



Bentleyuser.dk Årsmøde 2009

Nordic Civil 2009

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Workshop - X7
Working with Rail Geometry Bentley Rail Track V8i

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1. LESSON NAME: REGRESSION ANALYSIS ON EXISTING TRACKS

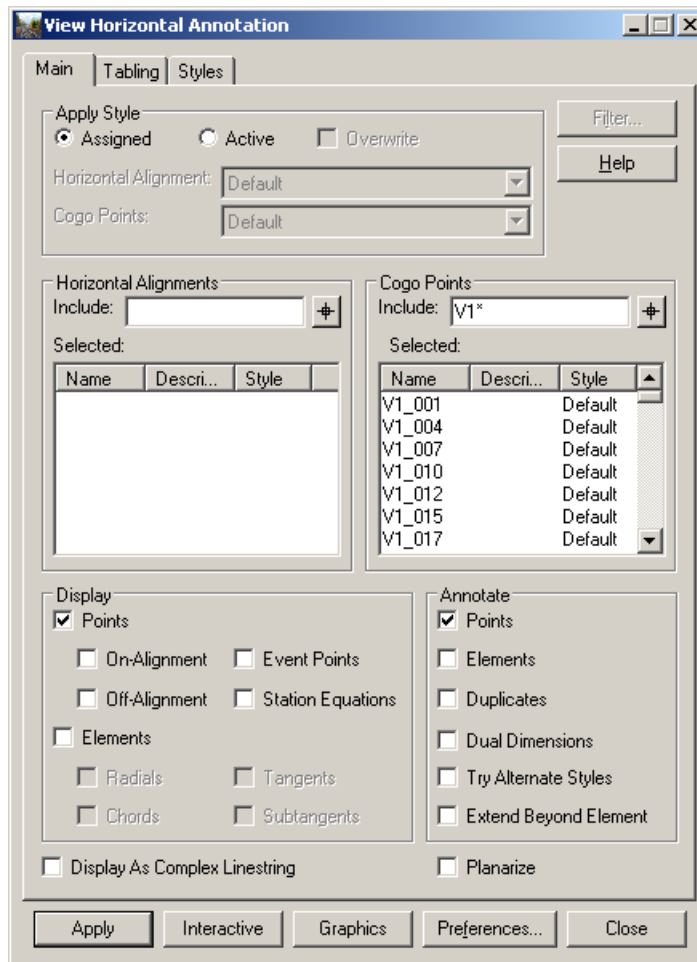
LESSON OBJECTIVE:

This lesson will show how to use the regression analysis for existing tracks

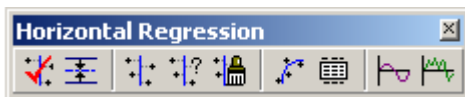
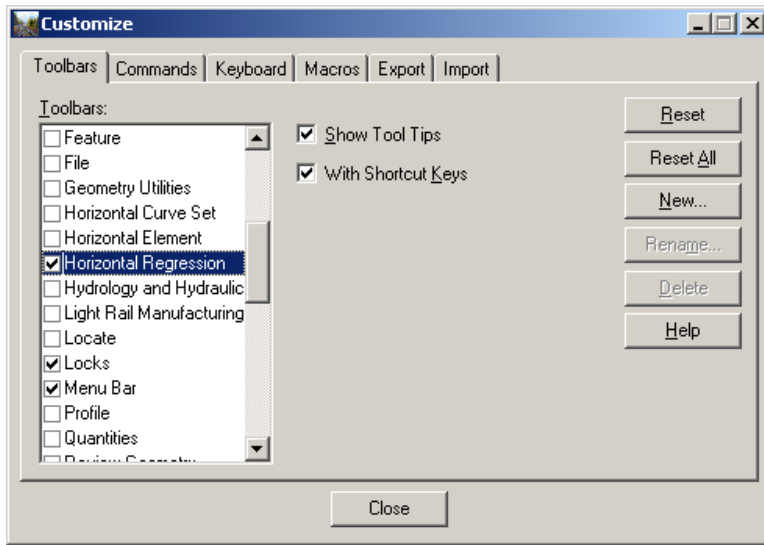
1.1 EXERCISE: REGRESSION ANALYSIS

This exercise will guide you through the steps to get a new alignment on survey points. The regression analysis allows you to find the best fit alignment based on survey points.

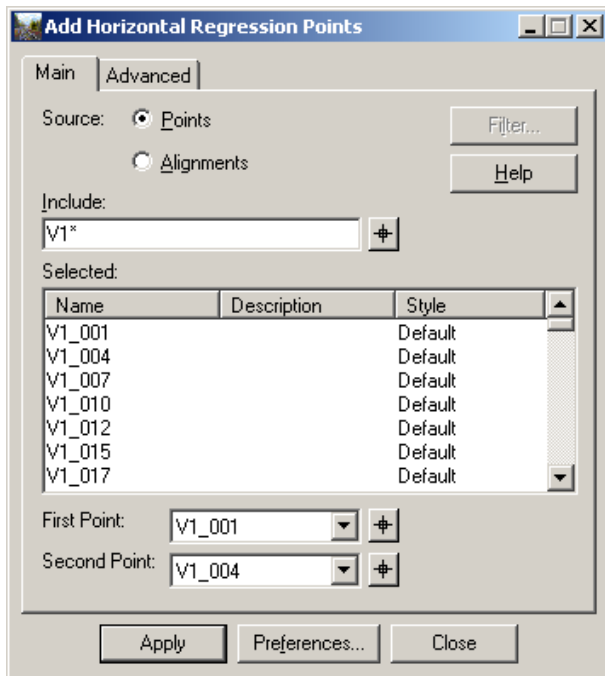
1. Load the file _work.dgn
2. Load the file Regression.alg
3. View the cogo points V1* Geometry > View Geometry > Horizontal Annotation ...



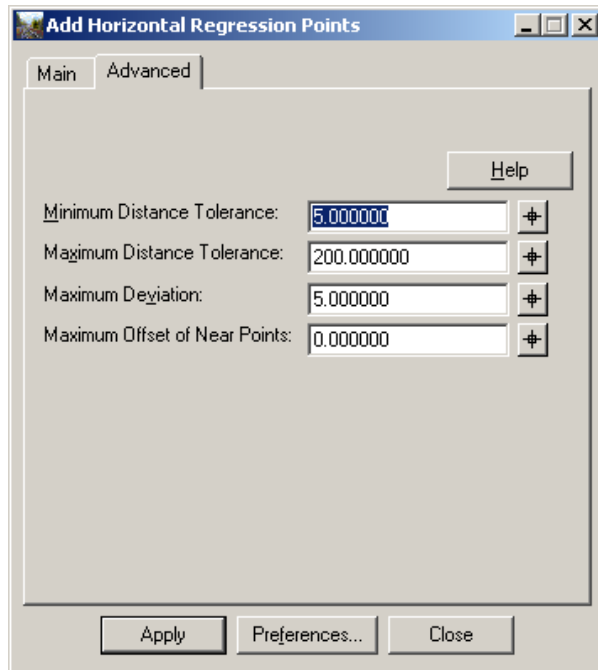
4. Customize BRT with the palette for Horizontal Regression Tools > Customize ...



5. Load survey points V1* into the regression buffer

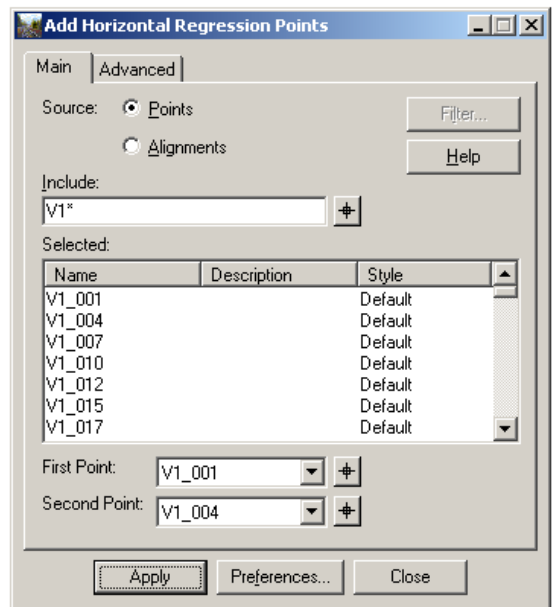
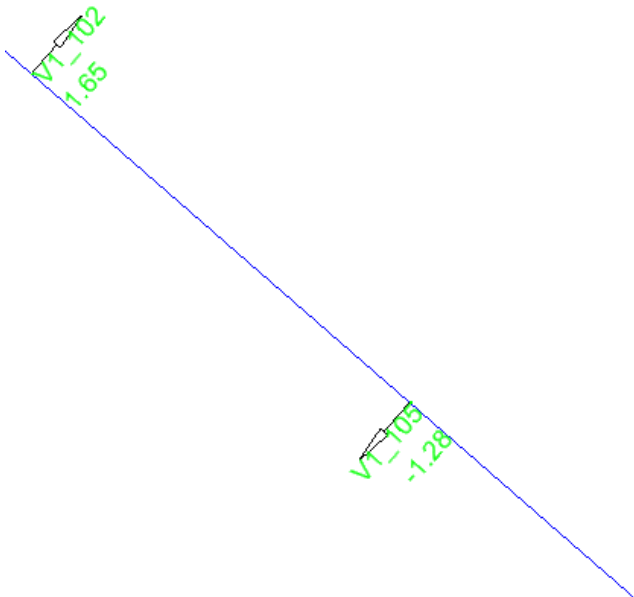


Under the Advanced tab you can define i.e. the regression band width or distance tolerances.



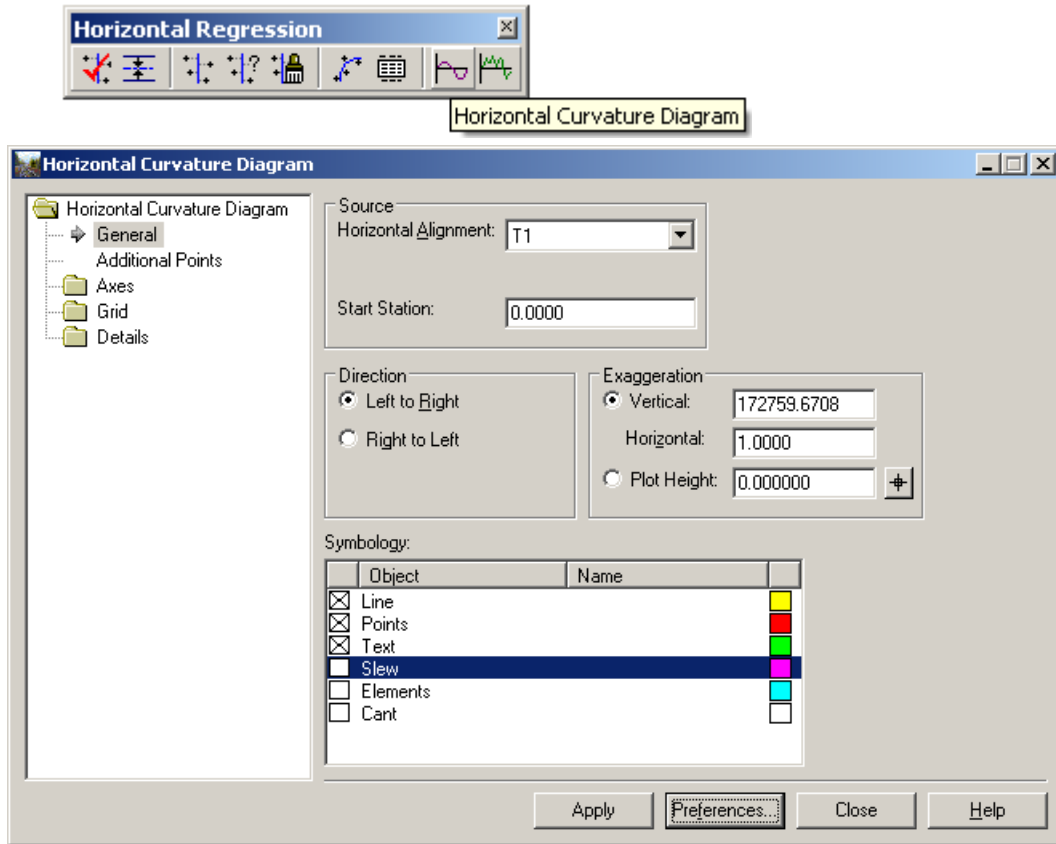
Go back to the Main tab and hit Apply.

The result should look like this:



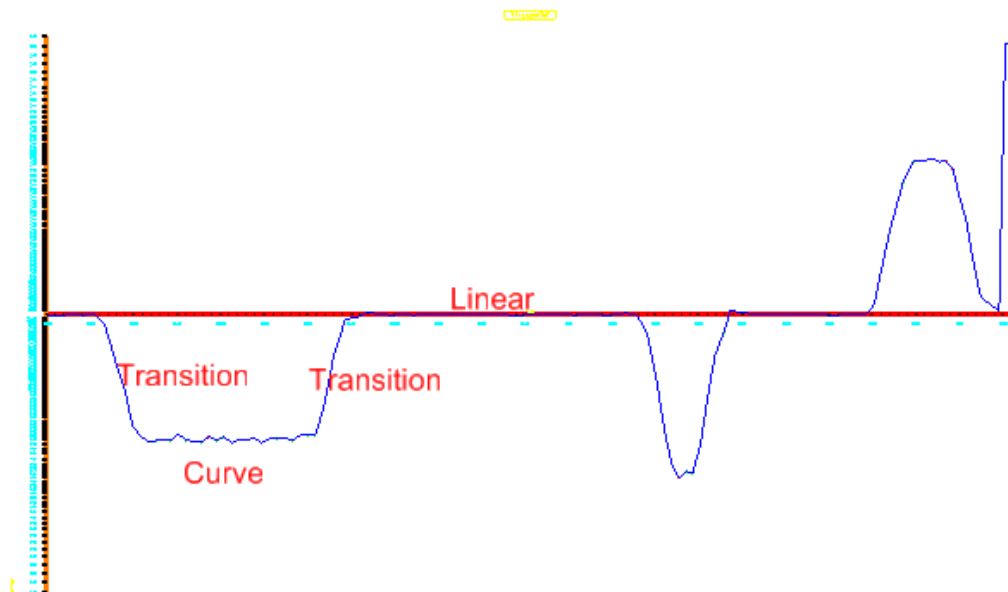
The blue line is the control line which gives you a graphical feedback that all points are now in the regression buffer.

6. Create a curvature diagram



Hit Apply and place the diagram into the drawing.

Note: Do not place the curvature diagram across the survey points in the plan

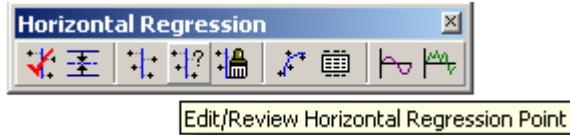


The diagram can be interpreted as shown above.

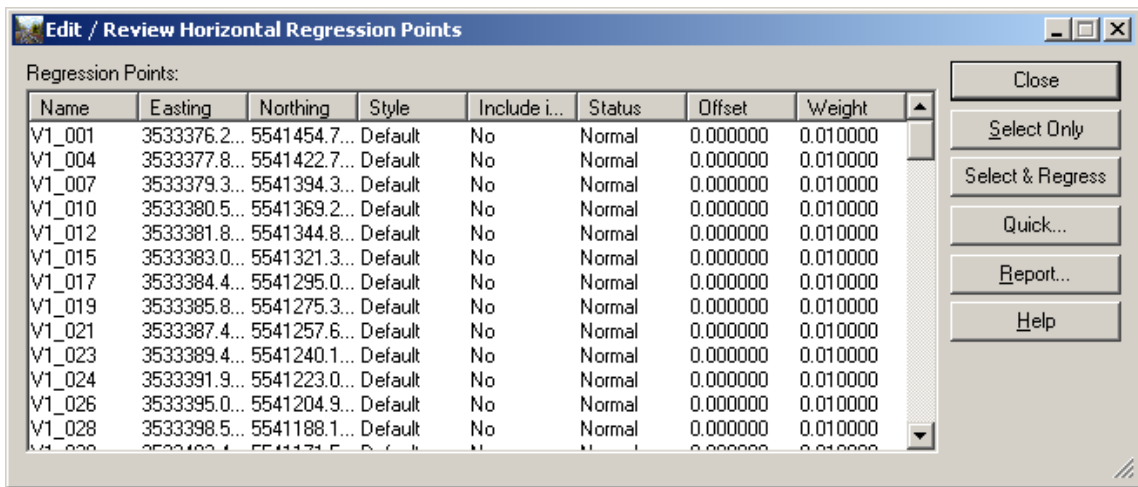
1.2 EXERCISE: ALIGNMENT CREATION

1.1.1 USE DIFFERENT REGRESSION METHODS FOR ALIGNMENT CREATION

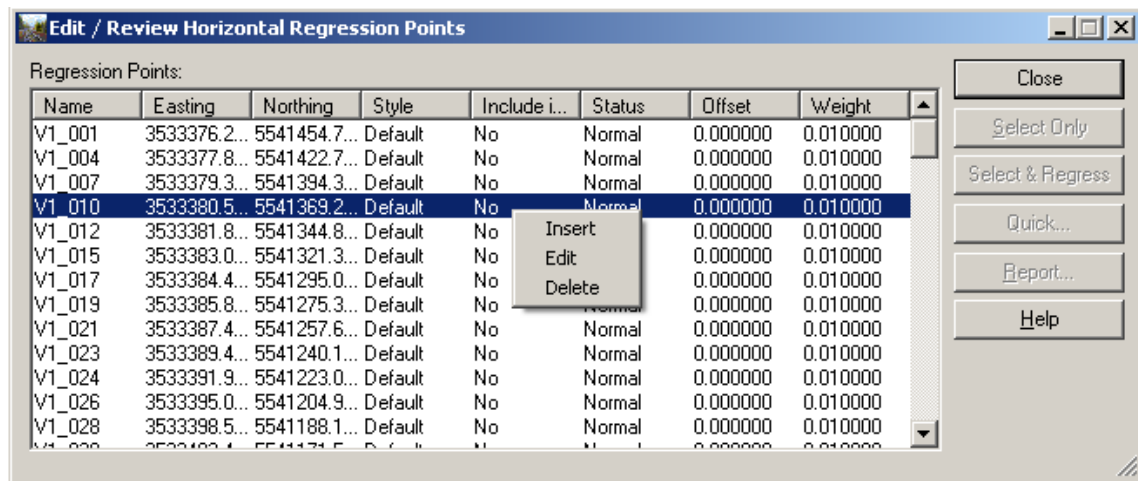
Use the Edit/Review regression points command



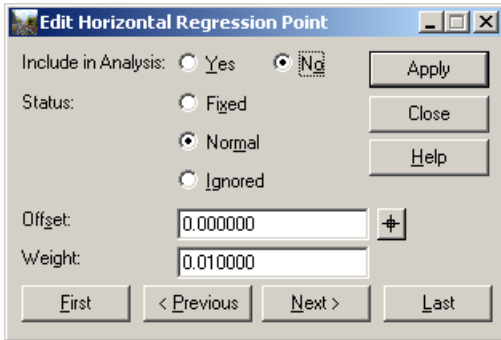
This command calls a dialog box which gives you the regression points.



If you select a point by using the right mouse click you can add the point to the regression analysis or change the point state.



You can select multiple regression points in the list before you click Edit; your edits will apply to all selected points.

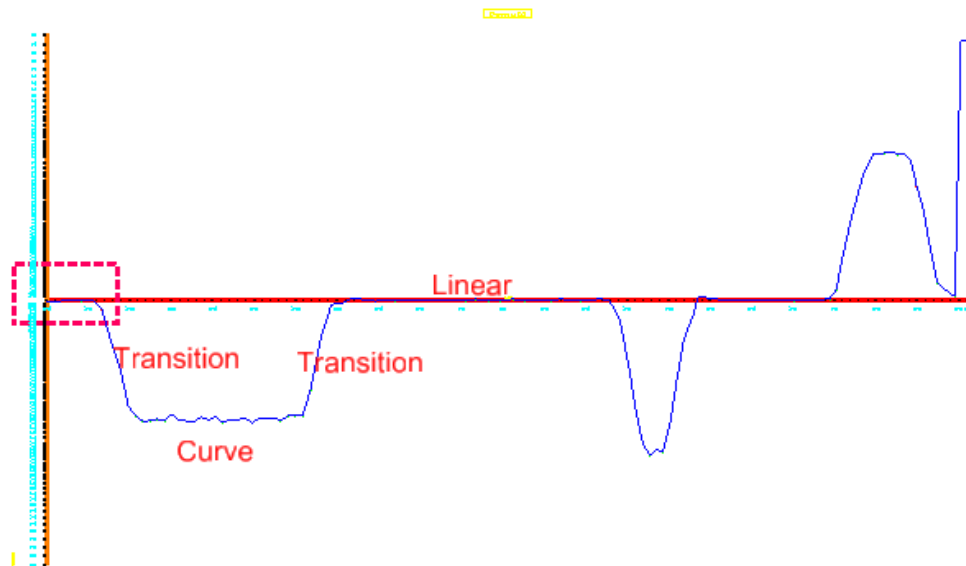


Close the dialog box.

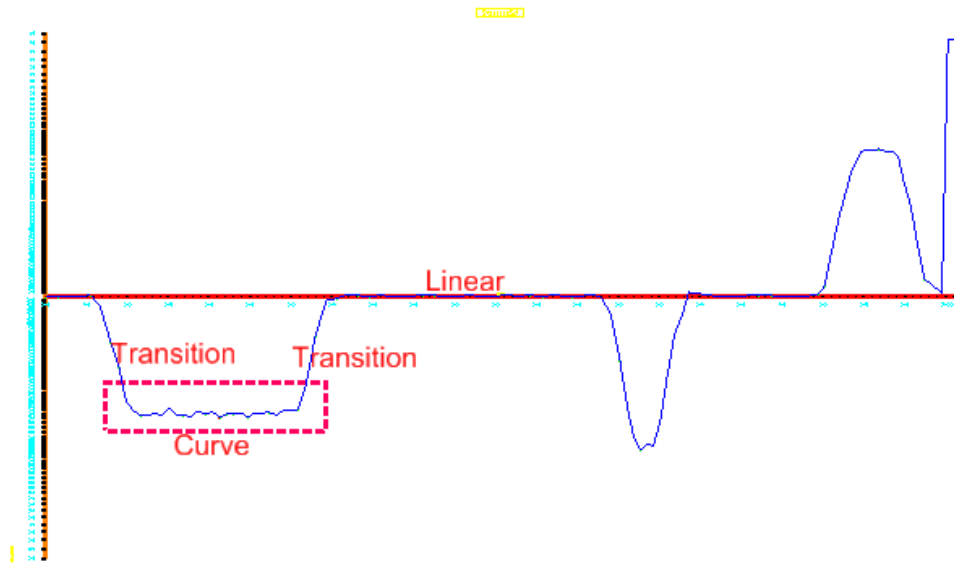
1.1.2 USE SELECT & REGRESS

Select & Regress lets you select points from graphics (plan, curvature, slew), then automatically regress an element using the selected points. The element created is added to the end of the horizontal element list.

