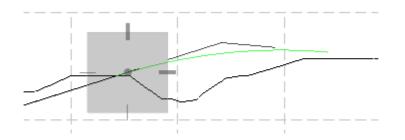


5. Add a Free Vertical Curve



6. Add a Floating Curve





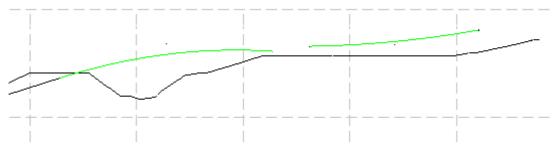
7. Add Fixed Curve

Simplified Vertical Element	×			
KKE <mark>k</mark> ke æ k k	R			
Add Fixed Curve				

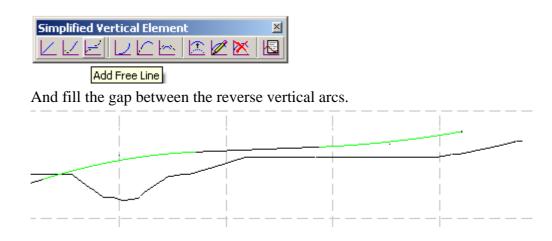
8. Use the following settings

Settings		
Dynamics		Close
Station:	0.000	Help
Elevation:	0.0000	
🗖 <u>G</u> rade:	0.000%	
Define Curve by		
r = (g2 · g1)/L	1.000	

You may have this solution:



9. Use Add Free Line



5. LESSON NAME: HORIZONTAL ELEMENT

LESSON OBJECTIVE:

This exercise will guide you through the steps to get started with Fixed Elements

5.1 EXERCISE: ADD FIXED ELEMENTS

This exercise will guide you through the steps to get started with Fixed Elements

- 1. Create a new horizontal alignment
- 2. Create New cogo points (3 new cogo points)

Geometry > Cogo Points > New ..

🎬 New Cogo Point			_ 🗆 🗡
Define <u>B</u> y:	Northing/Easting		Apply
<u>N</u> ame:	1		Close
No <u>r</u> thing:	3152.4213	 _+	Help
<u>E</u> asting:	3101.9562	+	
Ele <u>v</u> ation:	4.9100		
Horizontal Alignment:	A1 💌	- ф -	
Station:	0.000		
Offset:	0.000		
Elevațion:	0.0000		
Description:			
<u>S</u> tyle:	Default 💌		

You may have this result:

Yan Ku Balan Balan Marin	Linov 4-54 1: 3121-24 1: 3161-54 Gertuur 3

3. Add Fixed Horizontal Elements



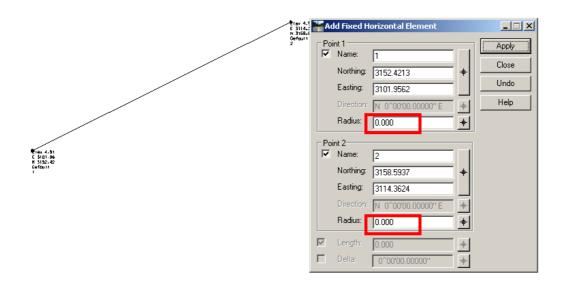
Elles 4.81 C Sign.86 H Sign.82 Gefortt

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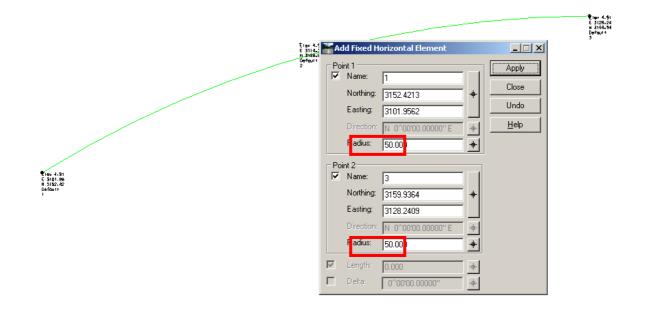
Use this command to add a fixed element using point, length or delta as controls then adds the solution to the alignment. This command is limited to clothoid spirals. creates the element and displays it into the alignment.

