Bentleyuser.dk Årsmøde 2010

Nordic Civil 2010

8.-10. November 2010, Munkebjerg Hotel, Vejle

Workshop - X15

Advanced Geometric Design for InRoads V8i

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LESSON NAME: SETUP GEOMETRY OPTIONS

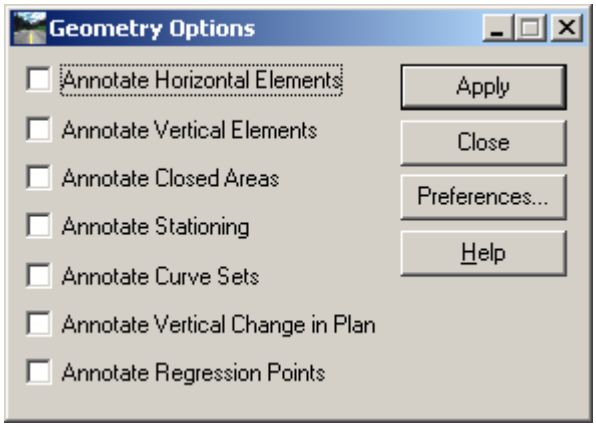
LESSON OBJECTIVE:

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

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 …

LESSON NAME: USING THE NEW GEOMETRY VIEW OPTIONS

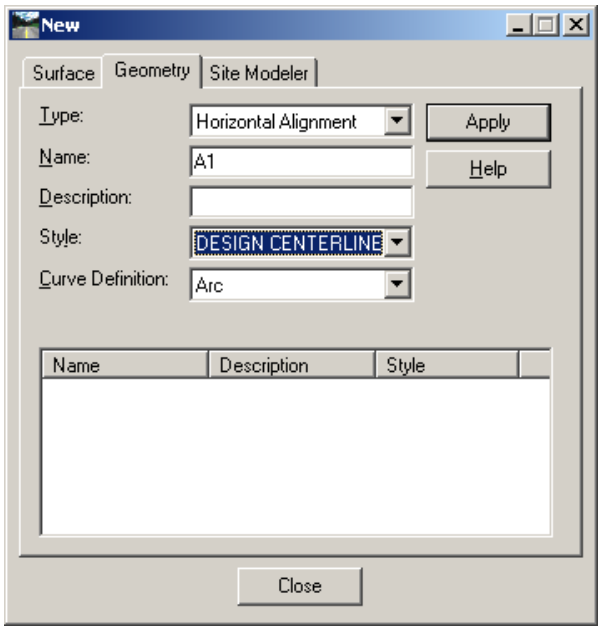
LESSON OBJECTIVE:

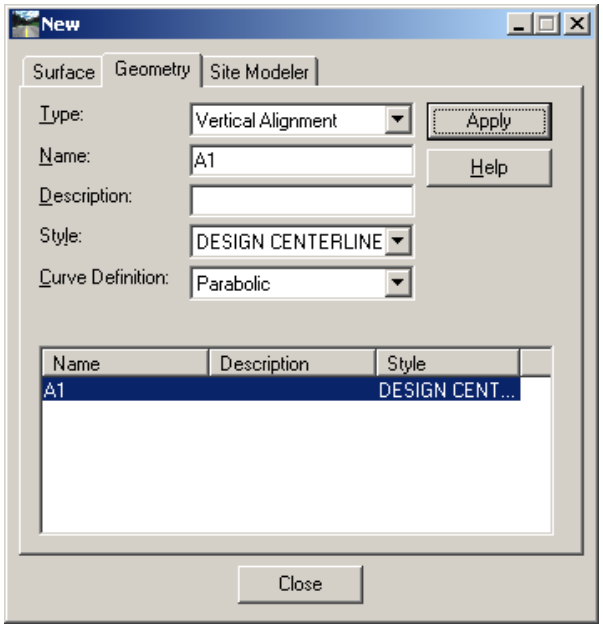
This lesson will show how to use the new Geometry Options

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



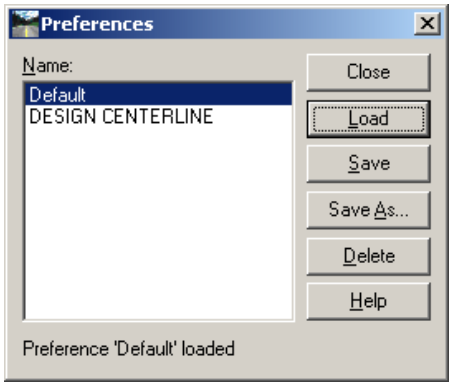


Close the dialog box

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

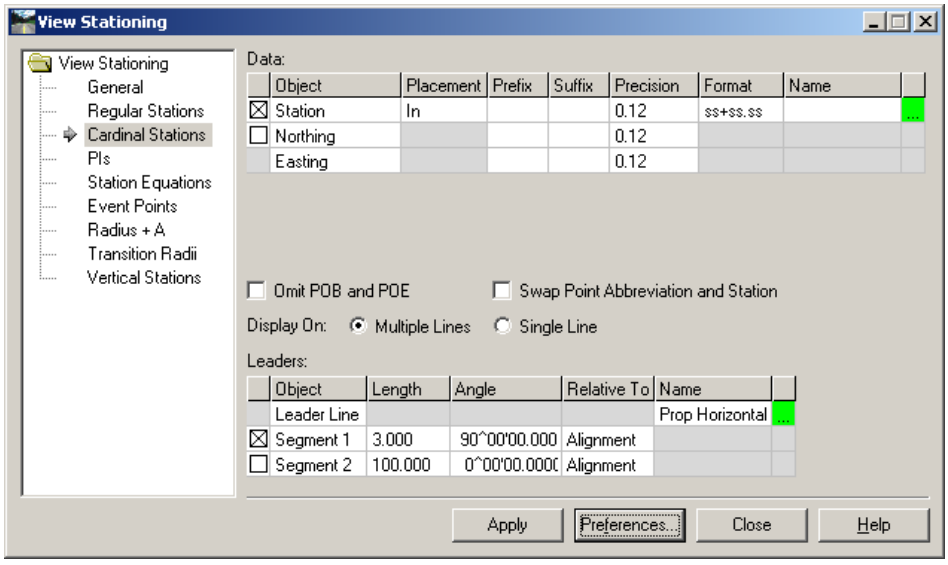
Insert a horizontal curve

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

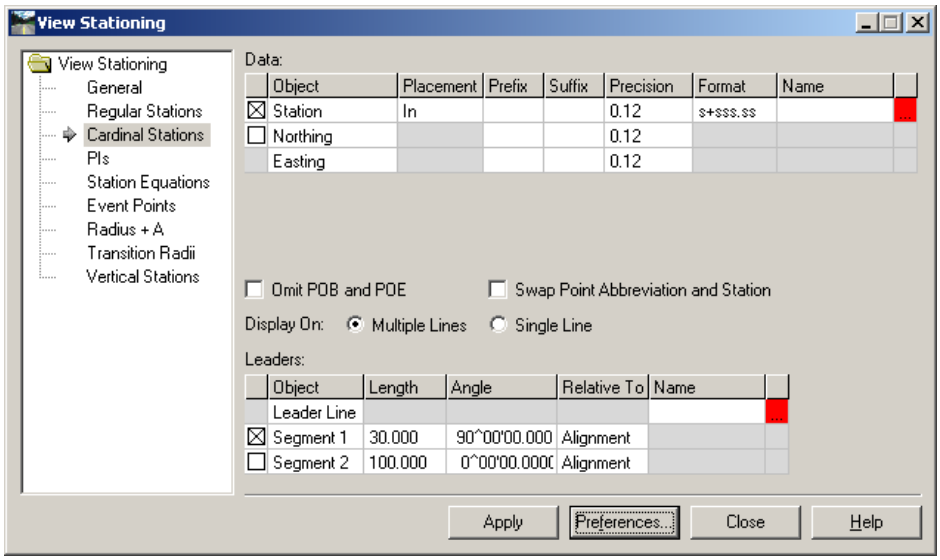


There 2 preferences with different annotation settings.

Default

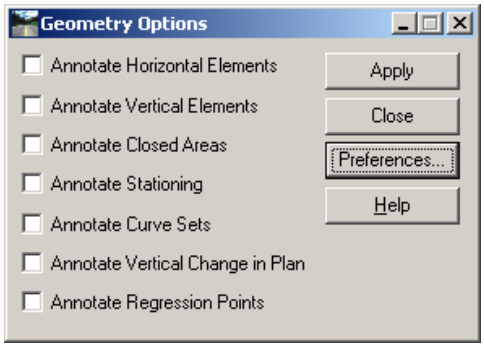


DEFINE CENTERLINE



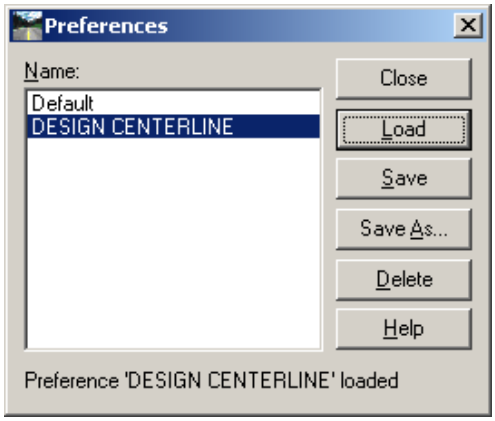
Close the dialog box.

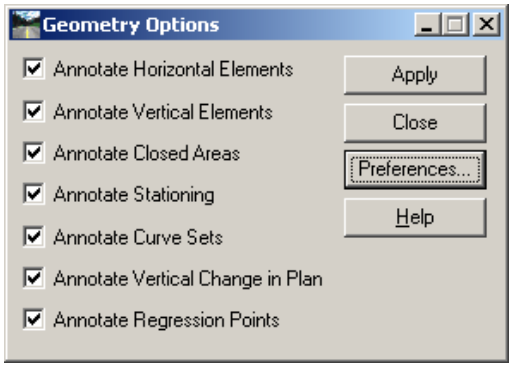
Go to Geometry > View Geometry > View Options > …



By Default all annotation is turned off.