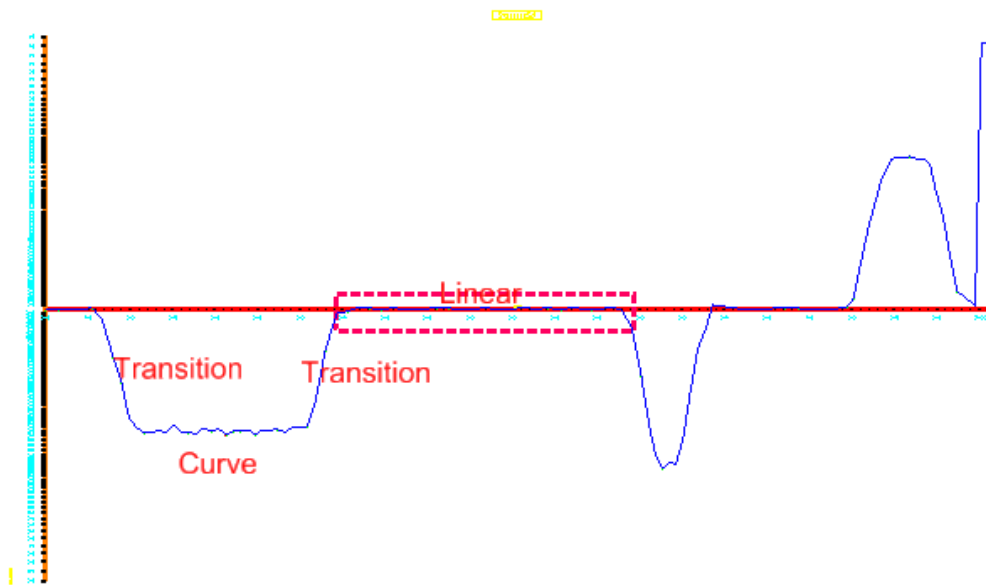
Place a selection fence along the points. Watch for the command on left lower side of MicroStation



Accept this solution and move on the next circular element.



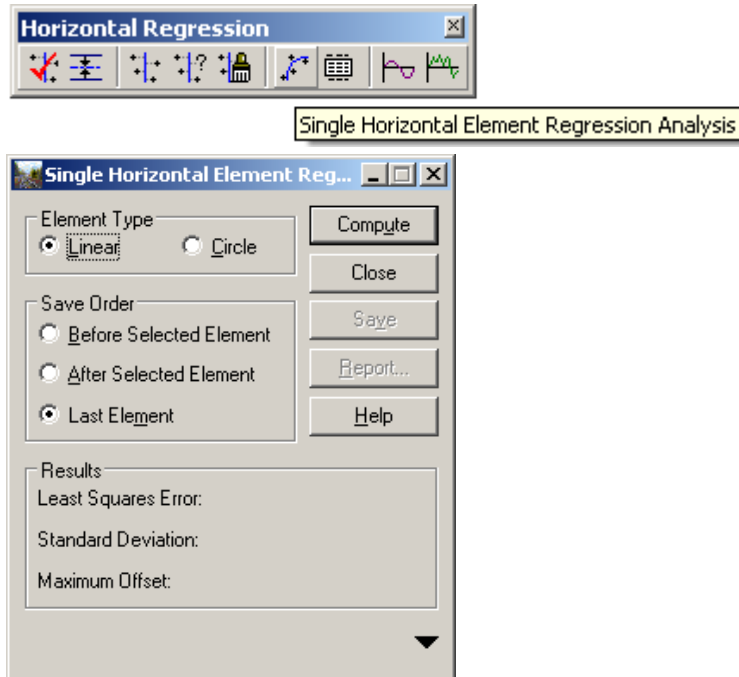
Accept this solution and move on the next linear elements.



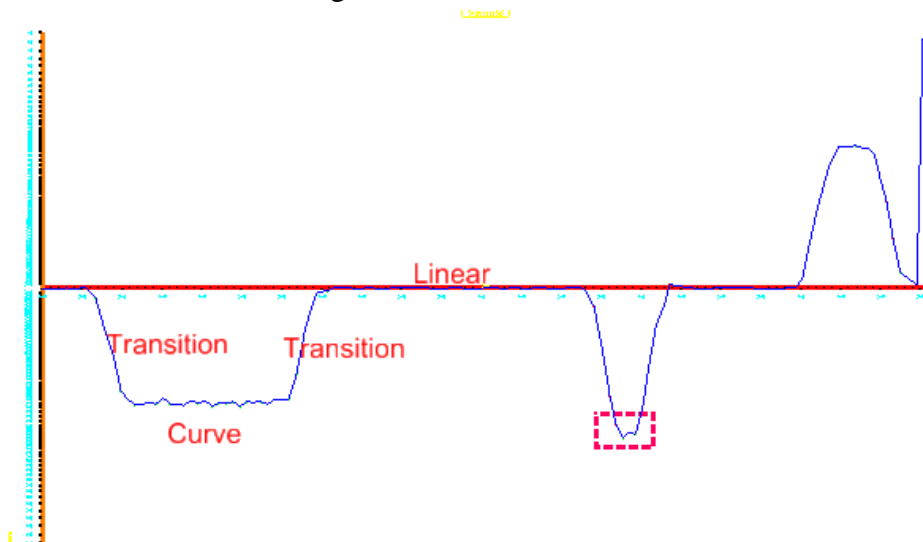
Accept this solution

1.1.3 USE REGRESS ONLY

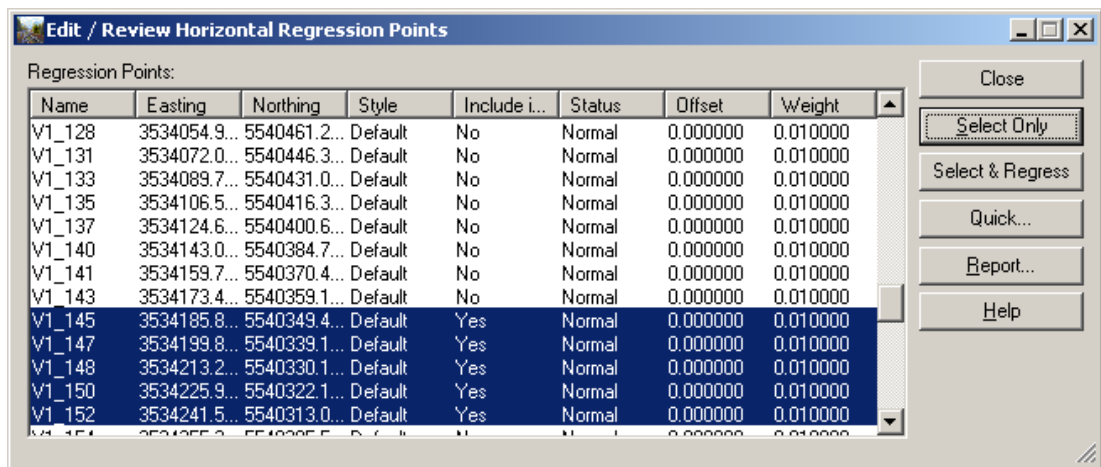
The Edit/Review regression point box must be open and you must call the Single Element Regression dialog box.



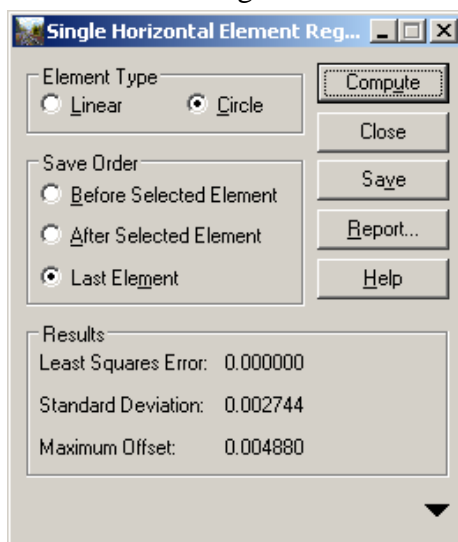
The box let you decide which type of element you want to regress. Select in the curvature diagram the next curve.



The point are selected in the dialog box as well



Select in the dialog box Curve and hit Compute.



Save the solution. If you click on Report the software gives you the slew values along the calculated element.

Move on with the next linear and circular element.

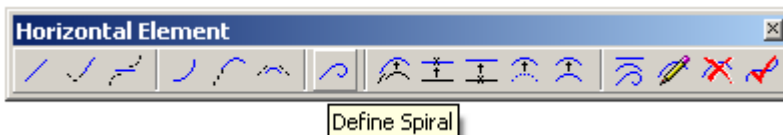
Check the Integrity.

Type	Station ...	Easting @ ...	Nothing ...	Direction @ Start	Easting @ ...	Nothing ...	Direction @ End	Length	Radius	Constant	Integrity ...	Integrity ...	Elemen
Linear	0.0000	3533376.222	5541454.722	136.746483	3533383.046	5541321.310	136.746483	133.58530			OK	OK	OK
Circular	133.9883	3533387.431	5541257.653	136.644484	3533590.884	5540873.258	146.990323	440.12034	-600.57447...		Non-coinci...	Non-coinci...	OK
Linear	573.7067	3533617.836	5540840.559	145.503037	3534143.064	5540384.745	145.503037	695.43628			Non-coinci...	Non-coinci...	OK
Circular	1269.1429	3534185.847	5540349.406	141.350109	3534241.528	5540313.018	132.349352	66.571528	-470.85835...		Non-coinci...	Non-coinci...	OK
Linear	1335.7145	3534356.074	5540254.465	129.707926	3534599.034	5540132.071	129.707926	272.04806			Non-coinci...	Non-coinci...	OK
Circular	1607.7625	3534677.030	5540088.717	136.886475	3534747.929	5540032.257	148.739341	90.764611	487.49904...		Non-coinci...	Non-coinci...	OK

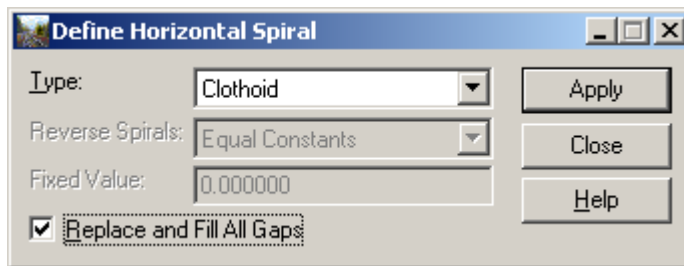
The elements are not connected but in the right order.

1.1.4 CLOSE THE TRACK WITH SPIRALS

Call the Horizontal Element palette



To make life easier turn the check box for Replace and Fill Gaps on.



Hit apply and identify the 1st and then the last (2nd) element in the alignment.

Check the Integrity again.

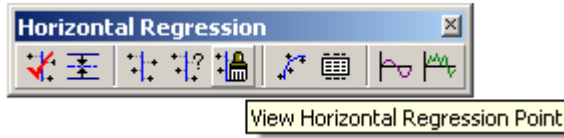
Type	Station ...	Easting @ ...	Nothing ...	Direction @ Start	Easting @ ...	Nothing ...	Direction @ End	Length	Radius	Constant	Integrity ...	Integrity ...	Elemen
Linear	0.0000	3533376.222	5541454.722	136.746483	3533383.046	5541321.310	136.746483	133.58530			OK	OK	OK
Clothoid	129.4426	3533382.034	5541325.448	136.746483	3533388.444	5541248.297	132.645849	77.363141		215.55957...	OK	OK	OK
Circular	206.8117	3533388.444	5541248.297	132.645849	3533566.600	5540886.686	149.069095	411.09446	-600.57447...		OK	OK	OK
Clothoid	617.9062	3533566.600	5540886.686	149.069095	3533616.576	5540841.652	145.503037	67.282398		201.01849...	OK	OK	OK
Linear	685.1891	3533616.576	5540841.652	145.503037	3534138.028	5540389.115	145.503037	690.43639			OK	OK	OK
Clothoid	1375.6245	3534138.028	5540389.115	145.503037	3534186.434	5540348.961	141.250493	62.905544		172.10345...	OK	OK	OK
Circular	1438.5301	3534186.434	5540348.961	141.250493	3534231.053	5540319.029	133.982203	53.757918	-470.85835...		OK	OK	OK
Clothoid	1492.2880	3534231.053	5540319.029	133.982203	3534286.858	5540289.333	123.707926	63.227022		172.54266...	OK	OK	OK
Linear	1595.5150	3534286.858	5540289.333	123.707926	3534594.425	5540134.393	123.707926	344.38923			OK	OK	OK
Clothoid	1898.3043	3534594.425	5540134.393	123.707926	3534663.931	5540096.993	134.863070	78.952237		196.18649...	OK	OK	OK
Circular	1978.8565	3534663.931	5540096.993	134.863070	3534747.929	5540032.257	148.739341	106.25916	487.49904...		OK	OK	OK

All gaps are close with transitions.

Save your work.

2. VIEW REGRESSION POINTS

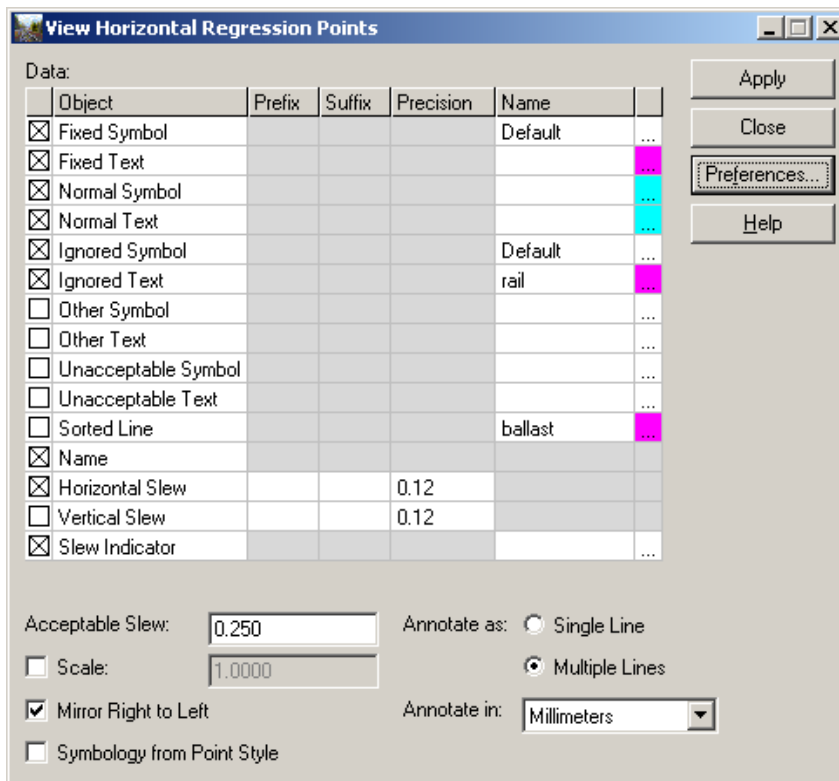
Geometry > View Geometry > Horizontal Regression > View Horizontal Regression ...



Used to display regression points for the active horizontal or vertical alignment. You can define different symbologies for different types of regression points: *fixed*, *normal*, and *ignored*. The status of a regression point is determined on the Edit Horizontal Regression Point dialog box.

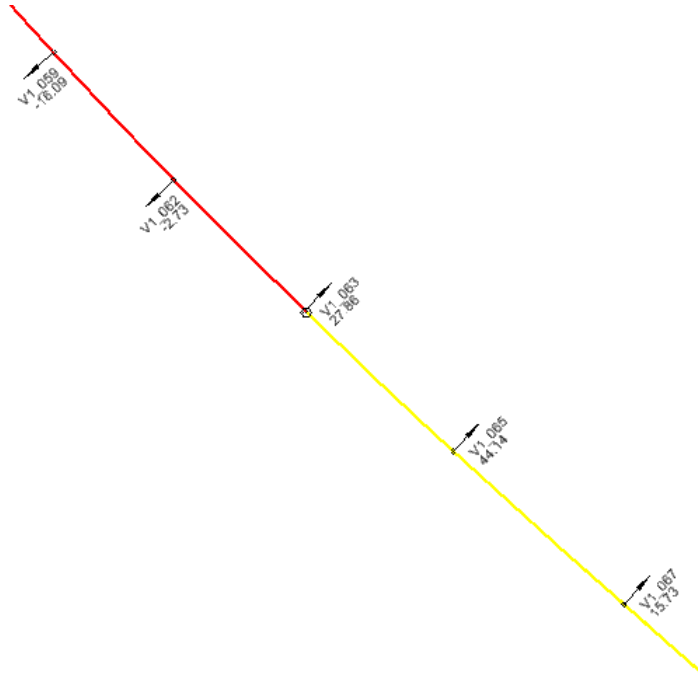
Other functions for this command:

- Annotate point name and slew value on multiple rows
- Display a directional indicator to indicate the slew direction
- Display other points of interest (platform edges, overhead line poles and other track furniture)
- Horizontal regression points are updated as the horizontal alignment is edited.



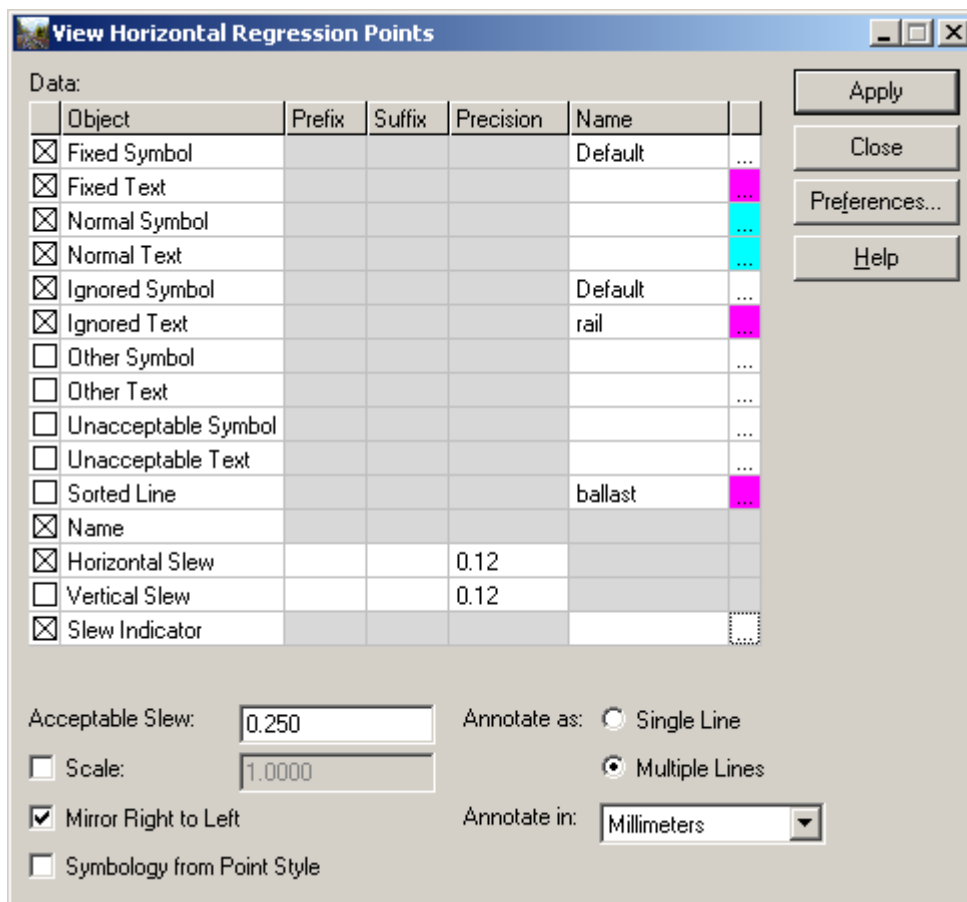
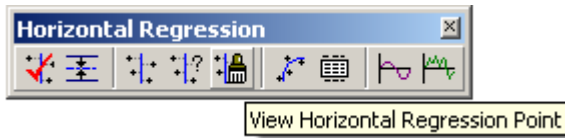
Hit Apply.

