Bentleyuser.dk Årsmøde 2009

Nordic Civil 2009

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Workshop - X13
Advanced Geometric Design for InRoads V8i

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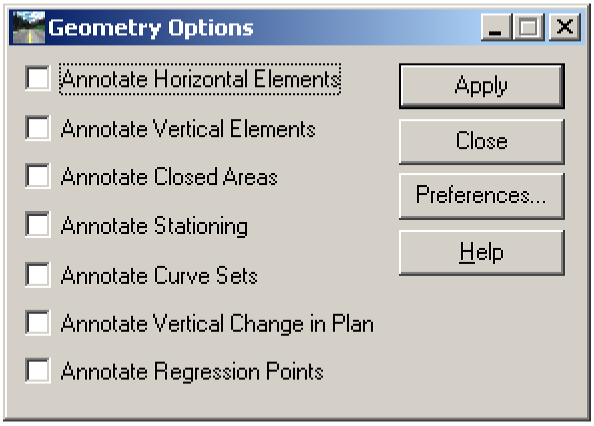
1. 1. LESSON NAME: SETUP GEOMETRY OPTIONS

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 …



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.

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 …

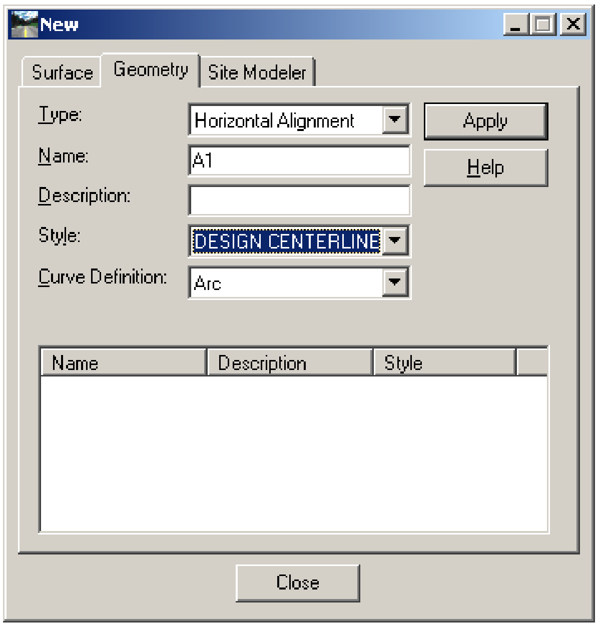
2. *LESSON NAME: USING THE NEW GEOMETRY VIEW OPTIONS*

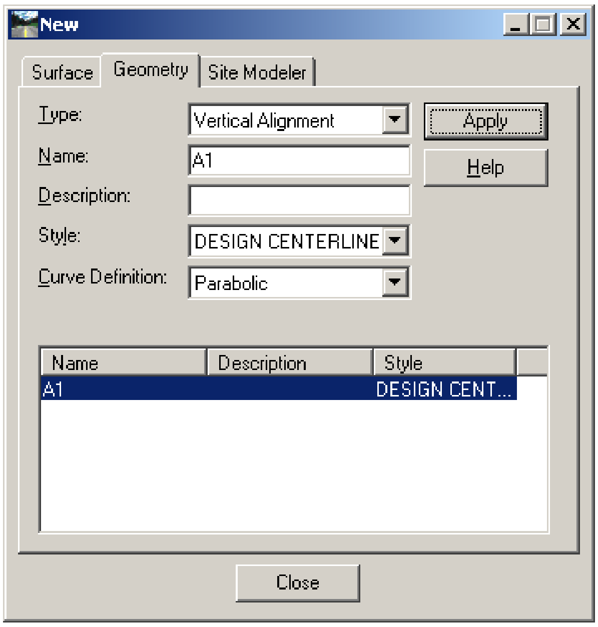
LESSON OBJECTIVE:
This lesson will show how to use the new Geometry Options

2.1 EXERCISE: USING GEOMETRY > VIEW OPTIONS

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

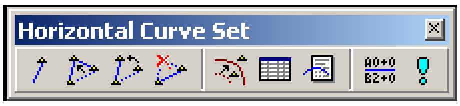
1. Create a new horizontal & vertical alignment





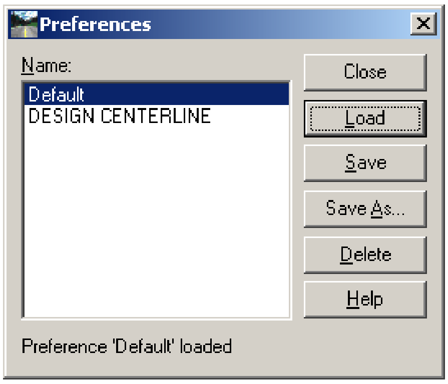
Close the dialog box

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



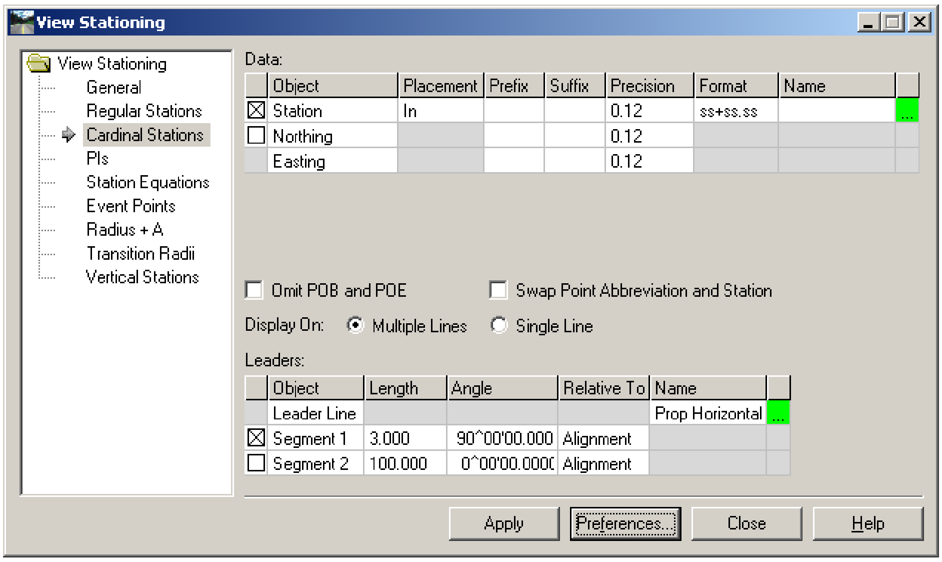
Insert a horizontal curve

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

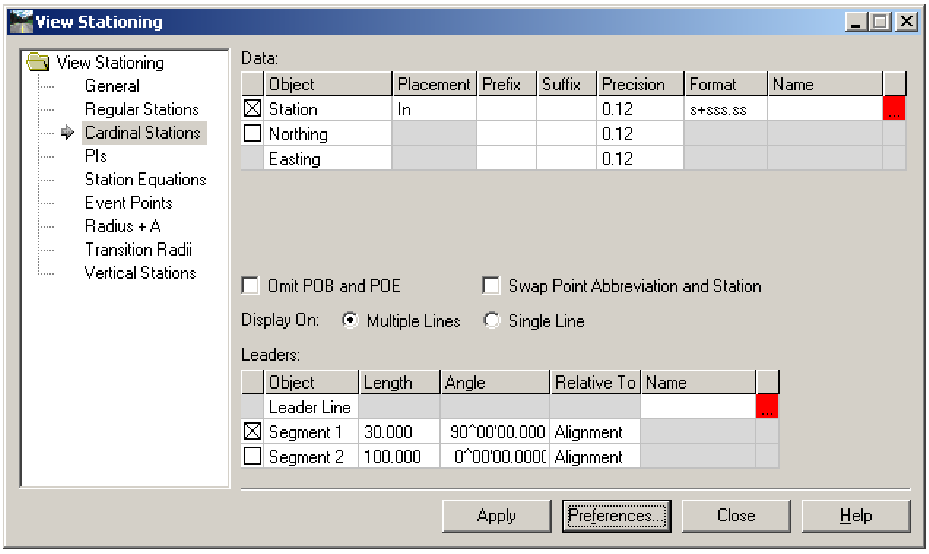


There 2 preferences with different annotation settings.

Default

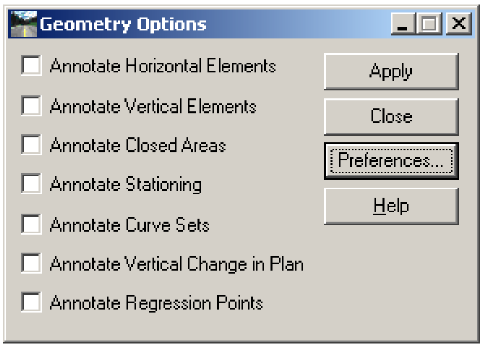


DEFINE CENTERLINE



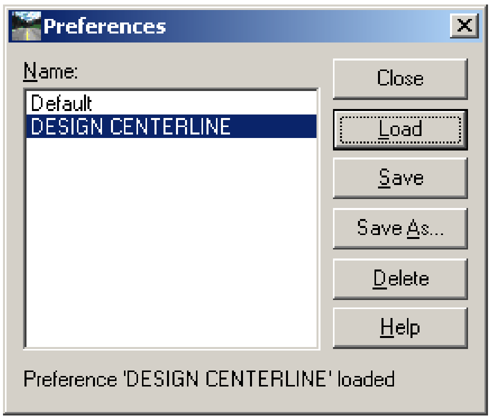
Close the dialog box.

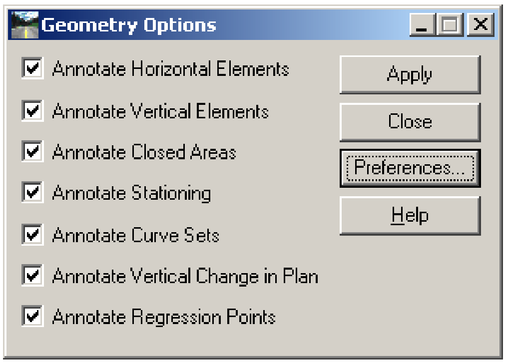
Go to Geometry > View Geometry > View Options > …



By Default all annotation is turned off.