The element type is determined by the following rules:

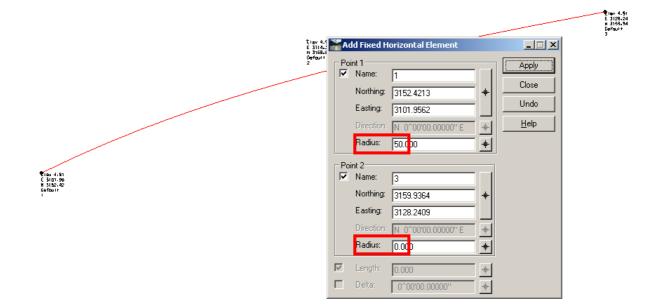
Linear: Point 1's Radius and Point 2's Radius is zero



Circular: Point 1's Radius and Point 2's Radius is equal and non-zero



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Spiral: Point 1's Radius and Point 2's Radius is non-equal and like sign

When the software successfully creates the element, this element is added to the undo buffer (single element undo).

Also the Point 1 data is updated with the computed data from computed element. This facilitates creating an alignment from a single interface and with the minimum number of data points.

6. LESSON NAME: SEGMENT ALIGNMENT

LESSON OBJECTIVE:

This lesson will show how to use the Segment Alignment Utility

6.1 EXERCISE: SEGMENT ALIGNMENT

This lesson will guide you how to use the Segment Alignment Utility

- 1. Load Segment.alg
- 2. Use the Segmentation Utility Geometry > Utilities > Segment Alignment

🚟 Segment /	Alignment	_ 🗆 🗙
Alignment:	S1 💌 🕈	Apply
🔲 Station Lim	its 51	Close
Start:	0.000 +	Undo
Stop:	721.678 +	Help
Number of Seg	iments: 10	
🔽 Segment A	lignment	
🔽 Add as Cog	go Points	
<u>S</u> eed Name	» <mark>1</mark>	
<u>D</u> escription:		
Style:	Default	

Apply.

Constructs a line by division or proportion along a line, constructs an arc by division or proportion along an arc or curve.

3. Check the horiz. Integrity an review the results

Туре	Station	Northing	Easting @	Direction @ Start Northing	Easting @	Direction @ End Length	Radius	Constant	Integrity	Integrity	Element I	Apply
inear	0.000	3086.7951	3216.0634	N 33^03'29.5660 3147.2801	3255.4302	N 33^03'29.5660 72.168				OK	OK	
.inear	72.168	3147.2801	3255.4302	N 33^03'29.5660 3196.6513	3287.5637	N 33^03'29.5660 58.907			OK	OK	OK	Close
Clothoid	131.075	3196.6513	3287.5637	N 33^03'29.5660 3207.7545	3294.8134	N 33^18'36.305213.260		141.421	OK	OK	OK	
Clothoid	144.336	3207.7545	3294.8134	N 33^18'36.3052 3229.8798	3309.8267	N 35^21'00.1583 26.740		141.421	OK	OK	OK	Help
Circular	171.075	3229.8798	3309.8267	N 35^21'00.1583 3265.6884	3337.7561	N 40^33'20.6613 45.428	500.000		OK	OK	OK	
Circular	216.503	3265.6884	3337.7561	N 40^33'20.6613 3316.9490	3388.4662	N 48^49'32.016072.168	500.000		OK	OK	OK	
Circular	288.671	3316.9490	3388.4662	N 48^49'32.0160 3360.3827	3446.0220	N 57^05'43.3708 72.168	500.000		OK	OK	OK	
Circular	360.839	3360.3827	3446.0220	N 57^05'43.3708 3395.0862	3509.2266	N 65^21'54.725572.168	500.000		OK	OK	OK	
Circular	433.007	3395.0862	3509.2266	N 65^21'54.7255 3420.3378	3576.7655	N 73^38'06.080372.168	500.000		OK	OK	OK	
Circular	505.175	3420.3378	3576.7655	N 73^38'06.0803 3424.1953	3590.6374	N 75^17'05.9880 14.399	500.000		OK	OK	OK	
Clothoid	519.573	3424.1953	3590.6374	N 75^17'05.9880 3433.3199	3629.5799	N 77^34'36.5803 40.000		141.421	OK	OK	OK	
_inear	559.573	3433.3199	3629.5799	N 77^34'36.5803 3437.1426	3646.9329	N 77^34'36.5803 17.769			OK	OK	OK	
inear	577.342	3437.1426	3646.9329	N 77^34'36.5803 3452.6680	3717.4109	N 77^34'36.580372.168			OK	OK	OK	
_inear	649.510	3452.6680	3717.4109	N 77^34'36.5803 3468.1935	3787.8889	N 77^34'36.5803 72.168			OK		OK	