The result should look like this:



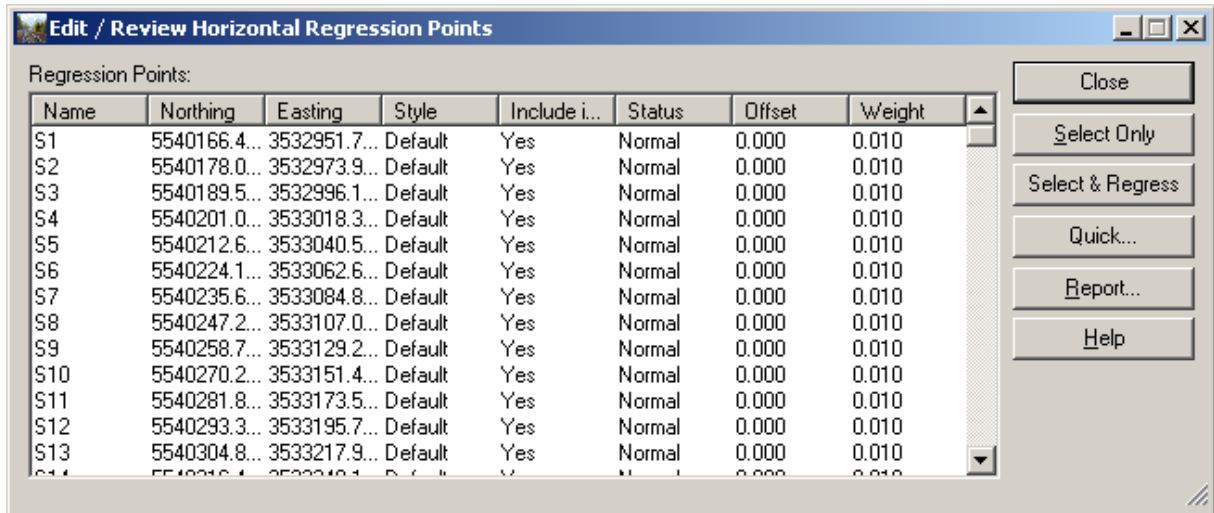
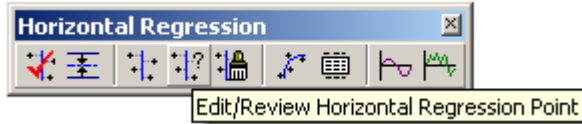
3. LOAD THE FILE IDEAL WORLD.ALG

3.1 DISPLAY THE REGRESSION POINTS

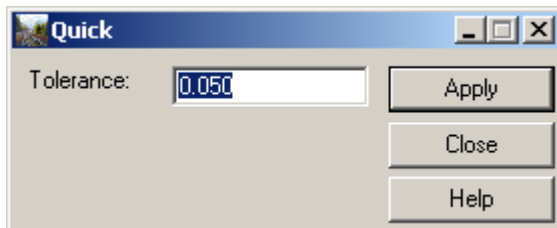


3.2 USE THE QUICK REGRESSION

Go to Edit/Review Horizontal Regression Points ...



Select Quick ...



Apply this tolerance.

The software creates a best fit alignment based on the regression points. Check the integrity.

WORKING WITH RAIL GEOMETRY BENTLEY RAIL TRACK V81

Type	Station...	Northing...	Easting @ ...	Direction @ Start	Northing...	Easting @ ...	Direction @ End	Length	Radius	Constant	Integrity ...	Integrity ...	Elemen
Linear	0.000	5540166.474	3532951.792	N 62°31'33.0" E	5540462.009	3533520.133	N 62°31'33.0" E	640.588			OK	OK	OK
Clothoid	640.588	5540462.009	3533520.133	N 62°31'33.0" E	5540487.843	3533571.127	N 64°20'42.4" E	57.167		226.853	OK	OK	OK
Circular	697.755	5540487.843	3533571.127	N 64°20'42.4" E	5540434.602	3534446.125	S 57°22'51.9" E	915.571	900.205		OK	OK	OK
Linear	1612.855	5540434.602	3534446.125	S 57°22'51.9" E	5540258.809	3534720.804	S 57°22'51.9" E	326.116			OK	OK	OK
Circular	1938.971	5540258.809	3534720.804	S 57°22'51.9" E	5540247.931	3535237.803	N 59°47'30.6" E	543.959	-496.069		OK	OK	OK
Linear	2482.007	5540247.931	3535237.803	N 59°47'30.6" E	5540482.590	3535640.856	N 59°47'30.6" E	466.387			OK	OK	OK
Circular	2948.394	5540482.590	3535640.856	N 59°47'30.6" E	5540507.578	3536195.905	S 64°56'49.5" E	577.745	599.018		OK	OK	OK
Linear	3525.467	5540507.578	3536195.905	S 64°56'49.5" E	5540084.593	3537100.816	S 64°56'49.5" E	998.890			OK	OK	OK

Select all elements and delete them.

Type	Station...	Northing...	Easting @ ...	Direction @ Start	Northing...	Easting @ ...	Direction @ End	Length	Radius	Constant	Integrity ...	Integrity ...	Elemen
Linear	0.000	5540166.474	3532951.792	N 62°31'33.0" E	5540462.009	3533520.133	N 62°31'33.0" E	640.588			OK	OK	OK
Clothoid	640.588	5540462.009	3533520.133	N 62°31'33.0" E	5540487.843	3533571.127	N 64°20'42.4" E	57.167		226.853	OK	OK	OK
Circular	697.755	5540487.843	3533571.127	N 64°20'42.4" E	5540434.602	3534446.125	S 57°22'51.9" E	915.571	900.205		OK	OK	OK
Linear	1612.855	5540434.602	3534446.125	S 57°22'51.9" E	5540258.809	3534720.804	S 57°22'51.9" E	326.116			OK	OK	OK
Circular	1938.971	5540258.809	3534720.804	S 57°22'51.9" E	5540247.931	3535237.803	N 59°47'30.6" E	543.959	-496.069		OK	OK	OK
Linear	2482.007	5540247.931	3535237.803	N 59°47'30.6" E	5540482.590	3535640.856	N 59°47'30.6" E	466.387			OK	OK	OK
Circular	2948.394	5540482.590	3535640.856	N 59°47'30.6" E	5540507.578	3536195.905	S 64°56'49.5" E	577.745	599.018		OK	OK	OK
Linear	3525.467	5540507.578	3536195.905	S 64°56'49.5" E	5540084.593	3537100.816	S 64°56'49.5" E	998.890			OK	OK	OK

Repeat the Quick regression by changing the tolerance. Tolerance defines the tolerance within all points shall fit.

Quick

Tolerance:

Apply

Close

Help

View the result.

Attempt to replace circular arcs (that should be transition spirals) with transition spirals. In this context the software looks for three adjacent circular arcs with the middle arc's radius less than the adjacent circular arcs' radii.

4. LESSON NAME: CANT ALIGNMENT CREATION

LESSON OBJECTIVE:

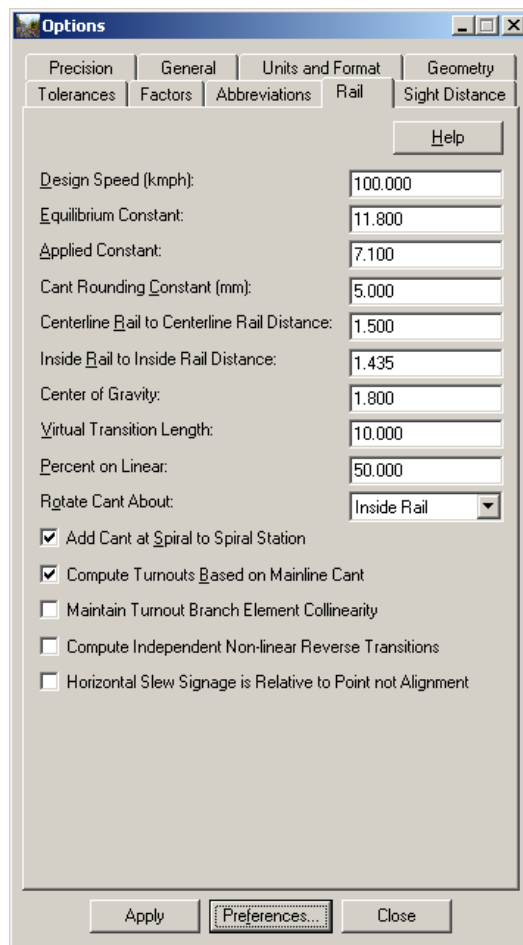
This lesson will show how use the Cant Alignment Creation

4.1 EXERCISE: CANT ALIGNMENT CREATION

This exercise will guide you through the Cant Alignment Creation

5.1.2 SETUP RAIL & GEOMETRY DEFAULTS

Go to Tools > Options > Rail ...



The Rail Tab specifies cant parameters for the Cant Editor and the Maglev Superelevation Editor commands located on the Geometry > Superelevation menu. Use this tab to set default cant values used by the Cant Editor and Maglev Superelevation Editor commands

The Equilibrium Constant specifies the equilibrium constant used to calculate the equilibrium cant. This value can differ in various countries.

The cant equation: $D = 11.8 * v^{**} / R$

1. Load the geometry file called Cant.alg
2. Use the empty alignment A1
3. Create a simple horizontal alignment by using the PI-method. Insert into the horizontal alignment some spirals.



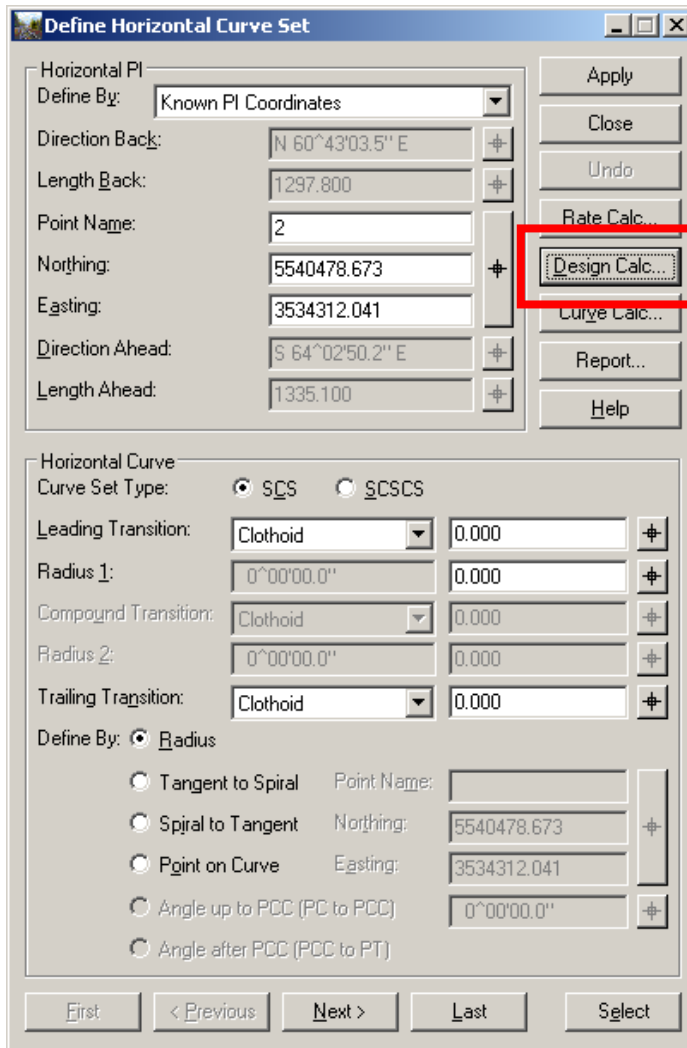
Add PI

Create 3 PI's

Insert curves and spirals



Define Curve



Use the Design Calculator to calculate the cant based on radius & speed

The 'Design Calculators' dialog box is shown with the following settings:

- Compute: Cant
- Define By: Applied Constant
- Design Speed (kmph): 100.000
- Equilibrium Constant: 11.800
- Applied Constant: 7.100
- Radius: 0.000 (with a secondary field of 900.000)
- Length: 80.000
- Transition: Clothoid
- Compound Transition Rate From: Start Stop
- Always Round Applied Cant

The 'Results' section displays the following values:

Equilibrium Cant (mm):	0.000	131.111
Applied Cant (mm):	0.000	80.000
Cant Deficiency (mm):	0.000	51.111
Non-compensating Lateral Acceleration (m/s*s):	0.000	0.335
Applied Rate of Change (mm/s):	27.778	
Deficiency Rate of Change (mm/s):	17.747	
Applied Cant Gradient:	1000.000	
Desirable Length @ 35 mm/s	63.492	
Minimum Length @ 55 mm/s	40.404	

In this dialog box the user can create various scenarios to get the best geometric values for improving speed on a new or existing alignment. This Design Calculator can also use for existing alignment to improve speed on tracks.

Based on given values the software can compute the applied cant based on speed:

Design Calculators

Cant Calculator | Table Lookups

Compute: **Speed** [OK] [Help] [Other Rules...]

Define By: Applied Cant

Design Speed (kmph): 99.293

Equilibrium Constant: 11.800

Applied Constant: 7.100

Radius: 1000.000 1000.000

Length: 80.000

Transition: Clothoid

Compound Transition Rate From: Start Stop

Always Round Applied Cant

Results

Equilibrium Cant (mm):	116.338	116.338
Applied Cant (mm):	70.000	70.000
Cant Deficiency (mm):	46.338	46.338
Non-compensating Lateral Acceleration (m/s*s):	0.303	0.303
Applied Rate of Change (mm/s):	0.000	
Deficiency Rate of Change (mm/s):	0.000	
Applied Cant Gradient:	0.000	
Desirable Length @ 35 mm/s	0.000	
Minimum Length @ 55 mm/s	0.000	

[Preferences...] [Cancel]

Toggle back to cant and click OK.

Horizontal PI

Define By: Known PI Coordinates

Direction Back: N 55°11'01.0" E

Length Back: 2087.848

Point Name:

Northing: 5540223.058

Easting: 3534717.804

Direction Ahead: S 57°09'48.4" E

Length Ahead: 2015.173

Horizontal Curve

Curve Set Type: SCS SCSCS

Leading Transition: Clothoid 80.000

Radius 1: 5°43'55.1" 1000.000

Compound Transition: Clothoid 0.000

Radius 2: 0°00'00.0" 0.000

Trailing Transition: Clothoid 80.000

Define By: Radius

Tangent to Spiral Point Name:

Spiral to Tangent Northing: 5539878.719

Point on Curve Easting: 3534222.668

Angle up to PCC (PC to PCC) 0°00'00.0"

Angle after PCC (PCC to PT)

Buttons: Apply, Close, Undo, Rate Calc..., Design Calc..., Curve Calc..., Report..., Help

Navigation: First, < Previous, Next >, Last, Select

The dialog box takes the defined values based on the design calculator. Hit apply and move on to the next PI.

Design Calculators

Cant Calculator | Table Lookups

Compute:

Define By:

Design Speed (kmph):

Equilibrium Constant:

Applied Constant:

Radius:

Length:

Transition:

Compound Transition Rate From: Start Stop

Always Round Applied Cant

Results

Equilibrium Cant (mm):	<input type="text" value="188.800"/>	<input type="text" value="188.800"/>
Applied Cant (mm):	<input type="text" value="115.000"/>	<input type="text" value="115.000"/>
Cant Deficiency (mm):	<input type="text" value="73.800"/>	<input type="text" value="73.800"/>
Non-compensating Lateral Acceleration (m/s*s):	<input type="text" value="0.483"/>	<input type="text" value="0.483"/>
Applied Rate of Change (mm/s):	<input type="text" value="0.000"/>	
Deficiency Rate of Change (mm/s):	<input type="text" value="0.000"/>	
Applied Cant Gradient:	<input type="text" value="0.000"/>	
Desirable Length @ <input type="text" value="35 mm/s"/>	<input type="text" value="0.000"/>	
Minimum Length @ <input type="text" value="55 mm/s"/>	<input type="text" value="0.000"/>	

Hit OK.

Define Horizontal Curve Set

Horizontal PI
 Define By: Known PI Coordinates

Direction Back: S 57°09'48.4" E
 Length Back: 2015.173
 Point Name:
 Northing: 5539130.342
 Easting: 3536410.994
 Direction Ahead: N 55°30'48.3" E
 Length Ahead: 1800.593

Apply
 Close
 Undo
 Rate Calc...
 Design Calc...
 Curve Calc...
 Report...
 Help

Horizontal Curve
 Curve Set Type: SCS SCSCS

Leading Transition: Clothoid 120.000
 Radius 1: 6°22'10.1" 900.000
 Compound Transition: Clothoid 0.000
 Radius 2: 0°00'00.0" 0.000
 Trailing Transition: Clothoid 120.000

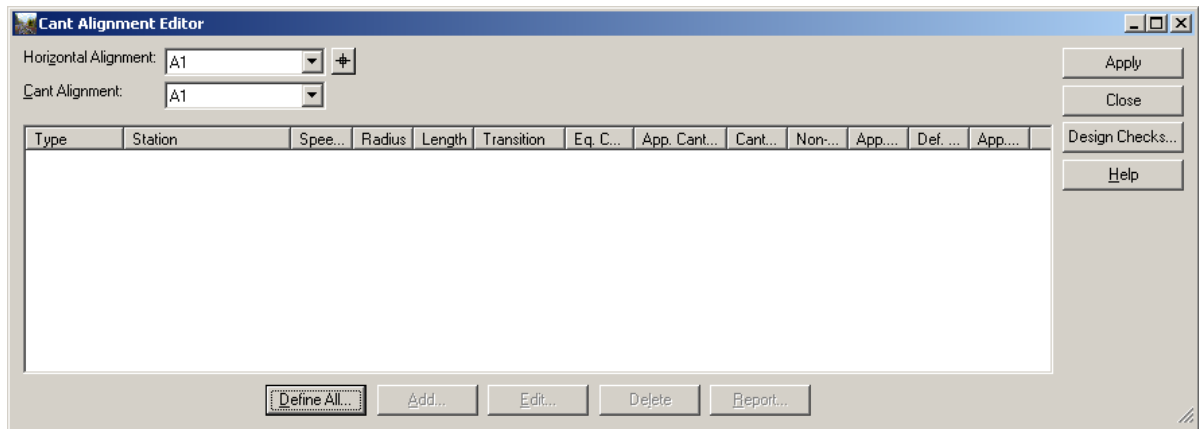
Define By: Radius

Tangent to Spiral Point Name:
 Spiral to Tangent Northing: 5539488.109
 Point on Curve Easting: 3535856.626
 Angle up to PCC (PC to PCC) 0°00'00.0"
 Angle after PCC (PCC to PT)

First < Previous Next > Last Select

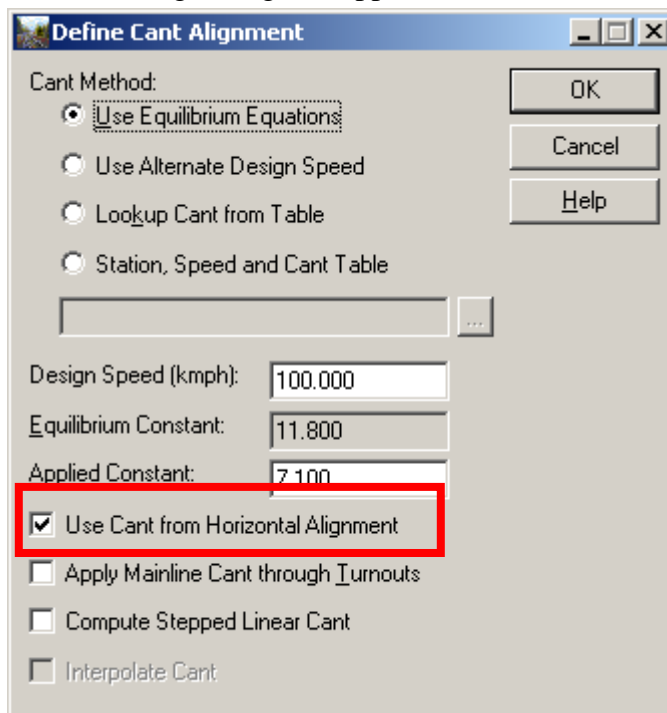
Hit Apply.

5.1.3 EDIT CANT



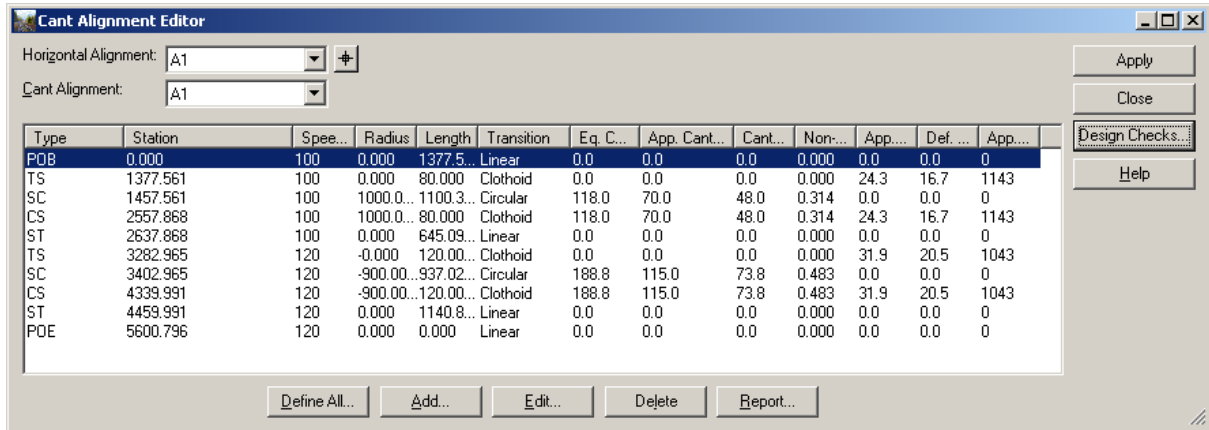
Click on Define All ...

The following dialog box appears:



We have already created cant on elements since we used the Design Calculator. Use Cant from Horizontal Alignment.

Hit OK.

