SCC Training:
Point Cloud Module

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1 Rail Moudule

The following outlines the main tools and functionality within the SCC Rails Modules.

1.1 Rail Traverse

The following outlines the steps to process a Rail traverse. Error checking, the application of Centre Error Correction and the introduction of Known Stations are examined.

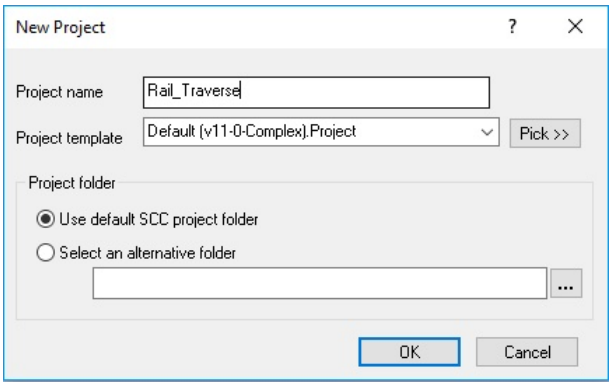
Creating A Project Directory

From the Main Screen, select 'DATA tab > New'’

Enter in a Project/Job name 'Rail_Traverse'

Select a Project Template from the list 'Default v11 Complex.Project'

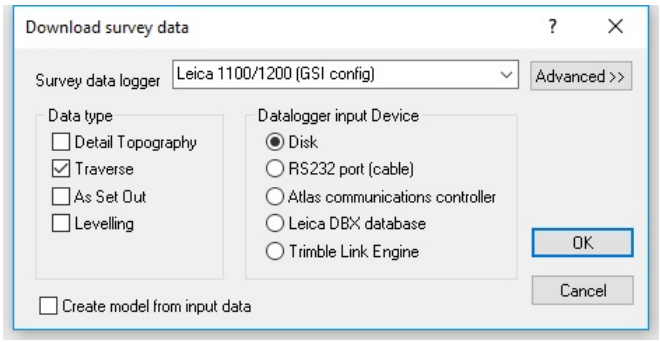
Select ‘OK’



Download Raw Data

From the Main Screen, select 'DATA tab > Download'

Set up the following:



Press 'Ok'

Select raw file '\RailData\Traverse\Rail-day.GSI'

Within the Leica data input (1100/1200/Wildsoft/LisCADD) dialog, pick 'Rail-day. GSIConfig' file and Press 'Ok'

Note: this file is within the SCC folder, as a result, available on the drop down menu

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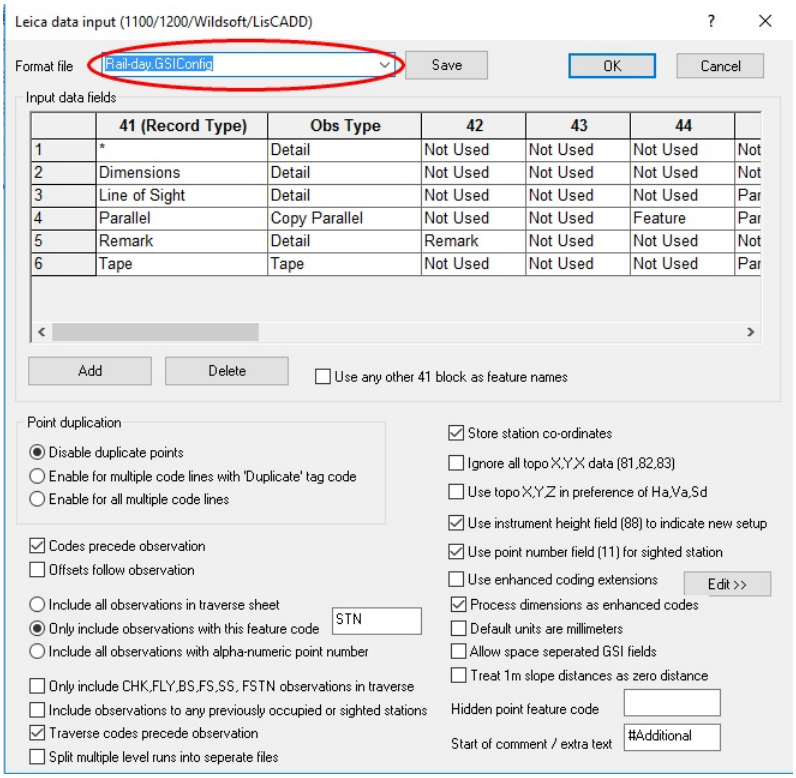
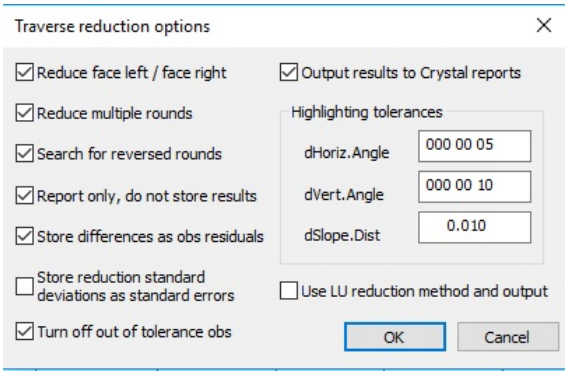


Error Checking

Go to the 'TRAVERSE tab > Adjust > Reduce'

Set up the following:



Press 'Ok'

Reduction Report

From the Pick A Report dialog, select 'SCC Traverse reduction (All).rpt' and Press 'Ok'

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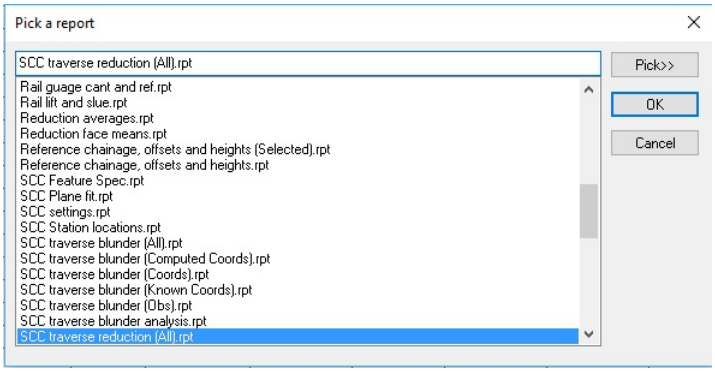

Examine Report:

Line	To Stn	RodHt	ha	va	sd	face
:L00016 110017	CST04	1.6480	275 14 00	269 56 15	122.2010	2
:L00015 110016	CST04	1.6480	095 13 54	090 03 48	122.2010	1
		Mean	095 13 57	090 03 47	122.2010	
		Spread	-000 00 06	000 00 03	0.0000	

Reduction means and differences

Setup	At Stn	Inst. Ht
1	CST02	1.5510

At Stn	To Stn	Mean Ha	Mean Va	Mean Sd
CST02	CST01	000 00 00.0	090 31 25.5	101.2770

Line	RodHt	Ha	Va	Sd	dHa	dVa	dSD
:L00003 1100	1.5550	000 00 00.0	090 31 24.5	101.2770	+000 00 00.0	-000 00 01.0	0.0000
:L00025 1100	1.5550	000 00 00.0	090 31 27.0	101.2770	+000 00 00.0	+000 00 01.5	0.0000
:L00019 1100	1.5550	000 00 00.0	090 31 26.5	101.2770	+000 00 00.0	+000 00 01.0	0.0000
:L00013 1100	1.5550	000 00 00.0	090 31 25.5	101.2770	+000 00 00.0	+000 00 00.0	0.0000
:L00002 1100	1.5550	000 00 00.0	090 31 24.0	101.2770	+000 00 00.0	-000 00 01.5	0.0000

At Stn	To Stn	Mean Ha	Mean Va	Mean Sd
CST02	CST03	195 13 41.8	090 06 17.4	52.0012

Line	RodHt	Ha	Va	Sd	dHa	dVa	dSD
:L00030 1100	1.6480	195 13 27.0	090 05 41.0	51.6010	-000 00 14.8	-000 00 36.4	-0.4000
:L00023 1100	1.6480	195 13 24.0	090 05 41.5	51.6010	-000 00 17.8	-000 00 35.9	-0.4000
:L00020 1100	1.6480	195 14 51.5	090 08 42.0	53.6010	+000 01 09.7	+000 02 24.6	1.6000
:L00014 1100	1.6480	195 13 22.5	090 05 41.5	51.6020	-000 00 19.3	-000 00 35.9	-0.4000
:L00005 1100	1.6480	195 13 24.0	090 05 41.0	51.6020	-000 00 17.8	-000 00 36.4	-0.4000

At Stn	To Stn	Mean Ha	Mean Va	Mean Sd
CST02	CST04	185 13 59.6	090 03 46.0	122.2010

Line	RodHt	Ha	Va	Sd	dHa	dVa	dSD
:L00028 1100	1.6360	185 14 01.5	090 03 46.0	122.2010	+000 00 01.8	-000 00 00.0	0.0000
:L00015 1100	1.6360	185 13 59.0	090 03 46.5	122.2010	-000 00 00.6	+000 00 00.5	0.0000
:L00021 1100	1.6360	185 13 59.0	090 03 45.0	122.2010	-000 00 00.6	-000 00 01.0	0.0000
:L00008 1100	1.6360	185 13 59.0	090 03 46.5	122.2010	-000 00 00.6	+000 00 00.5	0.0000

There is a notable Slope Distance Error:

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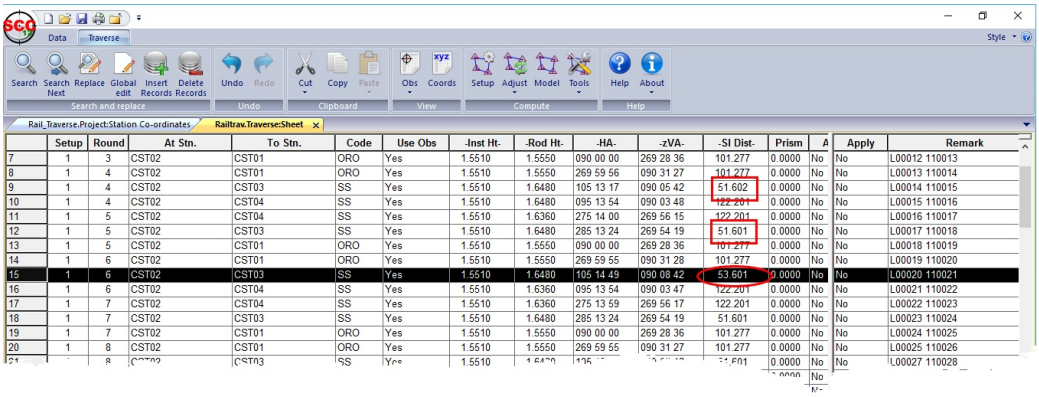
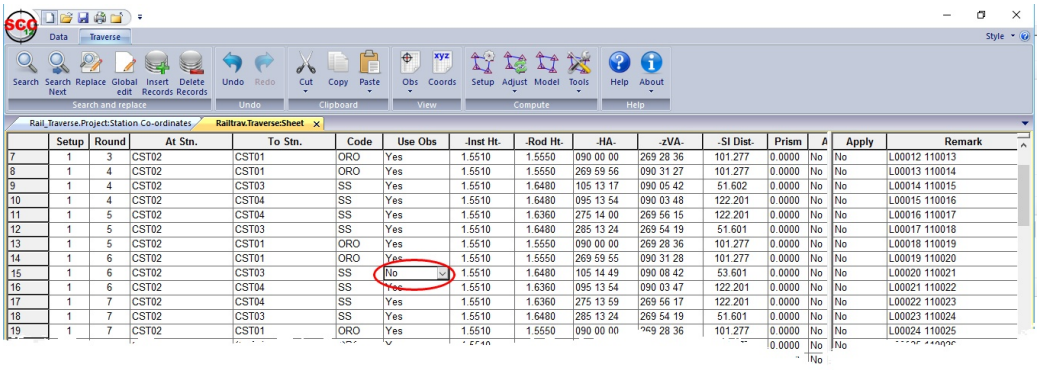


	Setup	Round	At Stn.	To Stn.	Code	Use Obs	-Inst Ht-	-Rod Ht-	-HA-	-zVA-	-SI Dist-	Prism	A	Apply	Remark
7	1	3	CST02	CST01	ORO	Yes	1.5510	1.5550	090 00 00	269 28 36	101.277	0.0000	No	No	L00012 110013
8	1	4	CST02	CST01	ORO	Yes	1.5510	1.5550	269 59 56	090 31 27	101.277	0.0000	No	No	L00013 110014
9	1	4	CST02	CST03	SS	Yes	1.5510	1.6480	105 13 17	090 05 42	51.602	0.0000	No	No	L00014 110015
10	1	4	CST02	CST04	SS	Yes	1.5510	1.6480	095 13 54	090 03 48	122.201	0.0000	No	No	L00015 110016
11	1	5	CST02	CST04	SS	Yes	1.5510	1.6360	275 14 00	269 56 15	122.201	0.0000	No	No	L00016 110017
12	1	5	CST02	CST03	SS	Yes	1.5510	1.6480	285 13 24	269 54 19	51.601	0.0000	No	No	L00017 110018
13	1	5	CST02	CST01	ORO	Yes	1.5510	1.5550	090 00 00	269 28 36	101.277	0.0000	No	No	L00018 110019
14	1	6	CST02	CST01	ORO	Yes	1.5510	1.5550	269 59 55	090 31 28	101.277	0.0000	No	No	L00019 110020
15	1	6	CST02	CST03	SS	Yes	1.5510	1.6480	105 14 49	090 08 42	53.601	0.0000	No	No	L00020 110021
16	1	6	CST02	CST04	SS	Yes	1.5510	1.6360	095 13 54	090 03 47	122.201	0.0000	No	No	L00021 110022
17	1	7	CST02	CST04	SS	Yes	1.5510	1.6360	275 13 59	269 56 17	122.201	0.0000	No	No	L00022 110023
18	1	7	CST02	CST03	SS	Yes	1.5510	1.6480	285 13 24	269 54 19	51.601	0.0000	No	No	L00023 110024
19	1	7	CST02	CST01	ORO	Yes	1.5510	1.5550	090 00 00	269 28 36	101.277	0.0000	No	No	L00024 110025
20	1	8	CST02	CST01	ORO	Yes	1.5510	1.5550	269 59 55	090 31 27	101.277	0.0000	No	No	L00025 110026