7. LESSON NAME: CHAIN POINTS

LESSON OBJECTIVE:

This lesson will show how to use the Chain Points Utility

7.1 EXERCISE: CHAIN POINTS BY COGO POINTS

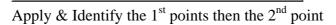
This lesson will guide you how to use the Chain Points Utility

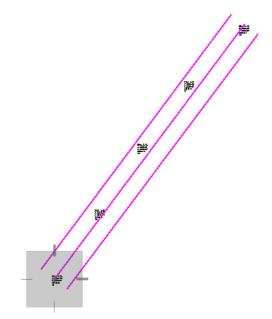
- 1. Load Chain Points.alg
- 2. View the cogo points

View Horizontal Annotation	_ 🗆 🗙		
Main Tabling Styles			
Apply Style Assigned Active Overwrit Horizontal Alignment: Default	e Filter		
Cogo Points: Default			
	jo Points ude: × +		
Selected: Se	ected:		
Name Descri Style N. T1 T2 T3 T4 T5 T6 T7 T6 T7	ame Descri Style ▲ Default Default Default Default Default Default Default		
Display Points	Annotate		
On-Alignment Event Points Off-Alignment Station Equations	Elements		
Elements	🗖 Dual Dimensions		
🗖 Radials 🗖 Tangents	Try Alternate Styles		
🗖 Chords 🗖 Subtangents	Extend Beyond Element		
Display As Complex Linestring	Planarize		
Apply Interactive Graphics	Preferences Close		

🎬 Chain Po	ints		
Points:			Apply
Selected:		_ 1	Close
Name	Descrip Style	•	
T1	Default		<u>Filter</u>
T2 T3	Default Default		Help
T4	Default	·	
T5	Default		
T6	Default	_	
T7	Default	-	
Create:	🔽 Horizontal 🛛 🗖	Feat	ure
Name:	ChainAlignment		
Description:			
Style:	Default		•
Bandwidth:	30.000		
🔲 Create a:	s a Closed Alignment or f	Featu	ire

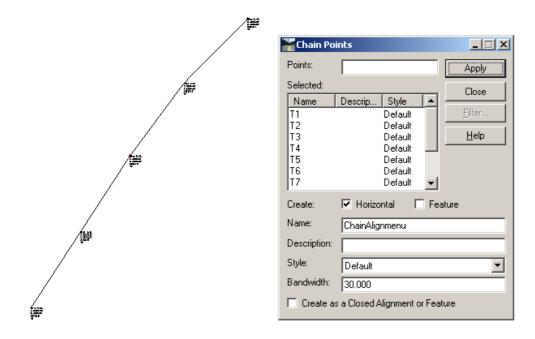
3. Use the Utility Geometry > Utilities > Chain Points by alignment





The magenta line views the bandwidth of 30 ft or m **Hint:** Turn the Cogo Snap Lock ON

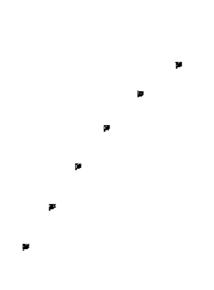
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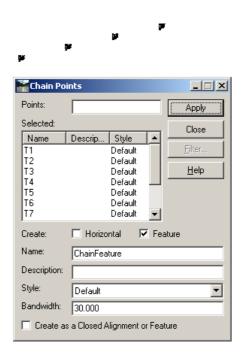


The result should look like this:

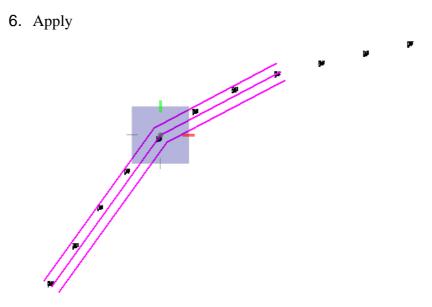
7.2 EXERCISE: CHAIN POINTS FOR FEATURES

- 4. Create a surface
- 5. Turn the Feature check box ON.