Load a preference called DESIGN CENTERLINE



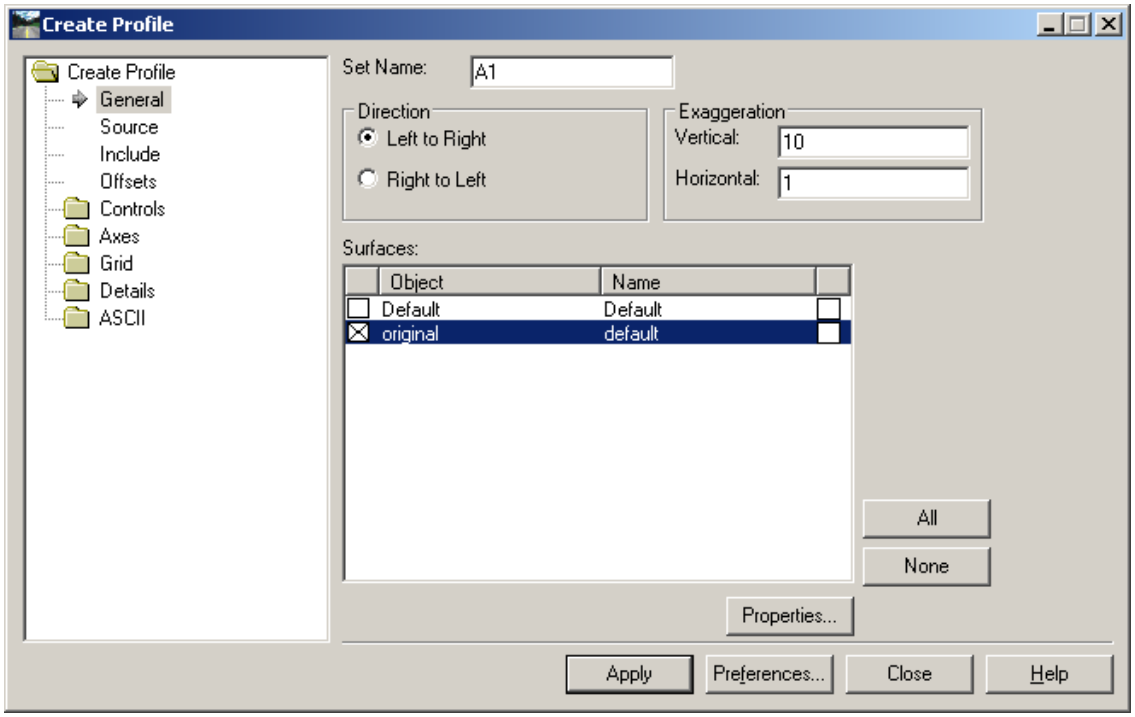


All Annotation is turned on for the design process.

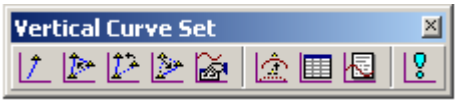
Move on with the alignment creation

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

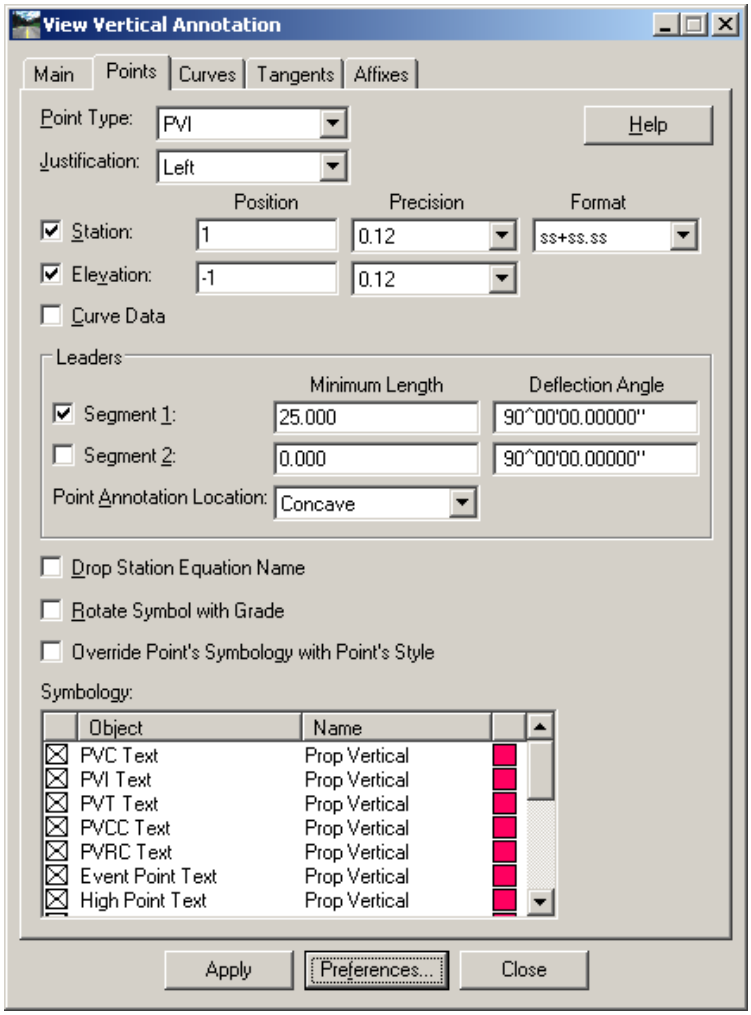
4. Create a profile turn the dtm on



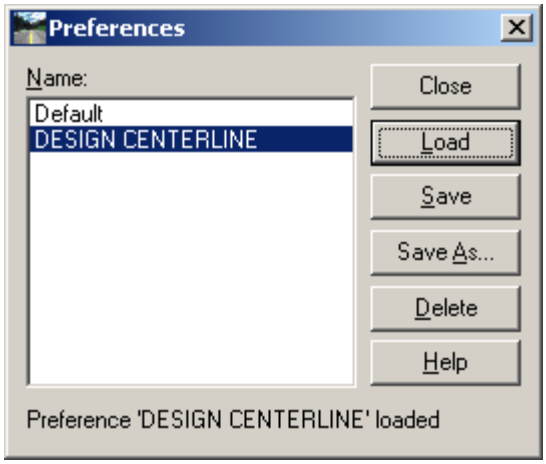
5. Use the vert. PI – Method or Element Method and design a simple vert. alignment



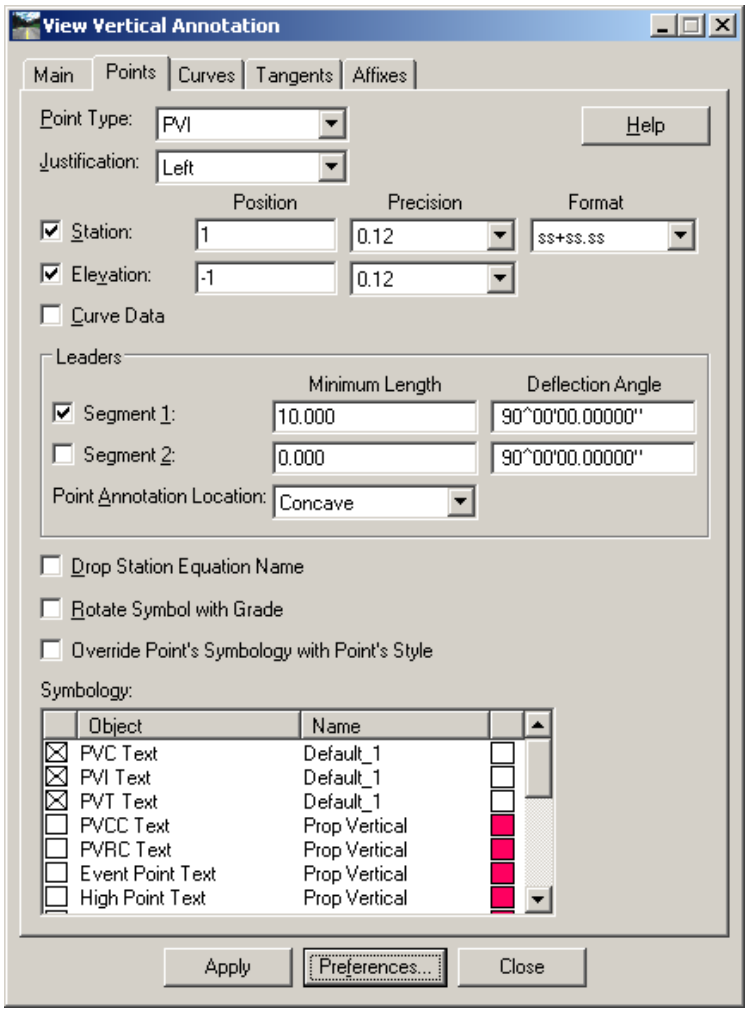
6. Annotate the vertical alignment Geometry > View Geometry > Vertical Annotation