Removing Error from Traverse:

Select 'No' within 'Use Obs' column for record 15 At Stn CST02 To Stn CST03

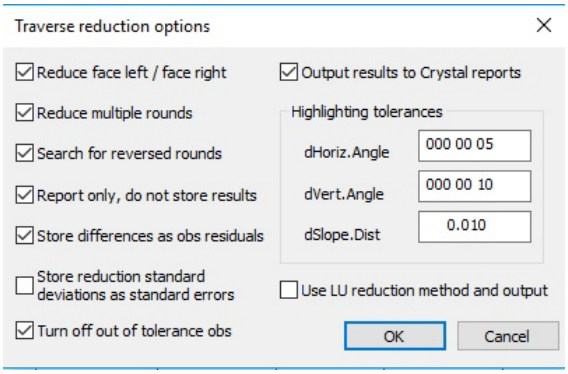


	Setup	Round	At Stn.	To Stn.	Code	Use Obs	-Inst Ht-	-Rod Ht-	-HA-	-zVA-	-SI Dist-	Prism	A	Apply	Remark
7	1	3	CST02	CST01	ORO	Yes	1.5510	1.5550	090 00 00	269 28 36	101.277	0.0000	No	No	L00012 110013
8	1	4	CST02	CST01	ORO	Yes	1.5510	1.5550	269 59 56	090 31 27	101.277	0.0000	No	No	L00013 110014
9	1	4	CST02	CST03	SS	Yes	1.5510	1.6480	105 13 17	090 05 42	51.602	0.0000	No	No	L00014 110015
10	1	4	CST02	CST04	SS	Yes	1.5510	1.6480	095 13 54	090 03 48	122.201	0.0000	No	No	L00015 110016
11	1	5	CST02	CST04	SS	Yes	1.5510	1.6360	275 14 00	269 56 15	122.201	0.0000	No	No	L00016 110017
12	1	5	CST02	CST03	SS	Yes	1.5510	1.6480	285 13 24	269 54 19	51.601	0.0000	No	No	L00017 110018
13	1	5	CST02	CST01	ORO	Yes	1.5510	1.5550	090 00 00	269 28 36	101.277	0.0000	No	No	L00018 110019
14	1	6	CST02	CST01	ORO	Yes	1.5510	1.5550	269 59 55	090 31 28	101.277	0.0000	No	No	L00019 110020
15	1	6	CST02	CST03	SS	No	1.5510	1.6480	105 14 49	090 08 42	53.601	0.0000	No	No	L00020 110021
16	1	6	CST02	CST04	SS	Yes	1.5510	1.6360	095 13 54	090 03 47	122.201	0.0000	No	No	L00021 110022
17	1	7	CST02	CST04	SS	Yes	1.5510	1.6360	275 13 59	269 56 17	122.201	0.0000	No	No	L00022 110023
18	1	7	CST02	CST03	SS	Yes	1.5510	1.6480	285 13 24	269 54 19	51.601	0.0000	No	No	L00023 110024
19	1	7	CST02	CST01	ORO	Yes	1.5510	1.5550	090 00 00	269 28 36	101.277	0.0000	No	No	L00024 110025

Re-run Reduction:

Go to the 'TRAVERSE tab > Adjust > Reduce'

Set up the following:



Press 'Ok'

Reduction Report

From the Pick A Report dialog, select 'SCC Traverse reduction (All).rpt' and Press 'Ok'

Review Results. Note how the Stand Deviation for Slope Distance is now 0.00

Remove Stations From the Project

Go to Project View, remove stations that have been downloaded from raw file

Select ''EDIT tab > Delete Records' set up the following:

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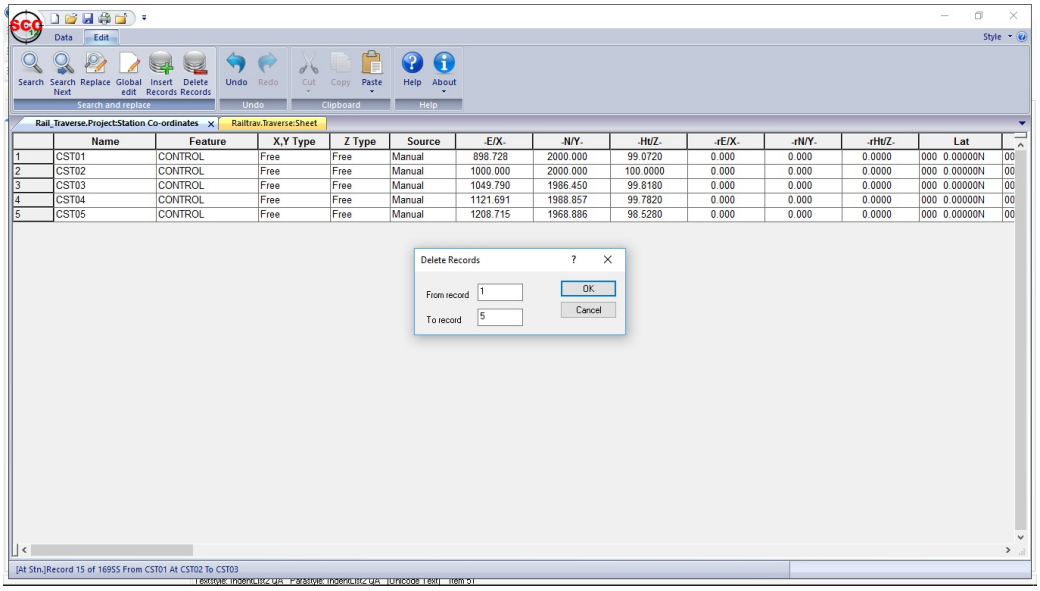
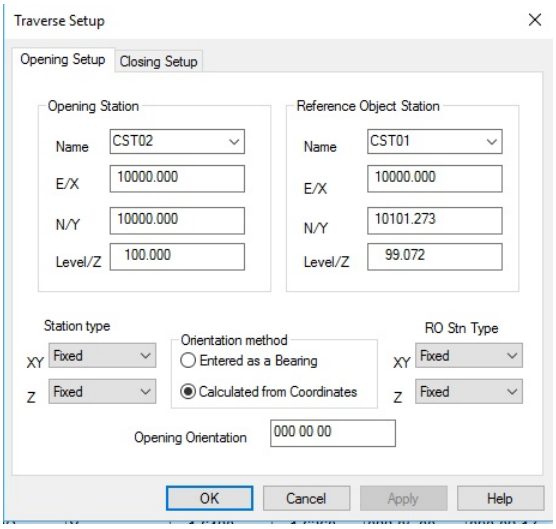


	Name	Feature	X,Y Type	Z Type	Source	-E/X-	-N/Y-	-Ht/Z-	-rE/X-	-rN/Y-	-rHt/Z-	Lat
1	CST01	CONTROL	Free	Free	Manual	898.728	2000.000	99.0720	0.000	0.000	0.0000	000 0.00000N
2	CST02	CONTROL	Free	Free	Manual	1000.000	2000.000	100.0000	0.000	0.000	0.0000	000 0.00000N
3	CST03	CONTROL	Free	Free	Manual	1049.790	1986.450	99.8180	0.000	0.000	0.0000	000 0.00000N
4	CST04	CONTROL	Free	Free	Manual	1121.691	1988.857	99.7820	0.000	0.000	0.0000	000 0.00000N
5	CST05	CONTROL	Free	Free	Manual	1208.715	1968.886	98.5280	0.000	0.000	0.0000	000 0.00000N

Adjust Traverse Based on Fixed Base Line

Go to 'TRAVERSE tab', Select 'Setup'

Set opening set up as shown below, allowing SCC to generate a RO values:



Press 'OK'

Select 'Adjust', set up the following and Press 'Ok'

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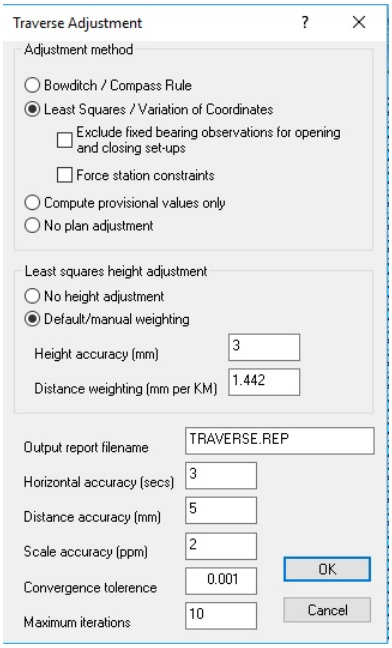
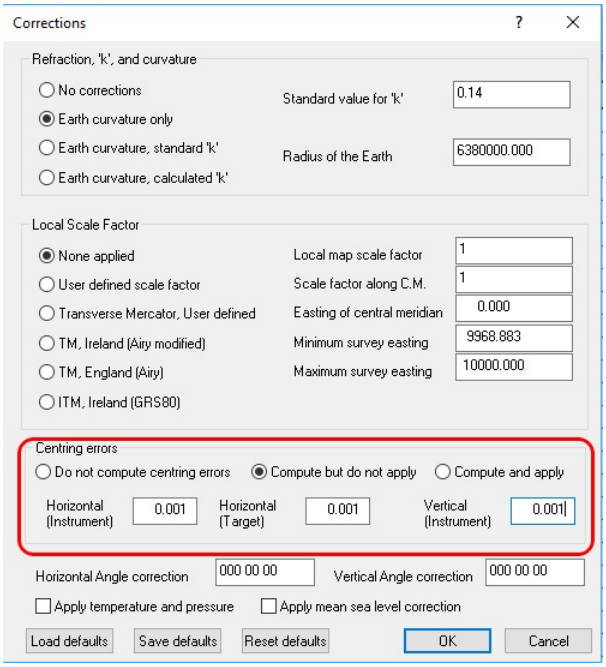


Review Results and select 'Yes, to use provisional coordinates'

Applying Corrections: Centring Error

Go to 'TRAVERSE tab', Select 'Adjust drop down > Corrections'

Set up Centring Errors as shown below and Press 'Ok':



Re-adjust and review report

Level Data

Open 'Levels.Traverse'

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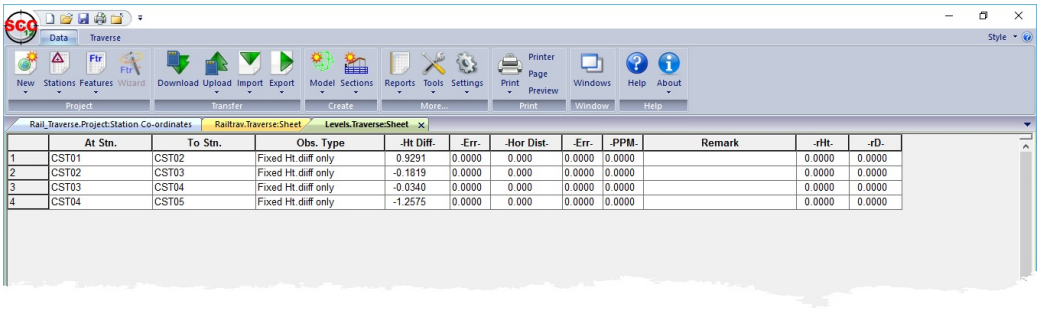
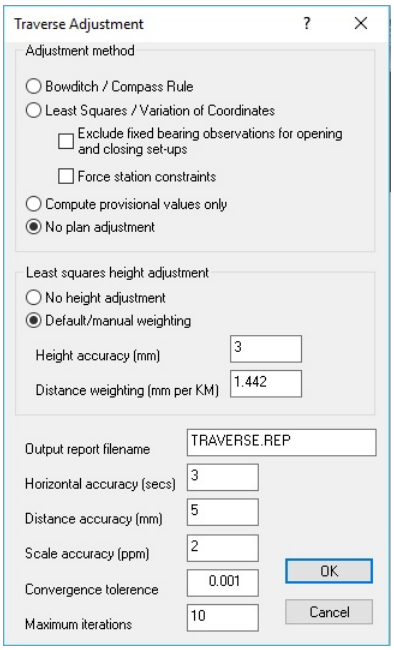


	At Stn.	To Stn.	Obs. Type	-Ht Diff-	-Err-	-Hor Dist-	-Err-	-PPM-	Remark	-rHt-	-rD-
1	CST01	CST02	Fixed Ht.diff only	0.9291	0.0000	0.000	0.0000	0.0000		0.0000	0.0000
2	CST02	CST03	Fixed Ht.diff only	-0.1819	0.0000	0.000	0.0000	0.0000		0.0000	0.0000
3	CST03	CST04	Fixed Ht.diff only	-0.0340	0.0000	0.000	0.0000	0.0000		0.0000	0.0000
4	CST04	CST05	Fixed Ht.diff only	-1.2575	0.0000	0.000	0.0000	0.0000		0.0000	0.0000