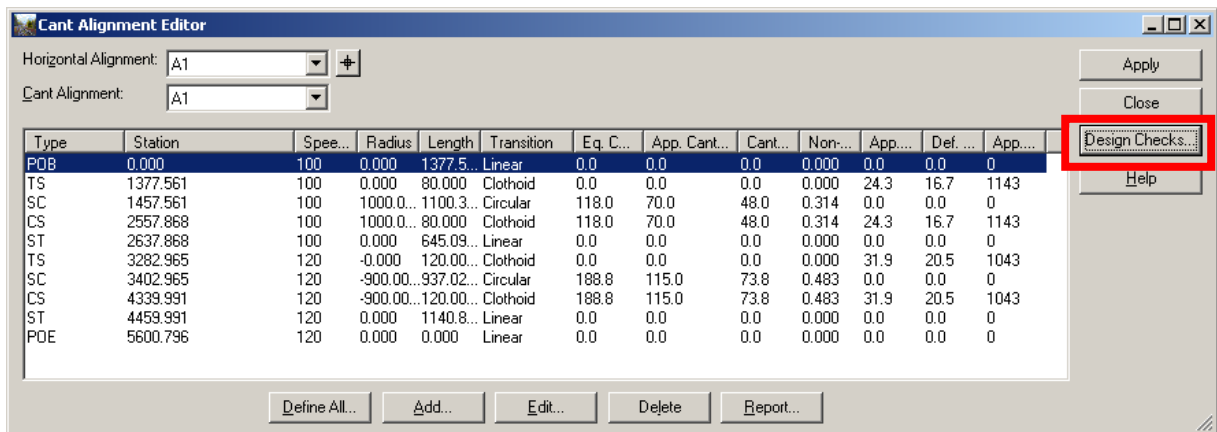


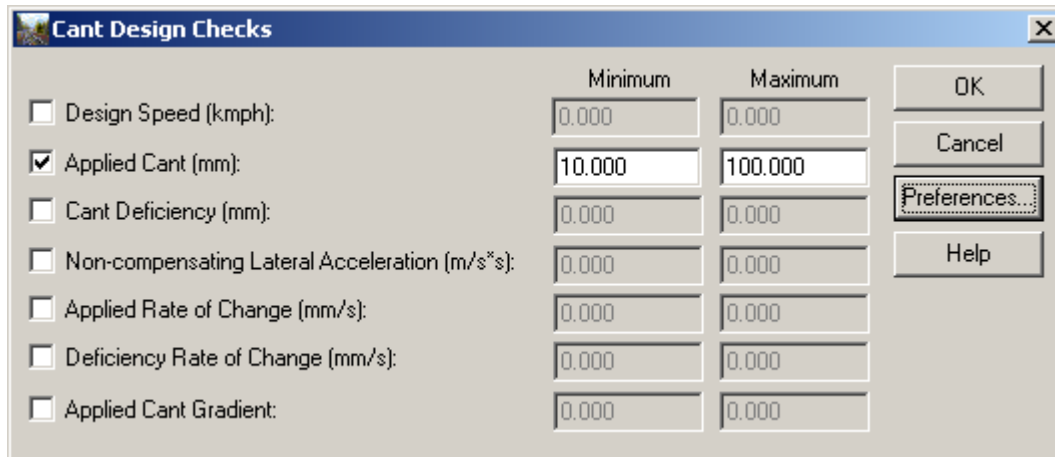
Apply adds the cant values to the alignment.

Note: Cant is defined by coordinate at the circular elements. Any changes in the horizontal alignment changes the cant! The changed values are shown in **RED**.

You also can setup the Design Check for cant related values. Click on Design Checks

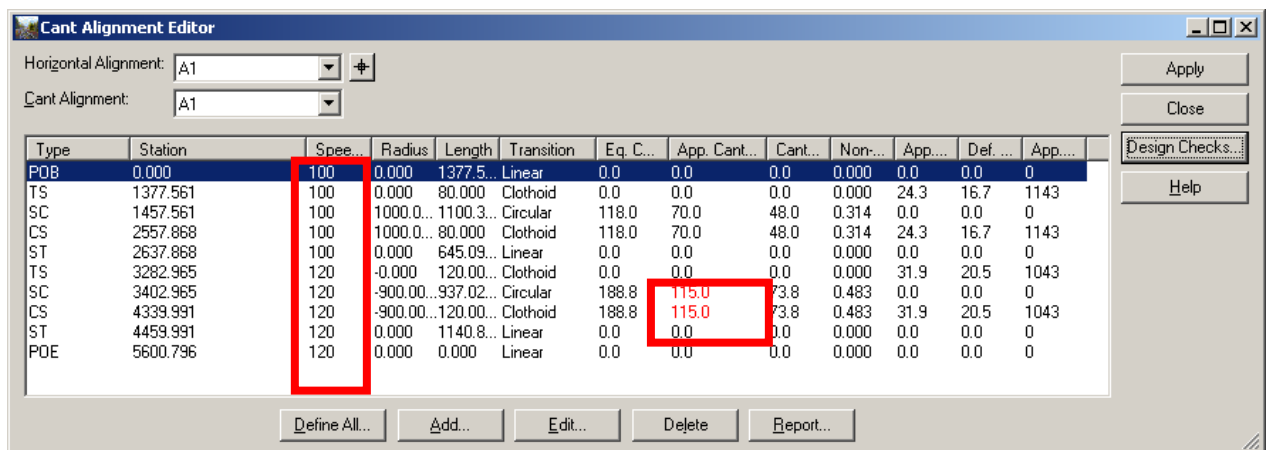
...





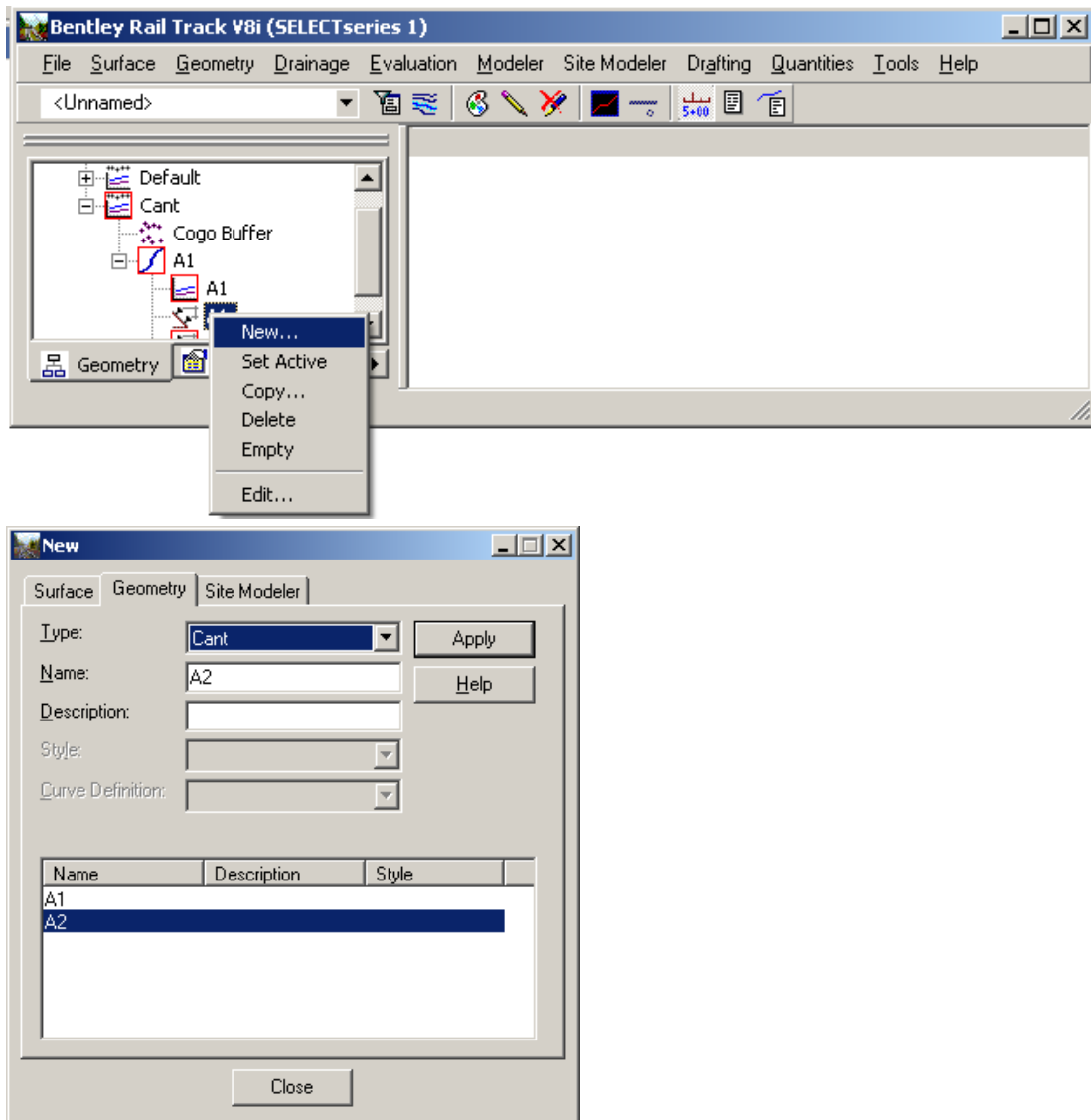
The Design Checks can be saved as Preferences ...

Hit OK.



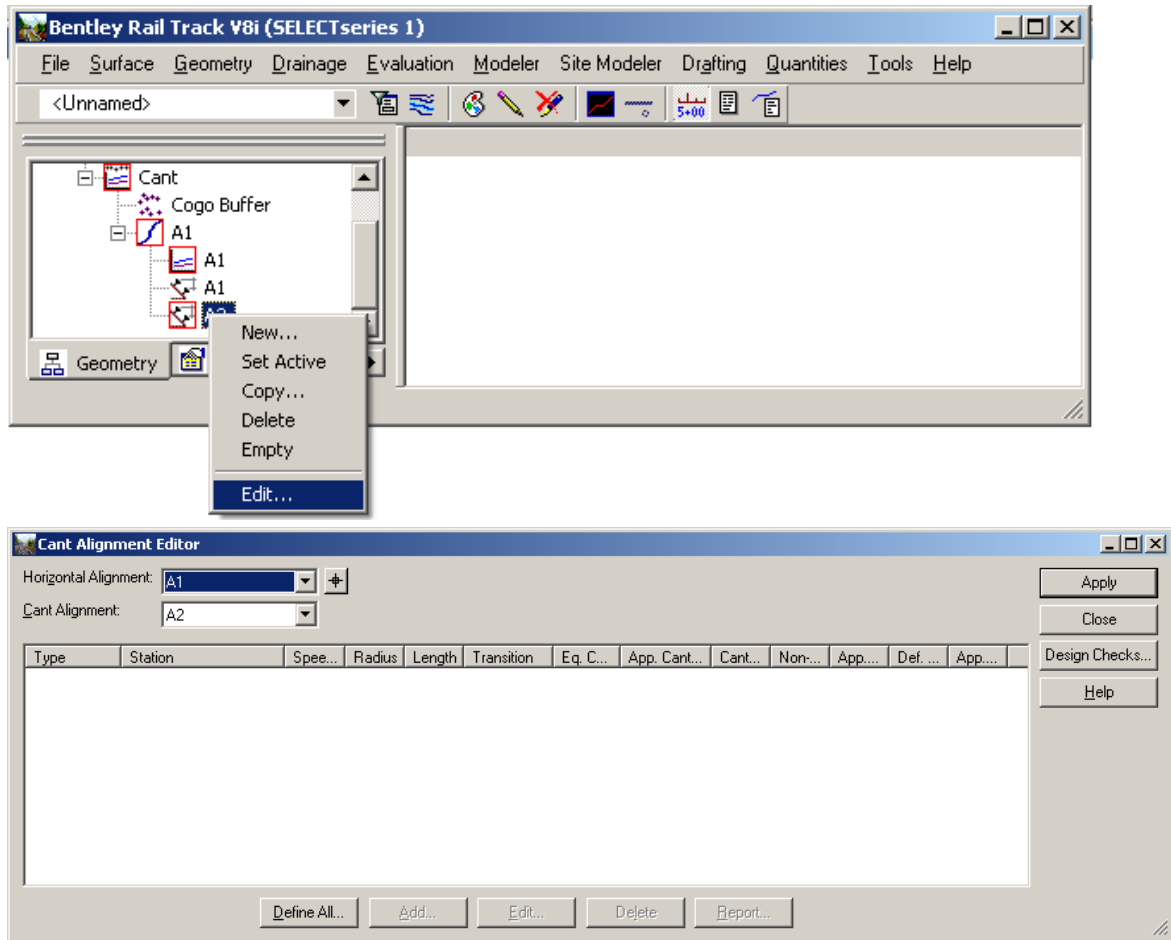
Hit Apply.

5.1.4 CREATE A NEW CANT ALIGNMENT USING THE EQUILIBRIUM EQUATION



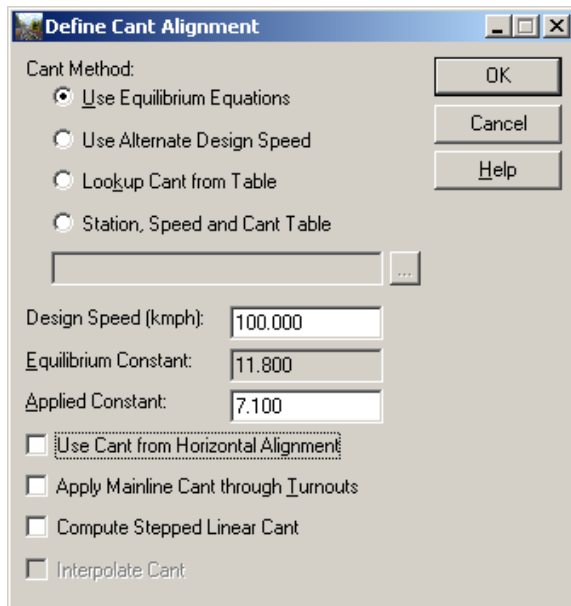
Hit Apply.

5.1.5 EDIT CANT

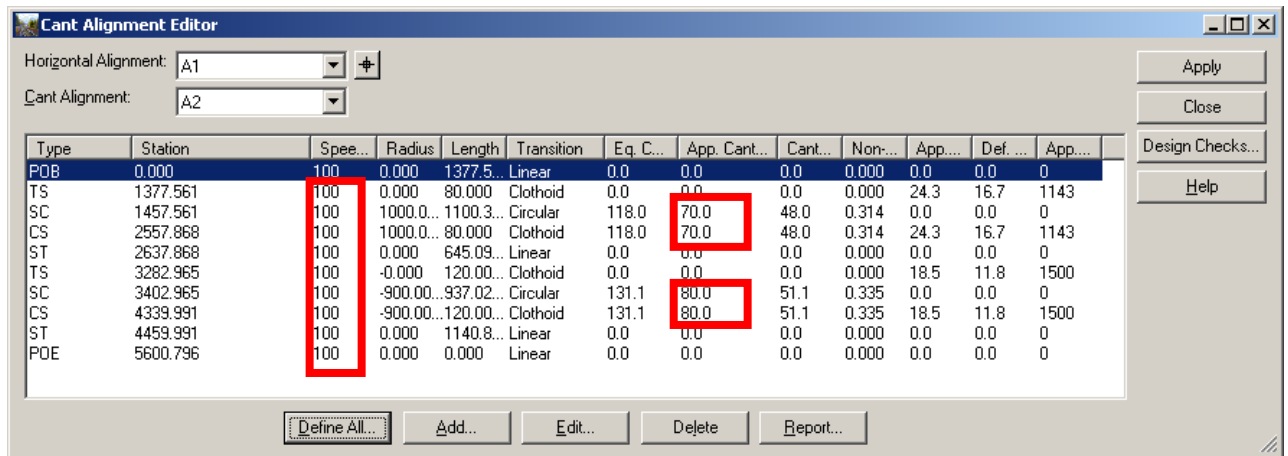


Click on Define All ...

The following dialog box appears:

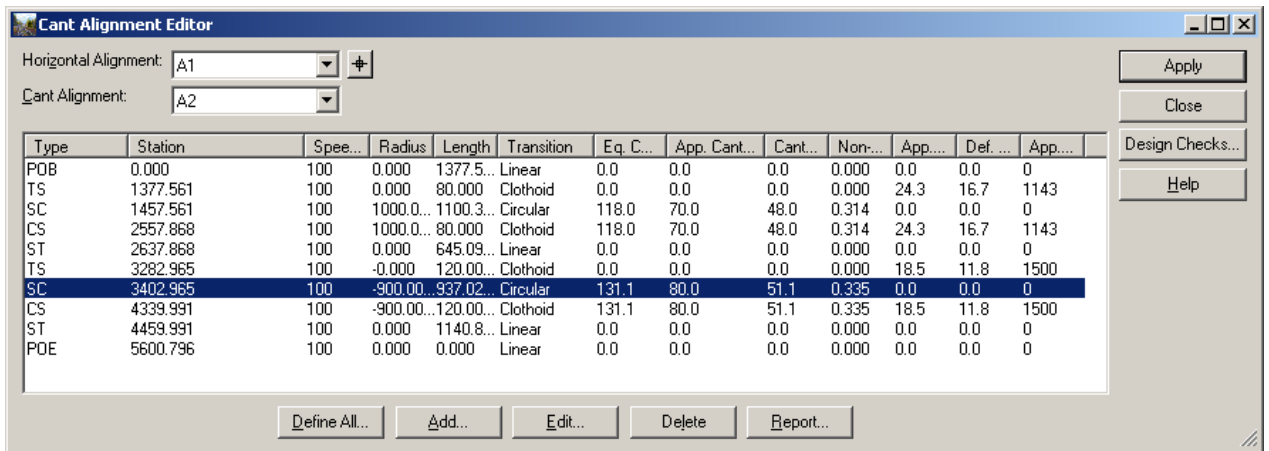


Turn OFF Use Cant from Horizontal Alignment. Hit OK.



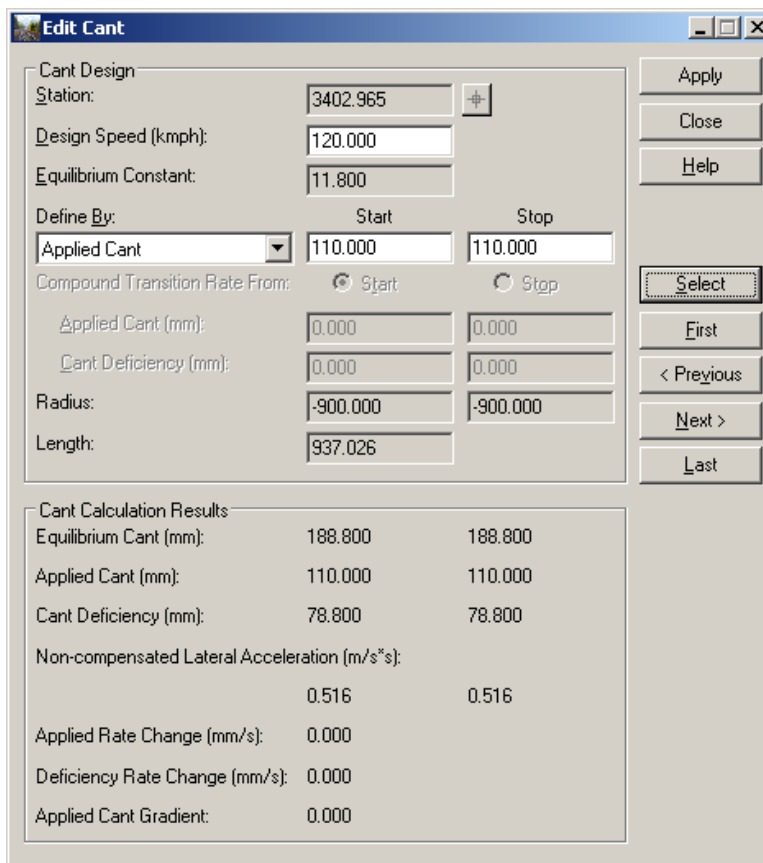
Hit Apply.

Select a cant

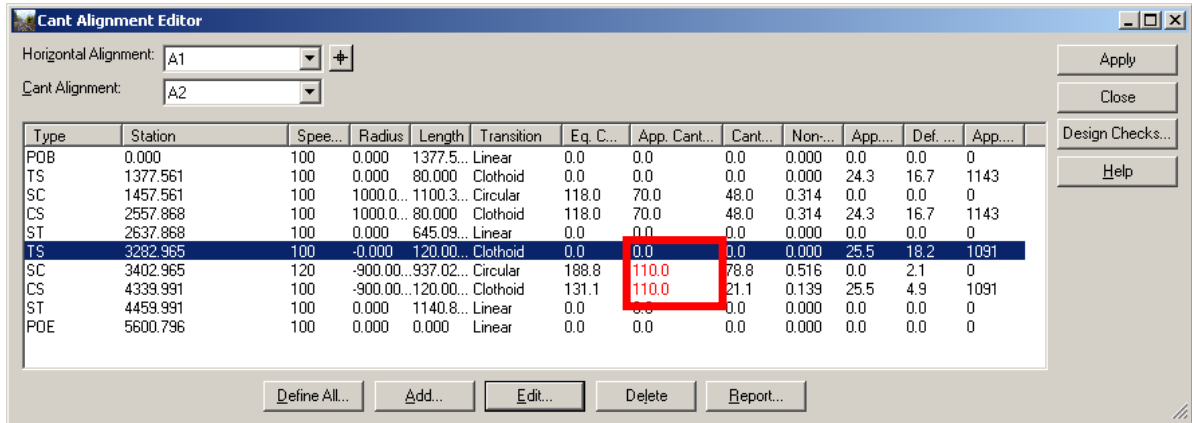


If you want to edit cant go to Edit ...

Change some values and take a look at the results.



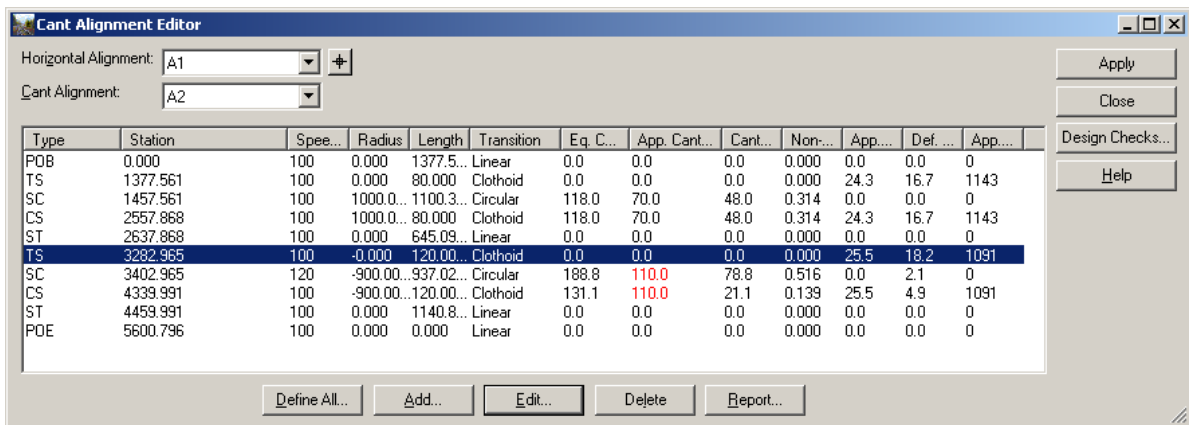
Hit Apply.