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

LESSON NAME: USING THE DESIGN CALCULATOR

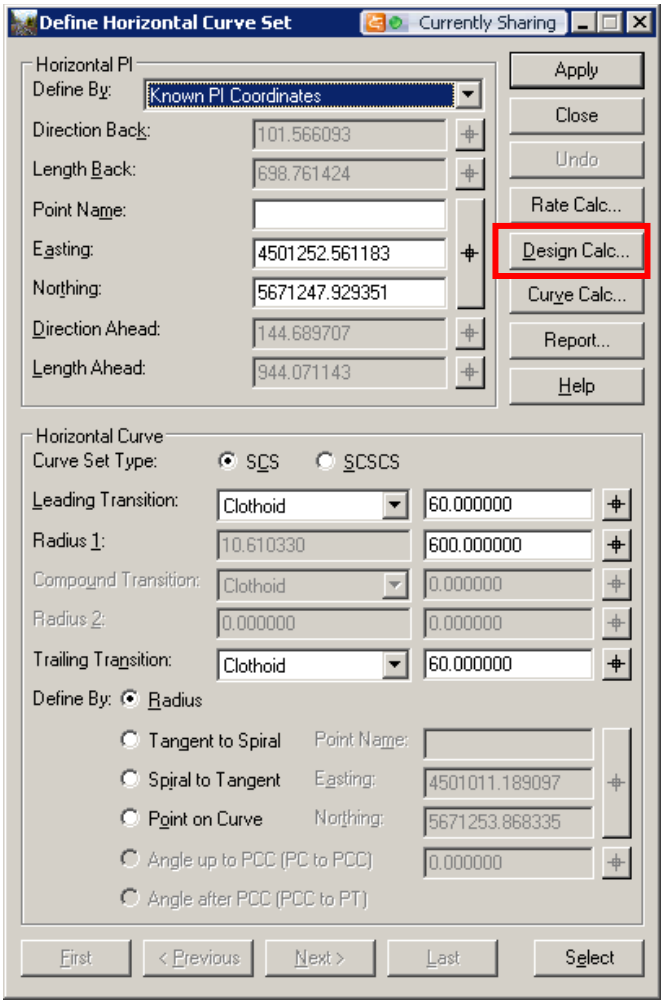
LESSON OBJECTIVE:

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

EXERCISE: SETTING UP THE NEW SIMPLIFIED GEOMETRY TOOLS

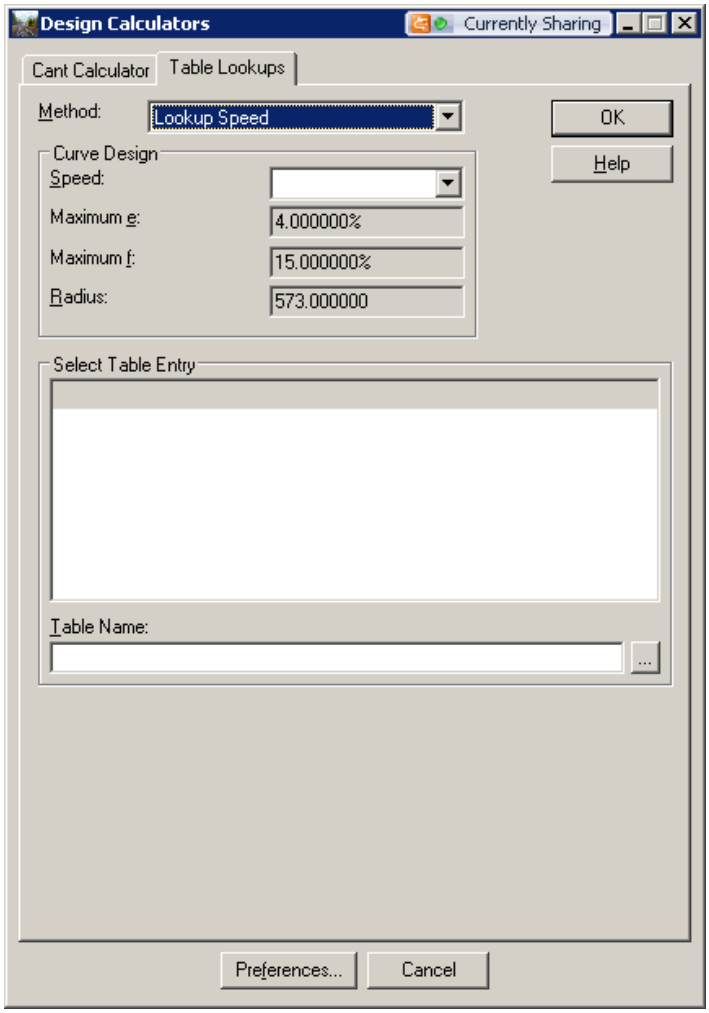
This exercise will guide you through the steps to get started with the Design Calculator

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



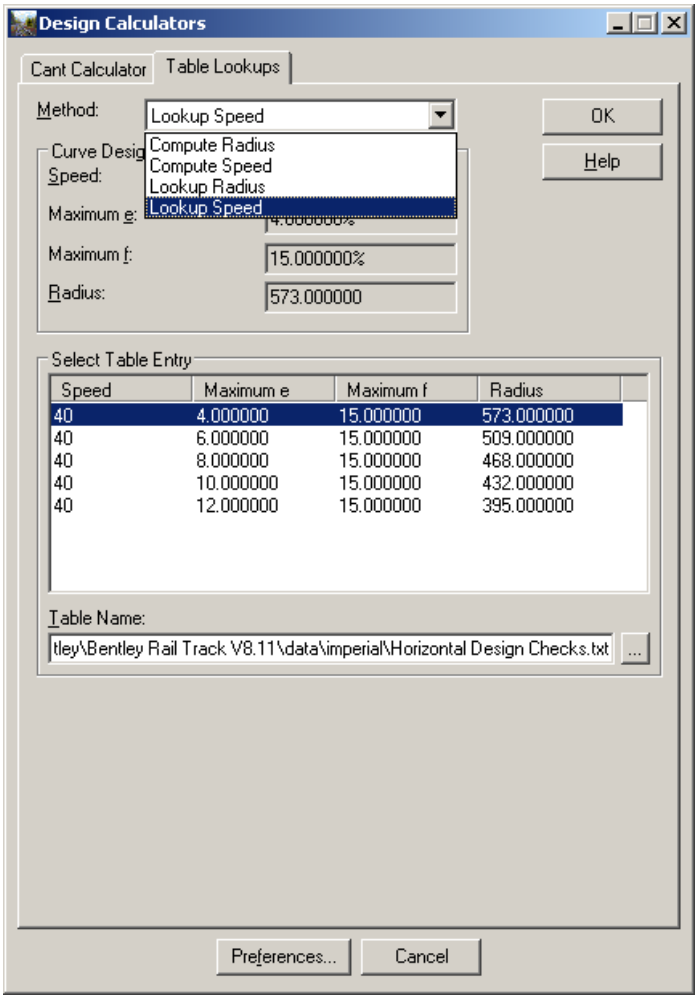
3. Use the Design Calculator

4. Use the Table Lookups

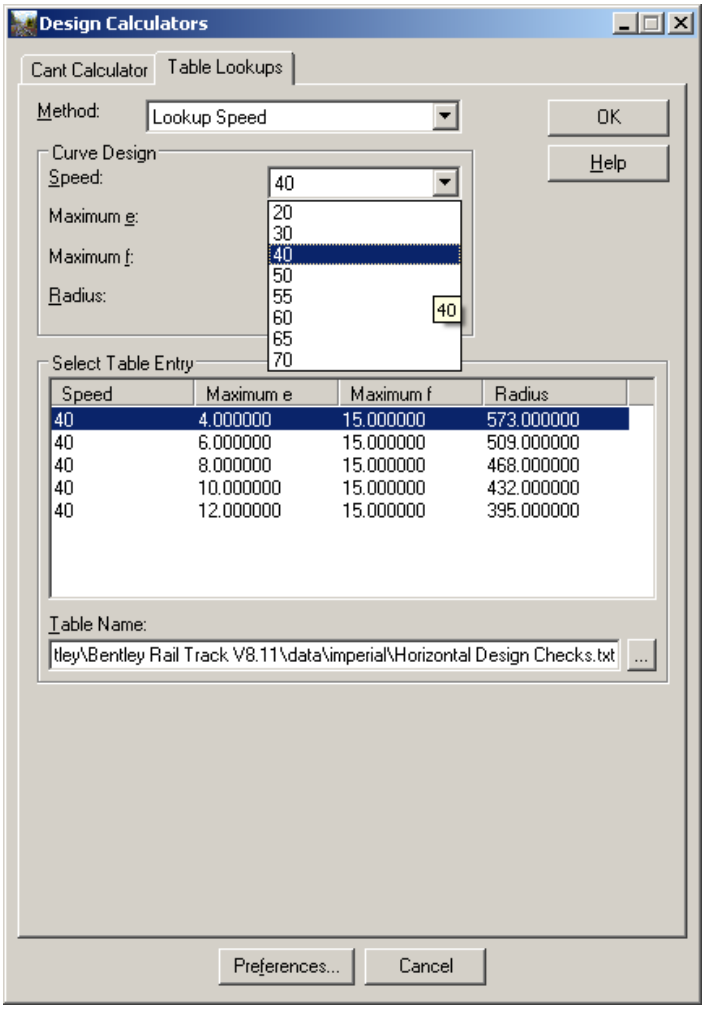


5. Select the Table name
6. You will find the table name in the product directory under … \data\i**mperia**l\Horizontal Design Checks.txt or …\data**metric**\Horizontal Design Checks.txt

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:

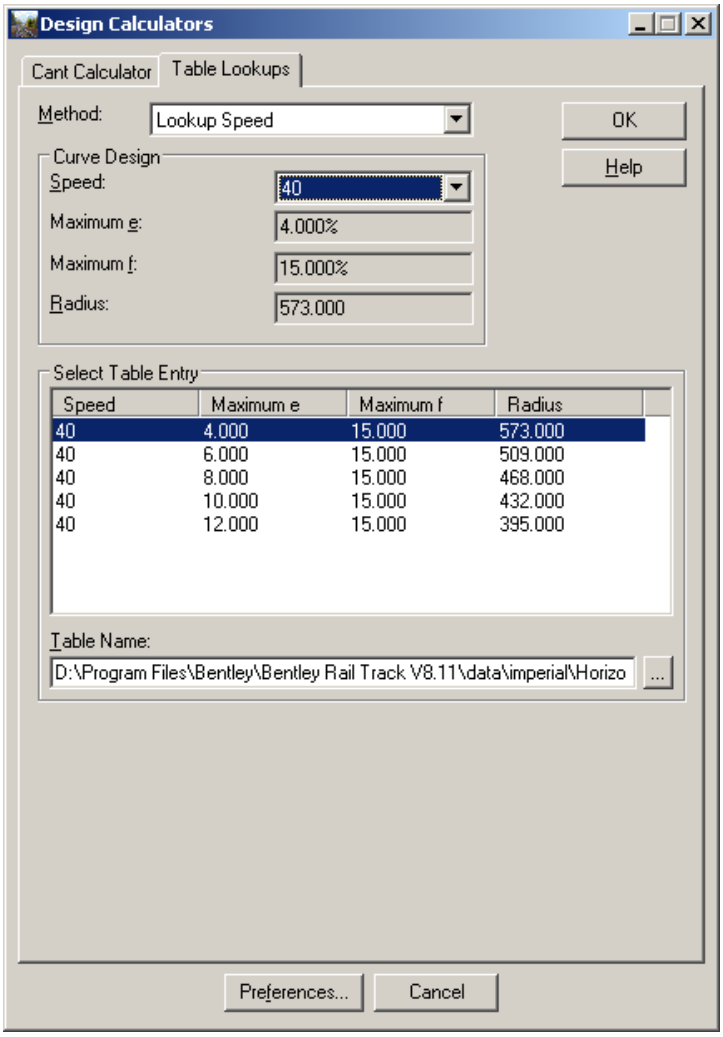
English - R=V^2/[15(e+f)], where R is the radius (ft), V is the vehicle speed (mph), e is the rate of roadway superelevation (ft/ft), and f is the side friction factor

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.