Go to 'TRAVERSE tab', Select 'Adjust'

Set up the following:

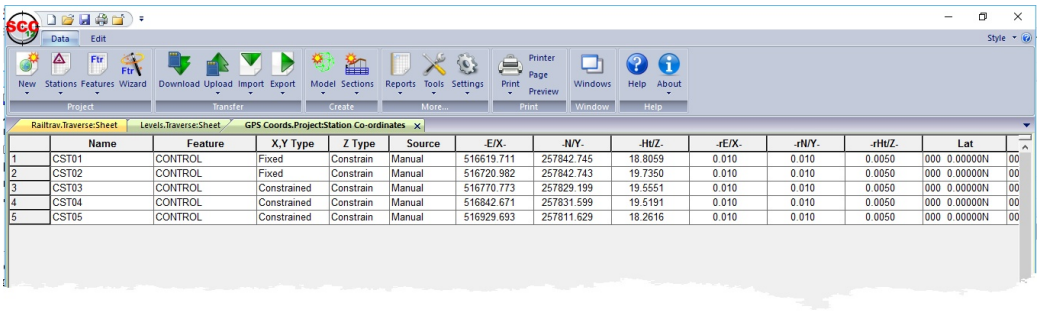


Select 'OK' and Review report

Select 'Yes, to use Adjusted Coordinates'

Known Station Values

Close existing project and open 'GPSCoords.Project'



	Name	Feature	X,Y Type	Z Type	Source	-E/X-	-N/Y-	-Ht/Z-	-rE/X-	-rN/Y-	-rHt/Z-	Lat
1	CST01	CONTROL	Fixed	Constrain	Manual	516619.711	257842.745	18.8059	0.010	0.010	0.0050	000 0.00000N
2	CST02	CONTROL	Fixed	Constrain	Manual	516720.982	257842.743	19.7350	0.010	0.010	0.0050	000 0.00000N
3	CST03	CONTROL	Constrained	Constrain	Manual	516770.773	257829.199	19.5551	0.010	0.010	0.0050	000 0.00000N
4	CST04	CONTROL	Constrained	Constrain	Manual	516842.671	257831.599	19.5191	0.010	0.010	0.0050	000 0.00000N
5	CST05	CONTROL	Constrained	Constrain	Manual	516929.693	257811.629	18.2616	0.010	0.010	0.0050	000 0.00000N

Note: Coordinates are constrained based on information from the GPS report (rE/X, rN.Y, rHt/Z)

Run Adjustment

Go to 'TRAVERSE tab', Select 'Adjust'

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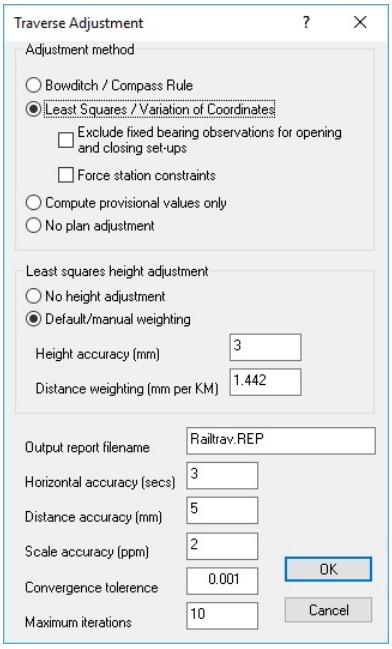
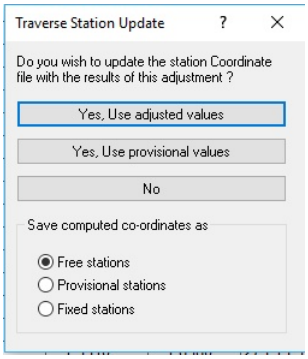


Press 'Ok' and Review Report

Select 'Yes, Use Adjustment Values'



1.2 Rail Analysis

SCC can be used for analysis and reporting of Rail data.

1.2.1 Rail Overlap

String comparison and overlap processing option are available within the model view under '**DESIGN tab > Rail button > Compare strings and remove overlaps**'. This requires a model with one or more overlapping strings, and an alignment for reference purposes. The following is an example of the usage of this function based around the sample data provided;

Creating A Project Directory

From the Main Screen, select 'DATA tab > New'’

Enter in a Project/Job name 'Overlap'

Select a Project Template from the list 'Default v11 Complex.Project'

Select ‘OK’

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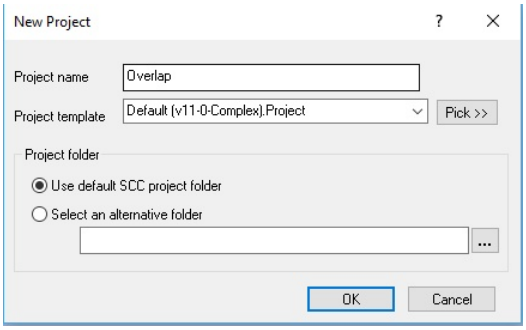
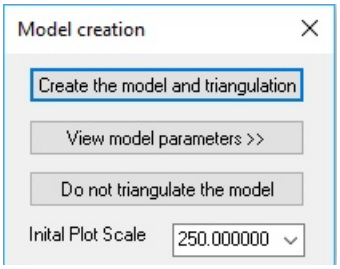


Create Model

Go to 'DATA tab > Model drop down > SCC Dataset'

Go to \RailData\Model\Biggin.Survey'

Select Initial Plot Scale of 250 and 'Create the model and triangulation'

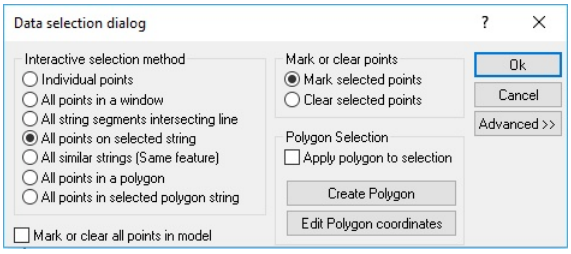


Select 'Ok' to model attribute dialog

Select RR String Information

Right click the mouse to bring up the Data Selection Dialog

Select 'All points on selected string' and 'Ok'



Left click mouse on RR line strings

String Overlap

Go to 'DESIGN tab > Overlaps' button

Set up the following:

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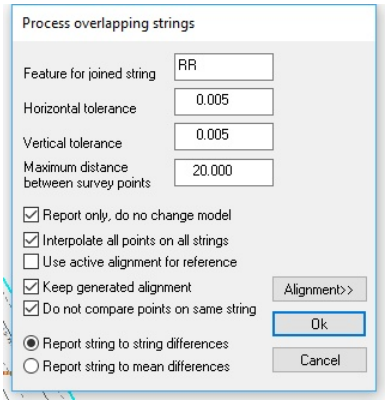
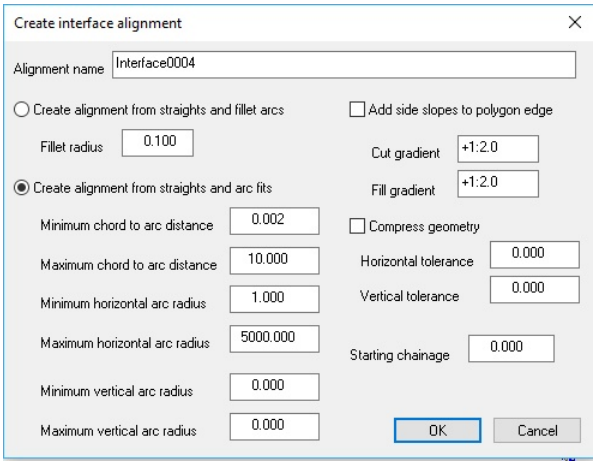
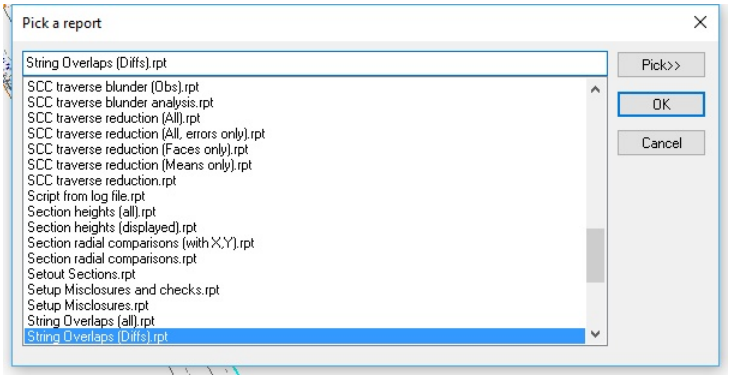


Press 'Alignment>>', set up the following and Press 'OK':



Pick 'String Overlap (Diff).rpt' and Press 'OK'



Review Report

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String overlap comparison
(Differences only)

Tel:
Fax:
email:
web:

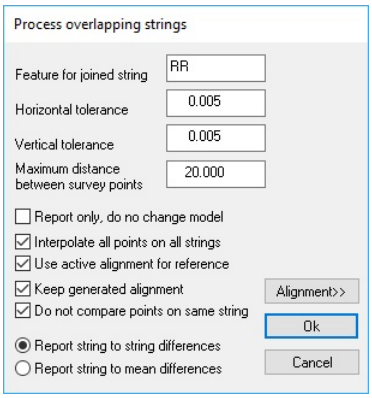
Point	Feature	Chainage	Offset	-E/X-	-N/Y-	-Ht/Z-	dDist	dZ	dOfs
9122	RR	110.670	0.000	7,767.785	8,016.056	21.577	0.001	-0.004	0.001
6131	RR	120.677	0.000	7,777.590	8,014.056	21.512	0.002	0.002	-0.002
9123	RR	120.712	-0.002	7,777.624	8,014.051	21.514	0.002	-0.002	0.002
6132	RR	130.774	-0.012	7,787.443	8,011.849	21.443	0.001	0.003	0.001
9141	RR	301.890	0.005	7,945.216	7,947.420	20.812	0.004	-0.003	-0.004
9142	RR	312.114	0.005	7,953.915	7,942.049	20.799	0.004	-0.002	-0.004
1037	RR	784.188	0.000	8,237.370	7,572.316	19.813	0.003	-0.004	0.003
2102	RR	784.192	0.002	8,237.370	7,572.311	19.810	0.005	0.004	-0.002
1036	RR	784.188	0.000	8,237.370	7,572.316	19.814	0.005	-0.004	0.002
2103	RR	794.331	0.000	8,242.384	7,563.499	19.785	0.001	0.005	0.001
1038	RR	794.352	0.001	8,242.393	7,563.481	19.790	0.001	-0.005	-0.001
1039	RR	804.406	0.001	8,247.364	7,554.741	19.766	0.001	0.000	0.000

Repeat String Overlap

Go to 'DESIGN tab > Overlaps' button

Set up the following and Press 'Ok':

This time ensure that 'Report only, do not change model' is not selected and 'Use active alignment for reference' is selected



On completion note the RR string is one complete string

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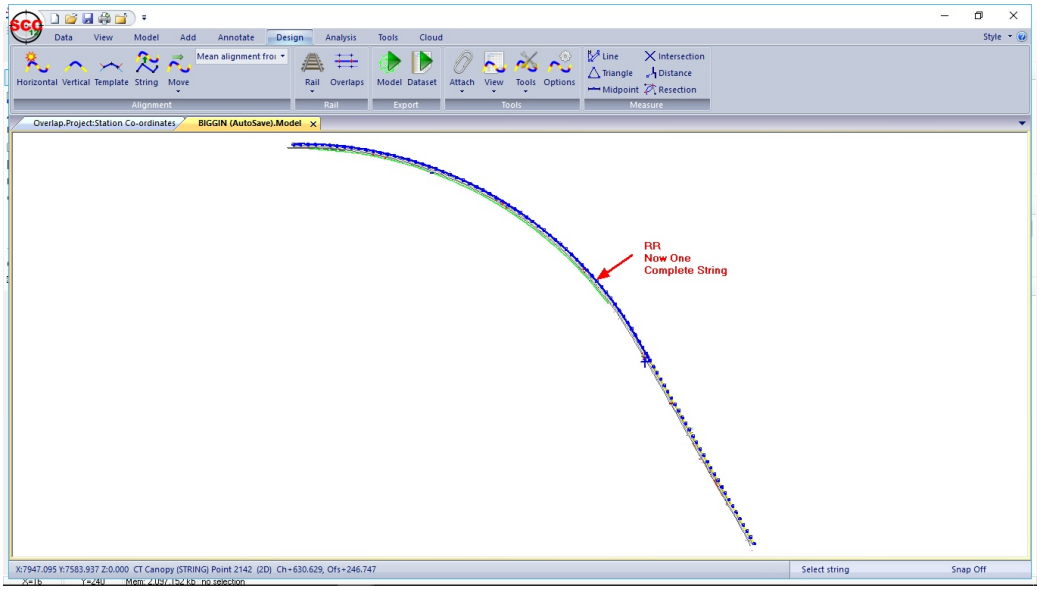


1.2.2 Cant & Gauge Reporting

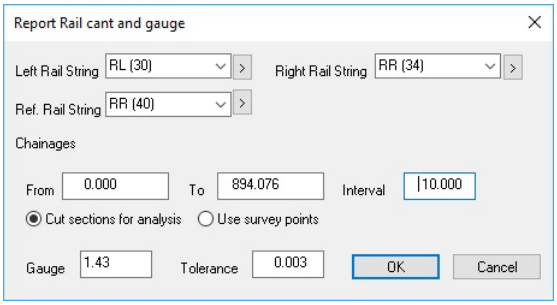
Using the opened data a Cant & Gauge report can be generated.