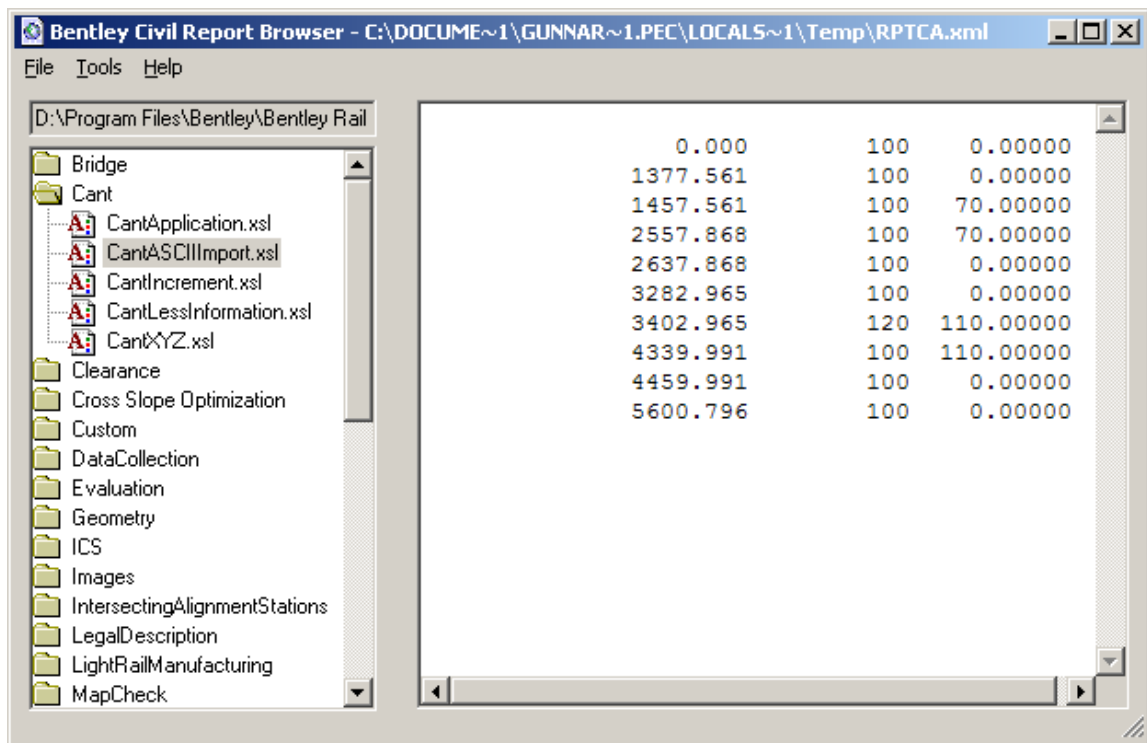


The user defined values are added to the alignment.

5.1.6 CREATE A REPORT (ASCII)

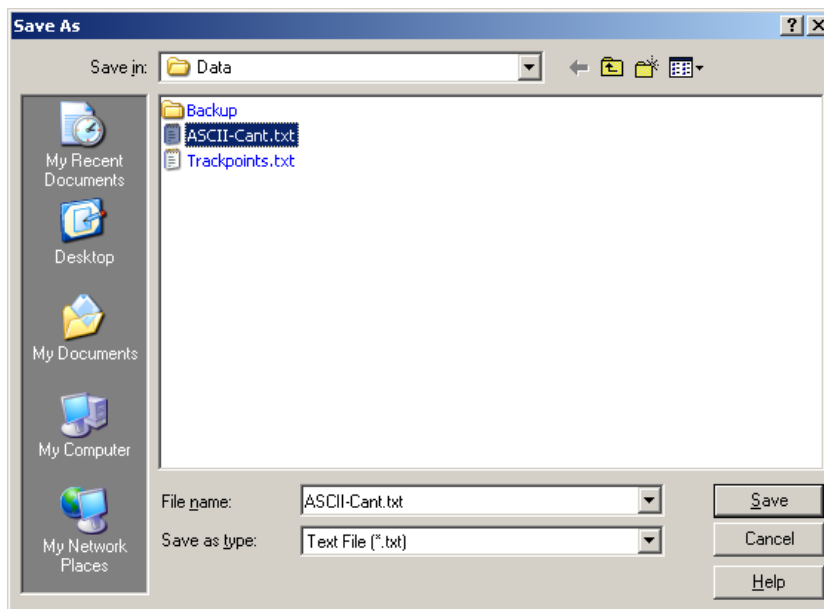
Click on Report ...





File > Save As ...

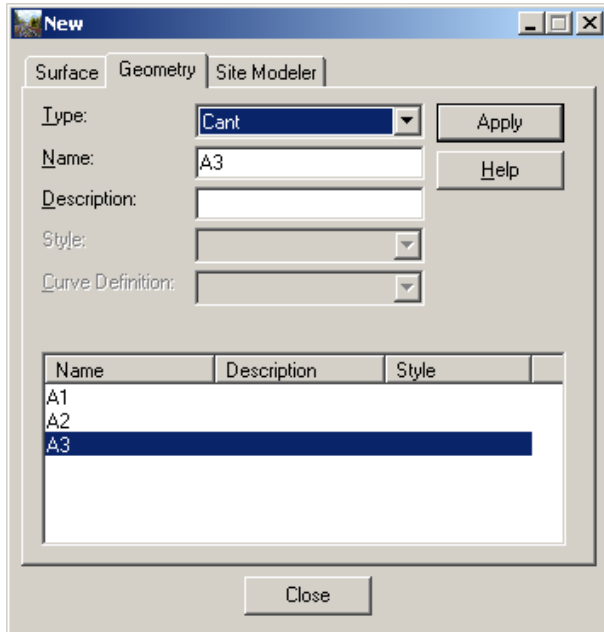
Save the report as *.txt file.



The user can change the cant values by editing the ASCII-file.

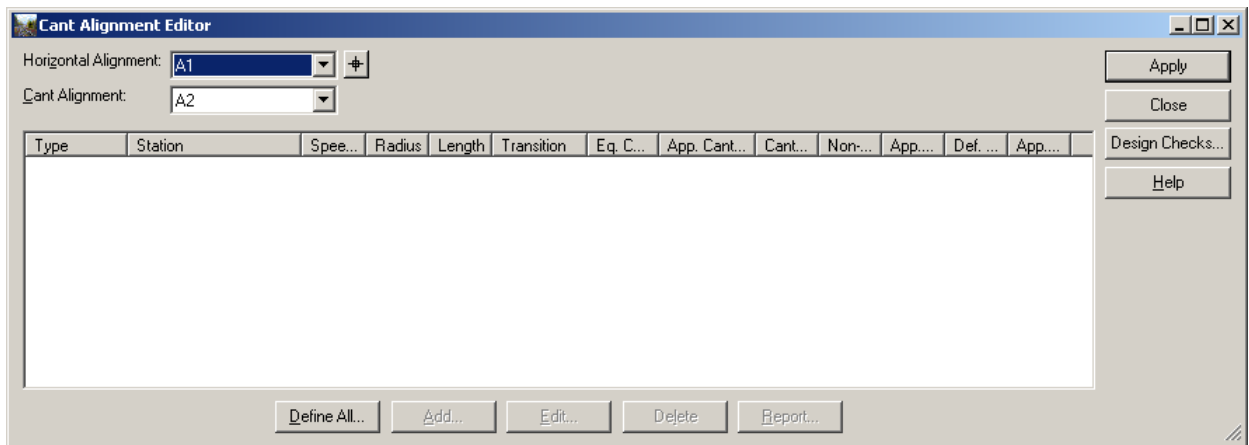
5.1.7 CANT FROM ASCII

Create a new cant alignment

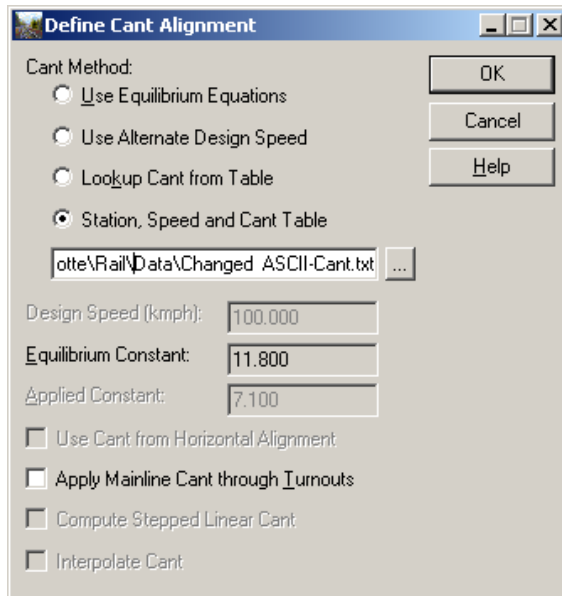


Click on Edit

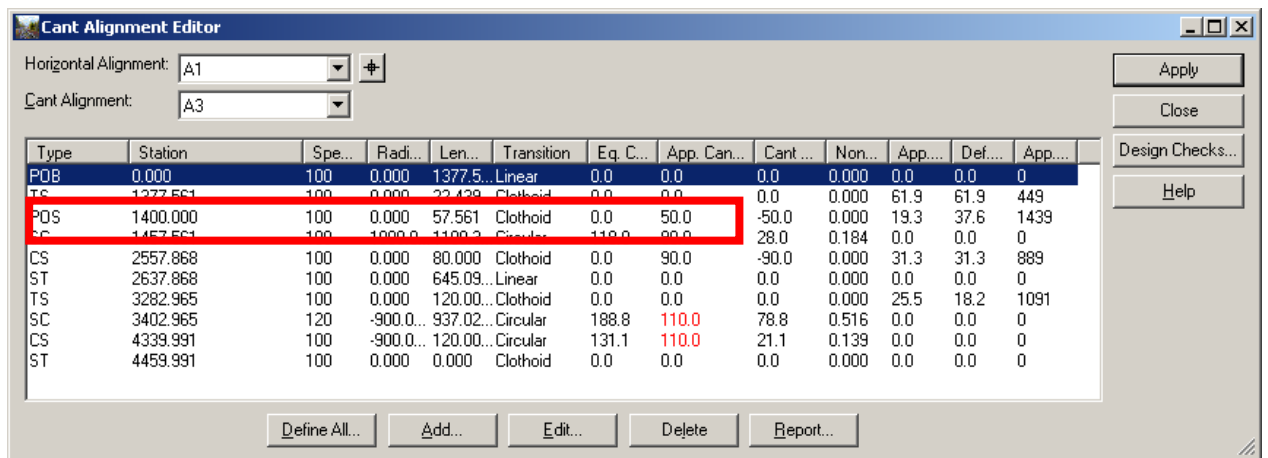
Define all ...



Use Cant from Table



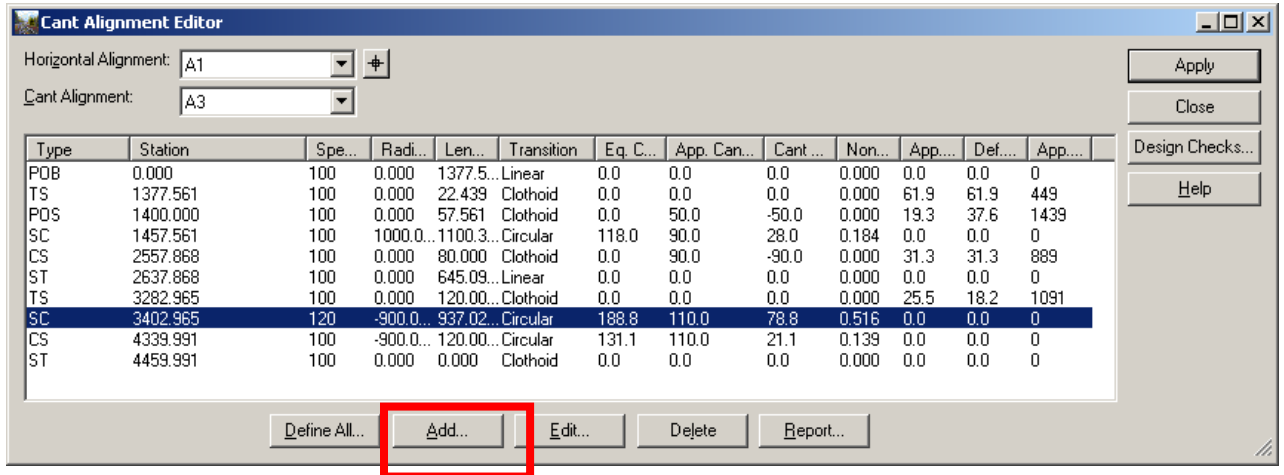
Select the file Changed ASCII-Cant.txt and hit OK.



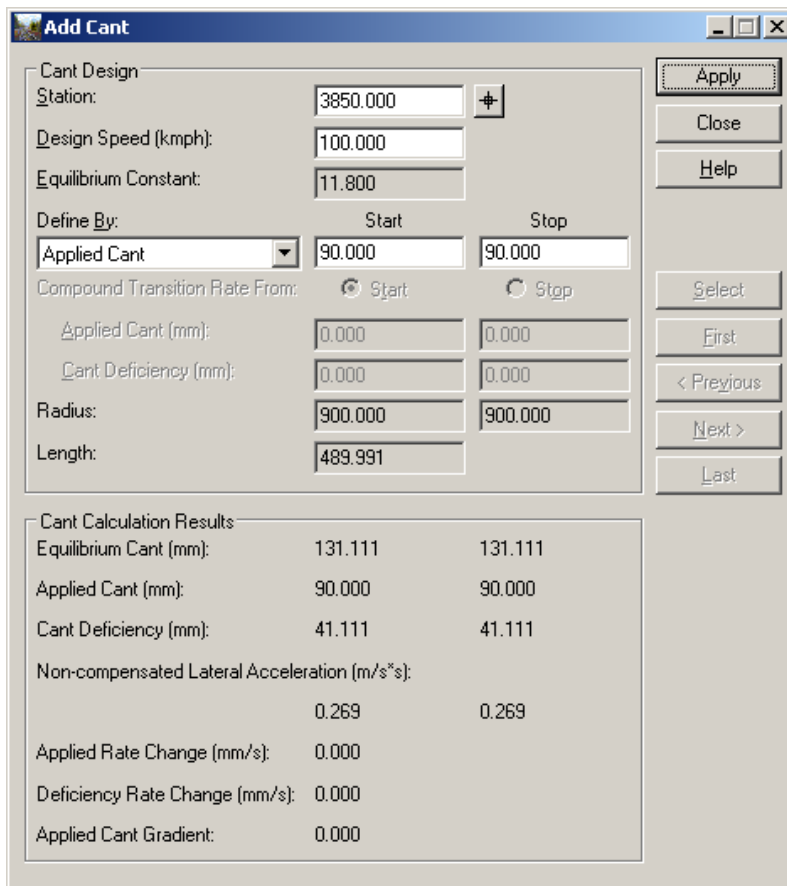
The user defined ASCII-values are applied. Hit Apply.

5.1.8 ADD CANT

Another way to change cant values is the ADD ... command

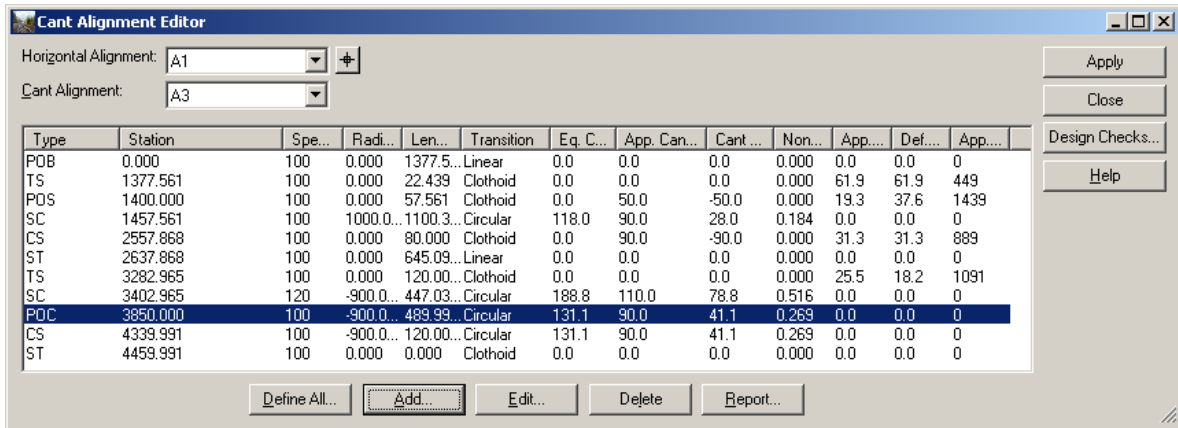


Click on ADD ...



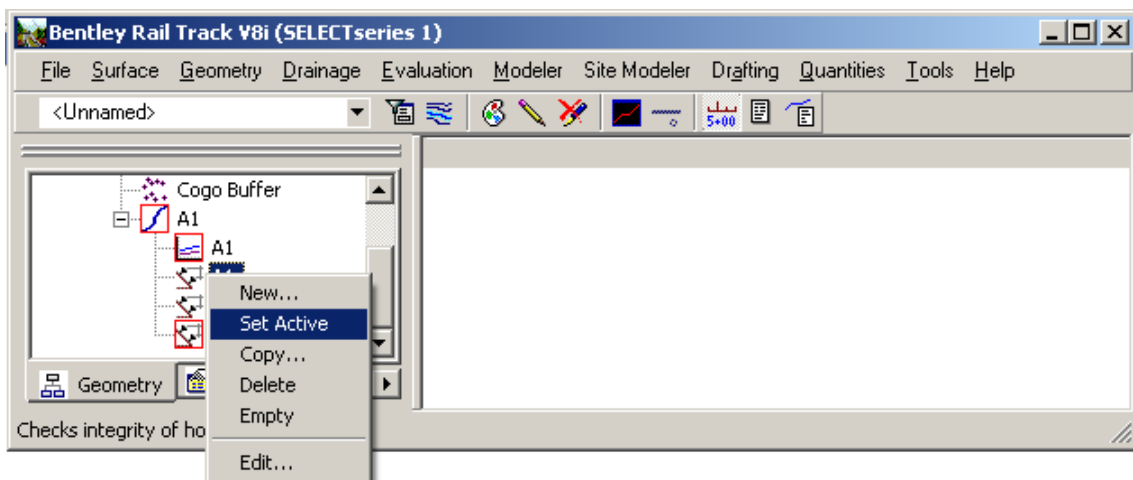
This dialog allows the user to add cant values at any station. The user can select the station using the radio button.

Apply adds the cant value at the selected station.



Apply stores the values at the alignment.

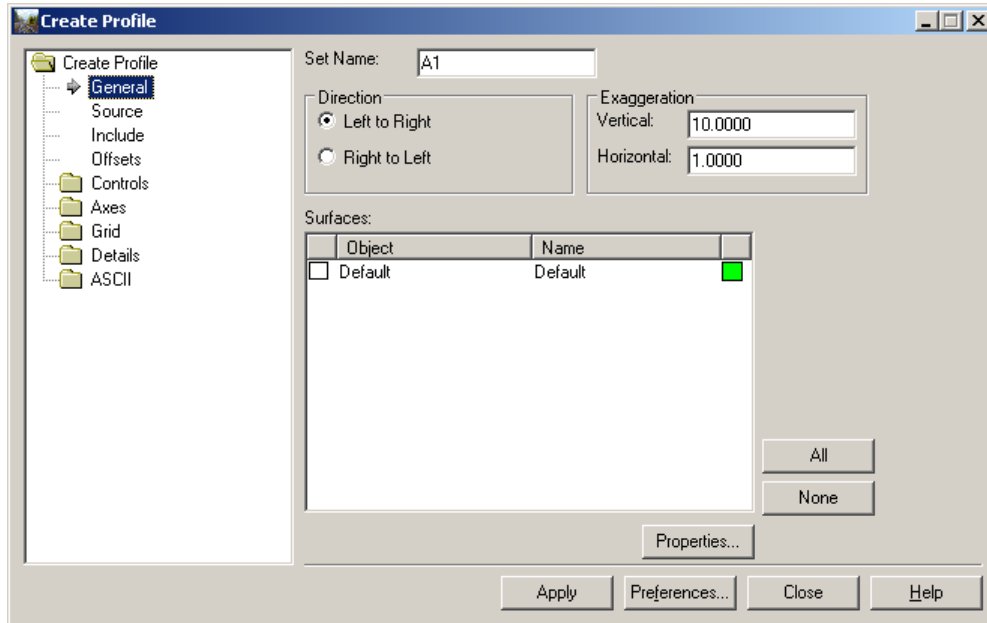
5.1.9 ACTIVATE CANT A1



5.1.10 CREATE A PROFILE ALONG ALIGNMENT

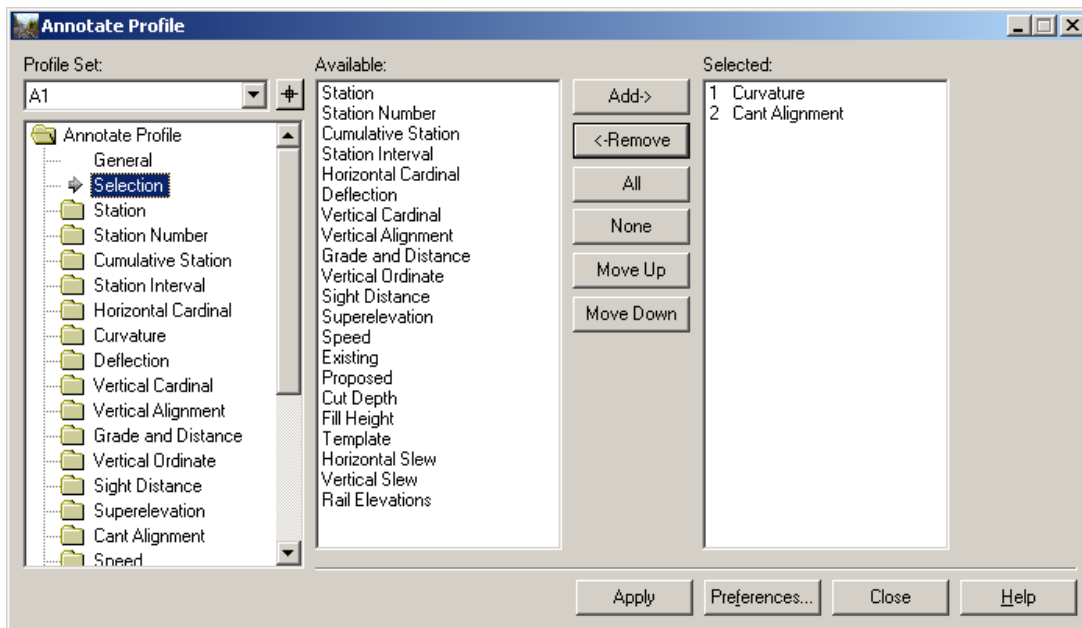
Evaluation > Profile > Profile > Create Profile ...