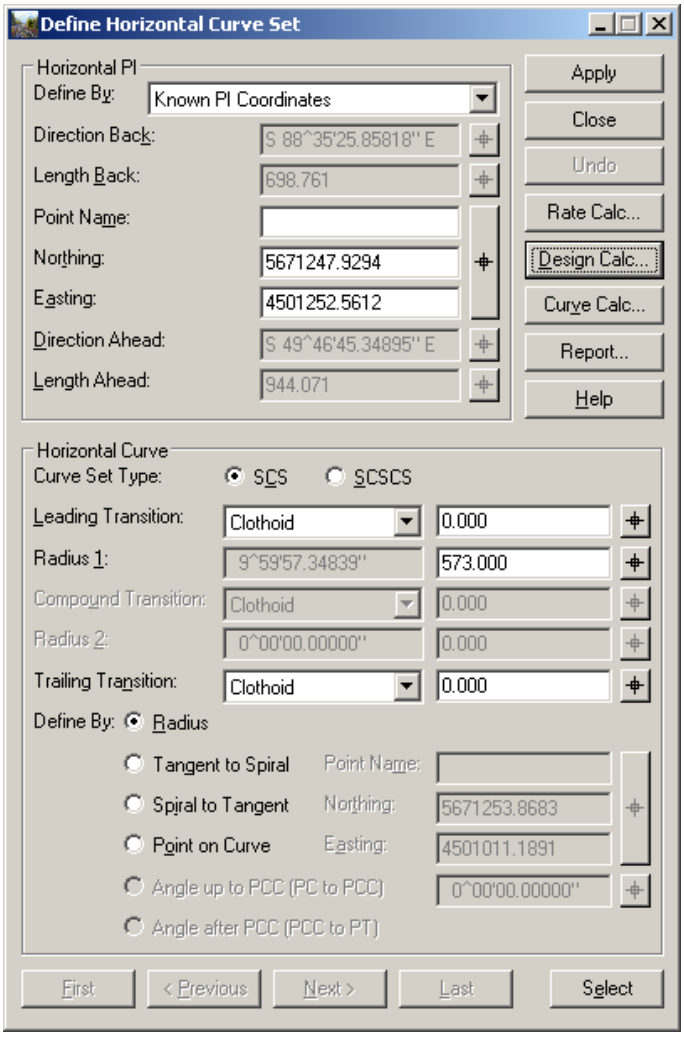
Lookup Radius – reads the values for radius, maximum f and speed values varying the rate of superelevation. These values are read from an ASCII file specified under Table Name and contains information from “A Policy on Geometric Design of Highways and Streets 1994” for imperial and metric units.

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.

LESSON NAME: SIMPLIFIED GEOMETRY TOOLS

LESSON OBJECTIVE:

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

EXERCISE: SETTING UP THE NEW SIMPLIFIED GEOMETRY TOOLS

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

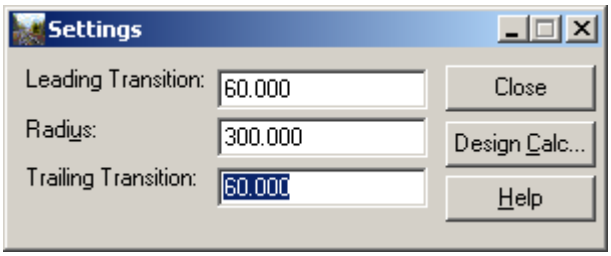
defines the trailing transition spiral's length or constant. This field honors Tools > Options > Geometry and Define Transitions by Length or Constant.

Design Calculator

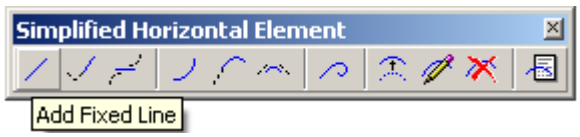
invokes the design calculator to define the transition lengths and radius from design criteria.

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:

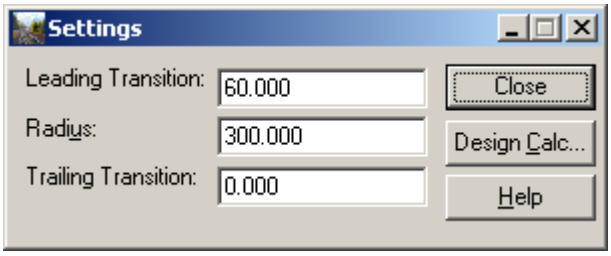


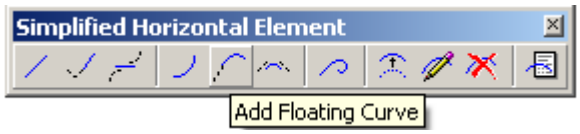
The command works a little bit different then the Horizontal Element Method.

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

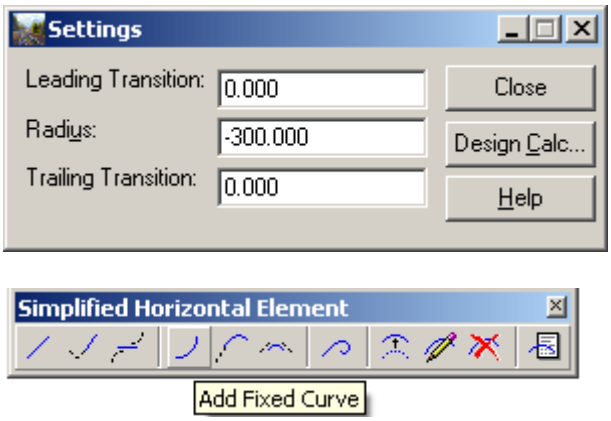
The software takes the values from the settings.

6. Add a Floating Curve and use these settings:

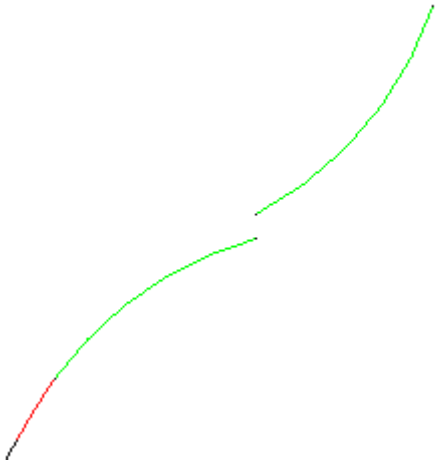




7. Add a Fixed Curve with the following settings

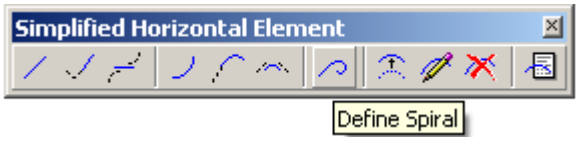


If you have a solution like shown



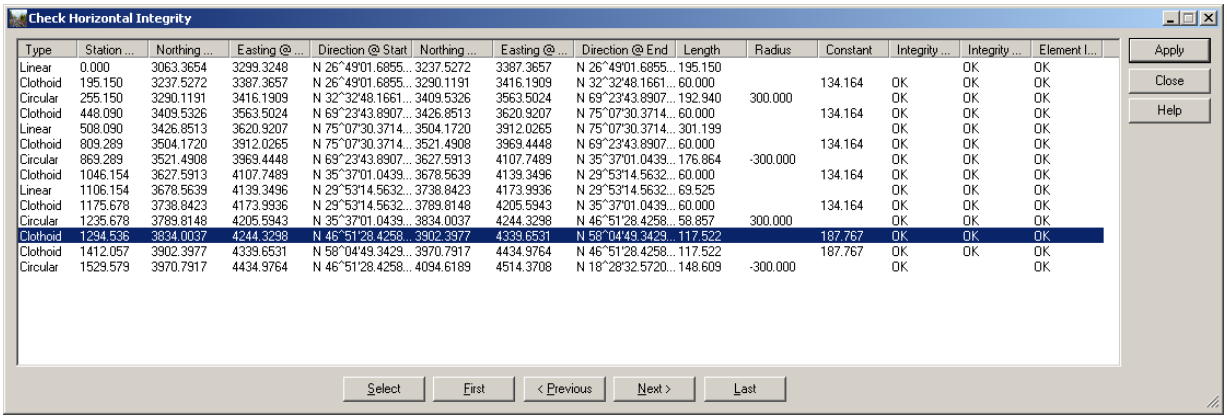
you can fill a reverse spiral between reverse arcs.

8. Use Define Spiral



The reverse spirals have the same parameter.