Reporting Cant & Gauge

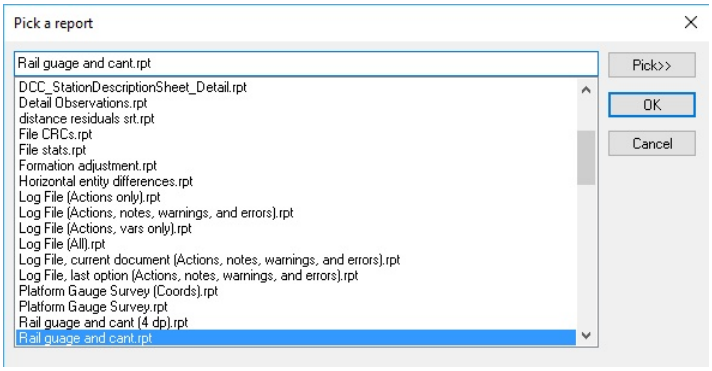
Go to 'DESIGN tab > Rail drop down menu > Report cant and gauge'

Note there must be an active alignment present

Set up the following and Press 'OK'



Pick 'Rail guage and cant.rpt'



Review Report

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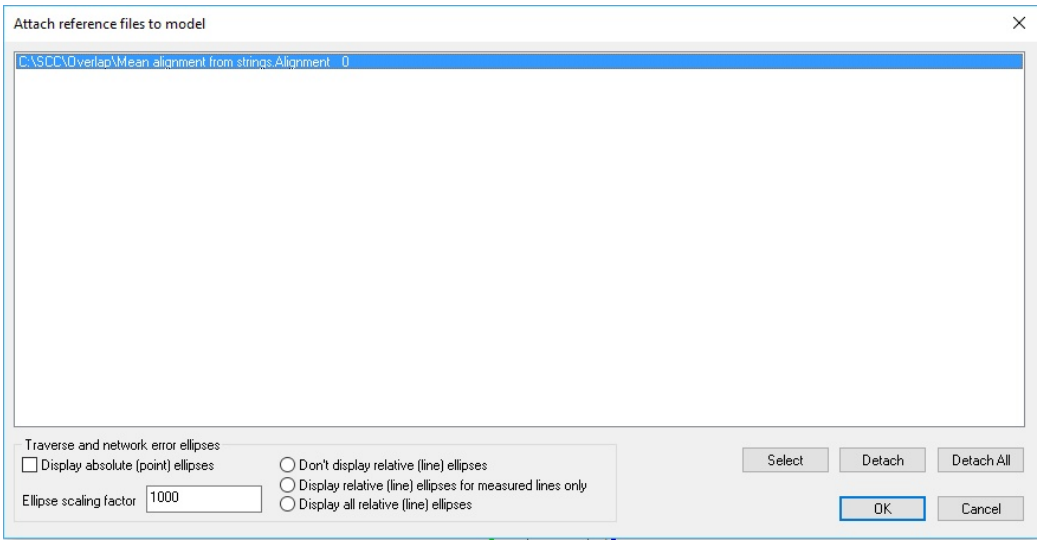
1.2.3 Lift & Slue Reporting

Using the opened data a Lift & Slue report can be generated.

Remove Existing Alignment

Go to 'DESIGN tab > Attach'

Highlight attached alignment, select 'Detach All' and 'Ok'



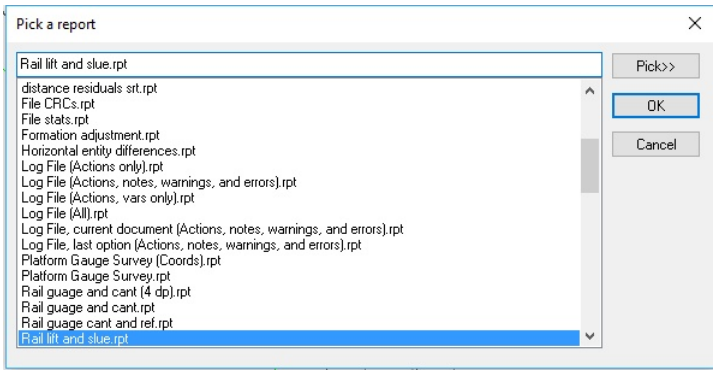
Attach Design Alignment

Go to 'DESIGN tab > Attach drop down menu > Alignment'

Select ' \rail-day\Lift & Slue\MC02.Alignment'

Reporting Lift & Slue

Go to 'DESIGN tab > Rail drop down menu > Report Lift and Slue



Review Report

1.3 2nd Rail

Using Parallel offset options within SCC, a 2nd rail string can be generated.

Go to 'DATA tab > Model drop down > SCC Dataset'

Go to '\rail-day\2nd Rail\Rail2.Survey'

Select Initial Plot Scale of 250 and 'Create the model and triangulation'

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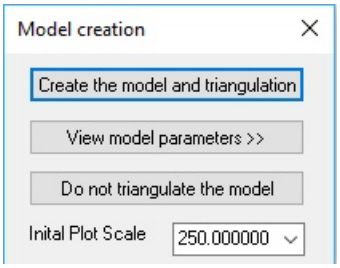


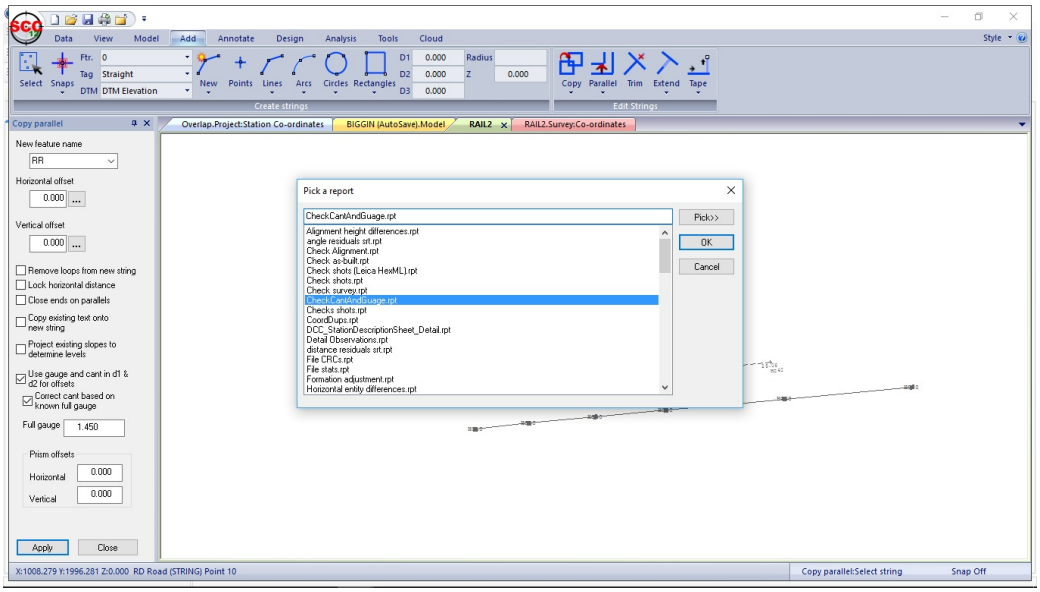
Select 'Ok' to model attribute dialog

Additional String

Go to 'ADD tab > Parallel'

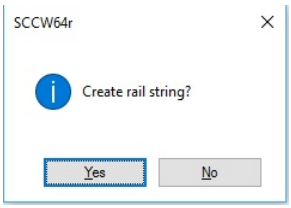
Set up the following Copy Parallel Options

Pick RD string on screen and then 'CheckCantAndGauge.rpt' from dialog. Press 'Ok'



Review Report

Select Yes to 'Create rail string' and click on screen to position string



1.4 Import Amberg Data

An input routine to support the Amberg Trolley data provided. This creates two points per line, one for left rail, one for right rail, using the station for string number and ident for point number. D1,D2, and D3 are used to store odometer, gauge, and super-elevation in the input file, such that they can be annotated as required. The rail features are named LRAIL and RRAIL.

Close all dataset and models. Leave existing Project file open

Importing Amberg Trolley Data

Go to 'DATA tab > Import drop down menu > Amberg GRPWin'

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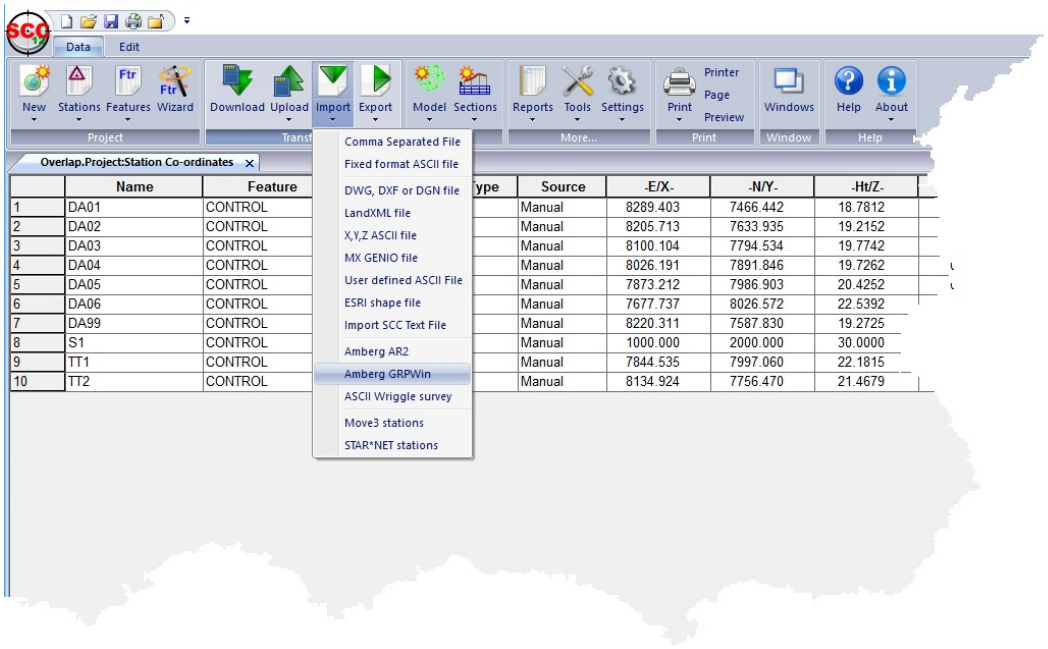
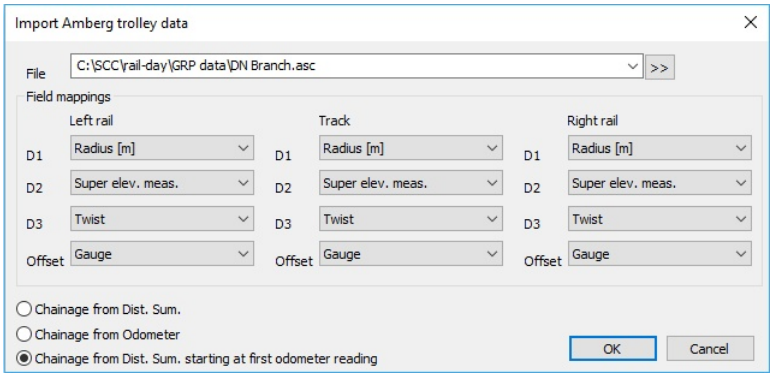
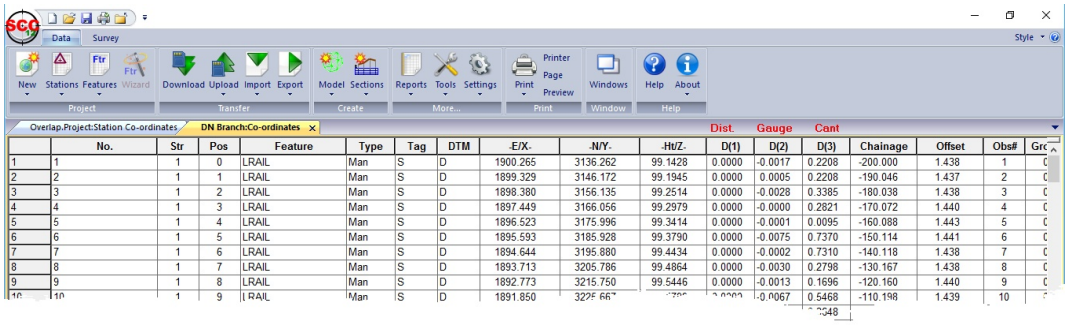


	Name	Feature	Type	Source	-E/X-	-N/Y-	-Ht/Z-
1	DA01	CONTROL		Manual	8289.403	7466.442	18.7812
2	DA02	CONTROL		Manual	8205.713	7633.935	19.2152
3	DA03	CONTROL		Manual	8100.104	7794.534	19.7742
4	DA04	CONTROL		Manual	8026.191	7891.846	19.7262
5	DA05	CONTROL		Manual	7873.212	7986.903	20.4252
6	DA06	CONTROL		Manual	7677.737	8026.572	22.5392
7	DA99	CONTROL		Manual	8220.311	7587.830	19.2725
8	S1	CONTROL		Manual	1000.000	2000.000	30.0000
9	TT1	CONTROL		Manual	7844.535	7997.060	22.1815
10	TT2	CONTROL		Manual	8134.924	7756.470	21.4679