WORKING WITH RAIL GEOMETRY BENTLEY RAIL TRACK V81



Hit Apply and place the profile in the drawing.

Annotate profile (Select Curvature, Cant Only & Rail Elevation)



Hit Apply.

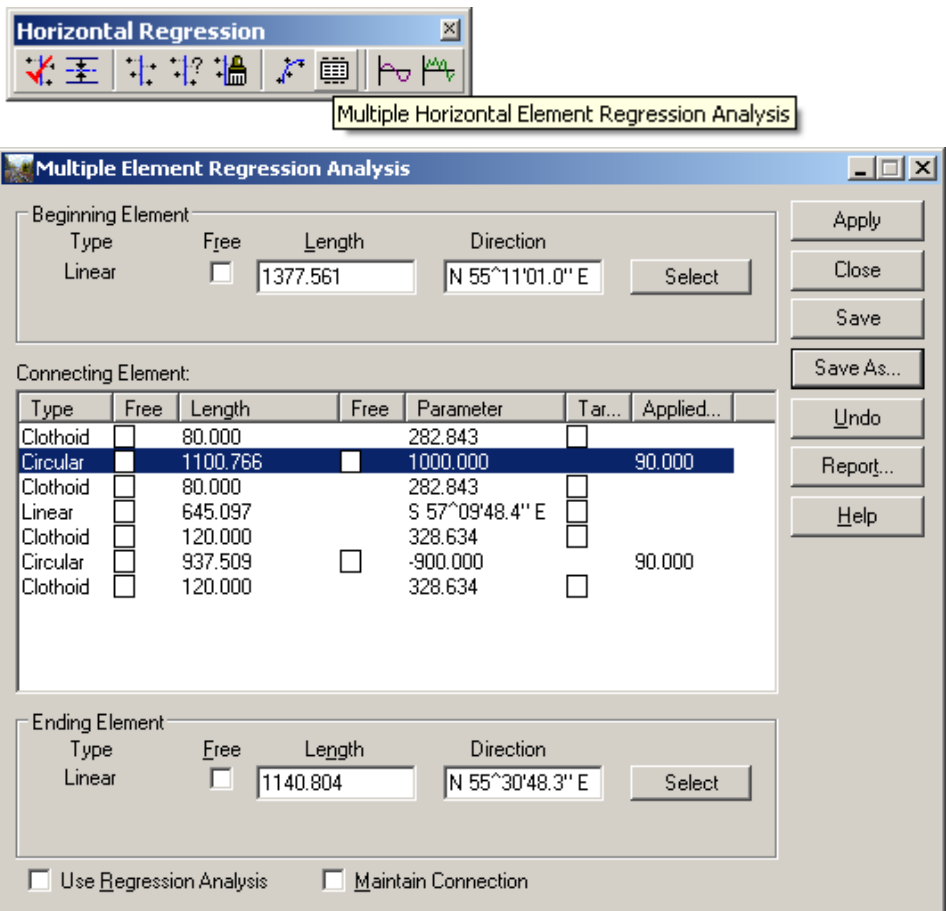
You can activate the different cant alignment and view the results.

4.2 EXERCISE: CHANGE HORIZONTAL GEOMETRY WITH MULTIPLE HORIZONTAL ELEMENT REGRESSION AND RECOMPUTING CANT

This exercise will guide you through the cant recomputing if the horiz. alignment has been changed

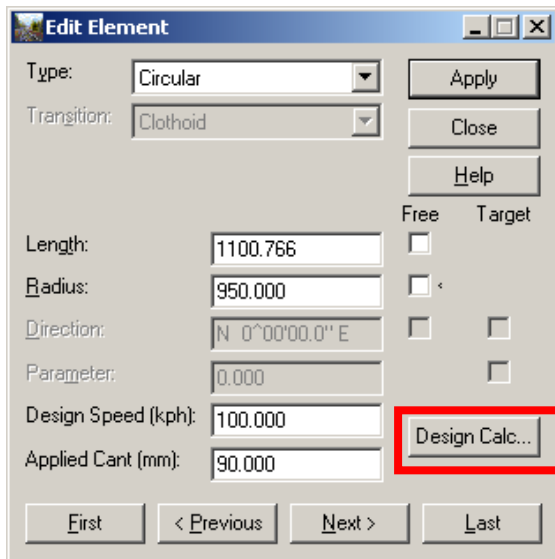
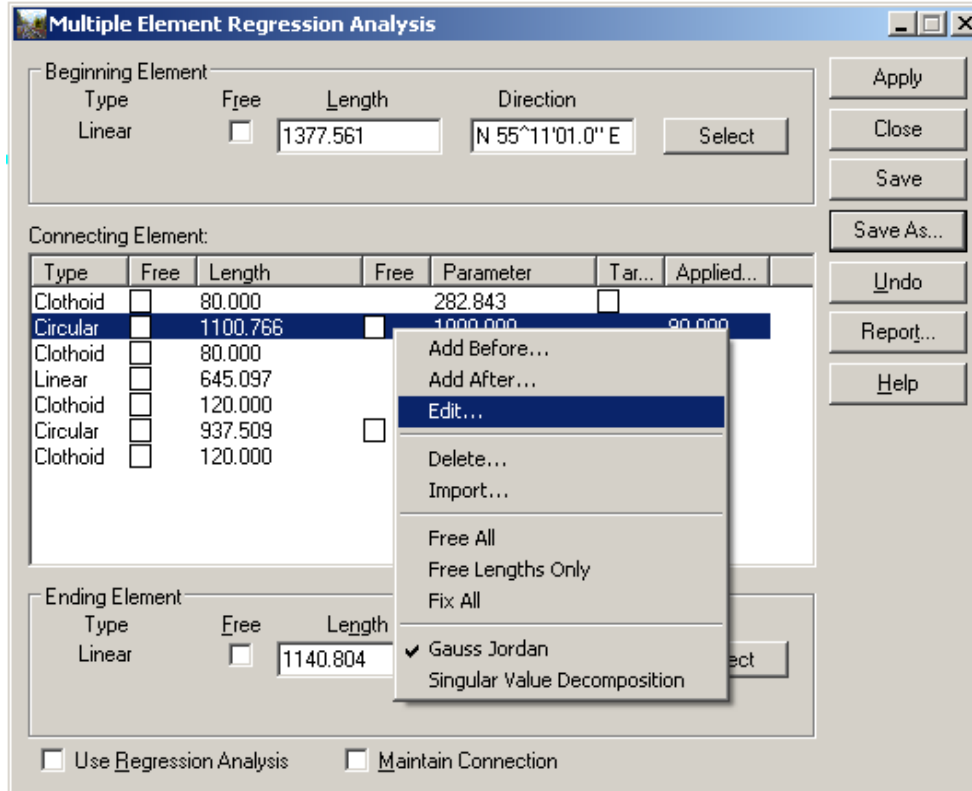
4.2.1 USE THE HORIZONTAL MULTIPLE ELEMENT REGRESSION ANALYSIS

Geometry > Horizontal Regression > Horizontal Multiple Element Regression Analysis ...

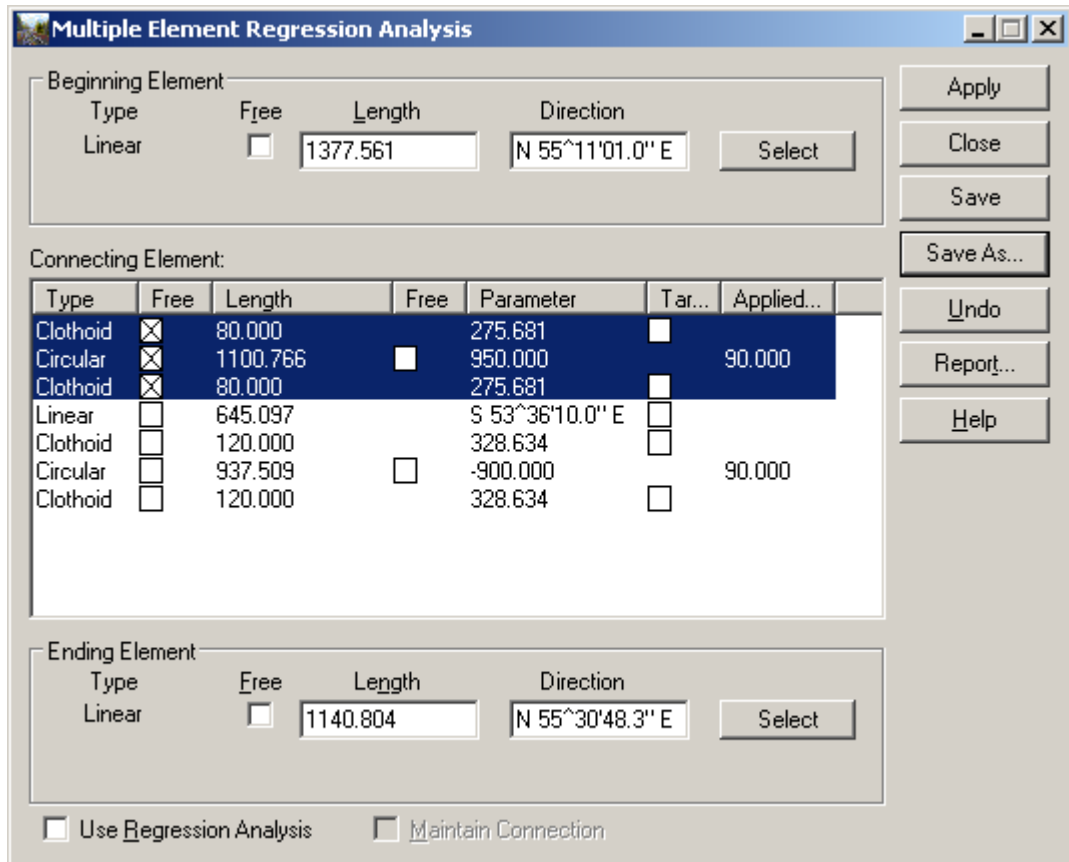


4.2.2 CHANGE A RADIUS

User the right mouse click to Edit ...

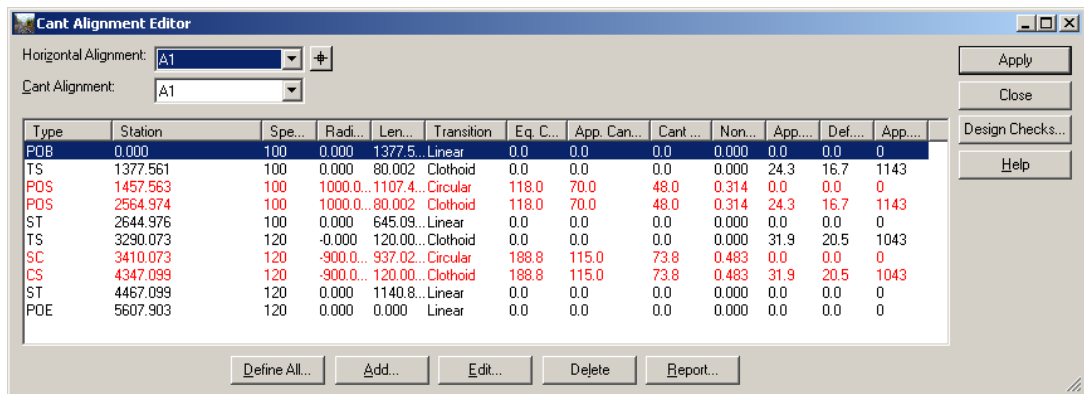


Free up the length from clothoids & radius



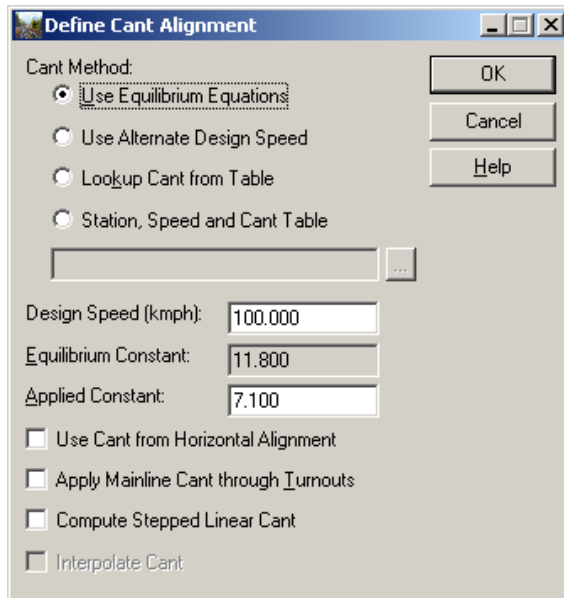
Hit Apply and save the solution.

4.2.3 EDIT CANT

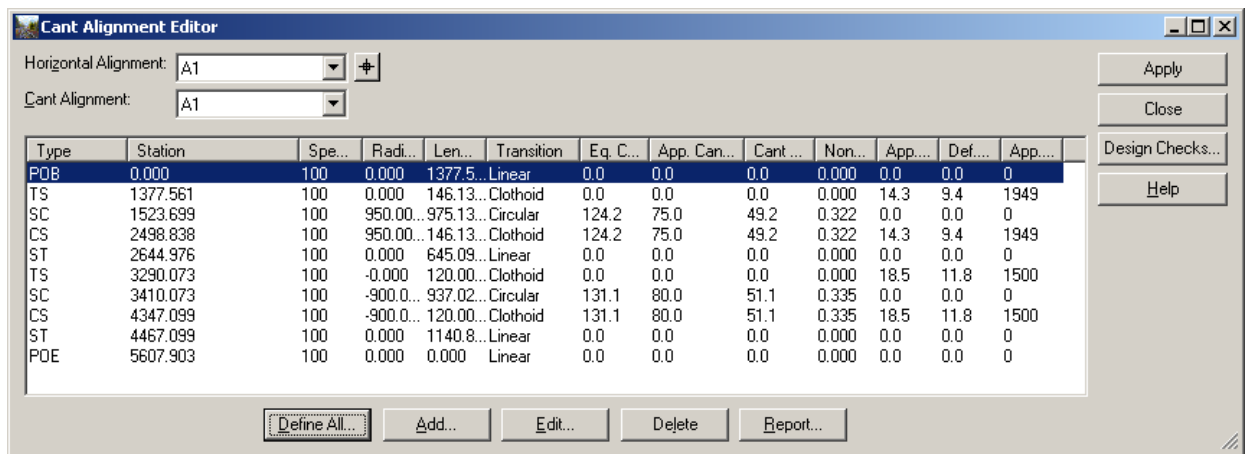


The geometry has been changed and the cant values as well since they are coordinative applied to the circular elements.

To optimize the cant based on the equilibrium equation you can click on Define All ...

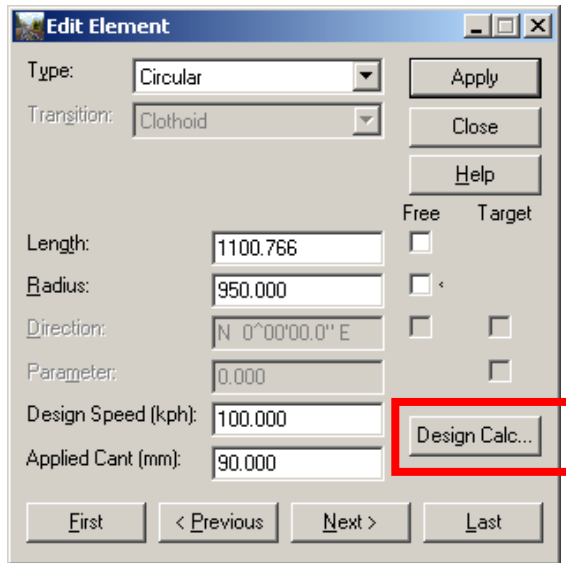


Apply.



The cant is now optimized for a given speed of 100 km/h.

During the design process the user can use various scenarios to Add, Change & Delete cant.



The Design Calculator helps to find the best solution.

5. LESSON NAME: TURNOUT CREATION

LESSON OBJECTIVE:

This lesson will show how to use the turnout commands.

You will find the turnout libraries in the Bentley Rail Track product under:

...\Program Files\Bentley\Bentley Rail Track V8.1.1\data\imperial\... for imperial units

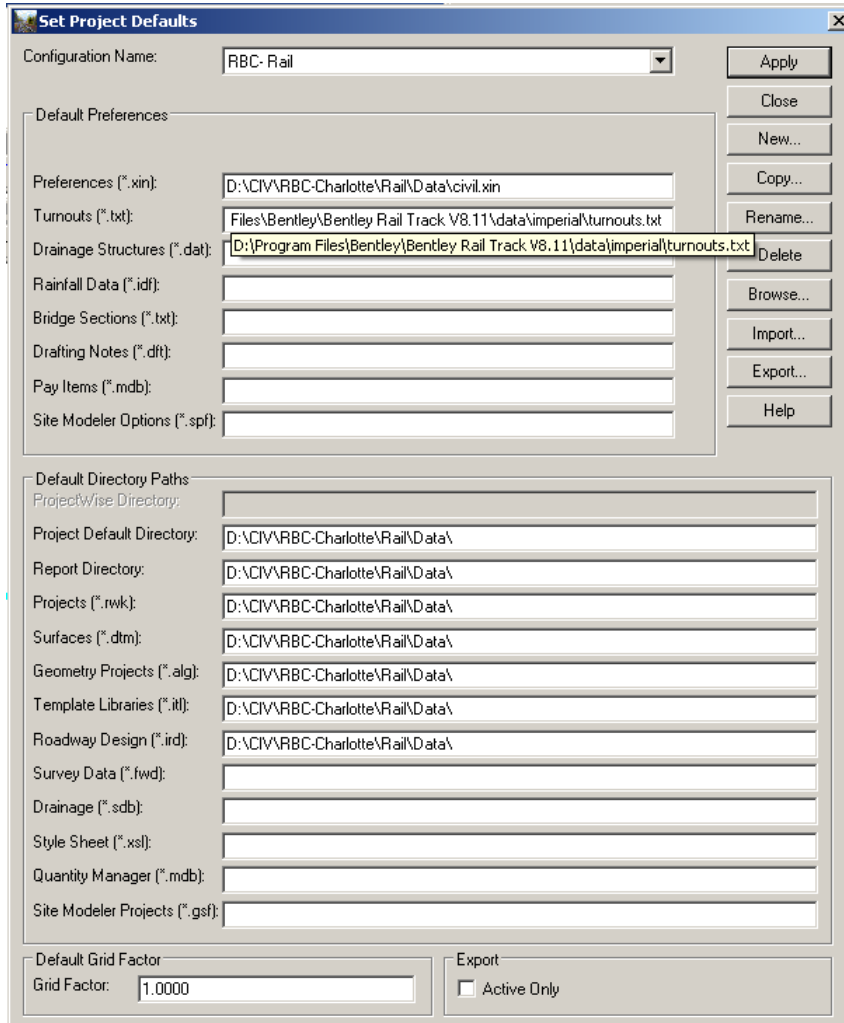
...\Program Files\Bentley\Bentley Rail Track V8.1.1\data\metric\... for metric units

5.1 EXERCISE: TURNOUT CREATION [IMPERIAL]

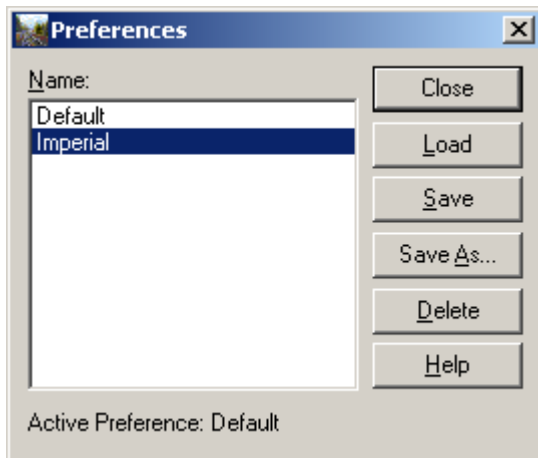
This exercise will guide you use the turnout commands

5.1.1 SETUP THE TURNOUT LIBRARY

To access the right turnout library you need to setup the library in the Project Defaults.



Under Tools > Options > Preference ... load the Imperial preference.

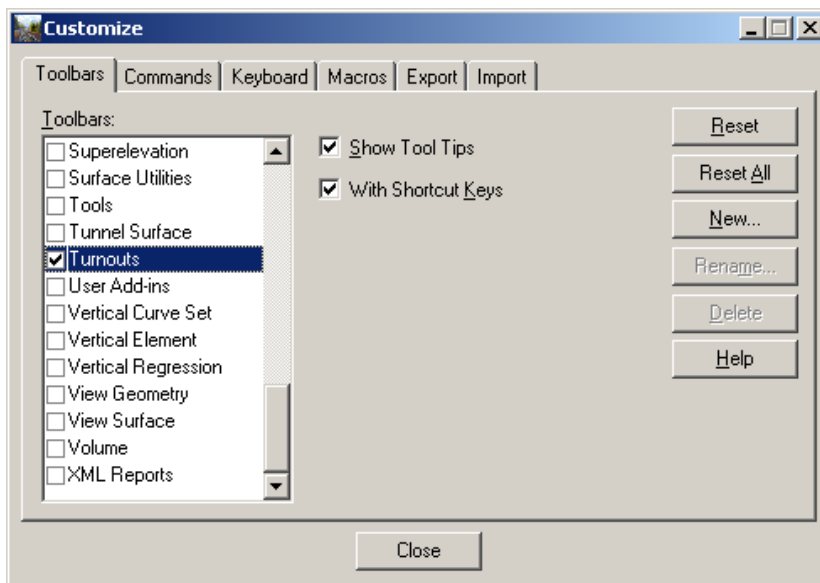


Close the dialog box.