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Identify the points you want to create a feature on.

7. Surface > View Surface > Features

_				
¥	🎬 View Featu	Jres		×
1	Surface:	ChainPoints 💌		Apply
	Fence Mode:	Ignore 💌		Close
-				Filter
/=				Edit Style
				Help
ha an	Features:			
/.	Name	Style	Description	-+
	ChainFeature	Default		
-				
	J			

8. Lesson NAME: CURVE FITTING

LESSON OBJECTIVE:

This lesson will show how to use the curve fitting utility to find the best fit alignment between 2 lines

8.1 EXERCISE:

This lesson will show how to use the curve fitting utility to find the best fit alignment between 2 lines

1. Load Curve Fitting.dgn

The graphic should display 2 line strings as surveyed features

2. Create a New Geometry Project

New		_ 🗆 🗵
Surface Geome	try Site Modeler	
<u>Т</u> уре:	Geometry Project	Apply
<u>N</u> ame:	CurveFitting	<u>H</u> elp
Description:		
Style:		J
<u>C</u> urve Definition:		- 1
Name	Description	
Segment Default		
CurveFitting		
ChainPoints Hrz. Elements		
HIZ. Elements		
1		
	Close	

- File > Import > Geometry > From Graphics ... Manual Section International Internationae I - 🗆 🗵 From Graphics ICS Vertical from Surface Type: Horizontal Alignment • Apply Geometry <u>N</u>ame: Control1 Description: Γ <u>H</u>elp Style: Default • Horizontal Curve Definition: Arc • Vertical Curve Definition: Parabolic Ŧ Target Geometry Project: CurveFitting • Horizontal Alignment: -🔲 Use Fence 🔲 Resolve Gaps 🔽 Resolve Nontangencies 🔲 Join Elements 🥅 No Duplicate Cogo Points All Selected Elements Added to Single Alignment Attribute Tags 🔲 Us<u>e</u> Tag Data Active -Name Conflicts: No Overwrite Ŧ Close
- 3. Import Geometry from Graphic lines

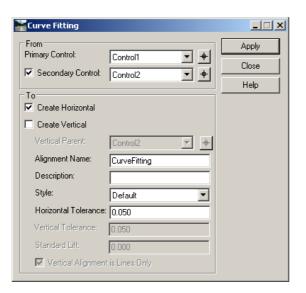
4. Create a Best Fit Alignment between control line

Uses a 3D line-string, in the form of a horizontal alignment, and creates a new horizontal alignment and vertical alignment that is defined with lines and arcs. The resultant geometry passes within a user-defined tolerance of the point data.

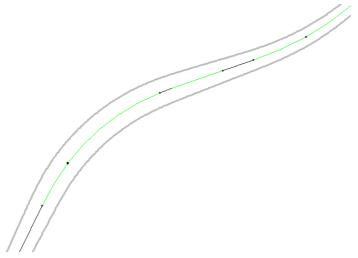
Curve Fitting does not create transition spirals. Transition spirals are created by Quick regression Analysis. Visit the rail seminar.

The Curve Fitting command's source data is an alignment defined as a line-string with xyz values. Quick regression's source is a regression buffer. Use this command to curve fit a horizontal and vertical alignment.

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The software has been created a new horizontal alignment.