Load a preference called DESIGN CENTERLINE



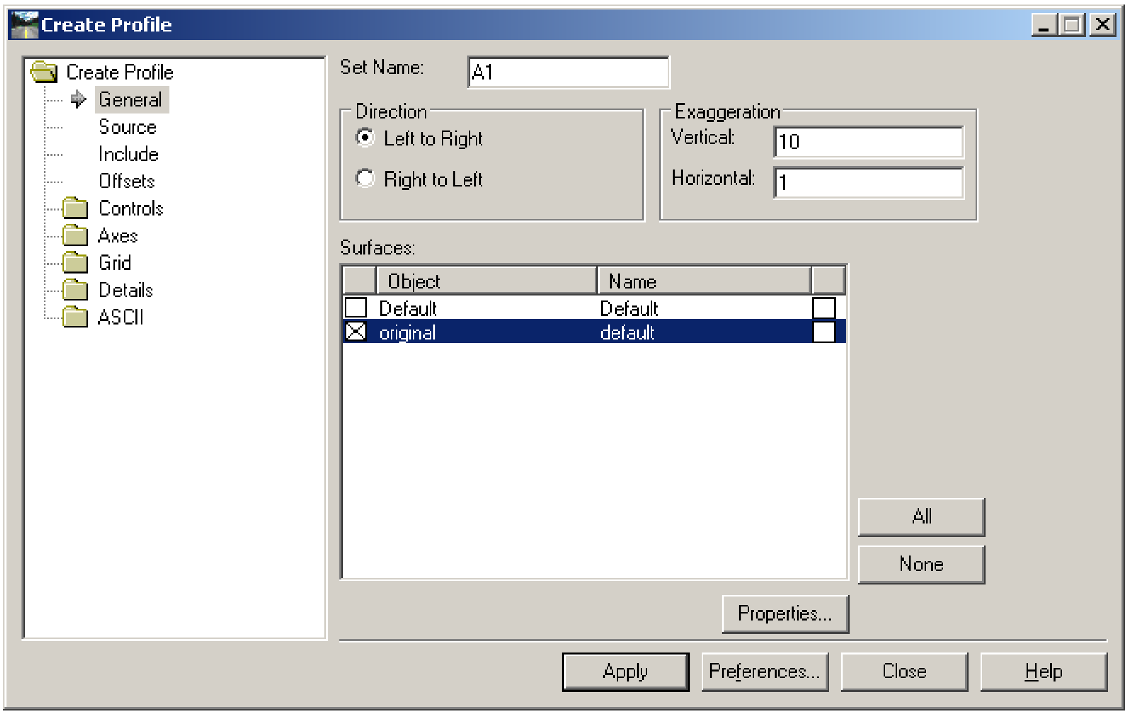


All Annotation is turned on for the design process.

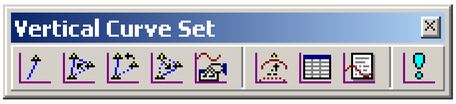
Move on with the alignment creation

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

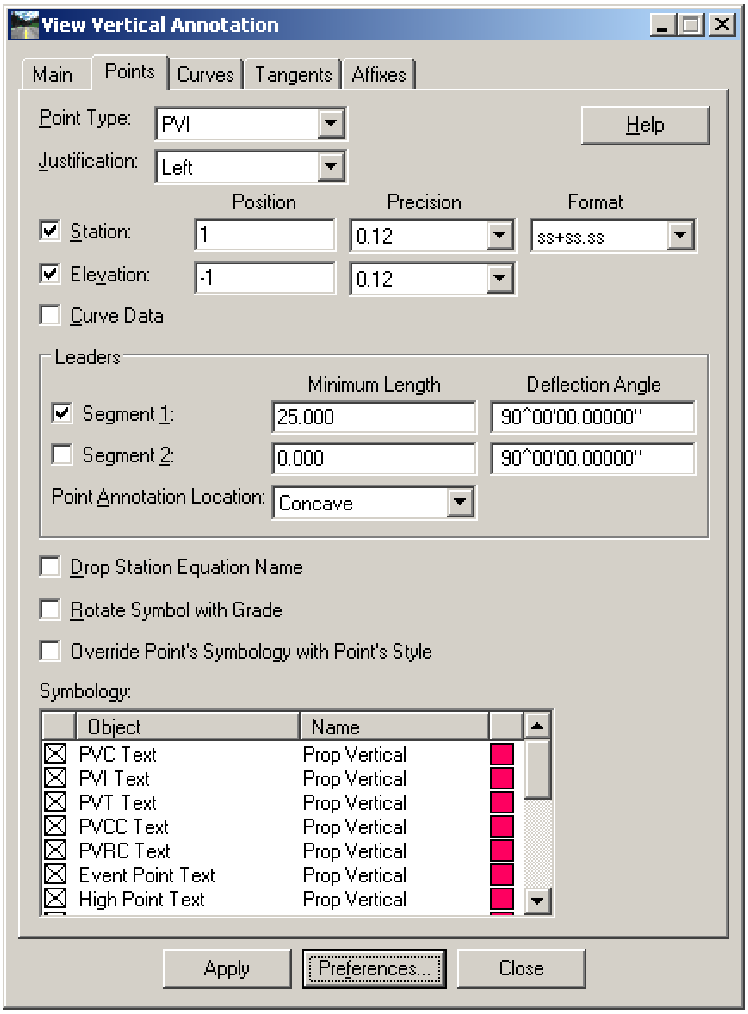
4. Create a profile turn the dtm on



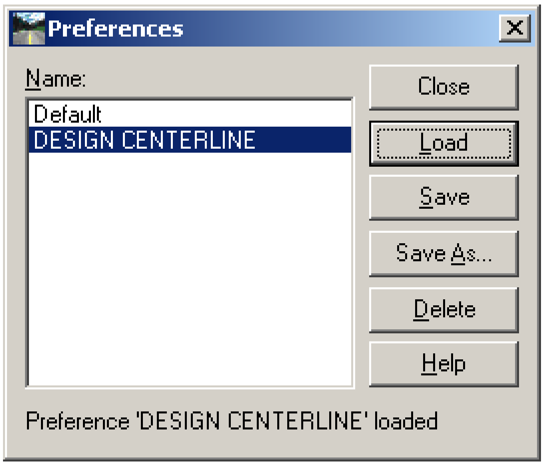
5. Use the vert. PI – Method or Element Method and design a simple vert. alignment



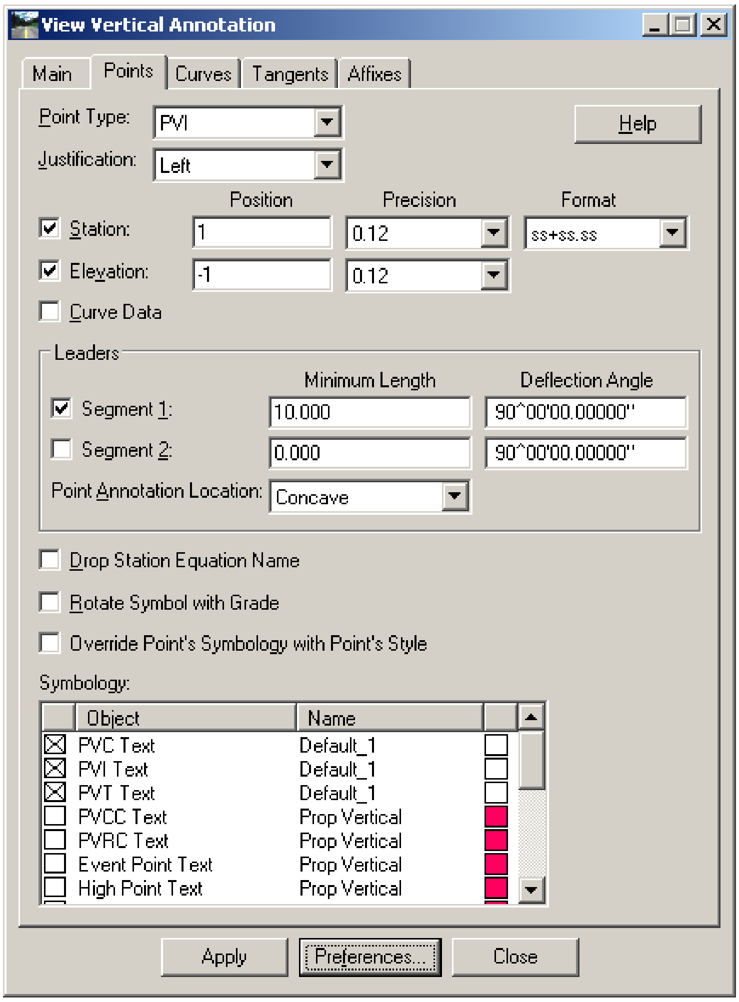
6. Annotate the vertical alignment Geometry > View Geometry > Vertical Annotation



There 2 different preferences for different annotation



Load the preference DESIGN CENTERLINE



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

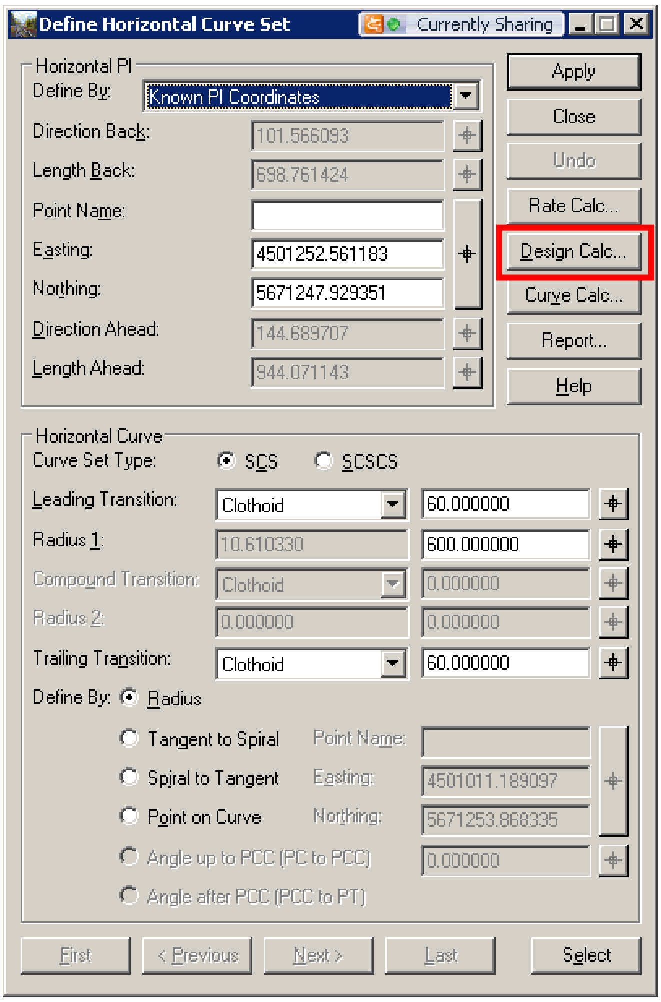
LESSON OBJECTIVE:

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

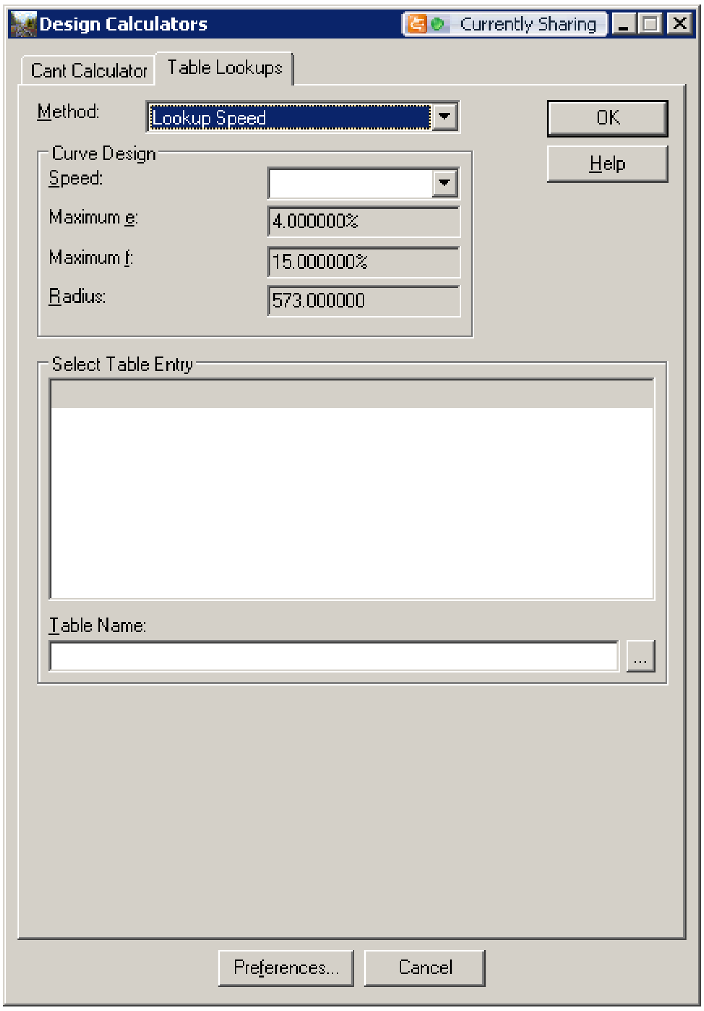
3.1 EXERCISE: SETTING UP THE NEW SIMPLIFIED GEOMETRY TOOLS

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 …

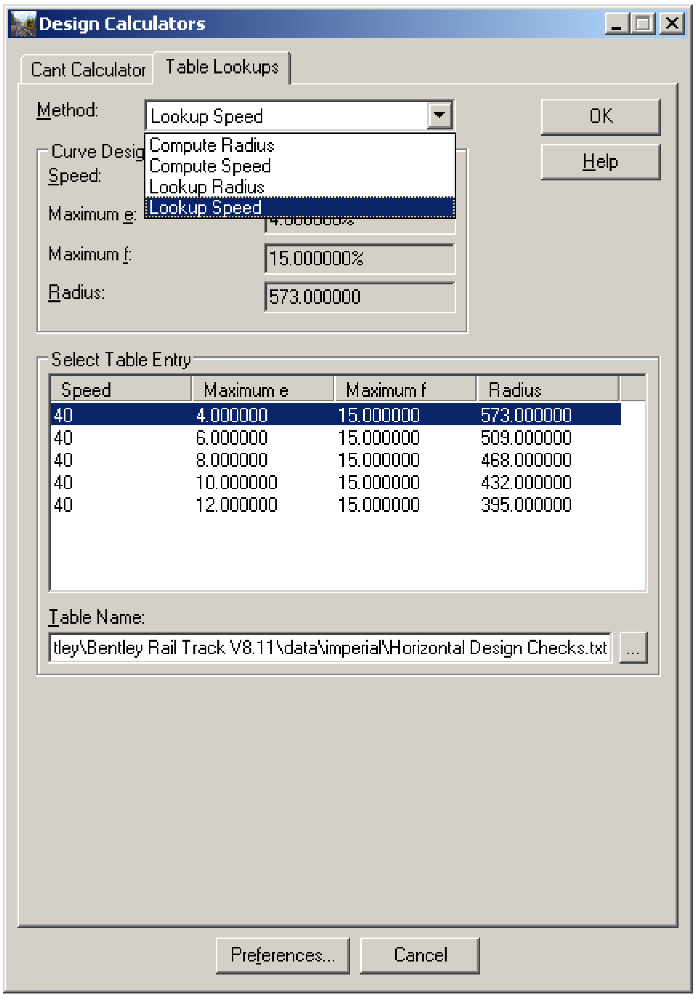


3. Use the Design Calculator
4. Use the Table Lookups

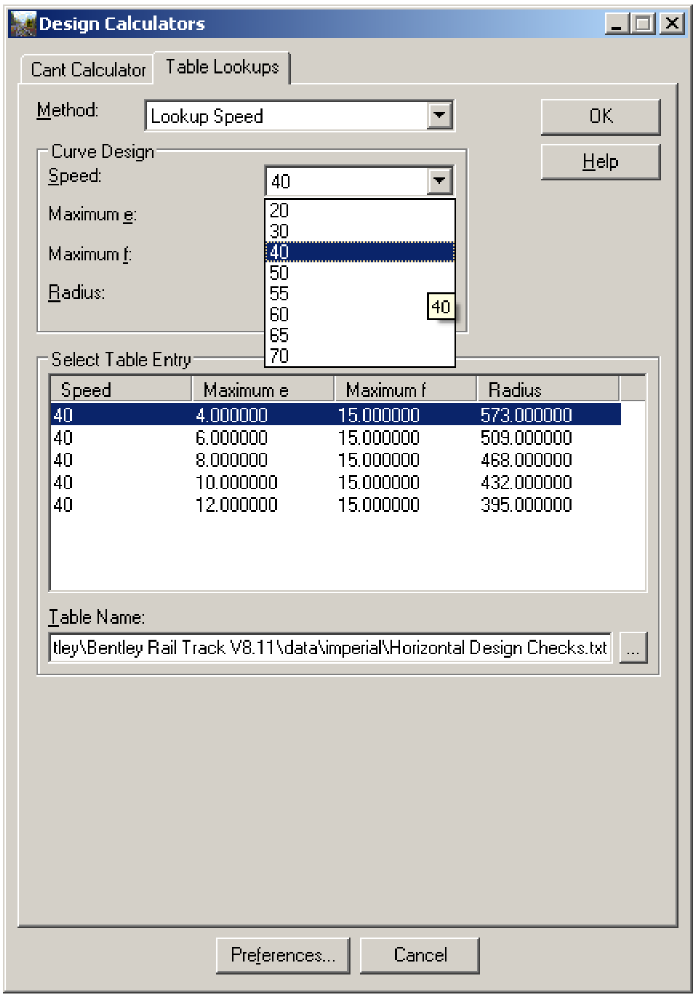


5. Select the Table name
6. You will find the table name in the product directory under … \data**imperial**\Horizontal Design Checks.txt or …\data**metric**\Horizontal Design Checks.txt

The user can now look for different design checks



Or can select different speeds.



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:

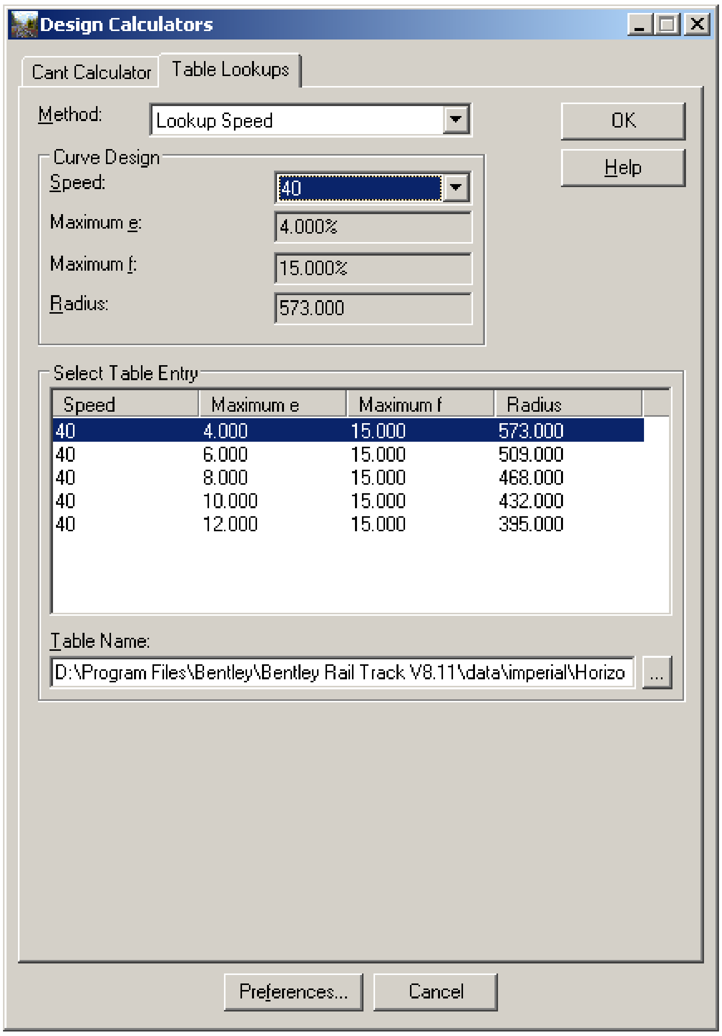
English - R=V^2/[15(e+f)], where R is the radius (ft), V is the vehicle speed (mph), e is the rate of roadway superelevation (ft/ft), and f is the side friction factor

Metric - 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.

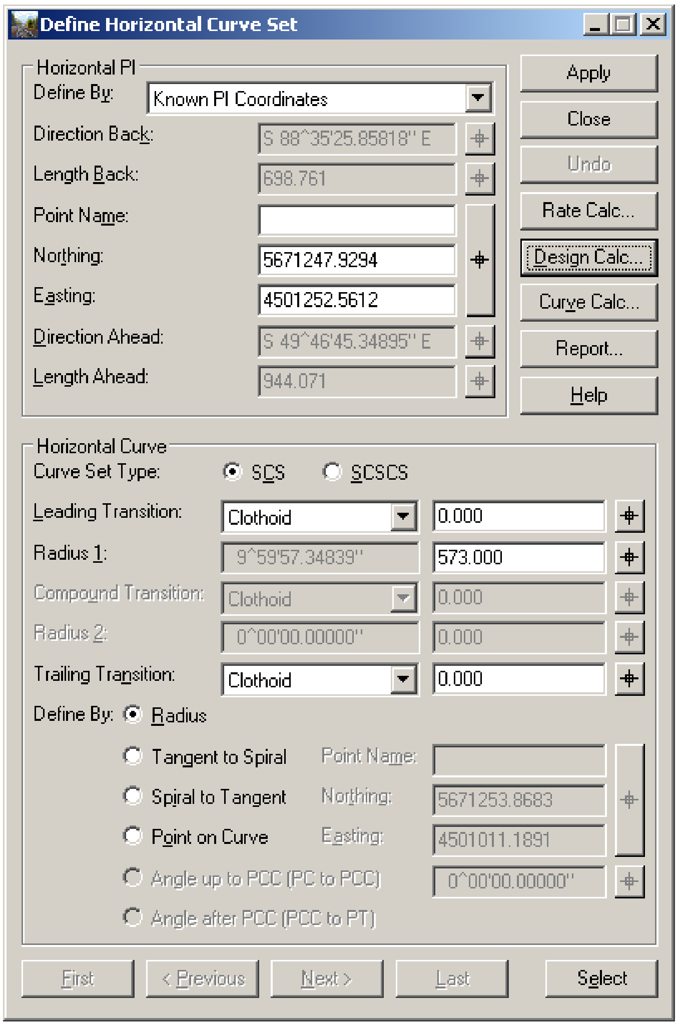
Lookup Radius – reads the values for radius, maximum f and speed values varying the rate of superelevation. These values are read from an ASCII file specified under Table Name and contains information from “A Policy on Geometric Design of Highways and Streets 1994” for imperial and metric units.