5.1.2 DESIGNING TURNOUTS

a. Imperial (AREMA)

Under Tools > Customize > Turnouts ...



For Imperial unit you should use the Alternate Turnout Library.

WORKING WITH RAIL GEOMETRY BENTLEY RAIL TRACK V81

Turnout Library

Name:

Description:

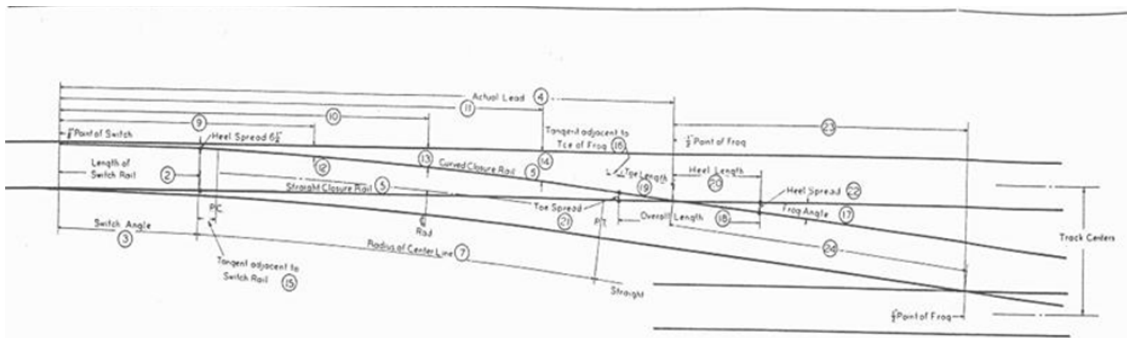
Switch Angle:

Actual Lead:

Radius of Center Line:

Frog Angle:

Heel Length:



TURNOUT AND CROSSOVER DATA

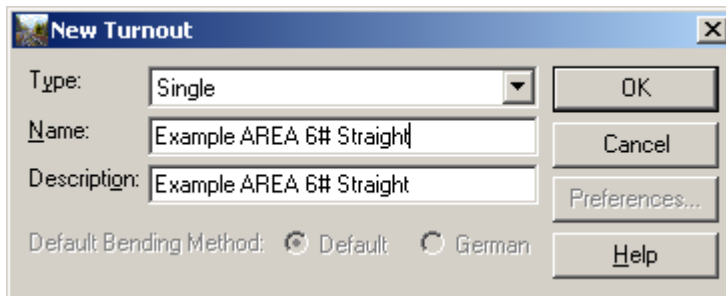
Frog Number	Properties of Switches				Closure Distance		Lead Curve		Gage Line Offsets										Properties of Frogs						Data for Crossovers							
	Length of Switch Rail	Switch Angle	Actual Lead	Radius of Center Line	Radius of Center Line	Degree of Curve	Feet	Degrees	1'	2'	3'	4'	5'	6'	7'	8'	9'	10'	11'	12'	13'	14'	15'	16'	17'	18'	19'	20'	13'-0" Track Centers	For change of 1'-0" in Track Centers		
	ft in	Deg/Min/Sec	ft in	ft in	ft in	ft in	Feet	Deg/Min/Sec	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	ft in	
5	11-0	2-39-54	42-6	28-0	28-4	17280	32-39-56	18-0	25-0	32-0	11	20	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	11-0	2-39-34	47-6	32-9	33-0	25857	22-17-56	19-2	27-4	35-6	12	21	2	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	16-6	1-46-22	68-1	40-10	41-1	36559	15-43-16	26-2	35-10	45-9	11	19	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	16-6	1-46-22	68-0	46-5	46-7	48126	11-46-44	27-7	38-8	49-9	11	20	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	16-6	1-46-22	72-3	49-6	49-7	61521	9-19-30	28-10	41-2	53-9	12	21	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	16-6	1-46-22	78-9	55-10	56-0	77939	7-21-24	29-11	43-5	56-1	12	21	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	22-0	1-19-46	91-10	62-10	63-0	92127	6-10-56	37-6	53-5	69-1	12	21	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	22-0	1-19-46	96-8	66-10	67-0	110463	5-11-20	38-8	55-5	72-1	12	21	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	30-0	1-19-46	107-0	76-5	76-6	156120	3-37-28	41-1	60-2	79-3	12	21	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	30-0	0-58-30	126-4	86-11	87-0	172077	3-19-46	51-9	73-6	95-3	12	21	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	30-0	0-58-30	131-4	91-11	92-0	200712	2-51-18	53-0	76-0	99-0	12	21	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	30-0	0-58-30	140-11	99-11	100-0	257879	2-13-20	55-0	80-0	105-0	12	21	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	30-0	0-58-30	151-11	110-11	111-0	328829	1-44-30	57-9	85-6	113-3	13	22	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

We want to create the following turnout AREMA #6 Straight with the following parameters:

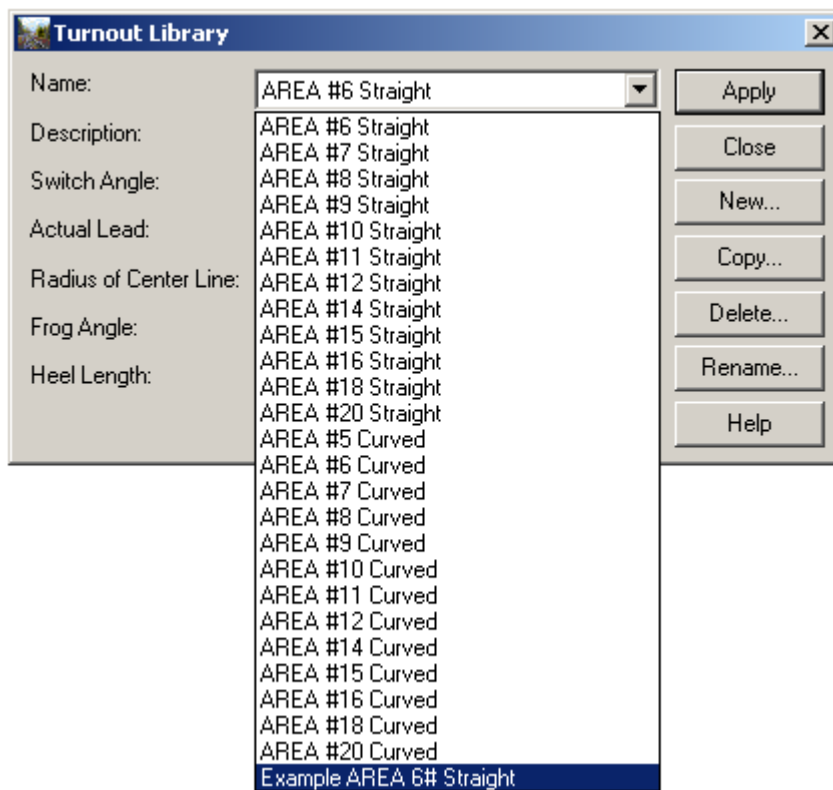
This is an example how to create a turnout.

- Switch Angle: 2^39'34.0"
- Actual Lead: 47.500
- Radius Of Centerline: 258.57
- Frog Angle: 9^31'38.0"
- Heel Length: 6.250

Click on New ...



Under Type you can select different turnout type such a s Single, Single Slips etc.
 Select the New turnout from the library.



Fill in the values:

The screenshot shows the 'Turnout Library' dialog box with the following fields and values:

Name:	Example AREA 6# Straight	Apply
Description:	Example AREA 6# Straight	Close
Switch Angle:	0°00'00.0"	New...
Actual Lead:	0.000	Copy...
Radius of Center Line:	0.000	Delete...
Frog Angle:	0°00'00.0"	Rename...
Heel Length:	0.000	Help

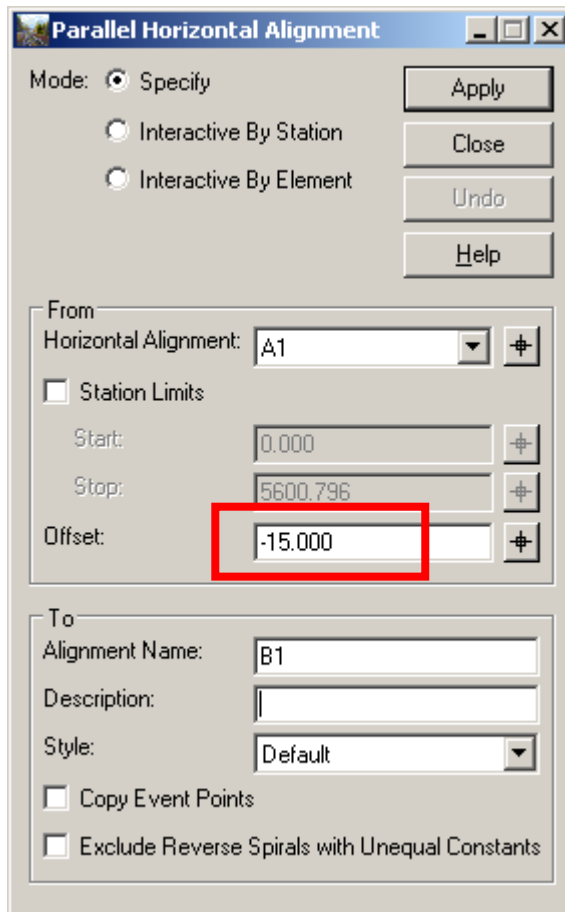
The screenshot shows the 'Turnout Library' dialog box with the following fields and values:

Name:	Example AREA 6# Straight	Apply
Description:	Example AREA 6# Straight	Close
Switch Angle:	2°39'34.0"	New...
Actual Lead:	47.500	Copy...
Radius of Center Line:	47.500	Delete...
Frog Angle:	9°31'38.0"	Rename...
Heel Length:	6.250	Help

Hit Apply. The turnout is now stored in the library.

5.1.3 TURNOUT DESIGN

To create a simple turnout connection between two tracks goes to Geometry > Utilities > Parallel Horizontal Alignment ...



Apply.

You will now have an alignment 15 ft to the left from alignment A1.

5.2 CREATE TURNOUT

Interactive

The screenshot shows the 'Create Turnout' dialog box with the following settings:

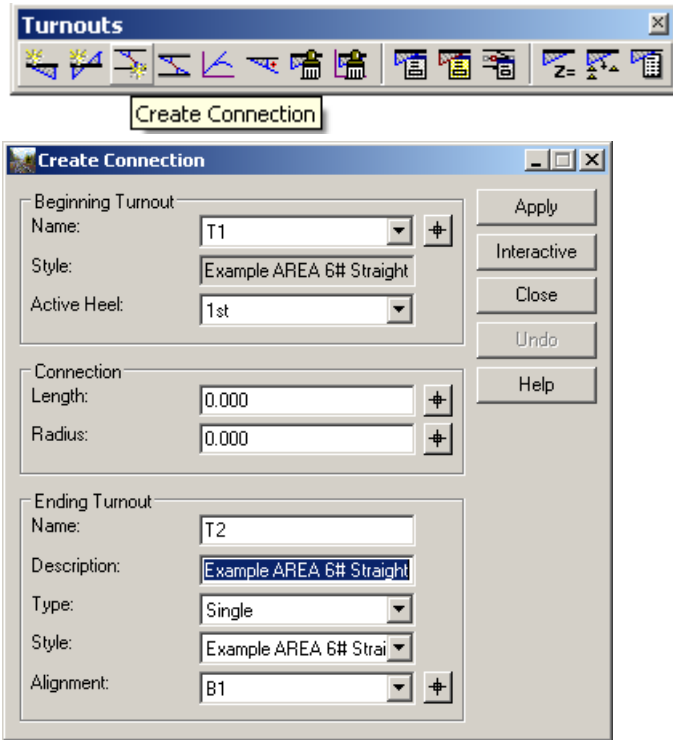
- Primary Control:**
 - Method: In Alignment
 - Alignment: A1
 - Station: 0.000
 - Offset from Placement Point: 0.000
 - Extend Mainline by Length: 0.000
- Turnout:**
 - Name: T1
 - Description: Example AREA 6# Straight
 - Type: Single
 - Style: Example AREA 6# Straight
 - Placement Point: .1
 - Hand: Left
 - Orientation: Leading

If you use Interactive you must follow the steps:

- Identify mainline alignment
- Identify point (turnout .1 as placement point)
- Identify orientation point (the direction for the branch)
- Accept.

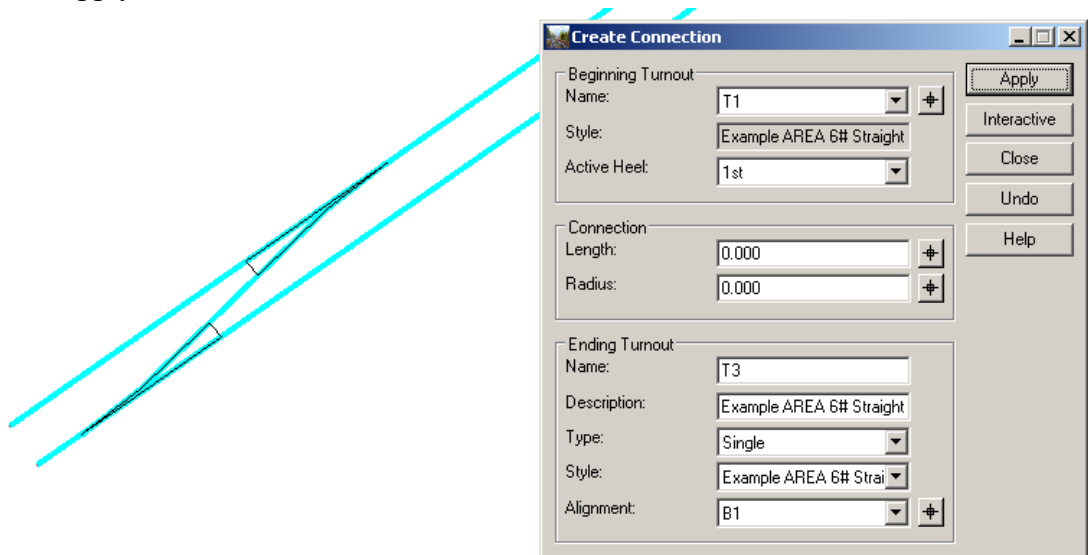
5.3 CREATE QUICK CONNECTION

An easy way to make a connection is the Quick Connection Command.



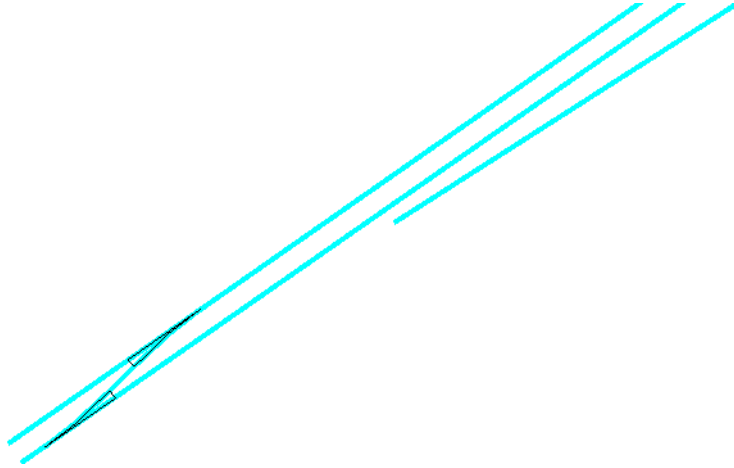
The software is using the same turnout which was place on alignment A1. To fill in a length is not needed in case you have a straight turnout connection.

Hit Apply.

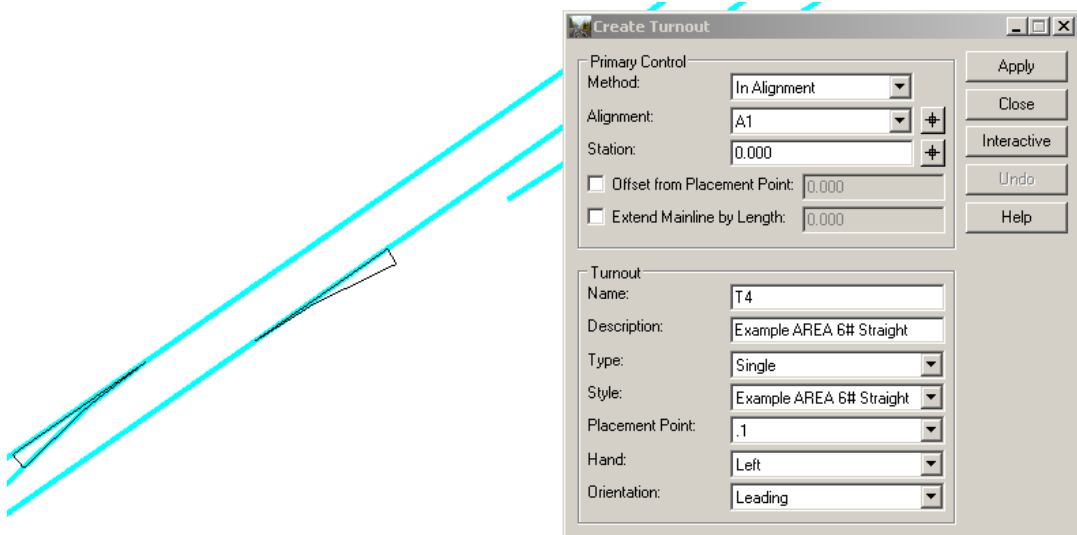


If you close the dialog box the turnout will store to the geometry.

Create a new horizontal alignment. Place a single fixed line close to the track A1.



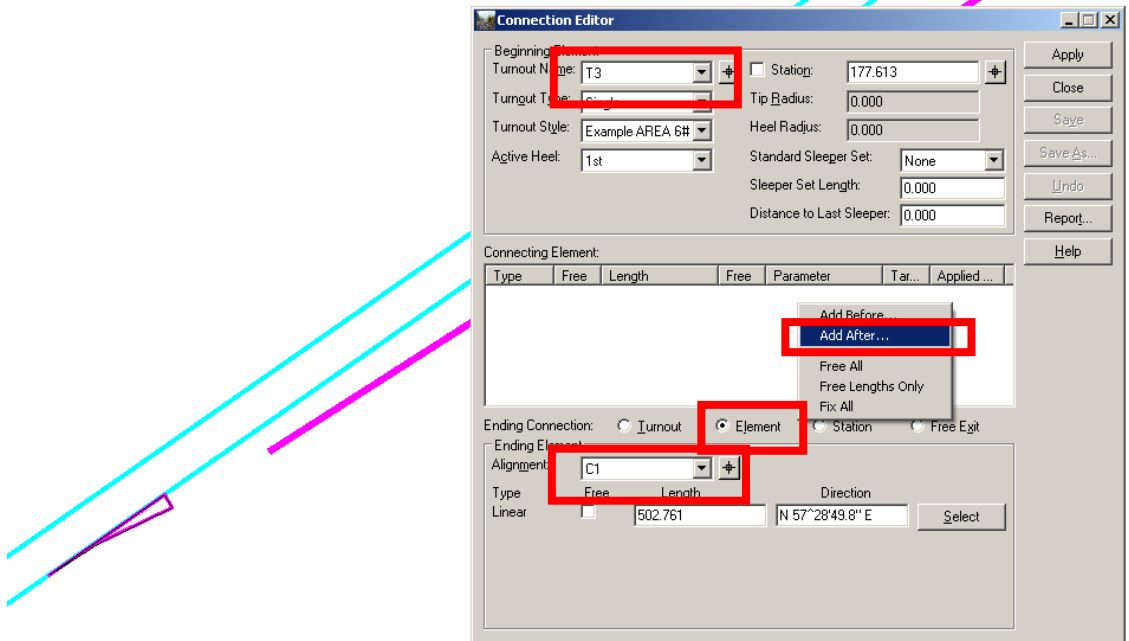
Place a new turnout in A1



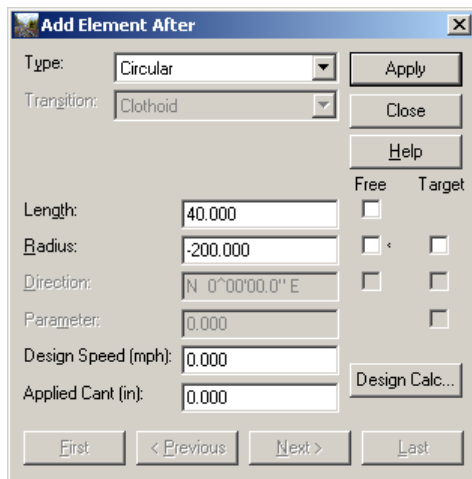
5.4 CREATE CONNECTION TURNOUT TO ELEMENT



Select the turnout and check on Element, Identify the alignment

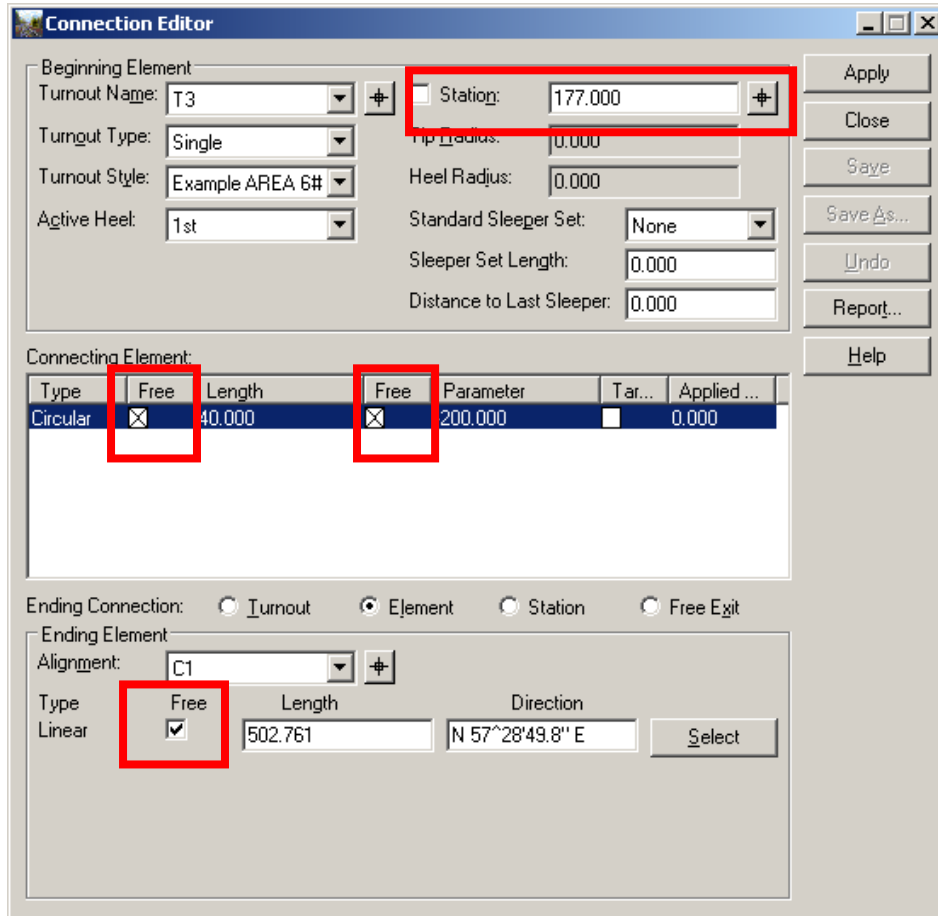


By using the right mouse click select Add After ...