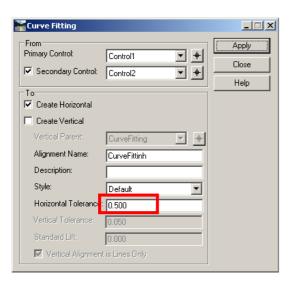


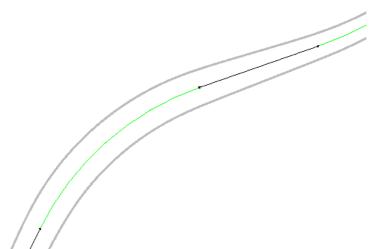
5. Check Integrity

Linear 0.000 3110 2555 3123 7249 N 26*064 13013303 9870 2218 6807 N 26*0645 13018*'E 215 742 OK OK OK Linear 263 722 3342 5533 3241 7743 N 35*0727 01143303 9870 2218 6807 N 25*06245 13013424 2588 3241 7743 N 35*0727 01043303 9870 2218 6807 N 25*06245 13013424 2588 3241 7743 N 35*0727 01049303 9241 7743 N 35*0727 0104'' E 0.652 OK N CK DK Linear 263 425 8343 1022 3242 1766 N 35*0727 01043431 136 3242 1577 N 35*0727 01049341 135 3242 1577 N 35*0727 01049341 135 3242 1576 N 56*37027 01049431 145 114 52 OK Non-coinci N Or coinci N Or coinci	Туре	Station	Northing	Easting @	Direction @ Start Northing	Easting @	. Direction @ End	Length	Radius	Constant	Integrity	Integrity	Elemen	Apply
Linear 260,772 3342,583 3241,7743 N 35*4072,70104343,1136 3242,1547 N 54*072,710141"E 0,652 OK Non-coinci 0K Linear 368,859 3441,7469 3326,6148 N 86*15924,63543417,973 337,3555 N 86*13706,61922"E 107,531 195149 Non-coinci 0K Linear 388,859 3447,7469 3326,6148 N 86*15924,43543417,973 337,3555 N 86*15723,330*E 29,842 Non-coinci 0K Non-coinci 0K Linear 380,441 3411,6154 3337,3501 N 70*3574,8324.347,777 3384,2538 N 70*5575,73393:"E 29,842 Non-coinci 0K Non-coinci 0K Direvalar 458,897 3437,5378 312,4583 N 70*5575,733933475,7578 3142,4583 N 70*5575,739833476,759 3142,4593 N 70*5575,7398 3142,4584 N 6K 0K Non-coinci 0K Linear 512,618 3458,8959 3460,0216 3459,2222 N 61*4572,92562*E 511.4 OK Non-coinci 0K Circular 512,818 3458,8959 3460,0215 3454,	Linear	0.000	3110.2655	3123.7249	N 26^06'45.1301 3303.9870	3218.6807	N 26^06'45.13018'' E	215,742				OK	OK	
Circular 261.425 3434.1022 2324.21706 N 857557.4333.2165.6637.73 3207.3578 3326.6637 N 857557.4353.117 107.554 1951.19 Macrosofte Name inser 368.99 3027.6638 3326.6517 3007.3578 3337.5501 N 657557.4353.117 11.42 Noncoinci Name Circular 380.441 3411.6154 3337.3501 N 7075577.3333.4427.7875 3342.4538 N 7075577.3333.712 23.942 Noncoinci OK Nameconici	Circular	215.742	3303.9870	3218.6807	N 26^06'45.1301 3342.5838	3241.7743	N 35^40'27.01041" E	45.030	269.833		OK	OK	OK	Close
inear 388,999 3007,4689 3326,5618 N 80°5572,43541° 11.482 Nen-coinci Non-coinci Non	inear	260.772	3342.5838	3241.7743	N 35^40'27.0104 3343.1136	3242.1547	N 35^40'27.01041" E	0.652			OK	Non-coinci	OK	
Jinuar 380,441 3411,6154 333,3501 N 7/15874,6944,3427,7875 3384,2538 N 7/15873,50187* 49,614 4266,102 Non-coinci	Circular	261.425	3343.1022	3242.1706	N 36^56'46.6779 3407.3978	3326.6697	N 68^31'06.51922" E	107.534	195.149			Non-coinci	Conflicti	Help
inear 430.054 3427.7889 3384.2533 N 70*557.33333437.5378 3412.4583 N 70*557.3333"."E 29.942 Non-coinci 0K 0K Direular 453.867 3437.5378 3412.4583 N 70*557.3333"."E 29.942 Non-coinci 0K 0K 0K 0K 0K 0K 0K 0K Non-coinci 0K Non	inear	368.959	3407.4689	3326.6418	N 68^55'24.4354 3411.5979	3337.3555	N 68^55'24.43541'' E	11.482			Non-coinci	Non-coinci	OK	
Sincular 459.897 347.5378 341.24593 N 07/5575.3333.3458.0216 3459.2222 N 6174572.25582* E 10.05 -319.176 OK OK Non-coinci. Non-coinci.	Circular								4266.102		Non-coinci.	Non-coinci		
inear 511.005 3458.0216 3459.2222 N 61^45'29.25963458.8799 3460.8201 N 61^45'29.25962''E 1.814 OK Non-coinci 0K Jicular 512.818 3458.8559 3460.8115 N 60^4114.01953537.9811 3547.0123 N 34'1434.62220''E 118.028 -255.726 Non-coinci 0K Non-coinci 0K Jinear 630.846 3537.9397 3547.0732 N 33''5745.53433''E 13.178 Non-coinci 0K Non-coinci 0K Jicular 44.024 3548.8600 3554.4479 N 32''3555.50683602.9555 3588.8609 N 32''120'B.4796''E 64.121 -11703.991 Non-coinci 0K	inear	430.054	3427.7889	3384.2533	N 70^55'57.3393 3437.5378	3412.4583	N 70^55'57.33937" E	29.842			Non-coinci	OK	OK	
Directlar 512.818 3458.8959 3460.8115 N 60 ⁺ /ult 40195 3537.9811 3547.0123 N 41 ⁺ /ult 342.220 ⁺ I 18.028 -255.726 Non-coinci. Non-coinci. N Linetar 630.846 3537.9397 3547.455.343 548.4552 N 33 ⁺ /5745.5343 ⁺ 1 3.178 Non-coinci. N Non-coinci. N Linetar 630.846 3537.9397 3554.4479 N 32 ⁺ /3548.8650 3554.45543 ⁺ N 33 ⁺ /5745.5343 ⁺ 1 3.178 Non-coinci. N Linetar 64.024 3548.8620 3554.4479 N 32 ⁺ /356.868.3602.9655 3588.8609 N 22 ⁺ 1006.4796 ⁺ /6 ⁺ 64.121 -11703.931 Non-coinci N	Circular							51.108	-319.176					
inear 630.846 3537.9397 3547.0732 N.33^5745.53433548.8695 3554.4352 N.33^5745.53433" E 13.178 Non-coinci OK Xicular 644.024 3548.8620 3554.4479 N.32^3656.50683602.9655 3588.8609 N.32^18'06.47976" E 64.121 -11703.991 Non-coinci OK														
Circular 644.024 3548.8620 3554.4479 N 32^36'56.5068 3602.9655 3588.8609 N 32^18'06.47976'' E 64.121 -11703.991 Non-coinci Non-coinci OK									-255.726					
	_inear													
Linear 708.145 3602.9579 3588.8727 N 32°24'54.78093764.9502 3691.7365 N 32°24'54.78094''E 191.892 Non-coinci OK	Circular								-11703.991			Non-coinci		
	inear	708.145	3602.9579	3588.8727	N 32^24'54.7809 3764.9502	3691.7365	N 32^24'54.78094'' E	191.892			Non-coinci.		OK	
4	41]]	