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.



You can save the settings as a preference.

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



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

4. *LESSON NAME: SIMPLIFIED GEOMETRY TOOLS*

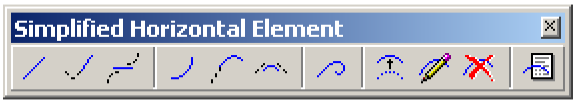
LESSON OBJECTIVE:
This lesson will show how to setup the new simplified geometry tools.

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

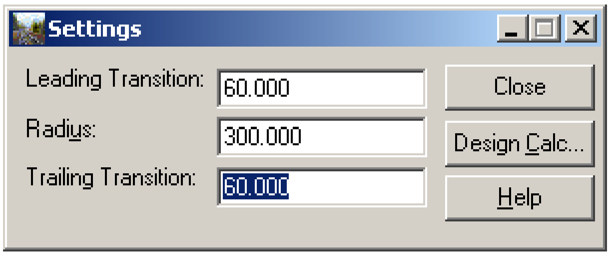
defines the trailing transition spiral's length or constant. This field honors Tools > Options > Geometry and Define Transitions by Length or Constant.

Design Calculator

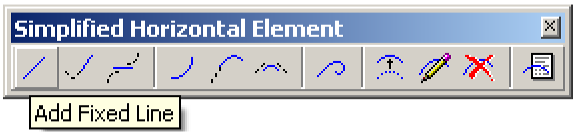
invokes the design calculator to define the transition lengths and radius from design criteria.

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:

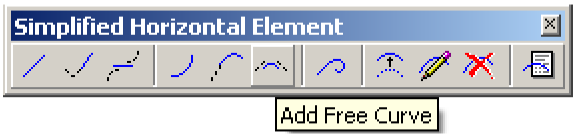


4. Start the design process with Add Fixed Line:



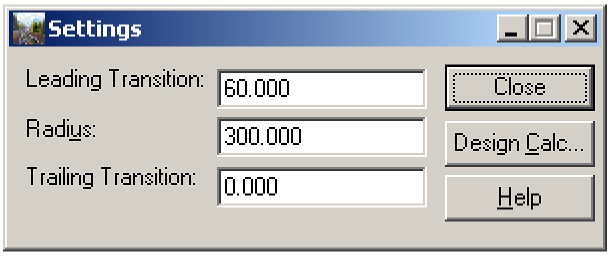
The command works a little bit different then the Horizontal Element Method.

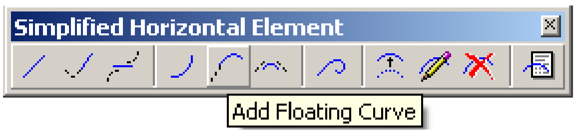
5. Fill the gaps with the Add Free Curve command.



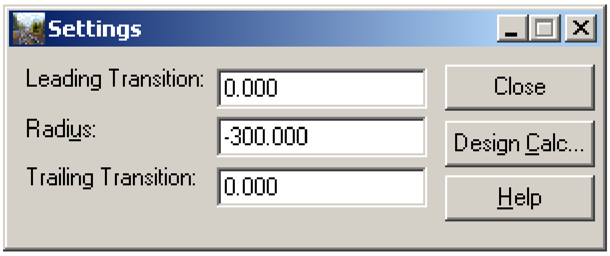
The software takes the values from the settings.

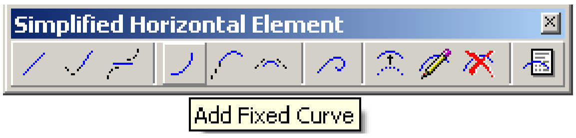
6. Add a Floating Curve and use these settings:



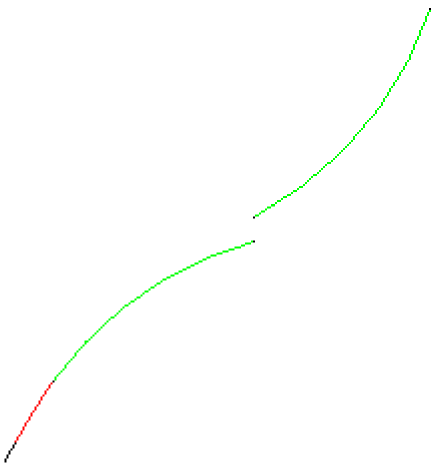


7. Add a Fixed Curve with the following settings



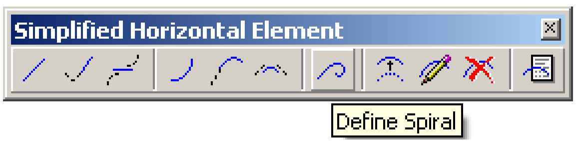


If you have a solution like shown



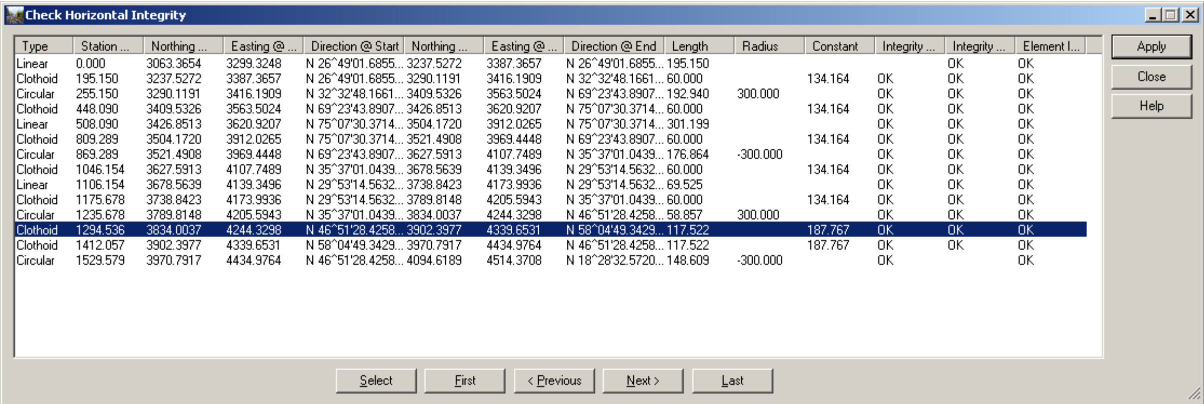
you can fill a reverse spiral between reverse arcs.

8. Use Define Spiral



The reverse spirals have the same parameter.

9. Check the Integrity.

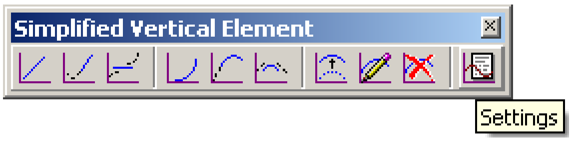


Type	Station ...	Northing ...	Easting @ ...	Direction @ Start	Northing ...	Easting @ ...	Direction @ End	Length	Radius	Constant	Integrity ...	Integrity ...	Element I...
Linear	0.000	3063.3654	3299.3248	N 26^49'01.6855...	3237.5272	3387.3657	N 26^49'01.6855...	195.150				OK	OK
Clothoid	195.150	3237.5272	3387.3657	N 26^49'01.6855...	3290.1191	3416.1909	N 32^32'48.1661...	60.000		134.164	OK	OK	OK
Circular	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
Clothoid	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
Linear	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
Linear	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
Clothoid	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
Clothoid	1412.057	3902.3977	4339.6531	N 58^04'49.3429...	3970.7917	4434.9764	N 46^51'28.4258...	117.522		187.767	OK	OK	OK
Circular	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

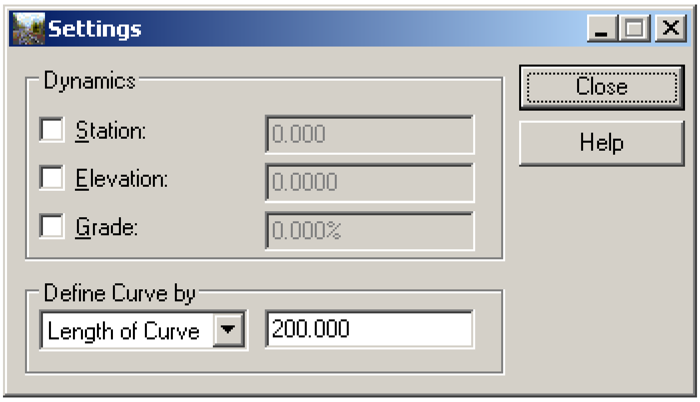
1. Create a vertical alignment
2. Create a profile
3. Setup your vertical geometry settings



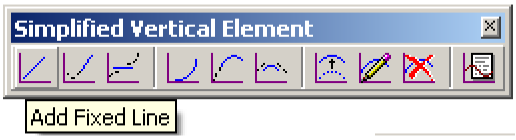
Define Curve by

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.