Pick 'DN Branch.asc', set up the following and then Press 'OK'



The dataset is present whereby the D1 is Dist, D2 is Gauge and D3 is Cant



	No.	Str	Pos	Feature	Type	Tag	DTM	-E/X-	-N/Y-	-Ht/Z-	D(1)	D(2)	D(3)	Chainage	Offset	Obs#
1	1	1	0	LRAIL	Man	S	D	1900.265	3136.262	99.1428	0.0000	-0.0017	0.2208	-200.000	1.438	1
2	2	1	1	LRAIL	Man	S	D	1899.329	3146.172	99.1945	0.0000	0.0005	0.2208	-190.046	1.437	2
3	3	1	2	LRAIL	Man	S	D	1898.380	3156.135	99.2514	0.0000	-0.0028	0.3385	-180.038	1.438	3
4	4	1	3	LRAIL	Man	S	D	1897.449	3166.056	99.2979	0.0000	-0.0000	0.2821	-170.072	1.440	4
5	5	1	4	LRAIL	Man	S	D	1896.523	3175.996	99.3414	0.0000	-0.0001	0.0095	-160.088	1.443	5
6	6	1	5	LRAIL	Man	S	D	1895.593	3185.928	99.3790	0.0000	-0.0075	0.7370	-150.114	1.441	6
7	7	1	6	LRAIL	Man	S	D	1894.644	3195.880	99.4434	0.0000	-0.0002	0.7310	-140.118	1.438	7
8	8	1	7	LRAIL	Man	S	D	1893.713	3205.786	99.4864	0.0000	-0.0030	0.2798	-130.167	1.438	8
9	9	1	8	LRAIL	Man	S	D	1892.773	3215.750	99.5446	0.0000	-0.0013	0.1696	-120.160	1.440	9
10	10	1	9	LRAIL	Man	S	D	1891.850	3225.667			-0.0067	0.5468	-110.198	1.439	10

Create Model

Go to 'DATA tab > Model drop down > SCC Dataset'

Pick 'DN Branch.Survey'

Select Initial Plot Scale of 250 and 'Create the model and triangulation'

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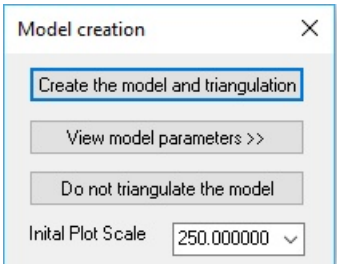


Note the Chainage/Offset system present is been read from the dataset not an active Alignment

1.5 Design From XML

The following describes how to create different surfaces in SCC from a given design and export to XML for Machine Guidance.

- Design data will be provided as an XML file with a given centreline string including cant and gauge

- Three design surfaces are generated: Rails (including gauge and cant), Ballast and Formation

- The Ballast layer will ramp down at chainage 380m and ramp up at chainage 480m

- A 0.300m gap will be maintained from the lowest sleeper end to formation

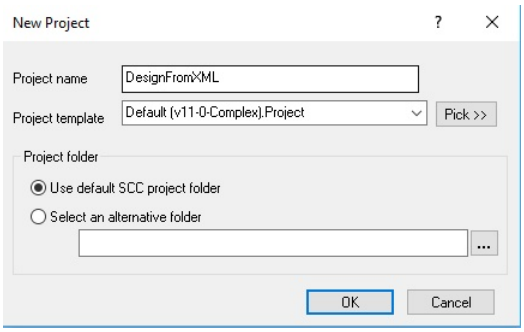
1.5.1 Create A Project Directory

From the Main Screen, select 'DATA tab > New'

Enter in a Project/Job name 'Design from XML

Select a Project Template from the list 'Default v11 Complex.Project'

Select 'OK'



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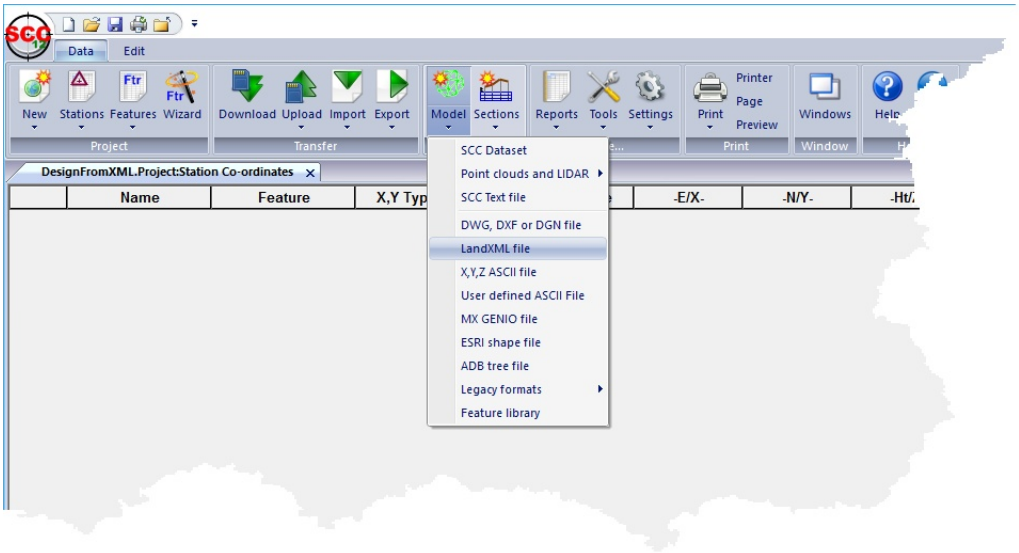
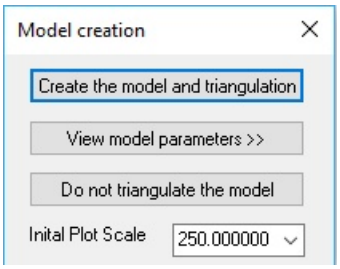
1.5.2 Modelling LandXML file

Within the 'DATA tab > Model drop down > LandXML file'



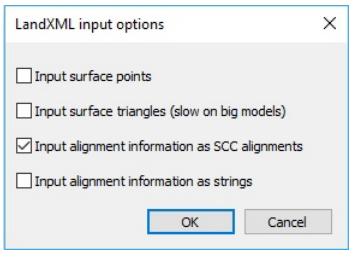
Go to '\rail-day\Design XML\Biggins v1.1.xml' and Press 'Open'

Select Initial Plot Scale of 250 and 'Create the model and triangulation'



Select 'Ok' to model attribute dialog

Set up the following and press 'Ok'



Select 'Home' within Model to Zoom Extent

1.5.3 Attach Design Alignment

Within Model, go to 'DESIGN tab > Attach drop down menu > Alignment'

Select 'Prop CL copy.Alignment

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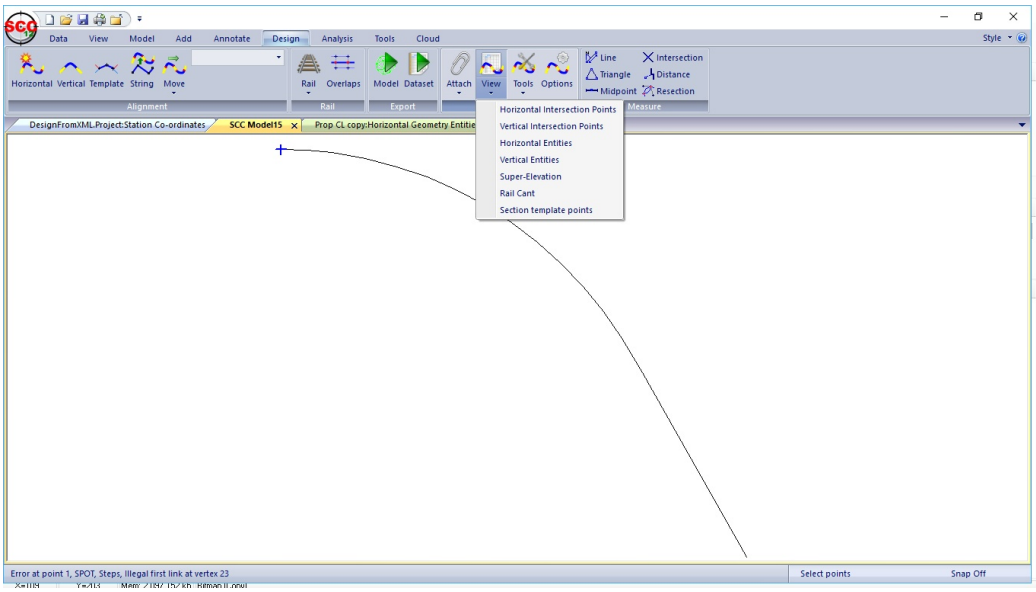
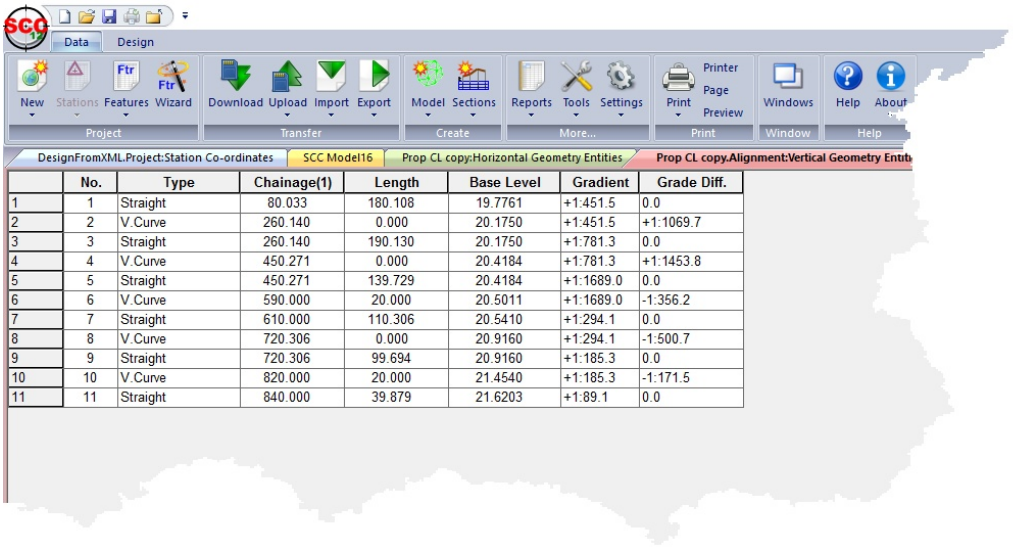
1.5.4 View Design Information



Within the 'DESIGN tab > View > Vertical Entities'



	No.	Type	Chainage(1)	Length	Base Level	Gradient	Grade Diff.
1	1	Straight	80.033	180.108	19.7761	+1:451.5	0.0
2	2	V.Curve	260.140	0.000	20.1750	+1:451.5	+1:1069.7
3	3	Straight	260.140	190.130	20.1750	+1:781.3	0.0
4	4	V.Curve	450.271	0.000	20.4184	+1:781.3	+1:1453.8
5	5	Straight	450.271	139.729	20.4184	+1:1689.0	0.0
6	6	V.Curve	590.000	20.000	20.5011	+1:1689.0	-1:356.2
7	7	Straight	610.000	110.306	20.5410	+1:294.1	0.0
8	8	V.Curve	720.306	0.000	20.9160	+1:294.1	-1:500.7
9	9	Straight	720.306	99.694	20.9160	+1:185.3	0.0
10	10	V.Curve	820.000	20.000	21.4540	+1:185.3	-1:171.5
11	11	Straight	840.000	39.879	21.6203	+1:89.1	0.0

Within the 'DESIGN tab > View > Rail Cant'

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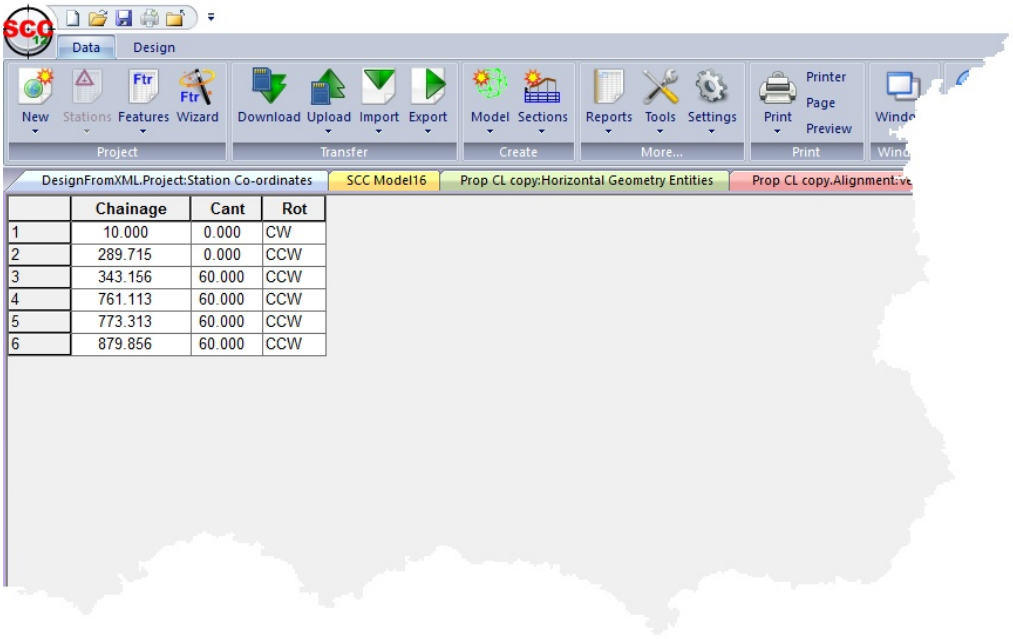