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As you can see there some issues with the colinearity. You can try to get a better geometrical result if you set the tolerance higher.





Check	Horizontal I	ntegrity											
Туре	Station	Northing	Easting @	Direction @ Start Northing.	. Easting @.	Direction @ End	Length	Radius	Constant	Integrity	Integrity	Elemen	Apply
Linear	0.000	3110.3637	3123.5260	N 26^16'13.1807 3299.4852	3216.8738	N 26^16'13.18078'' E	210.905				OK	OK	
Circular	210.905	3299.4852	3216.8738	N 26^16'13.1807 3409.1068		N 68^57'53.99602'' E	166.450	223.374		OK	OK	OK	Close
inear	377.354	3409.1068	3336.9992	N 68^57'53.9960 3437.7728		N 68^57'53.99602'' E	79.863			OK	OK	OK	
Circular	457.218	3437.7728	3411.5406	N 68^57'53.9960 3561.3207	3562.4335	N 32^24'54.78094'' E	198.366	-310.961		OK	OK	OK	Help
.inear	655.584	3561.3207	3562.4335	N 32^24'54.7809 3764.9502	3691.7365	N 32^24'54.78094'' E	241.214			OK		OK	
<u>(</u>													
				<u>S</u> elect	rst < <u>P</u> re	evious <u>N</u> ext >	Last						