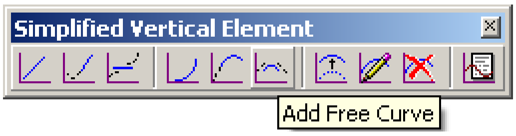
Note: This dialog should remain active while using the Simplified Horizontal Elements commands. As you change settings on this dialog, commands that use these settings instantly reflect these settings



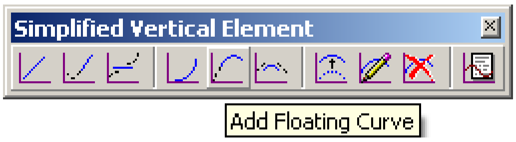
4. Create a Fixed Vertical Line

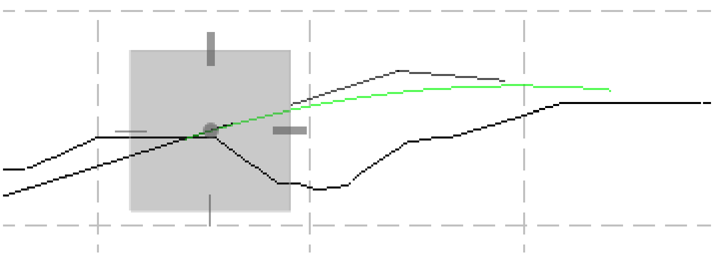


5. Add a Free Vertical Curve

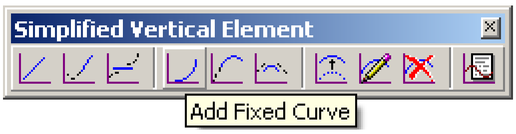


6. Add a Floating Curve

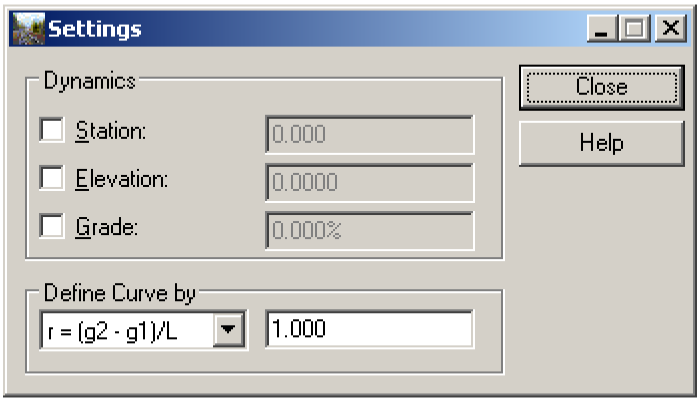




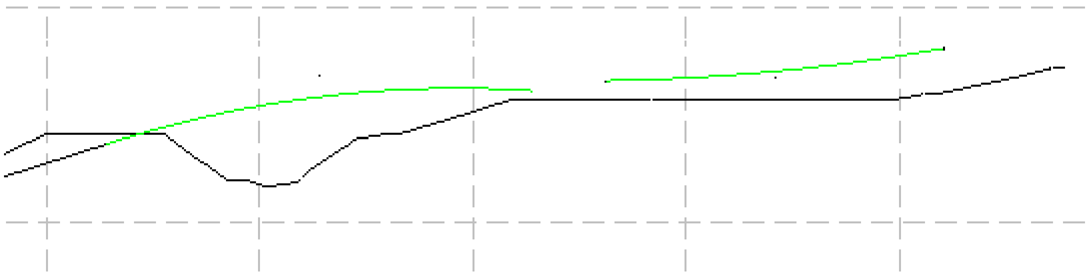
7. Add Fixed Curve



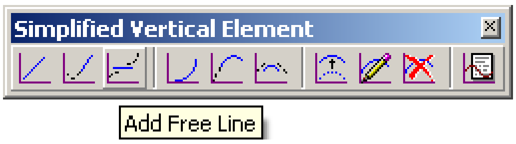
8. Use the following settings



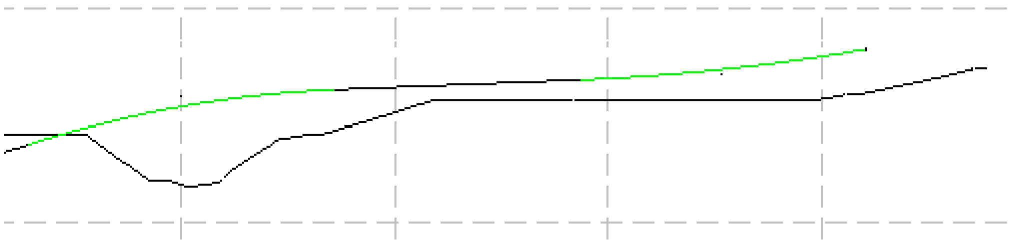
You may have this solution:



9. Use Add Free Line



And fill the gap between the reverse vertical arcs.



5. LESSON NAME: HORIZONTAL ELEMENT

LESSON OBJECTIVE:

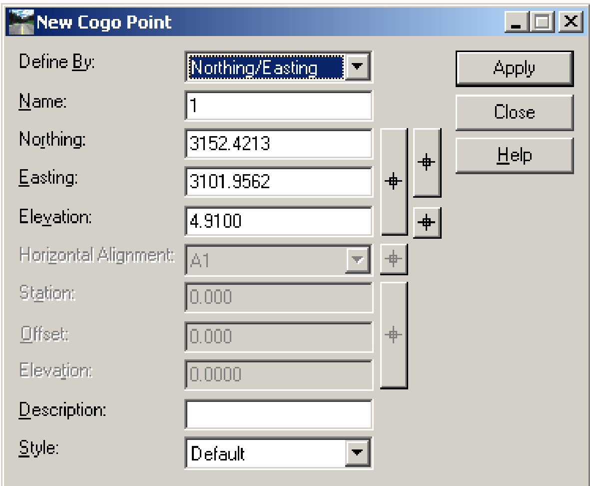
This exercise will guide you through the steps to get started with Fixed Elements

5.1 EXERCISE: ADD FIXED ELEMENTS

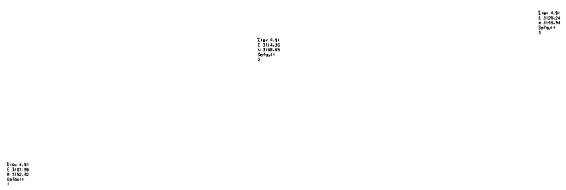
This exercise will guide you through the steps to get started with Fixed Elements

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

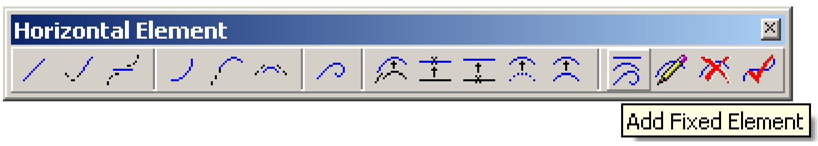
   Geometry > Cogo Points > New ..



You may have this result:



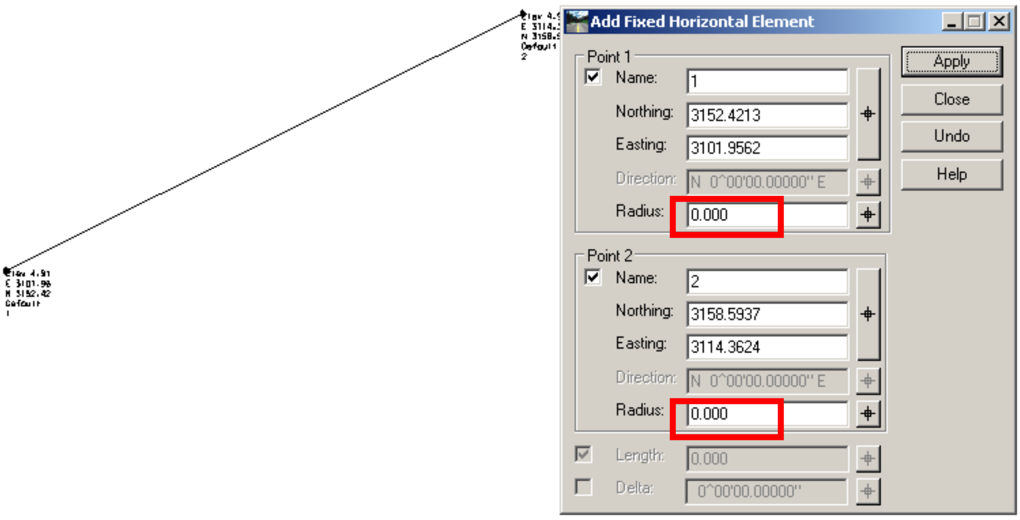
3. Add Fixed Horizontal Elements



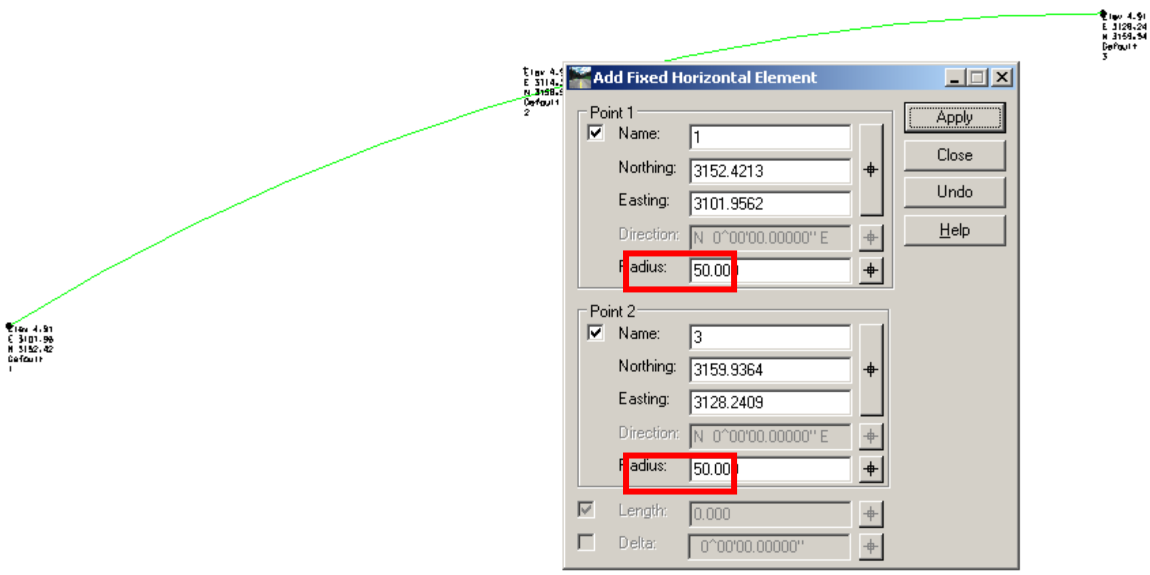
Use this command to add a fixed element using point, length or delta as controls then adds the solution to the alignment. This command is limited to clothoid spirals. creates the element and displays it into the alignment.