	Chainage	Cant	Rot
1	10.000	0.000	CW
2	289.715	0.000	CCW
3	343.156	60.000	CCW
4	761.113	60.000	CCW
5	773.313	60.000	CCW
6	879.856	60.000	CCW

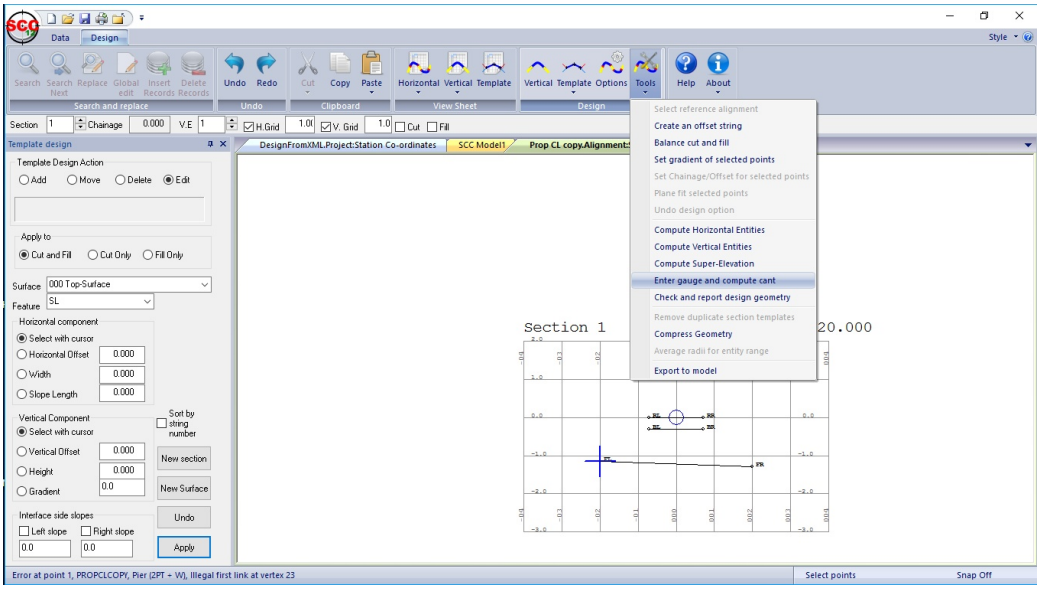
NOTE: If no Cant values where present in the XML file, values can be entered manually by viewing Rail Cant and then selecting 'DESIGN tab > Insert Records'. Cant is entered in mm. CW is Clockwise / CCW is Counter Clockwise.

Save Alignment

1.5.5 Creating Design Gauge & Cant

Go to 'DESIGN tab > Template button'

Then 'DESIGN tab > Tools > Enter gauge and compute cant'



Set up the following:

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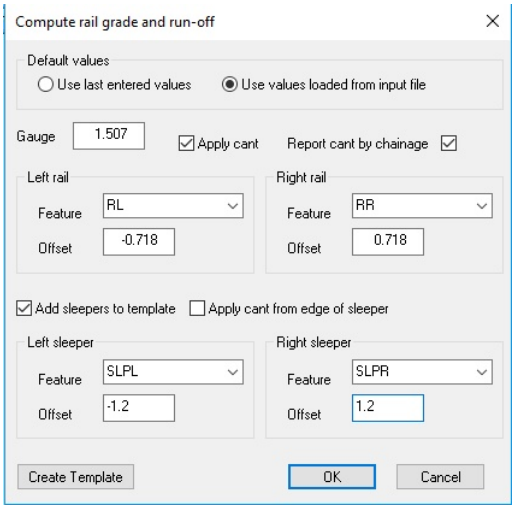


NOTE:

The dialog uses values from the input XML file

Enter the Cant Base

Apply cant will apply cant form Cant Station (Cant entered is mm)

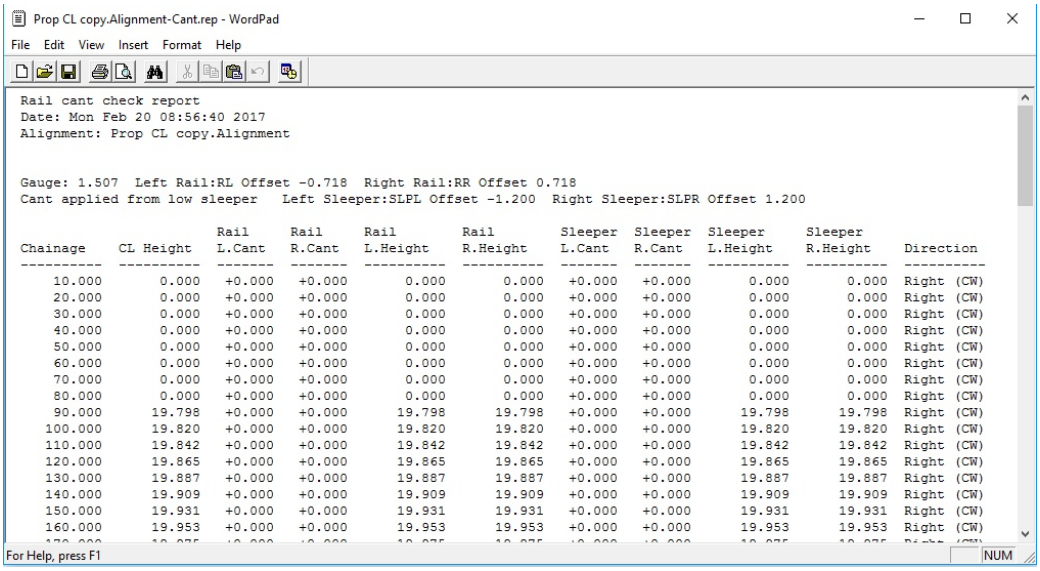
Report Cant by Chainage will give a report file showing cant, gauge and rail levels before continuing

Add Sleepers to template will include sleepers on the rail surface

Apply cant from edge of sleeper will apply cant from edge of sleeper

Select 'Create Template' which will use setting to create a section template

Press 'OK' to create a report



A Section Template is created.

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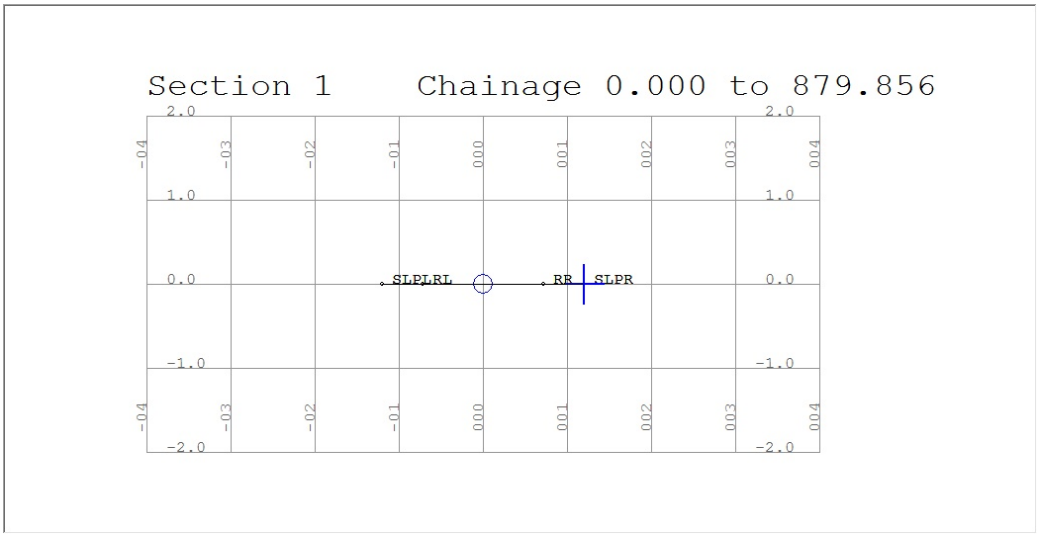


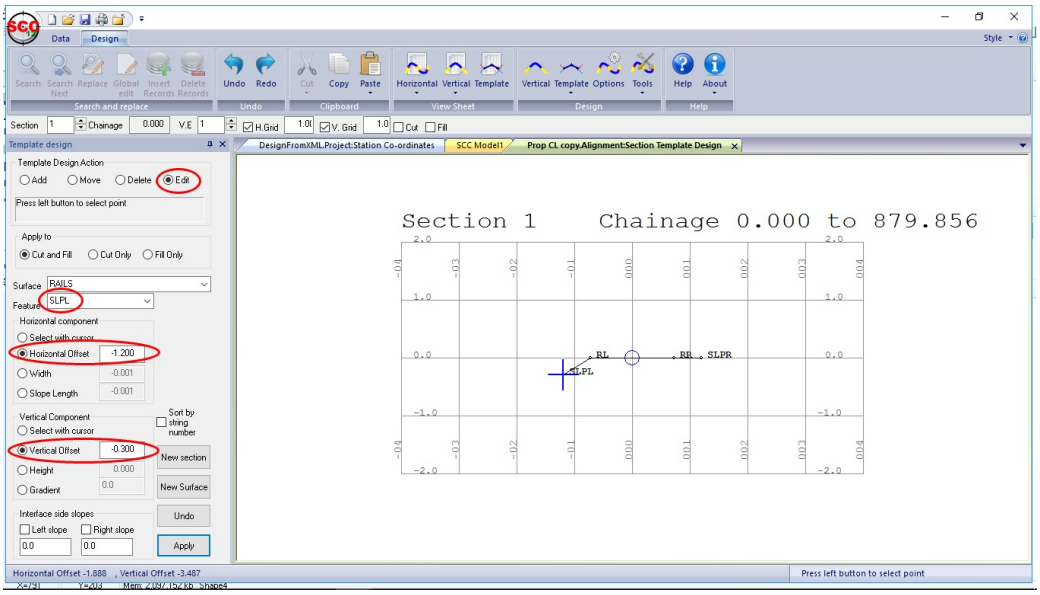
1.5.6 Applying Sleeper Vertical & Horizontal Offset

Within Template Design, select 'EDIT'

Left click mouse on 'SLPL' on screen

Set up SLPL: Horz. Offset -1.20 / Vert. Offset -0.3 (300mm lower than rails) as shown

Press 'Apply'



Left click mouse on 'SLPL' on screen

Set up SLPR: Horz. Offset 1.20 / Vert. Offset -0.3 (300mm lower than rails) as shown

Press 'Apply'

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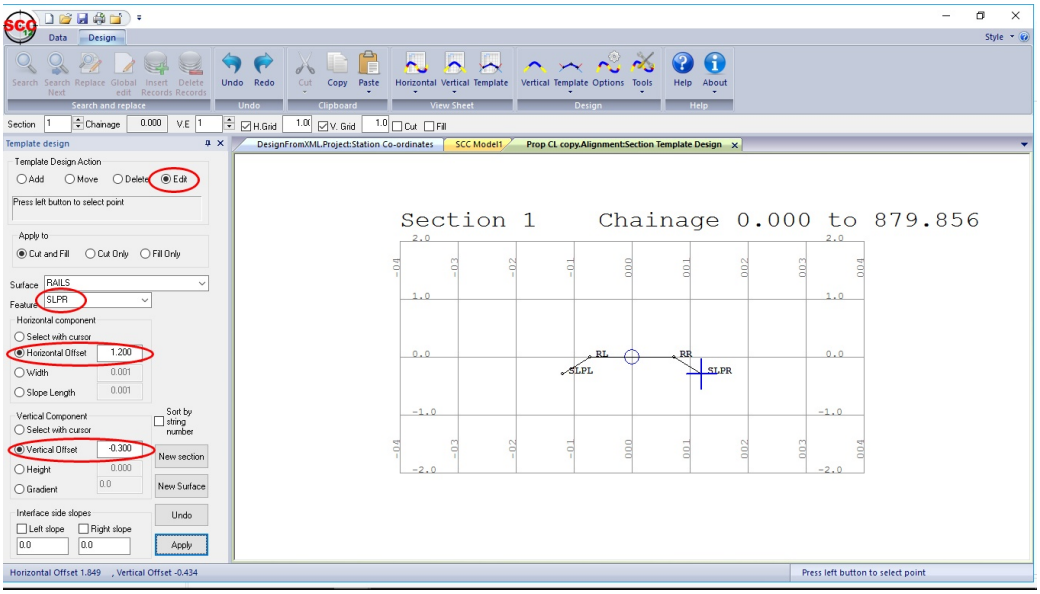
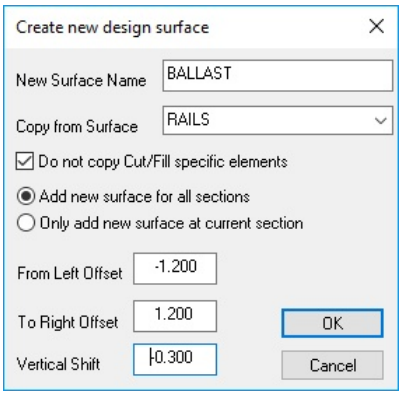
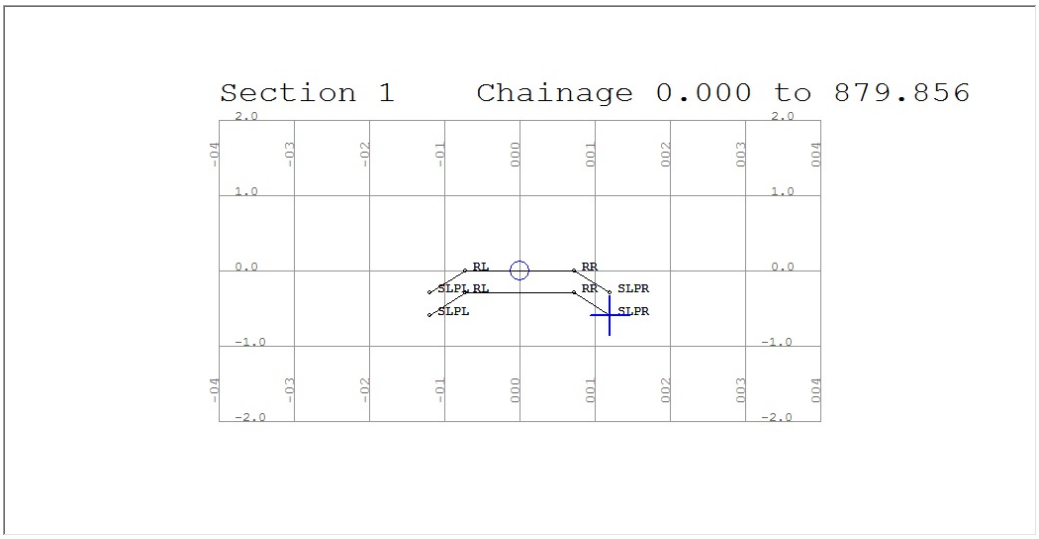