9. Check the Integrity.



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

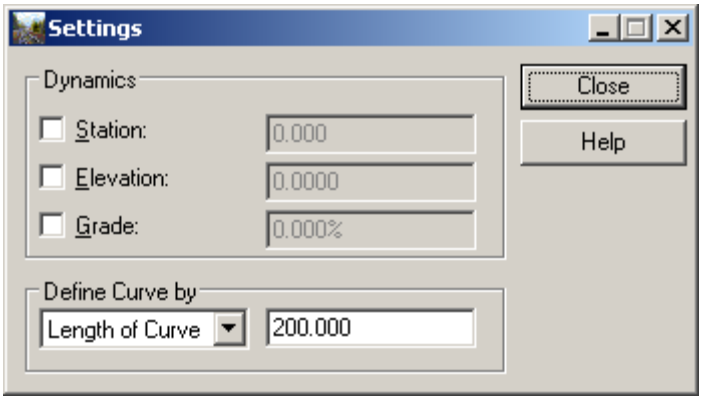
VERTICAL DESIGN

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

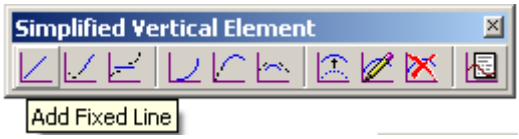
Define Curve by

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.

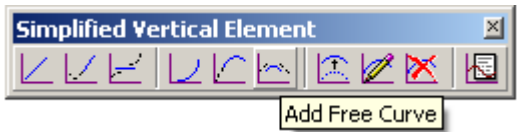
Note: This dialog should remain active while using the Simplified Horizontal Elements commands. As you change settings on this dialog, commands that use these settings instantly reflect these settings



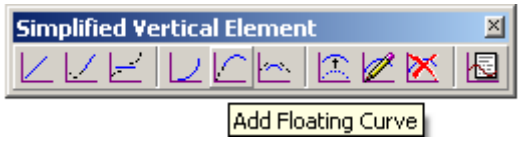
4. Create a Fixed Vertical Line

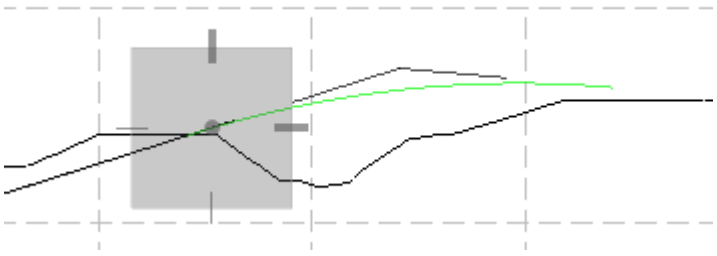


5. Add a Free Vertical Curve

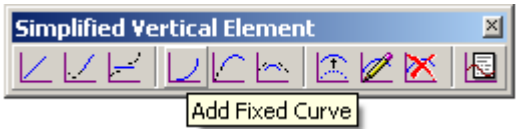


6. Add a Floating Curve

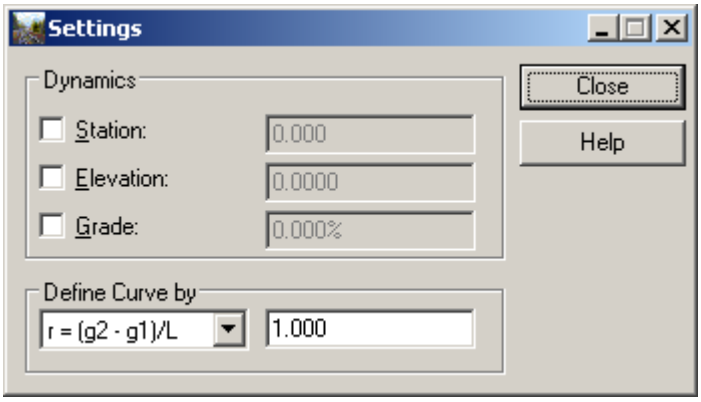




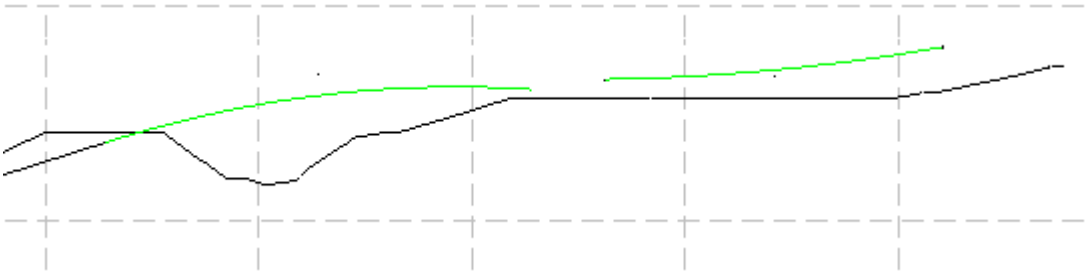
7. Add Fixed Curve



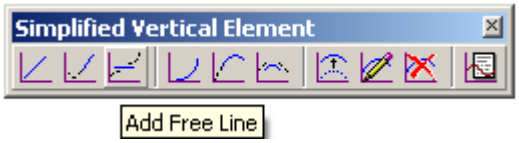
8. Use the following settings



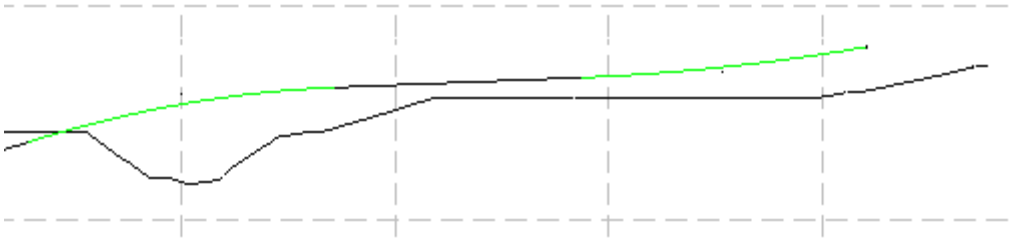
You may have this solution:



9. Use Add Free Line



And fill the gap between the reverse vertical arcs.



LESSON NAME: HORIZONTAL ELEMENT

LESSON OBJECTIVE:

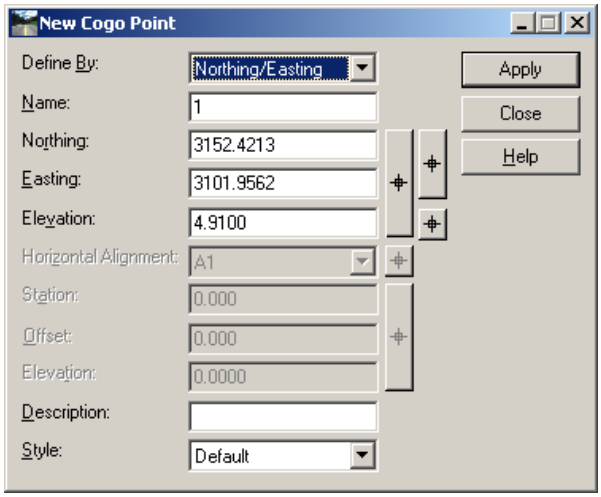
This exercise will guide you through the steps to get started with Fixed Elements

EXERCISE: ADD FIXED ELEMENTS

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

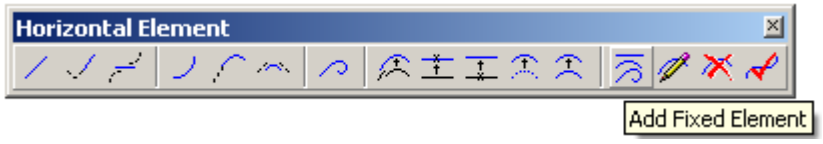
1. Create a new horizontal alignment
2. Create New cogo points (3 new cogo points)

   Geometry > Cogo Points > New ..



You may have this result:

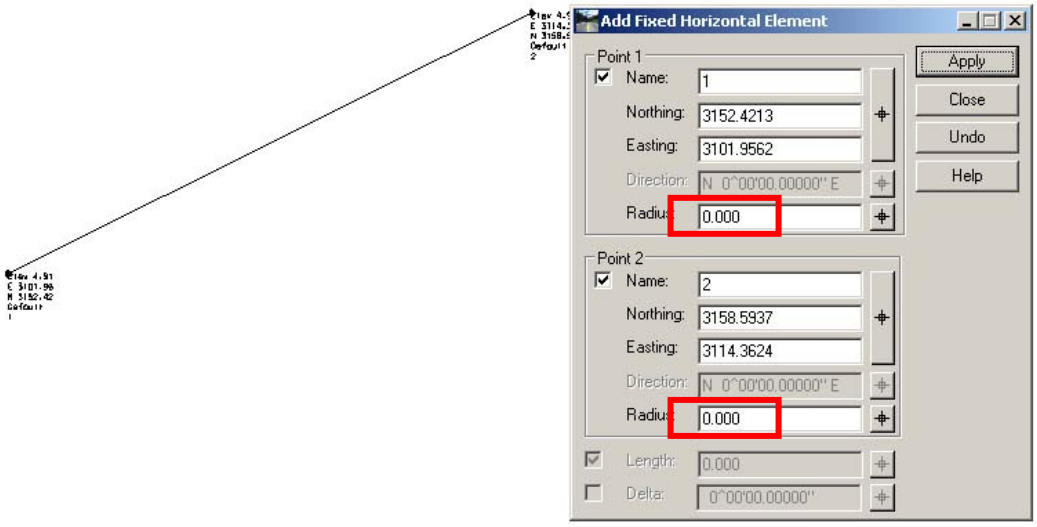
3. Add Fixed Horizontal Elements



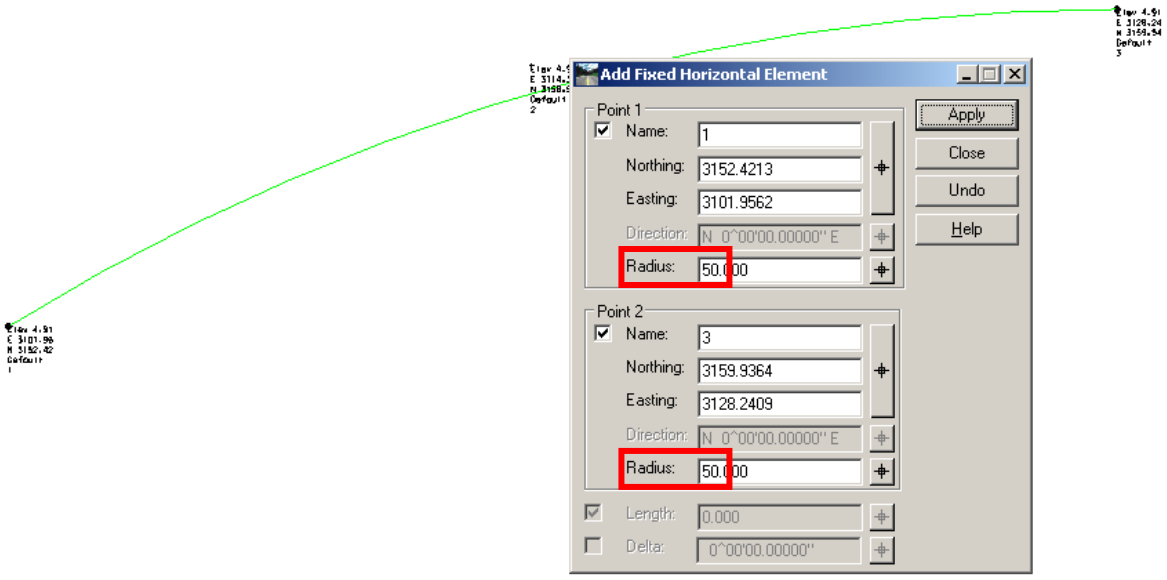
Use this command to add a fixed element using point, length or delta as controls then adds the solution to the alignment. This command is limited to clothoid spirals. creates the element and displays it into the alignment.

The element type is determined by the following rules:

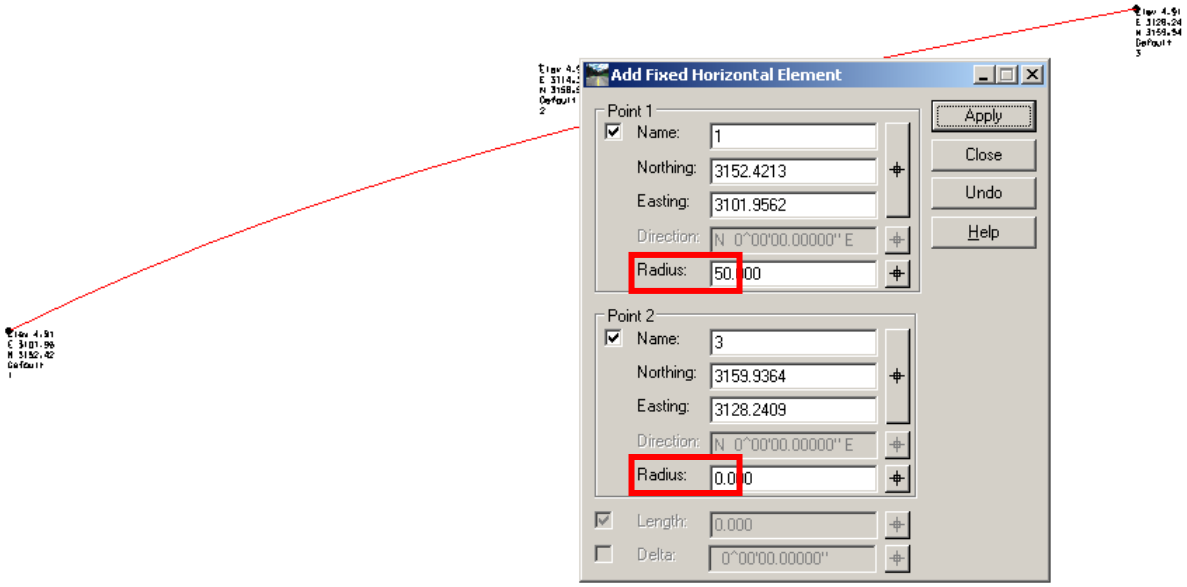
Linear: Point 1's Radius and Point 2's Radius is zero



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.

LESSON NAME: SEGMENT ALIGNMENT

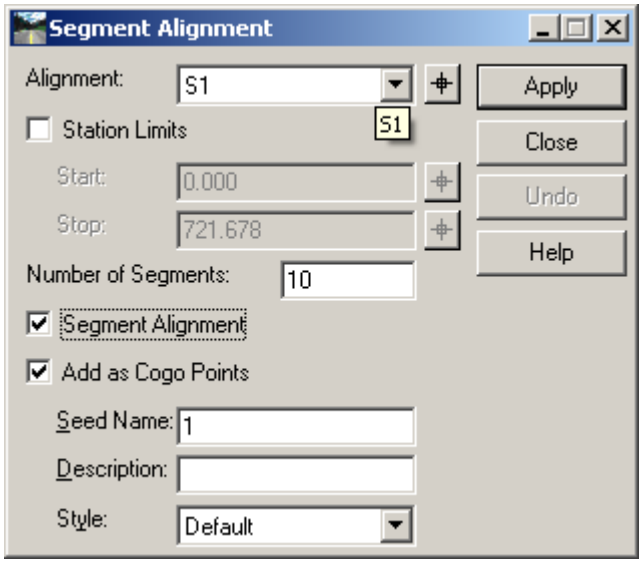
LESSON OBJECTIVE:

This lesson will show how to use the Segment Alignment Utility

EXERCISE: SEGMENT ALIGNMENT

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

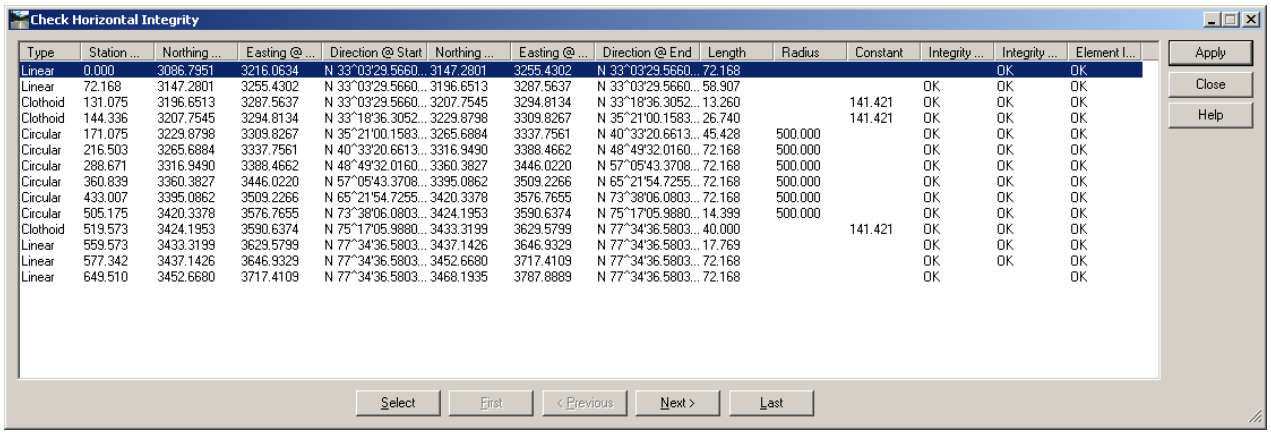
1. Load Segment.alg
2. Use the Segmentation Utility Geometry > Utilities > Segment Alignment



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



LESSON NAME: CHAIN POINTS

LESSON OBJECTIVE:

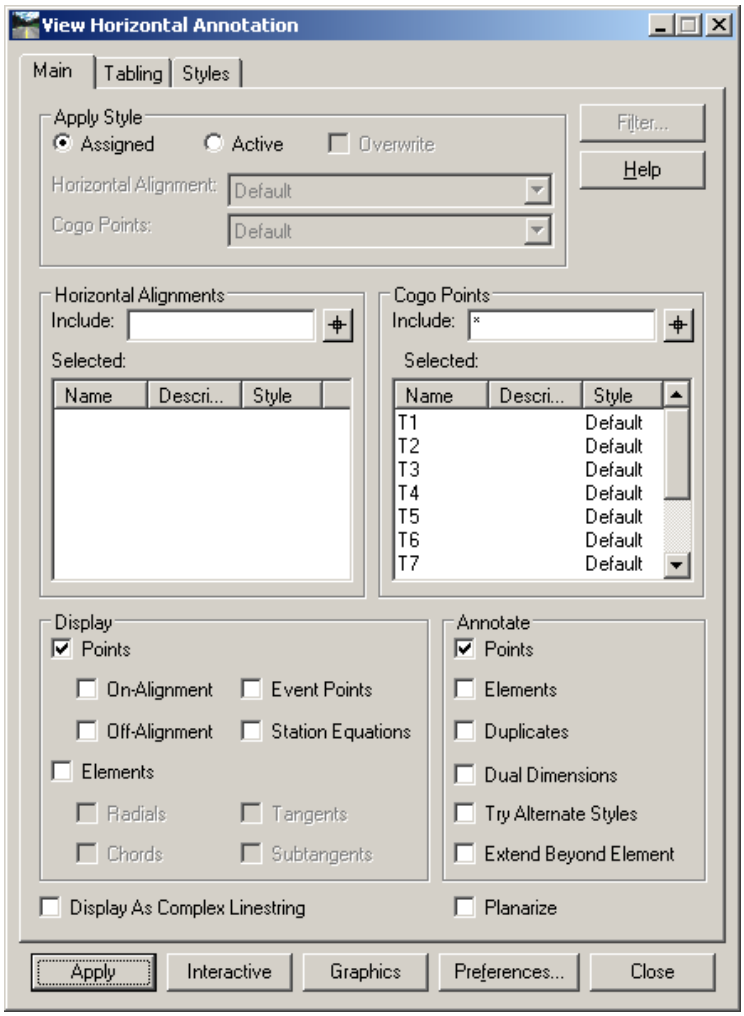
This lesson will show how to use the Chain Points Utility