The element type is determined by the following rules:

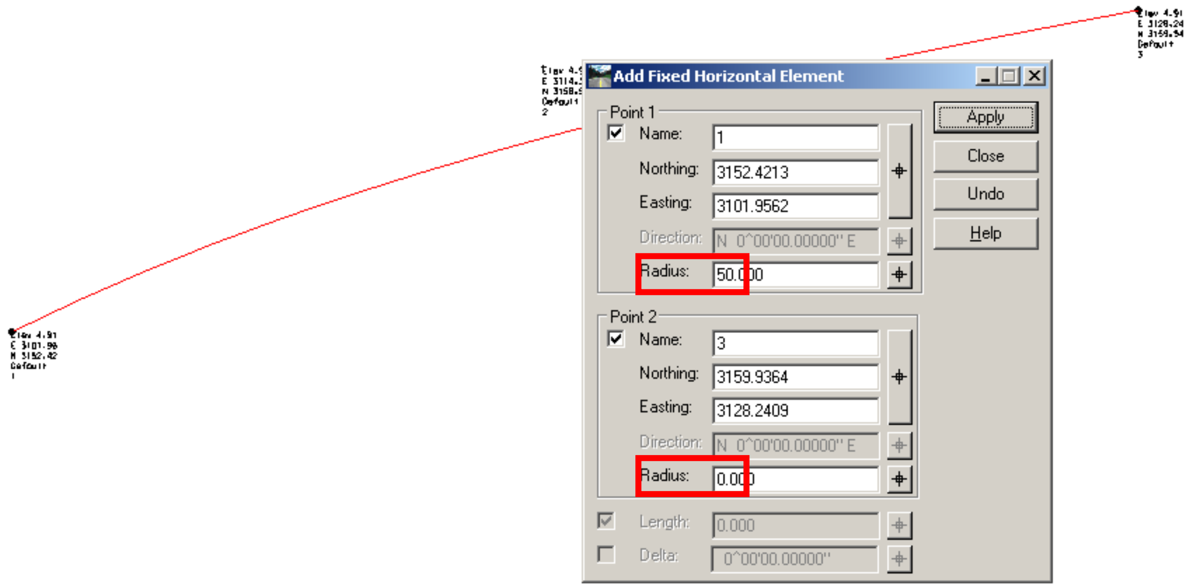
Linear: Point 1's Radius and Point 2's Radius is zero



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



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.

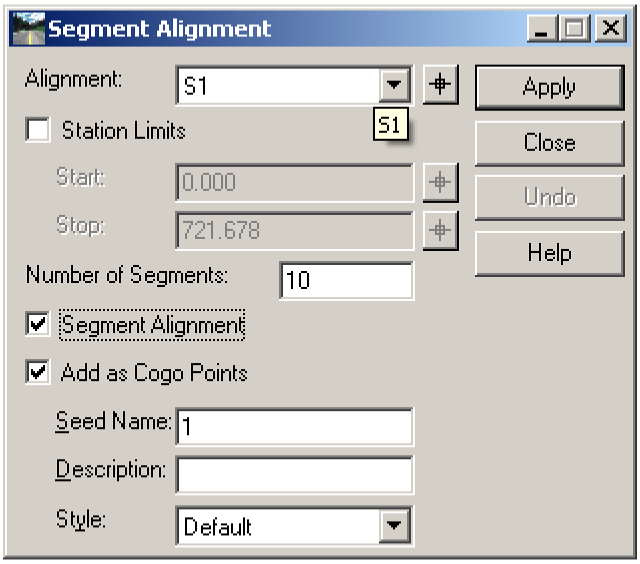
6. *Lesson Name: Segment Alignment*

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

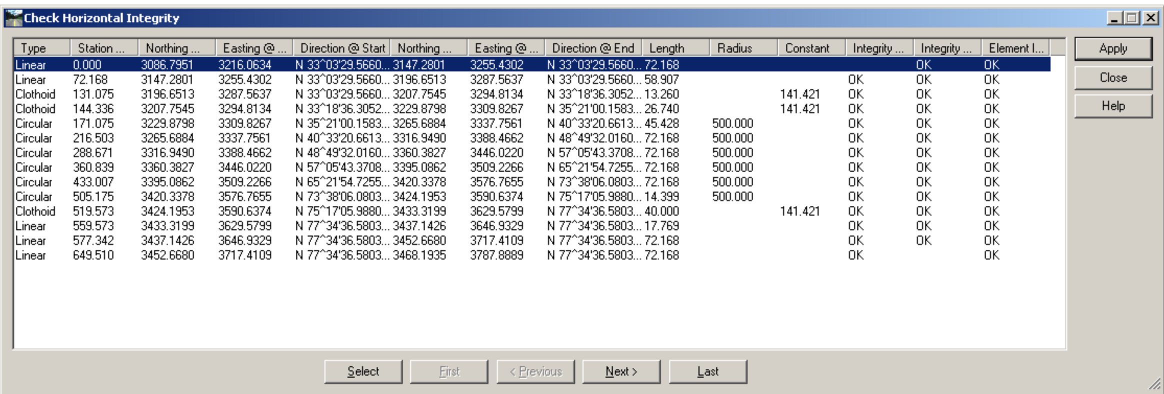
1. Load Segment.alg
2. Use the Segmentation Utility Geometry > Utilities > Segment Alignment



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



Check Horizontal Integrity

Type	Station ...	Northing ...	Easting @ ...	Direction @ Start	Northing ...	Easting @ ...	Direction @ End	Length	Radius	Constant	Integrity ...	Integrity ...	Element I...
Linear	0.000	3086.7951	3216.0634	N 33^03'29.5660...	3147.2801	3255.4302	N 33^03'29.5660...	72.168				OK	OK
Linear	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
Clothoid	131.075	3196.6513	3287.5637	N 33^03'29.5660...	3207.7545	3294.8134	N 33^18'36.3052...	13.260		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
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 48^49'32.0160...	72.168	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 65^21'54.7255...	72.168	500.000		OK	OK	OK
Circular	433.007	3395.0862	3509.2266	N 65^21'54.7255...	3420.3378	3576.7655	N 73^38'06.0803...	72.168	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
Linear	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
Linear	577.342	3437.1426	3646.9329	N 77^34'36.5803...	3452.6680	3717.4109	N 77^34'36.5803...	72.168			OK	OK	OK
Linear	649.510	3452.6680	3717.4109	N 77^34'36.5803...	3468.1935	3787.8889	N 77^34'36.5803...	72.168			OK		OK

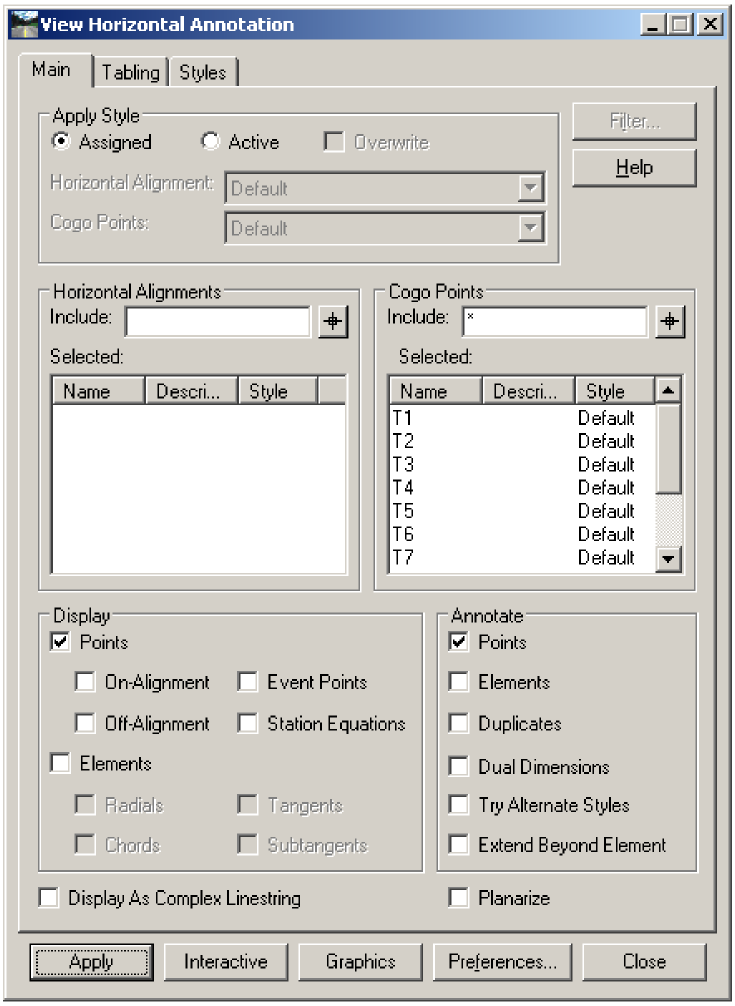
7. *LESSON NAME: CHAIN POINTS*

LESSON OBJECTIVE:
This lesson will show how to use the Chain Points Utility

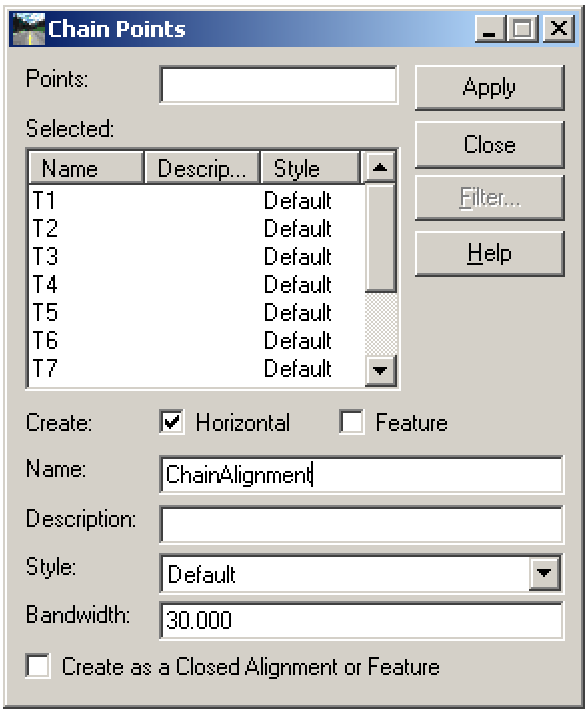
7.1 EXERCISE: CHAIN POINTS BY COGO POINTS

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

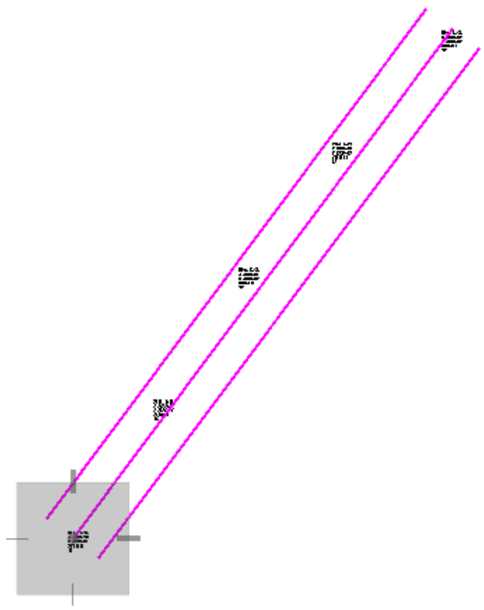
1. Load Chain Points.alg
2. View the cogo points