1.5.7 Add Ballast Layer

Select 'New Surface'

Set up the following and Press 'OK'





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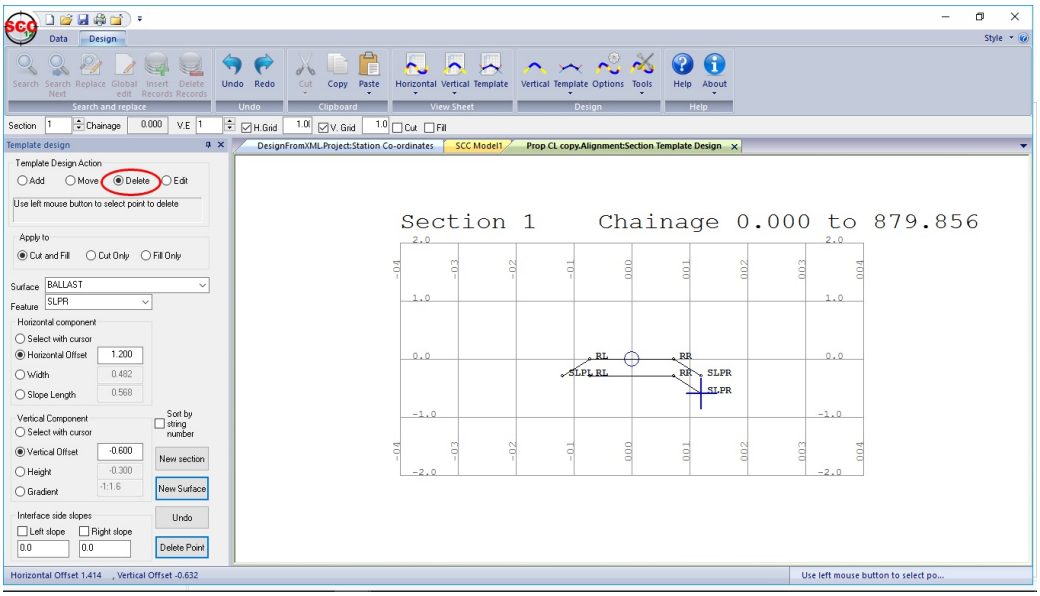
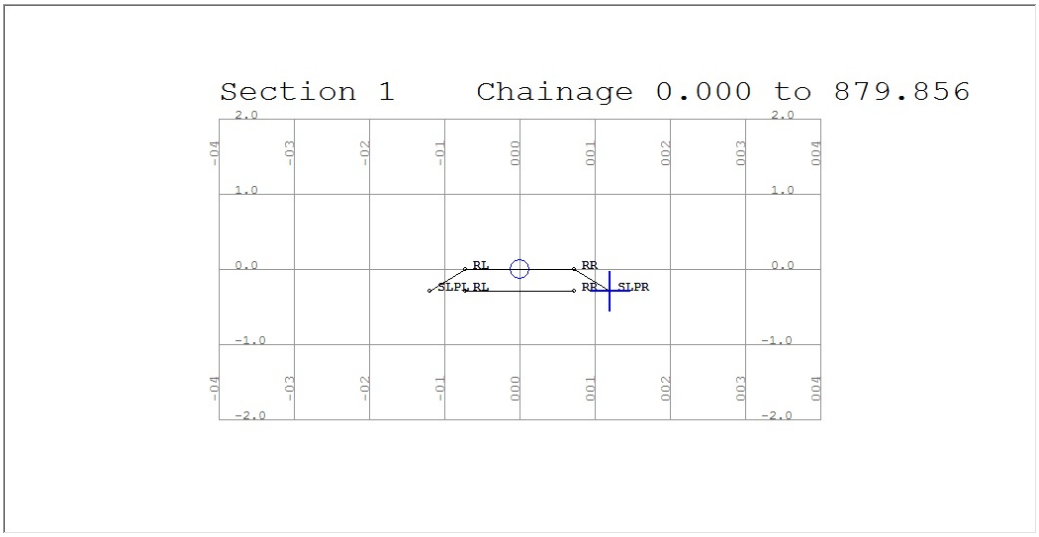
1.5.8 Removing Sleepers From Ballast Surface

Select 'Delete'

Left click mouse on 'SLPL' and then select 'Delete Point'

Left click mouse on 'SLPR' and then select 'Delete Point'





1.5.9 Editing Ballast Surface

Select 'Edit'

Left click mouse on 'BL' point

Enter Horz, Offset -0.2 and Vert. Offset -0.3

Press 'Edit Point'

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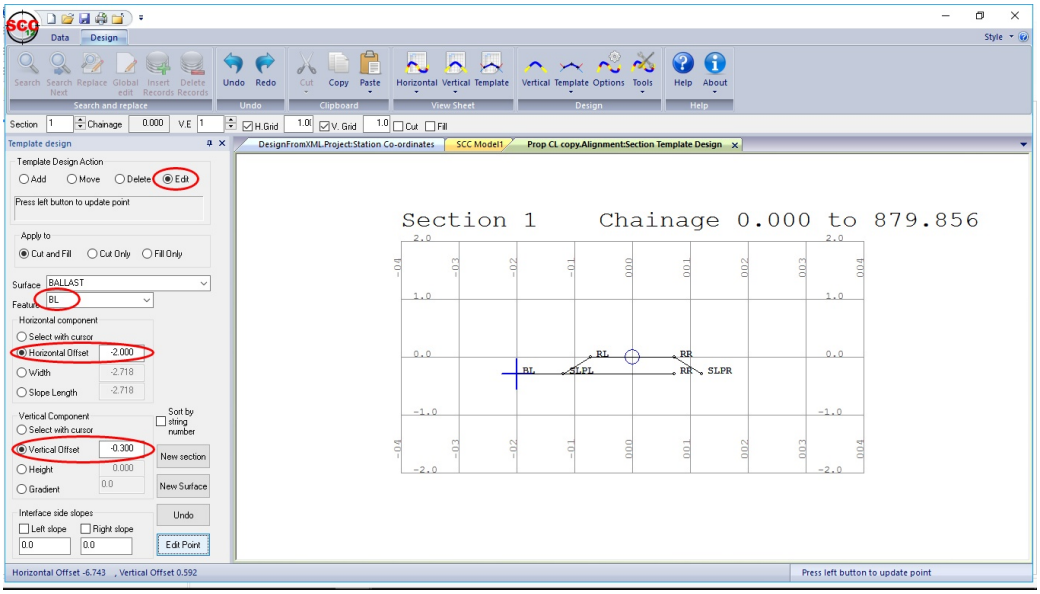
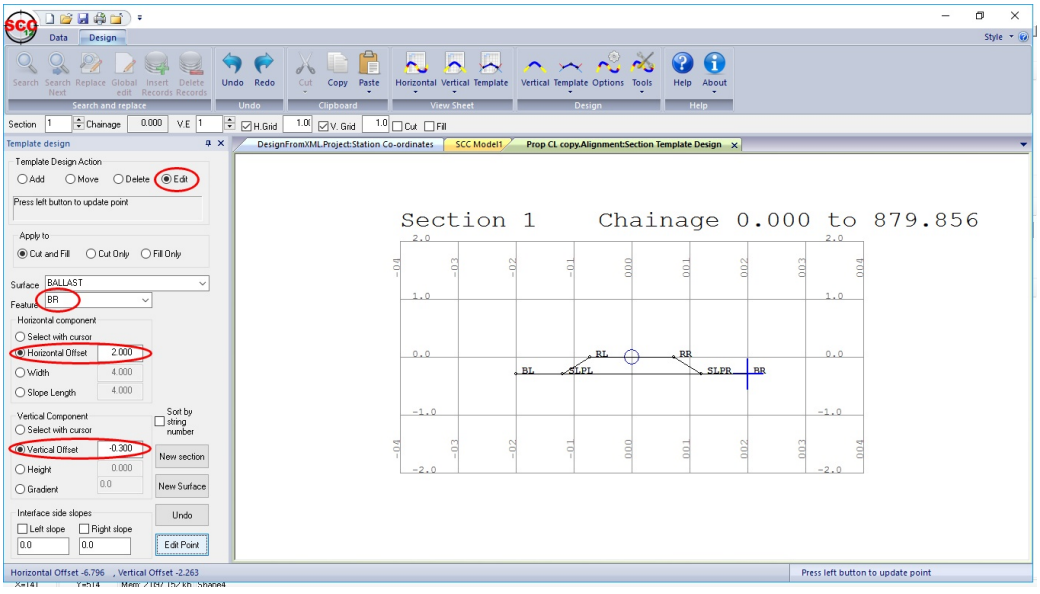


Left click mouse on 'BR' point

Enter Horz, Offset 0.2 and Vert. Offset -0.3

Press 'Edit Point'



1.5.10 Add Formation Layer

Select 'New Surface'

Set up the following and Press 'OK'

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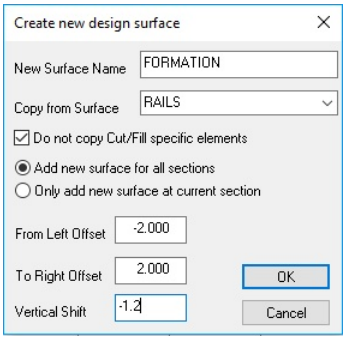
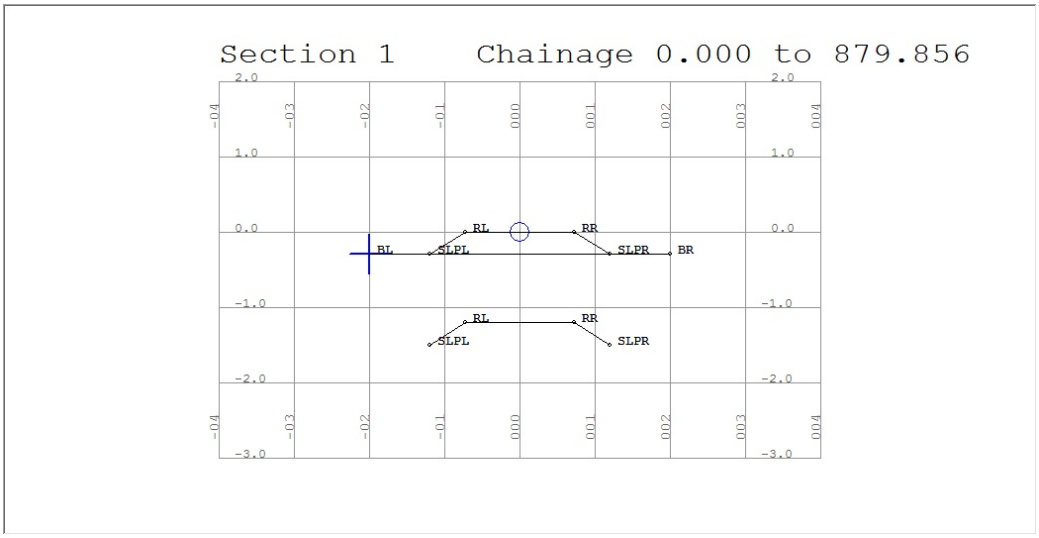