EXERCISE: CHAIN POINTS BY COGO POINTS

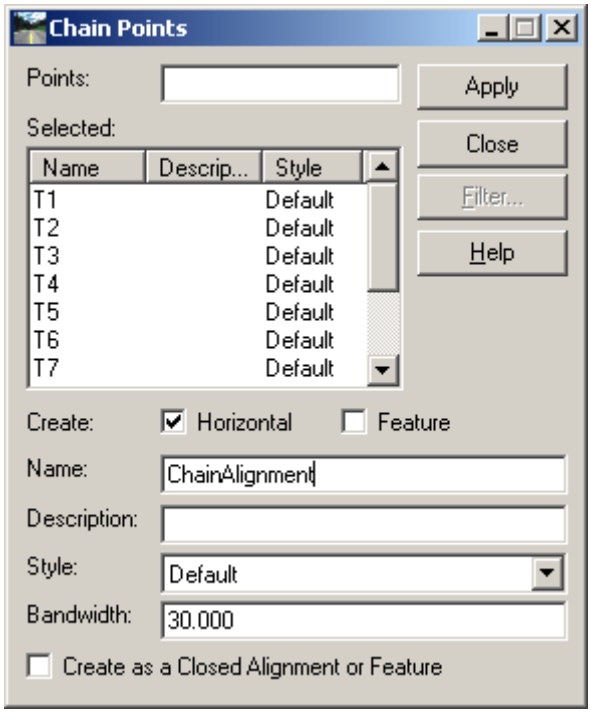
This lesson will guide you how to use the Chain Points Utility

1. Load Chain Points.alg

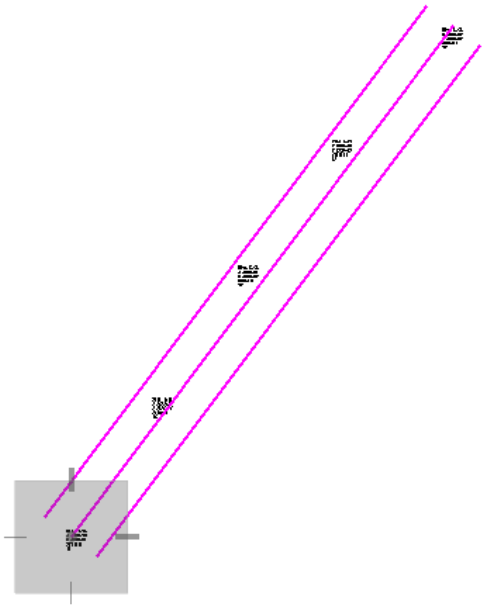
2. View the cogo points



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



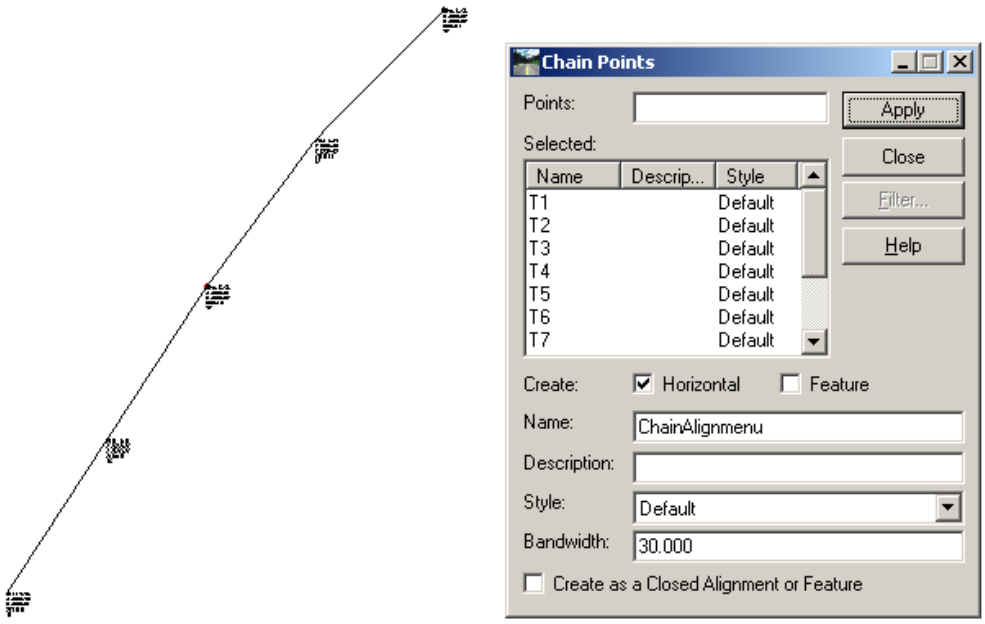
Apply & Identify the 1st points then the 2nd point



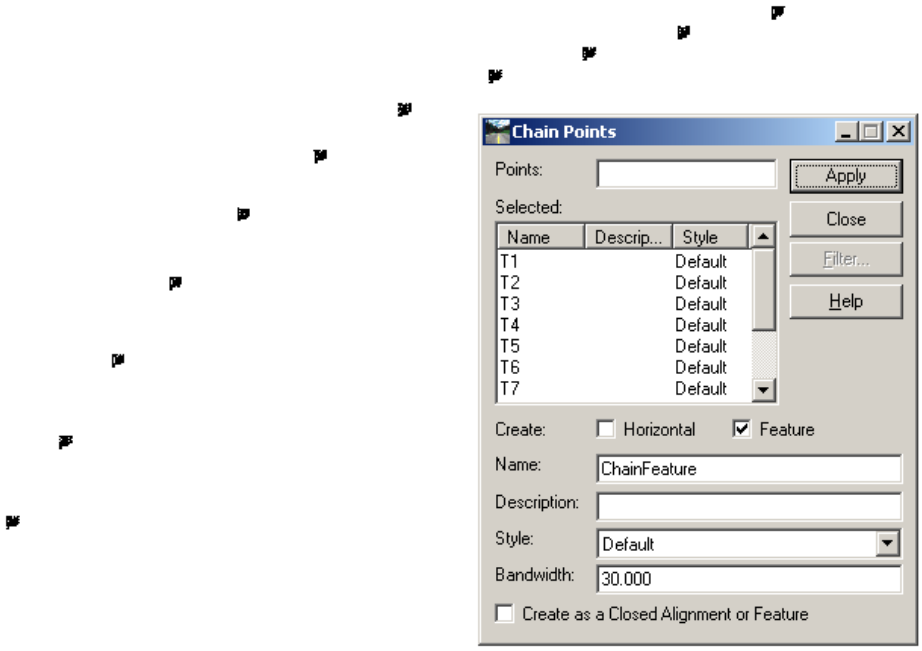
The magenta line views the bandwidth of 30 ft or m

Hint: Turn the Cogo Snap Lock ON

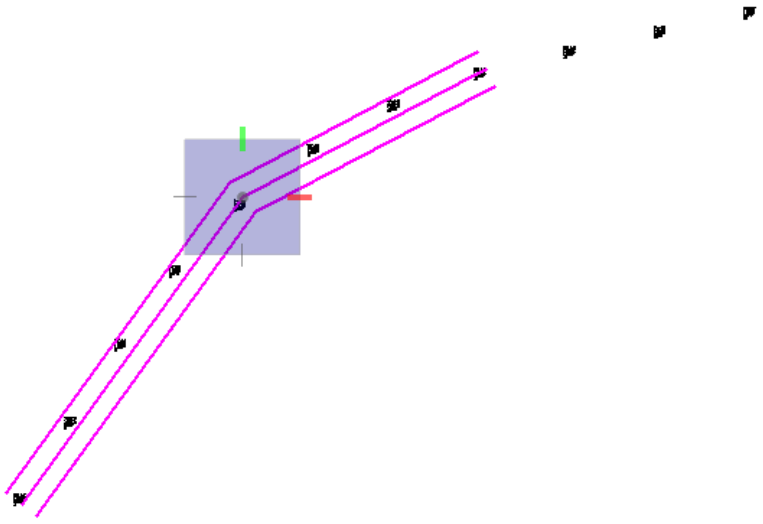
The result should look like this:



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

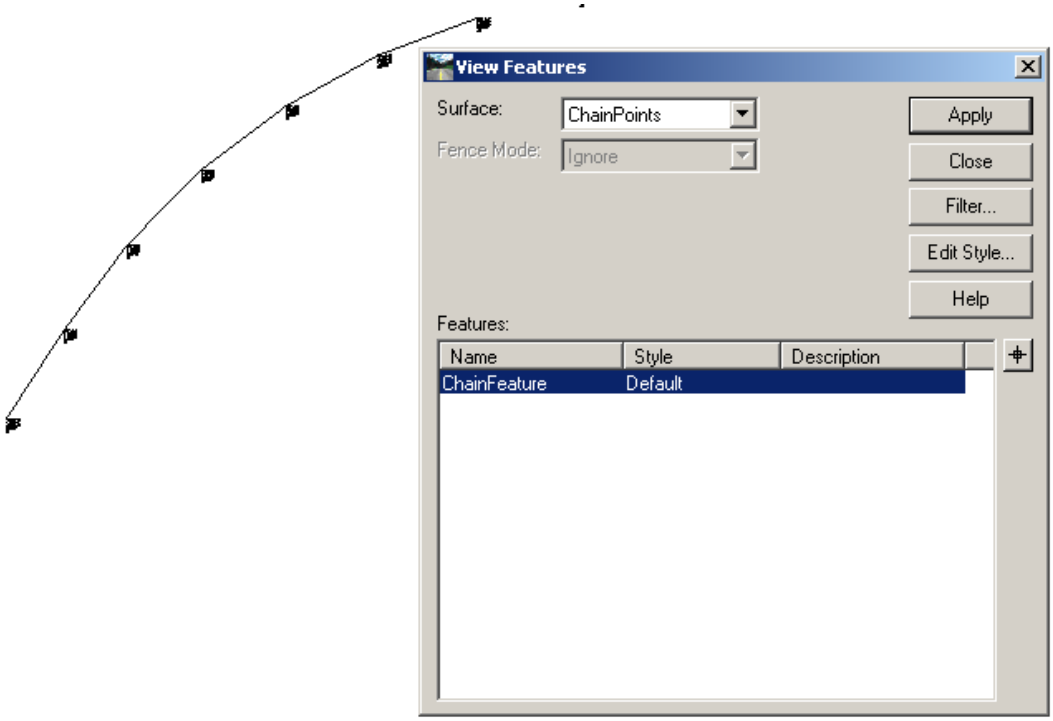


6. Apply



Identify the points you want to create a feature on.