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



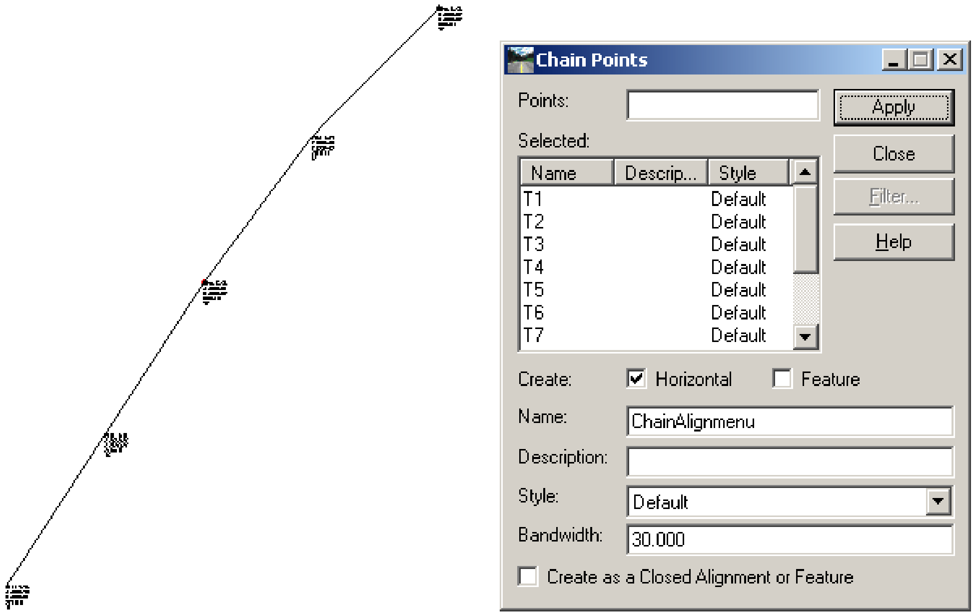
Apply & Identify the 1st points then the 2nd point



The magenta line views the bandwidth of 30 ft or m

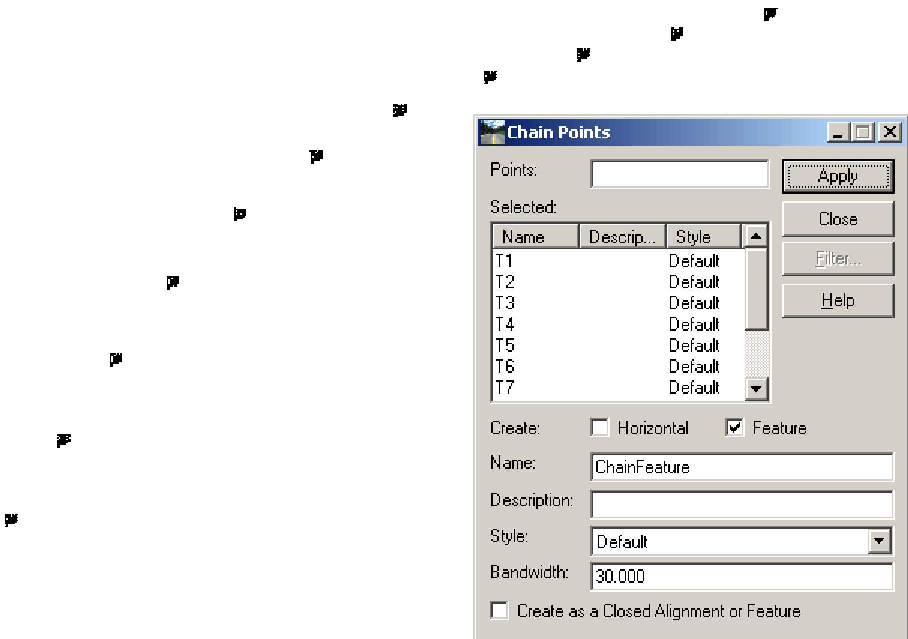
Hint: Turn the Cogo Snap Lock ON

The result should look like this:

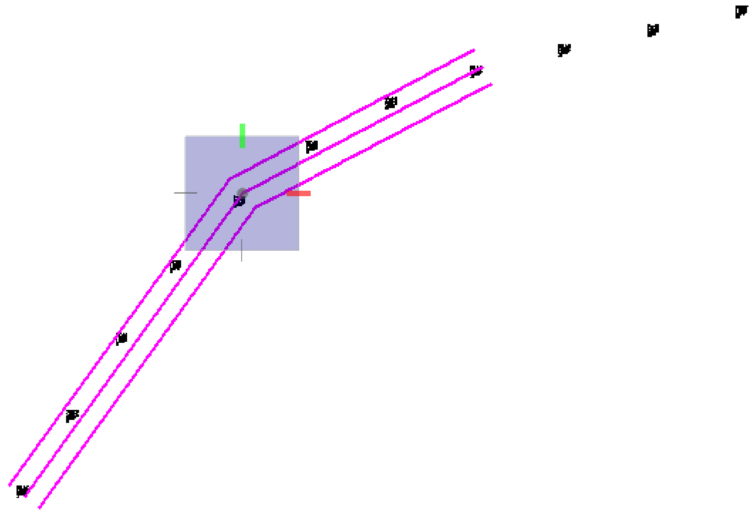


7.2 EXERCISE: CHAIN POINTS FOR FEATURES

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

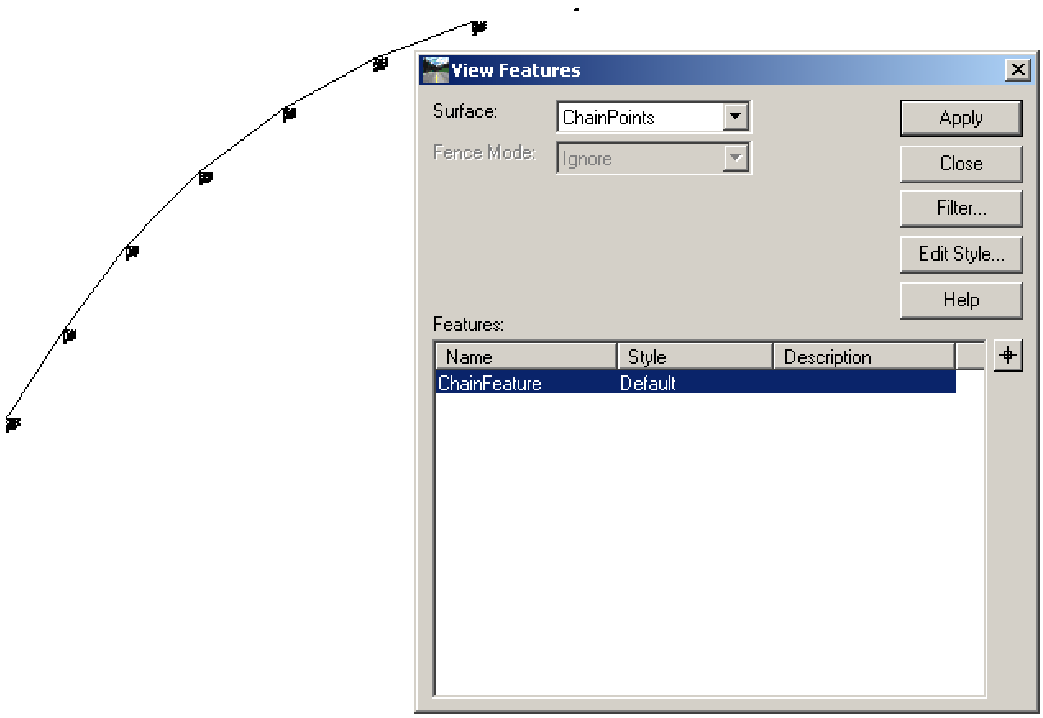


6. Apply



Identify the points you want to create a feature on.

7. Surface > View Surface > Features



8. *LESSON NAME: CURVE FITTING*

LESSON OBJECTIVE:

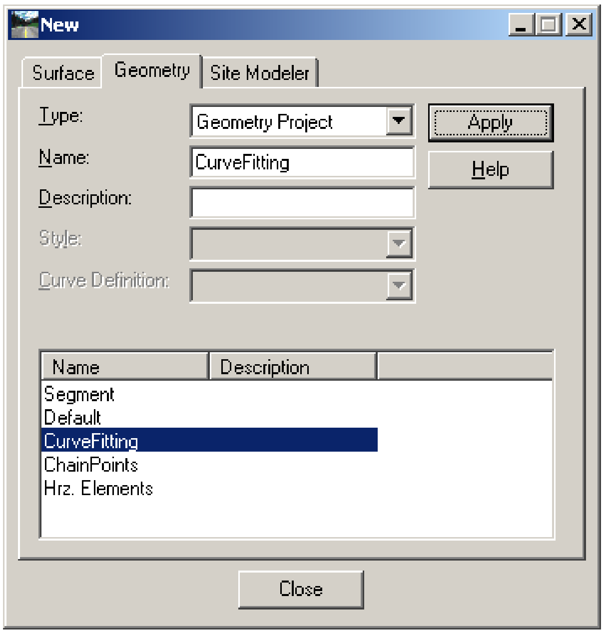
This lesson will show how to use the curve fitting utility to find the best fit alignment between 2 lines

8.1 EXERCISE:

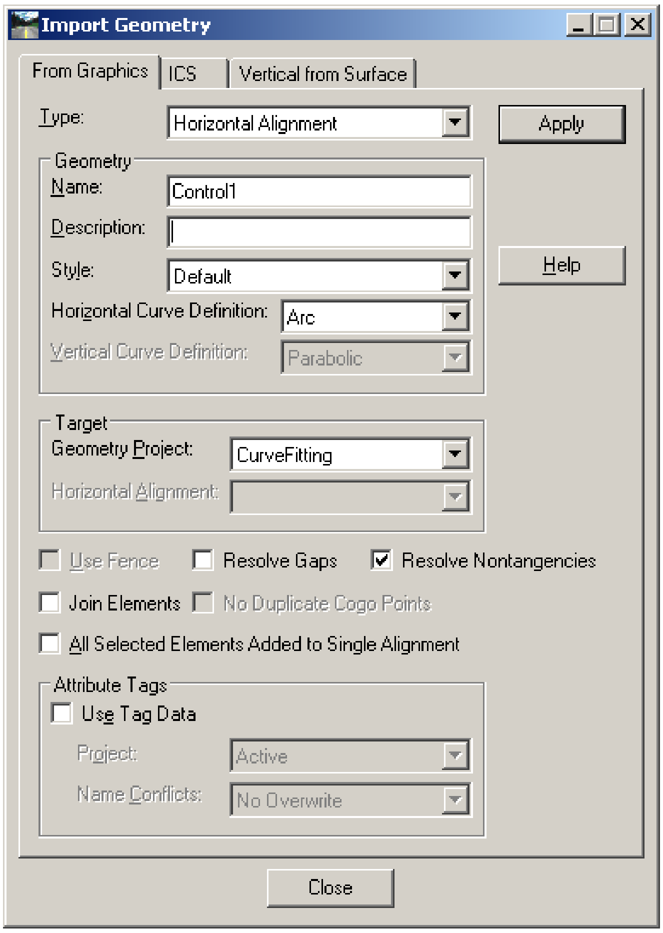
This lesson will show how to use the curve fitting utility to find the best fit alignment between 2 lines