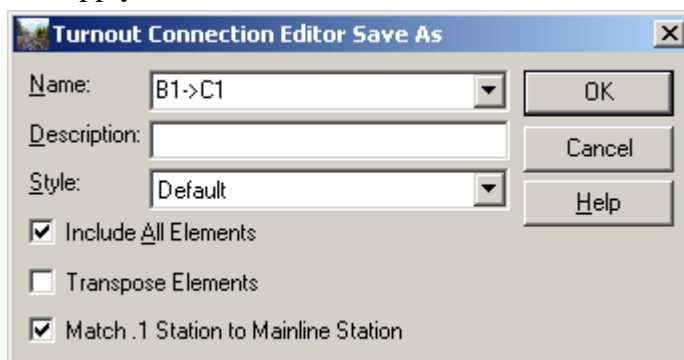


Select as connecting type a Circular element. Hit Apply.

If you want to set the turnout to a given station then key in the station and do not free the turnout.



Free up the length & radius of the connecting element and the ending element. Hit Apply and Save the solution with Save As ...



Save As .. saves the whole connection including the alignment C1. Other options for turnout connections:

- Free Exit

connects a turnout to nothing. For example, adds elements of known length and radii to the end of a turnout

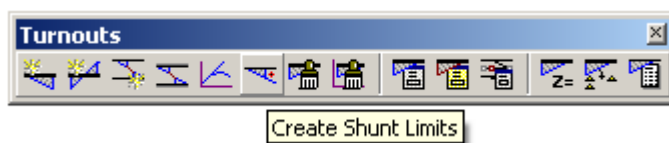
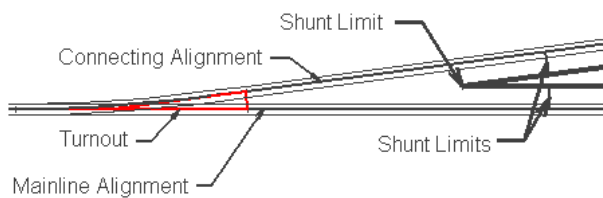
- Station

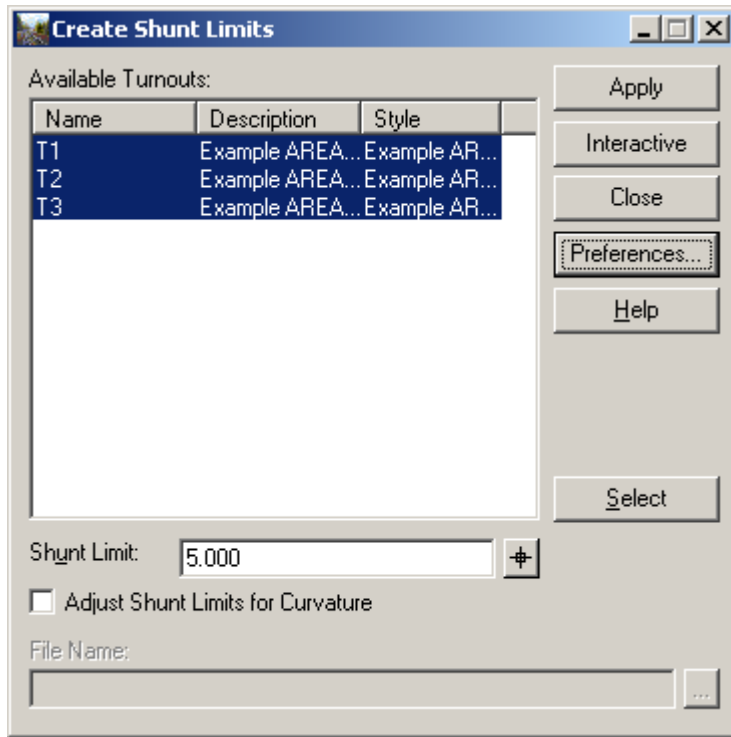
defines the ending turnout's tip station. If on then the value is free to change during computations. If off then this value is fixed during computations. This freedom is persisted with the geometry

6. CREATE SHUNT LIMITS

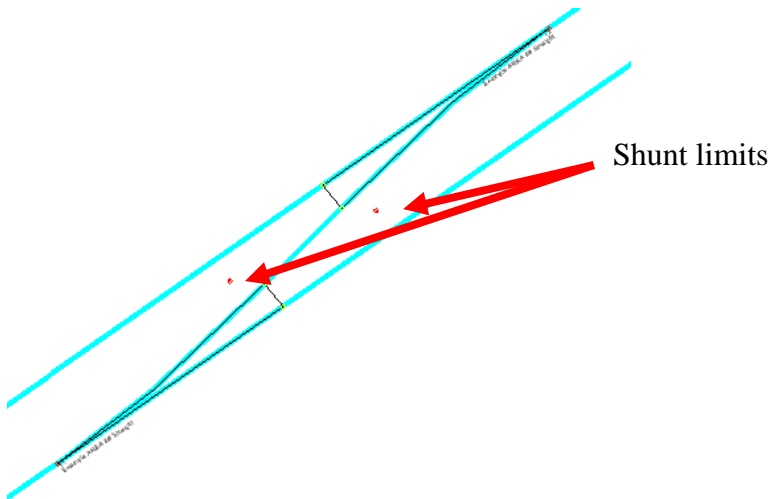
The Create Shunt Limits command computes a shunt point. A shunt point is a physical point at which a train must stop to avoid colliding with another train if two trains occupy a turnout and mainline track.

This picture explains how a shunt limit will be created.



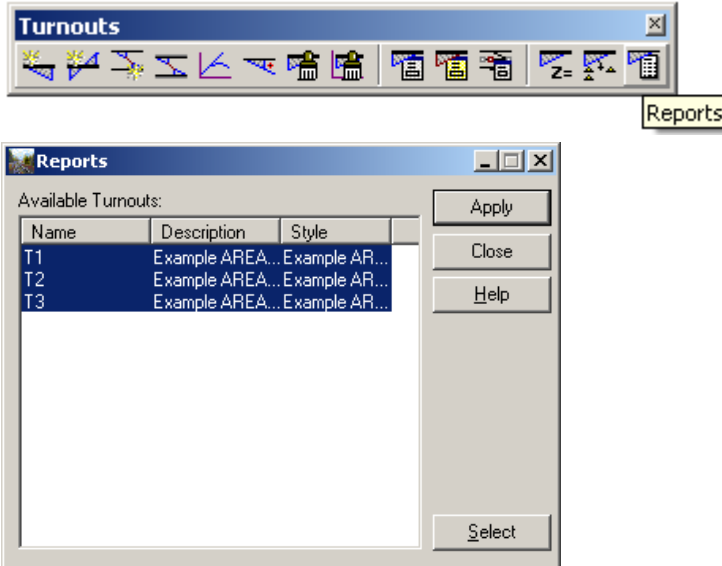


Hit Apply.

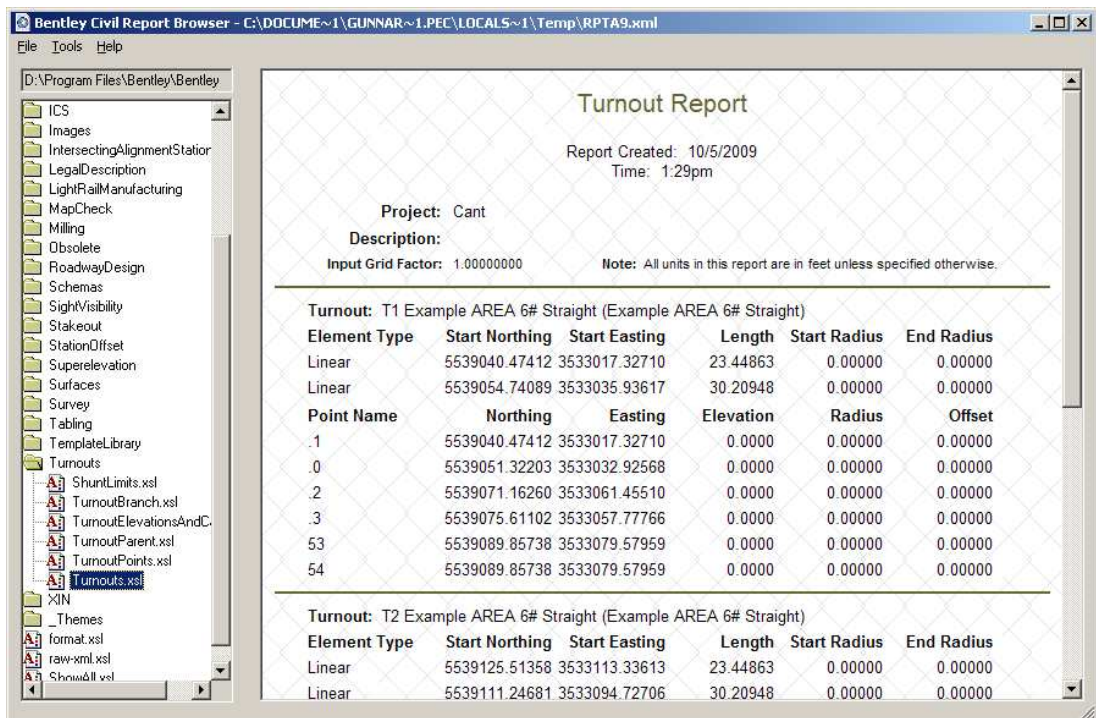


6.1 REPORTING

If you want to create reports on turnout connections the use the report command



There several report templates available.



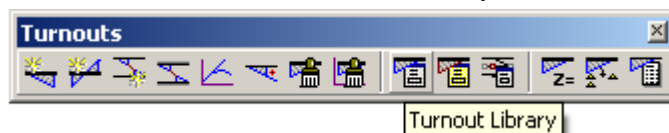
6.2 EXERCISE: TURNOUT CREATION [METRIC]

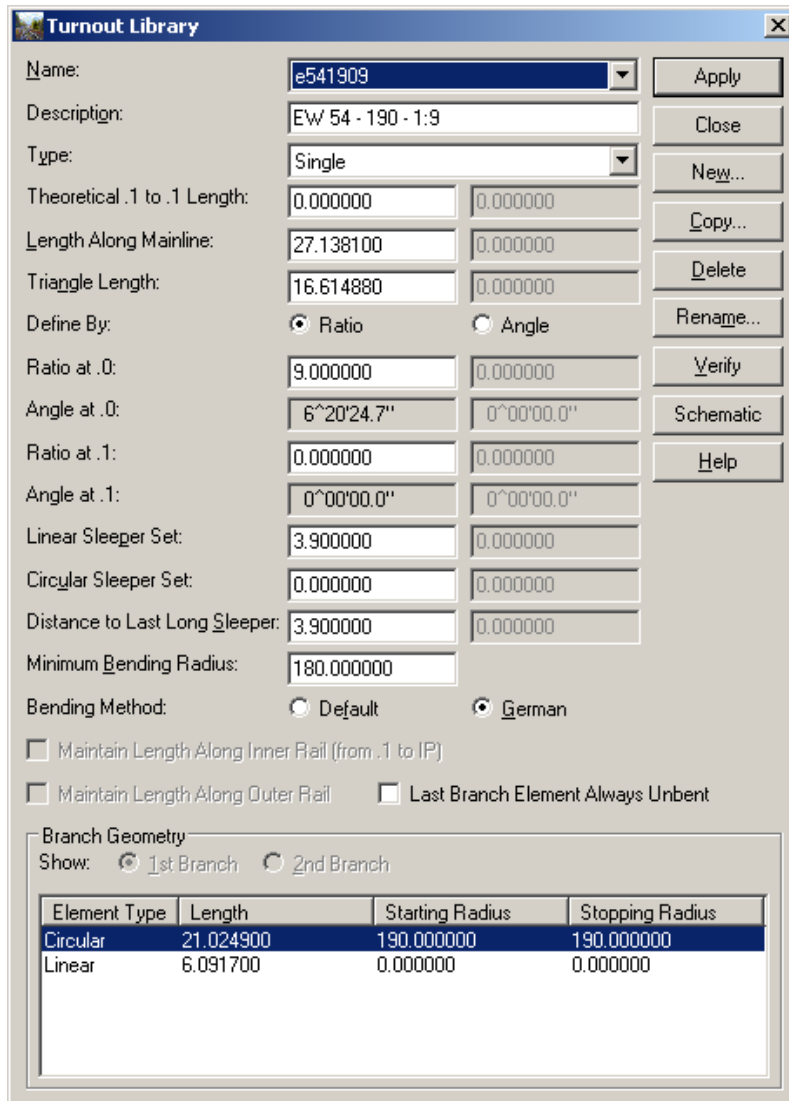
If the user wants to create metric turnouts then metric units needs to be setup in Tools > Options ...

If metric unit applied then the Alternate Turnout Library cannot be used.



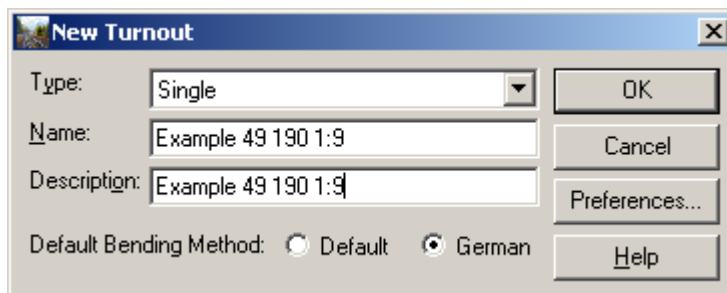
The user must use the Turnout Library.





If the user wants to create turnouts he has to follow a similar workflow like in the previous exercise.

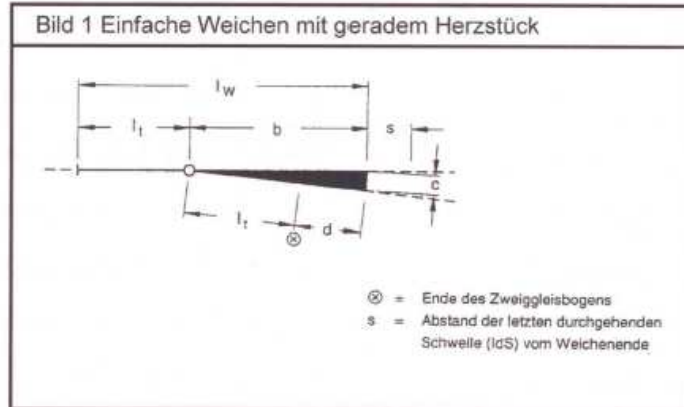
Click on New ...



The bending method is German

A typical turnout schematic drawing with a straight frog

Einfache Weichen mit geradem Herzstück



Weiche EW	l ₁ [m]	b [m]	d [m]	l _w [m]	c [m]	s [m]	zul. v Zweiggleis	[km/h] Stammgleis
49-Pa-190-1:9	10,5232	16,6149	6,0917	27,1381	1,8376	4,051	40	100
49-	10,7007	24,5374	13,8367	35,2381	1,7493	6,573	50	120
54-300-1:14	10,7007	27,1084	16,4077	37,8090	1,9326	5,125		160
60-								200 (230)
49-500-1:14 49-Pa-500-1:14	17,8344	24,5366	6,7022	42,3710	1,7491	6,573	60	120
54-500-1:14	17,8344	27,1080	9,2736	44,9424	1,9326	5,125	60	160
60-								200 (230)
60-500-1:14 -fb	17,8344	27,1080	9,2736	44,9424	1,9326	5,125	60	> 200
54-760-1:18,5	20,5256	32,4087	11,8831	52,9343	1,7499	9,920	80	160
60-						9,920		200 (230)

Turnout Library

Name:

Description:

Type:

Theoretical .1 to .1 Length:

Length Along Mainline:

Triangle Length:

Define By: Ratio Angle

Ratio at .0:

Angle at .0:

Ratio at .1:

Angle at .1:

Linear Sleeper Set:

Circular Sleeper Set:

Distance to Last Long Sleeper:

Minimum Bending Radius:

Bending Method: Default German

Maintain Length Along Inner Rail (from .1 to IP)

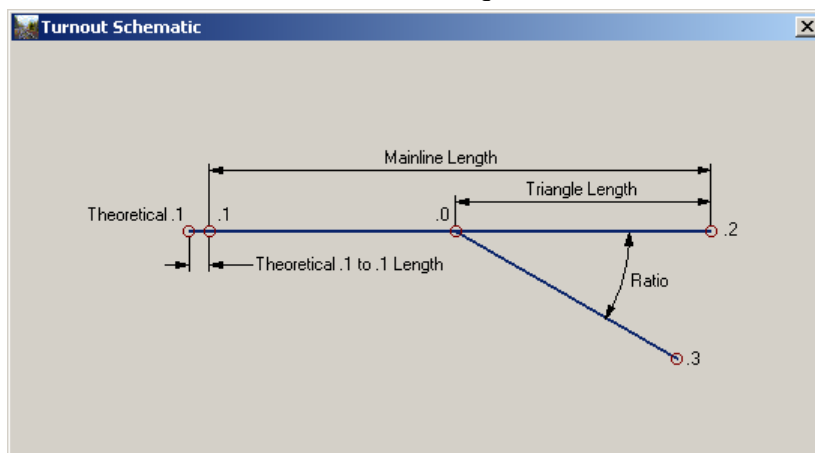
Maintain Length Along Outer Rail Last Branch Element Always Unbent

Branch Geometry

Show: 1st Branch 2nd Branch

Element Type	Length	Starting Radius	Stopping Radius

The Schematic shows the user the required values.



Fill out the turnout values:

Length Along Mainline: 27.1281

Triangle Length: 16.6149

Ratio: 9.000

Turnout Library

Name: Example 49 190 1:9 [Apply]

Description: Example 49 190 1:9 [Close]

Type: Single [New...]

Theoretical .1 to .1 Length: 0.000000 0.000000 [Copy...]

Length Along Mainline: 27.138100 0.000000 [Delete]

Triangle Length: 16.614900 0.000000 [Rename...]

Define By: Ratio Angle [Verify]

Ratio at .0: 9.000000 0.000000 [Schematic]

Angle at .0: 6^20'24.7" 0^00'00.0"

Ratio at .1: 0.000000 0.000000 [Help]

Angle at .1: 0^00'00.0" 0^00'00.0"

Linear Sleeper Set: 0.000000 0.000000

Circular Sleeper Set: 0.000000 0.000000

Distance to Last Long Sleeper: 0.000000 0.000000

Minimum Bending Radius: 0.000000

Bending Method: Default German

Maintain Length Along Inner Rail (from .1 to IP)

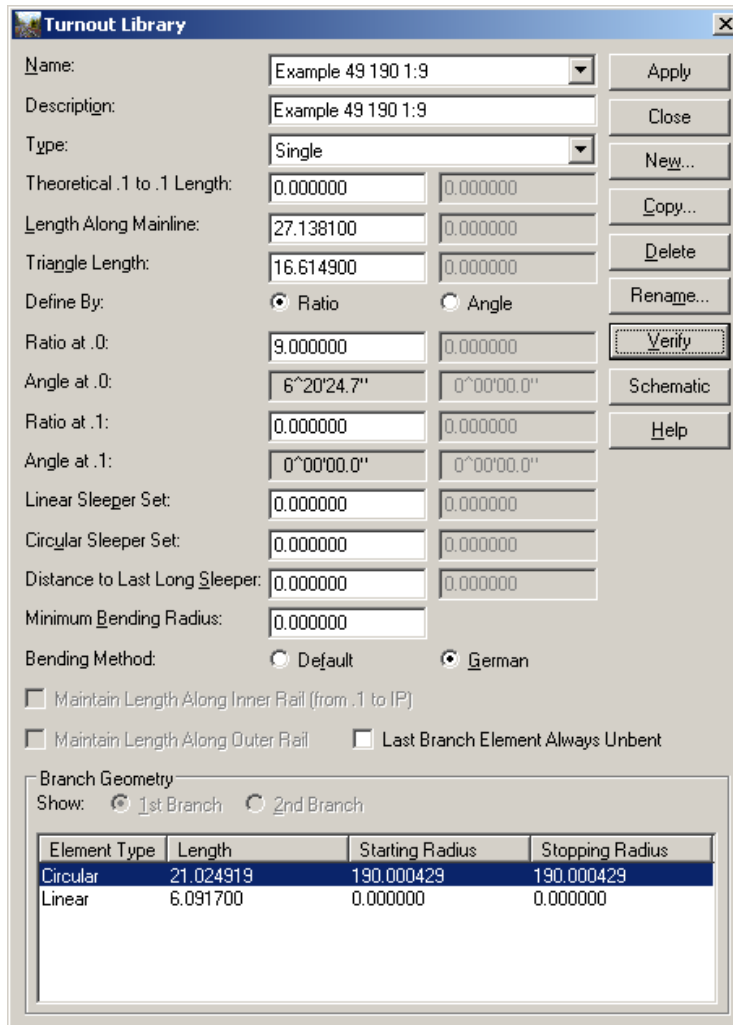
Maintain Length Along Outer Rail Last Branch Element Always Unbent

Branch Geometry

Show: 1st Branch 2nd Branch

Element Type	Length	Starting Radius	Stopping Radius

Click on Verify.



Apply. The New turnout has been stored in the library and can now used for design.