7. Surface > View Surface > Features



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

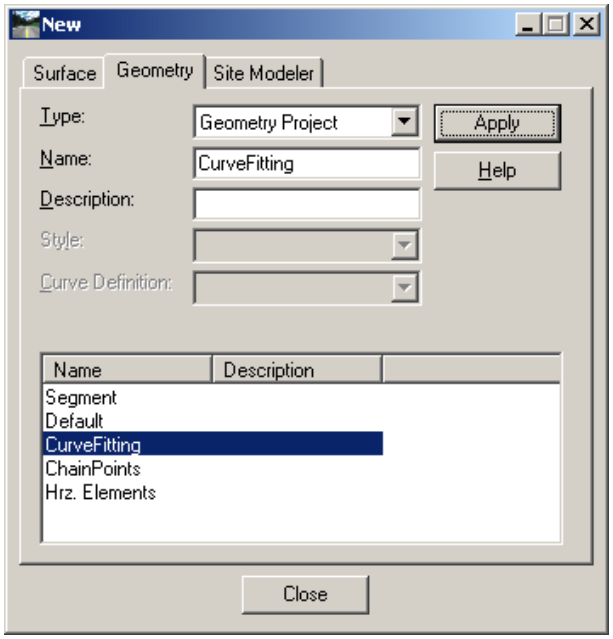
EXERCISE:

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

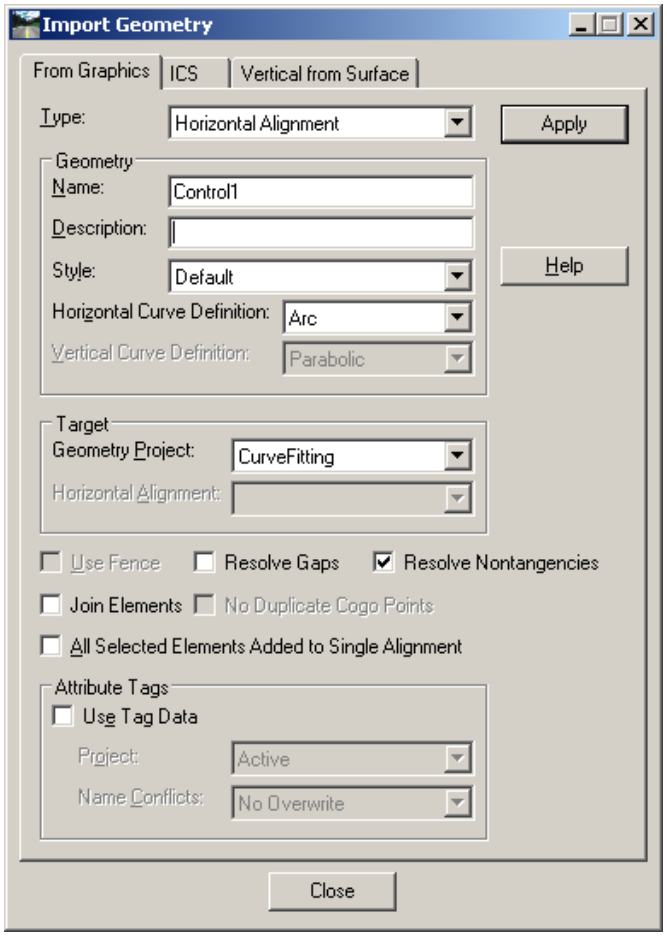
   The graphic should display 2 line strings as surveyed features

2. Create a New Geometry Project



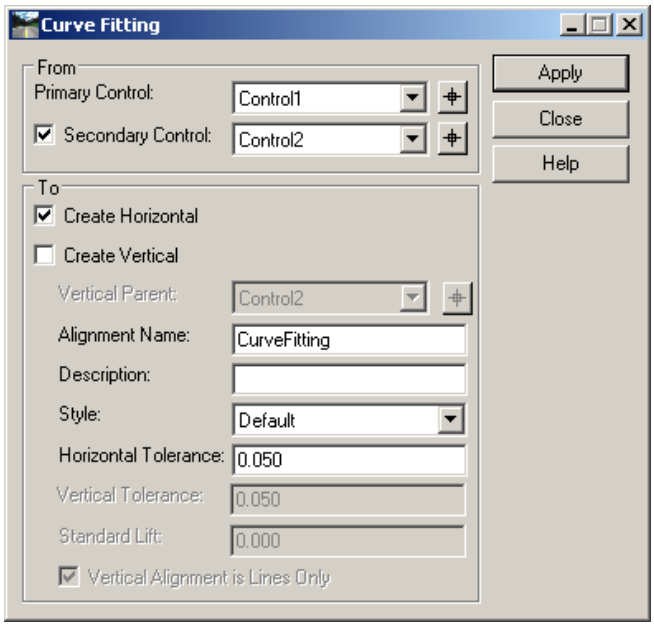
3. Import Geometry from Graphic lines

   File > Import > Geometry > From Graphics …

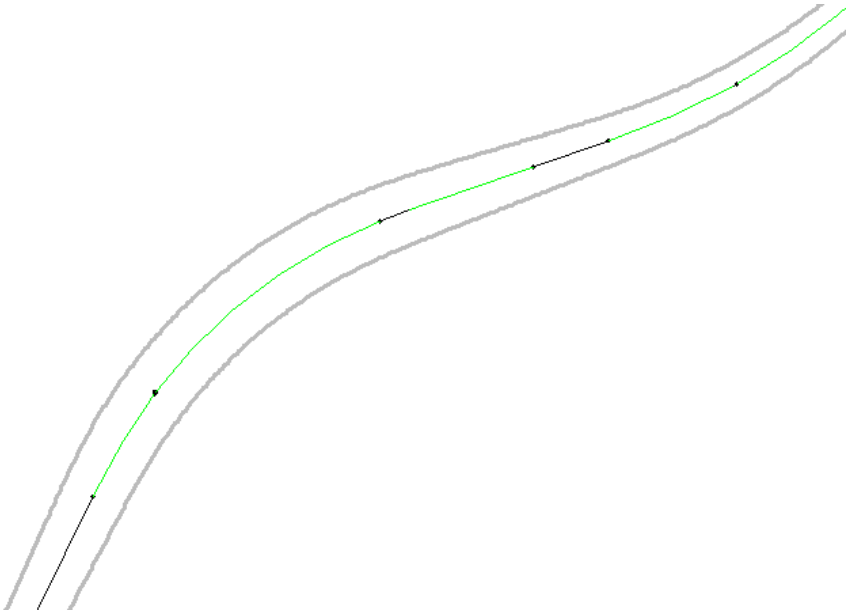


4. Create a Best Fit Alignment between control line

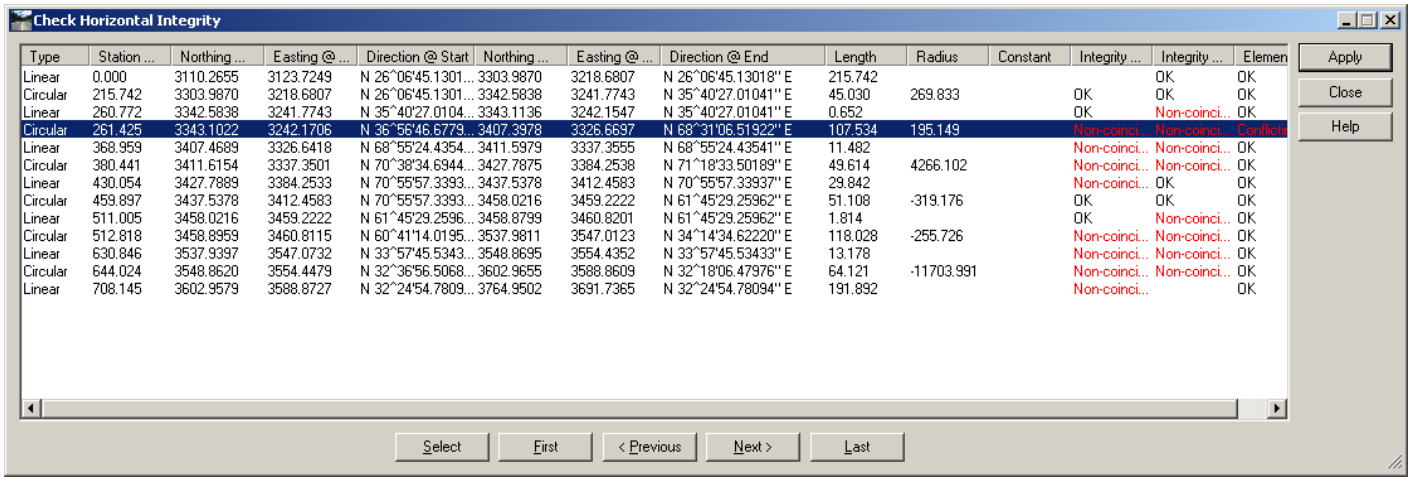
Uses a 3D line-string, in the form of a horizontal alignment, and creates a new horizontal alignment and vertical alignment that is defined with lines and arcs. The resultant geometry passes within a user-defined tolerance of the point data.
Curve Fitting does not create transition spirals. Transition 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



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.