1. Load Curve Fitting.dgn

   The graphic should display 2 line strings as surveyed features
2. Create a New Geometry Project



3. Import Geometry from Graphic lines
   File > Import > Geometry > From Graphics …

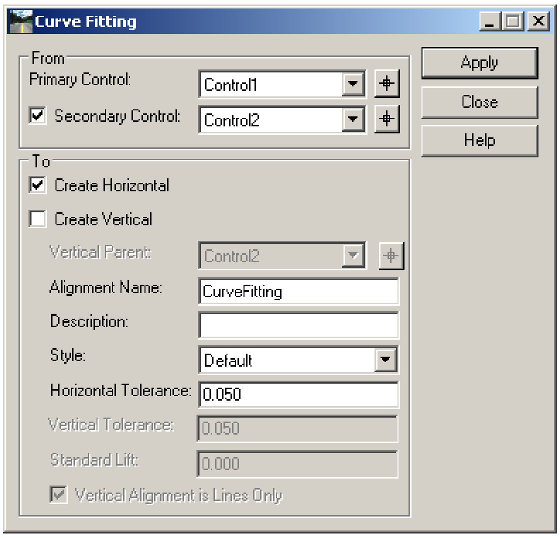


4. Create a Best Fit Alignment between control line

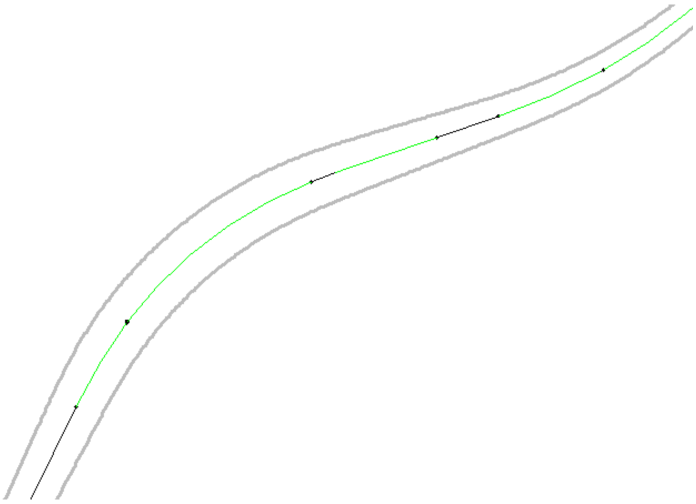
Uses a 3D line-string, in the form of a horizontal alignment, and creates a new horizontal alignment and vertical alignment that is defined with lines and arcs. The resultant geometry passes within a user-defined tolerance of the point data.

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

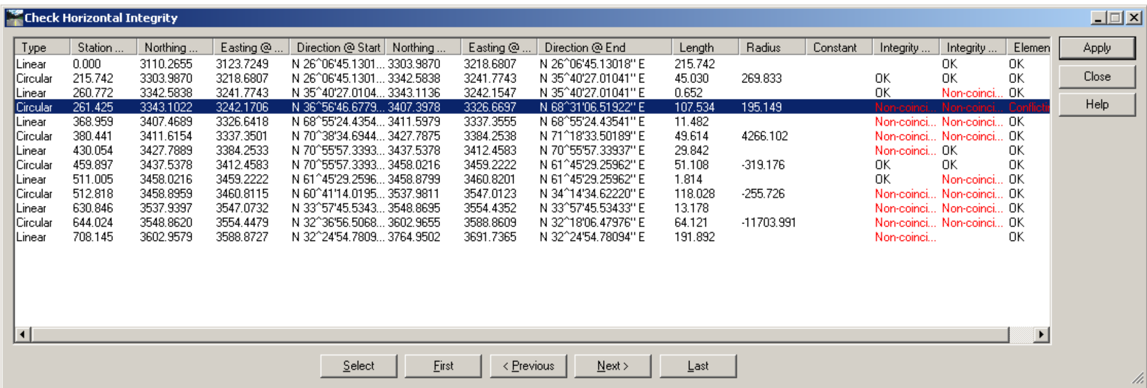
The Curve Fitting command's source data is an alignment defined as a line-string with xyz values. Quick regression's source is a regression buffer.
Use this command to curve fit a horizontal and vertical alignment.



The software has been created a new horizontal alignment.

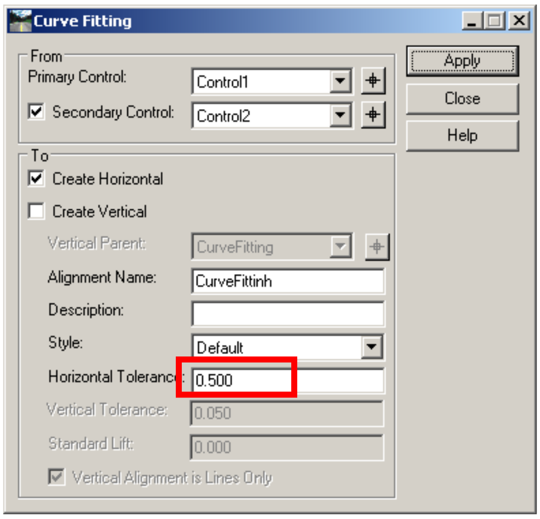


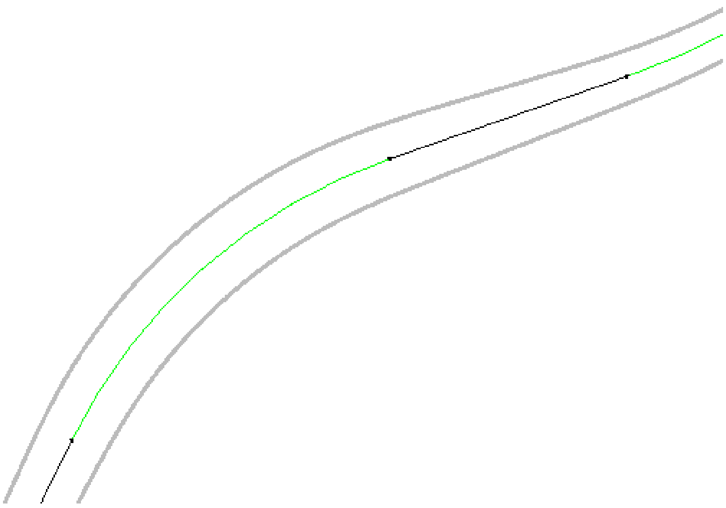
5. Check Integrity

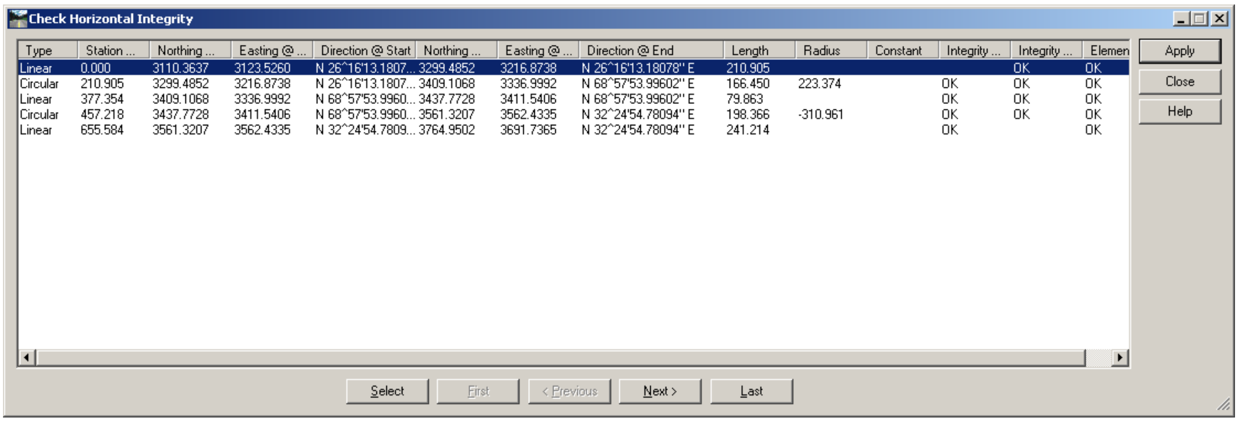


Type	Station ...	Northing ...	Easting @ ...	Direction @ Start	Northing ...	Easting @ ...	Direction @ End	Length	Radius	Constant	Integrity ...	Integrity ...	Elemen
Linear	0.000	3110.2655	3123.7249	N 26^06'45.1301...	3303.9870	3218.6807	N 26^06'45.13018'' E	215.742				OK	OK
Circular	215.742	3303.9870	3218.6807	N 26^06'45.1301...	3342.5838	3241.7743	N 35^40'27.01041'' E	45.030	269.833		OK	OK	OK
Linear	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
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...	Non-coinci...	Conflicti
Linear	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
Circular	380.441	3411.6154	3337.3501	N 70^38'34.6944...	3427.7875	3384.2538	N 71^18'33.50189'' E	49.614	4266.102		Non-coinci...	Non-coinci...	OK
Linear	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
Circular	459.897	3437.5378	3412.4583	N 70^55'57.3393...	3458.0216	3459.2222	N 61^45'29.25962'' E	51.108	-319.176		OK	OK	OK
Linear	511.005	3458.0216	3459.2222	N 61^45'29.2596...	3458.8799	3460.8201	N 61^45'29.25962'' E	1.814			OK	Non-coinci...	OK
Circular	512.818	3458.8959	3460.8115	N 60^41'14.0195...	3537.9811	3547.0123	N 34^14'34.62220'' E	118.028	-255.726		Non-coinci...	Non-coinci...	OK
Linear	630.846	3537.9397	3547.0732	N 33^57'45.5343...	3548.8695	3554.4352	N 33^57'45.53433'' E	13.178			Non-coinci...	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
Linear	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

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 Integrity

Type	Station ...	Northing ...	Easting @ ...	Direction @ Start	Northing ...	Easting @ ...	Direction @ End	Length	Radius	Constant	Integrity ...	Integrity ...	Elemen
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	3336.9992	N 68^57'53.99602" E	166.450	223.374		OK	OK	OK
Linear	377.354	3409.1068	3336.9992	N 68^57'53.9960...	3437.7728	3411.5406	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
Linear	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

Apply Close Help
Select First < Previous Next > Last