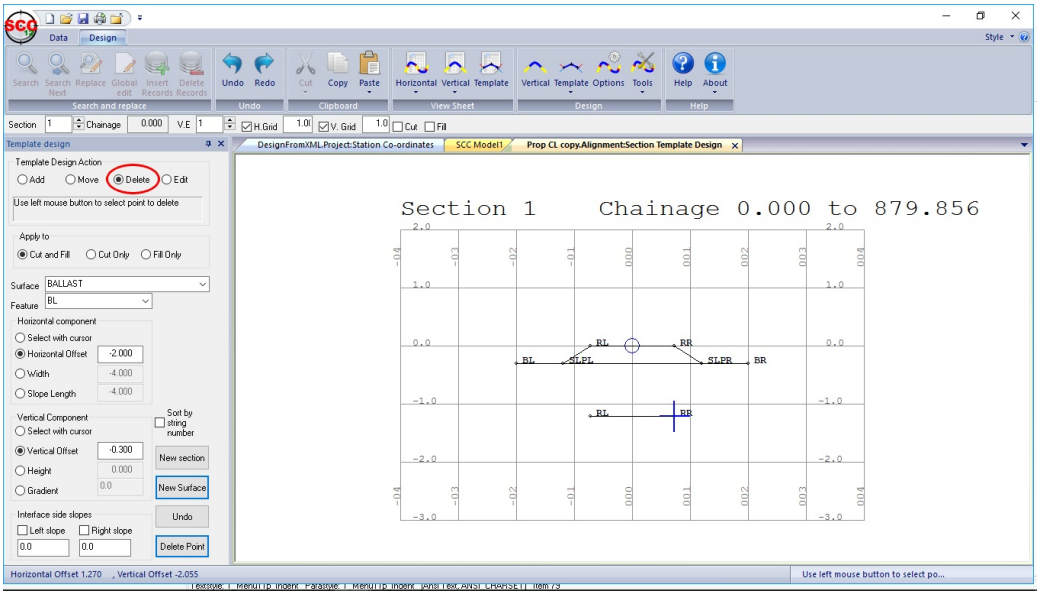


1.5.11 Removing Sleepers From Formation Surface

Select 'Delete'

Left click mouse on 'SLPL' and then select 'Delete Point'

Left click mouse on 'SLPR' and then select 'Delete Point'



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1.5.12 Editing Formation Surface

Need to change Feature Codes on Formation surface and apply offset and grade change

Select 'Edit'

Left click on 'RL' on Formation Surface

Enter New feature code 'FL'

Horz, Offset -2 and Gradient +1:30

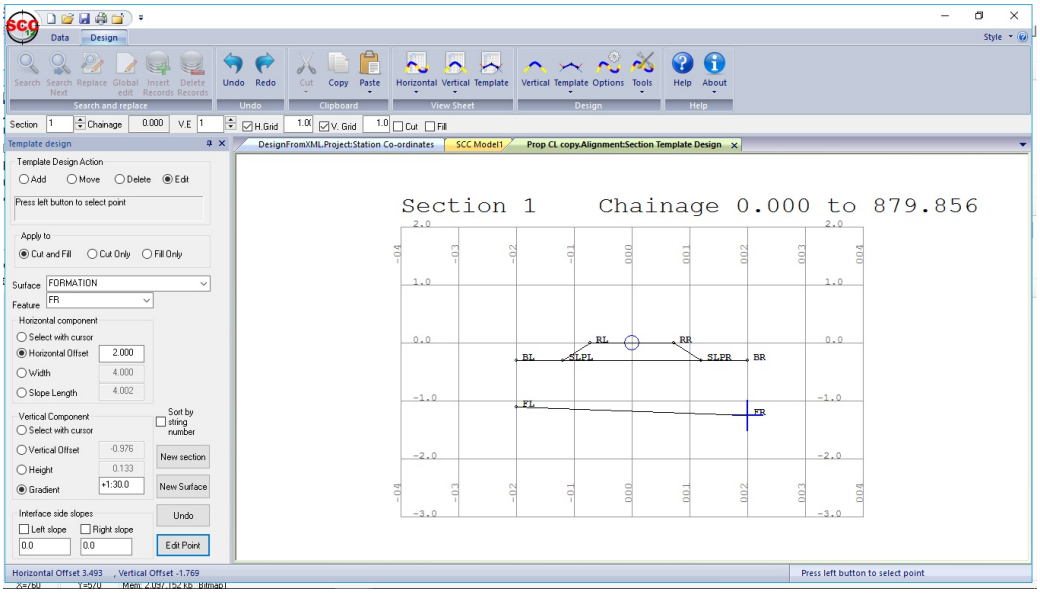
Press 'Edit Point'

Left click on 'RR' on Formation Surface

Enter New feature code 'FR'

Horz, Offset 2 and Gradient -1:30

Press 'Edit Point'

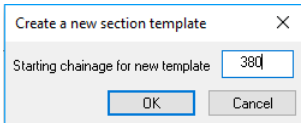


1.5.13 Adding Ramp at Chainage 380 to 480

Ramp down at Chainage 380 and ramp up at Chainage 480

Select 'New Section'

Enter Starting chainage for new template of 380 and press 'OK'



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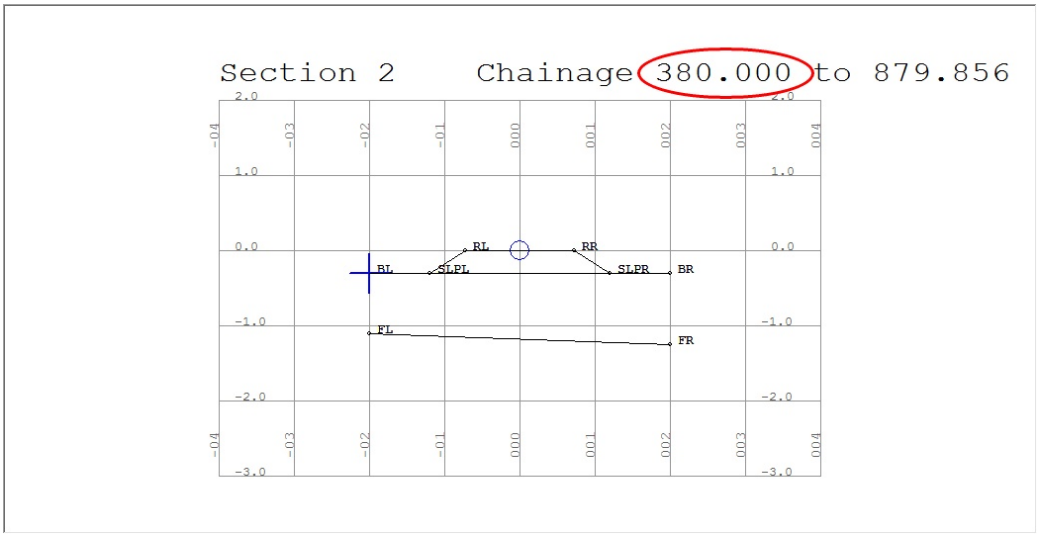
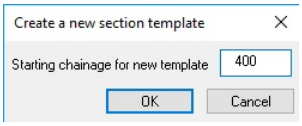


Select 'New Section'

Enter Starting chainage for new template of 400 and press 'OK'



1.5.14 Inputting Ramp Design on Ballast layer

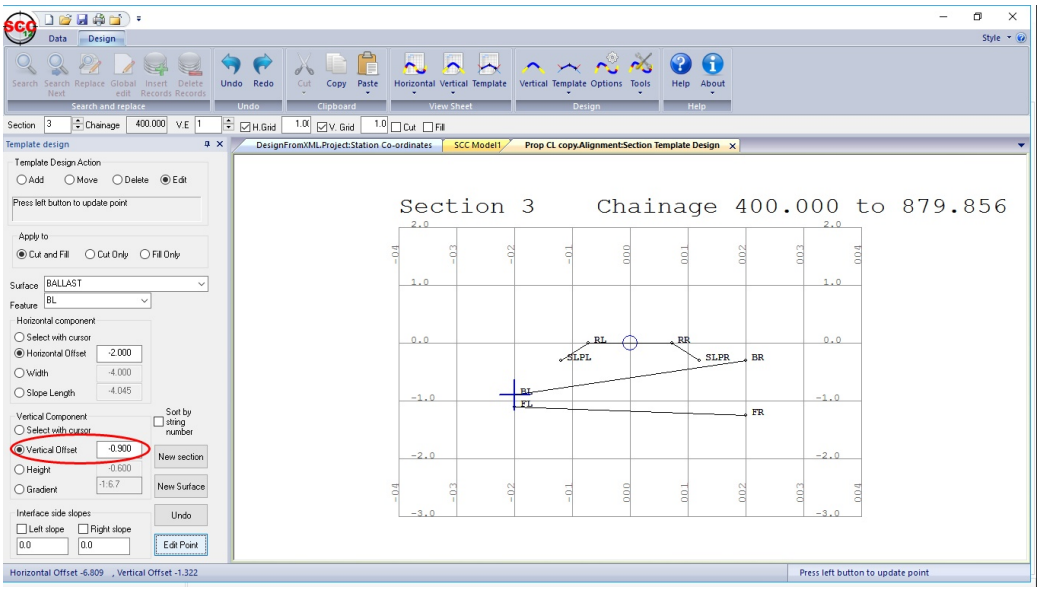
Section 3 Chainage 400

Select 'Edit'

Left click on 'BL' on Ballast Surface

Horz, Offset -2 and Vert. Offset -0.9

Press 'Edit Point'



Left click on 'BR' on Ballast Surface

Horz, Offset 2 and Vert. Offset -0.9

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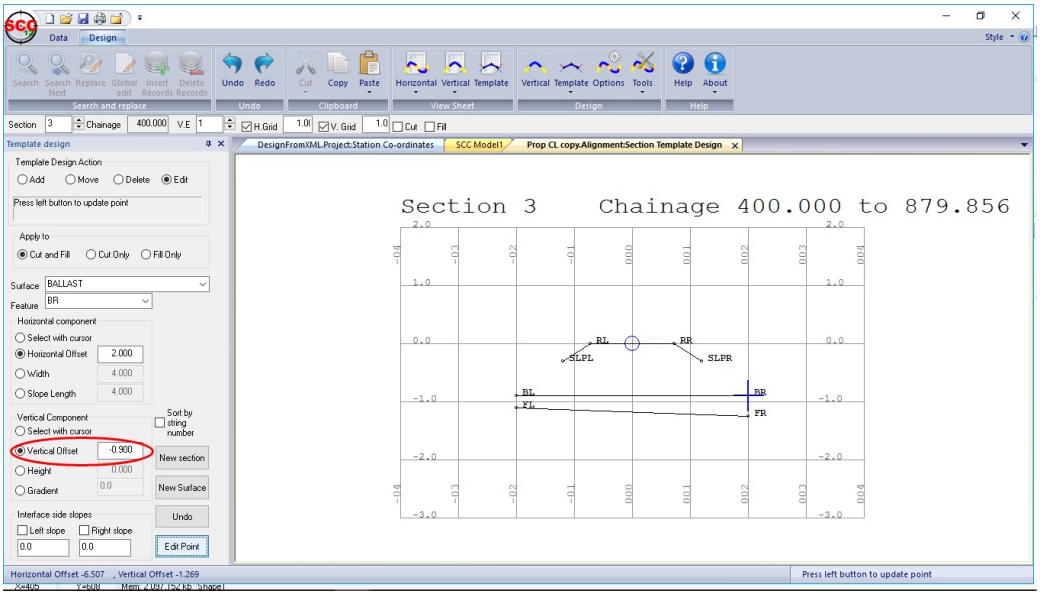
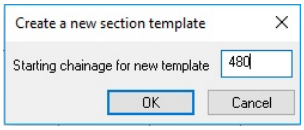
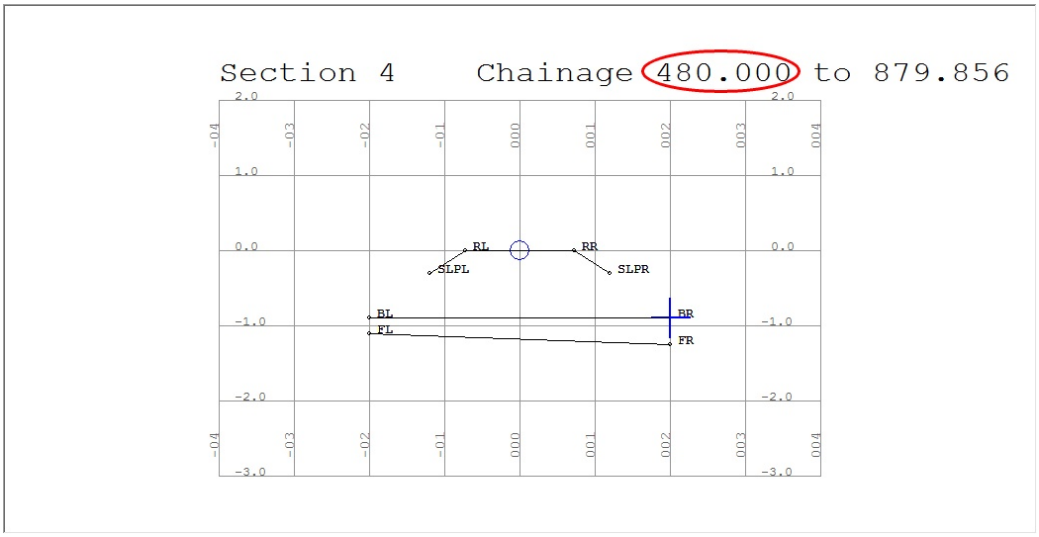
Press 'Edit Point'



Select 'New Section'

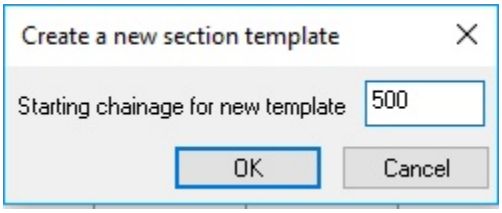
Enter Starting chainage for new template of 480 and press 'OK'





Select 'New Section'

Enter Starting chainage for new template of 500 and press 'OK'



Section 5 Chainage 500

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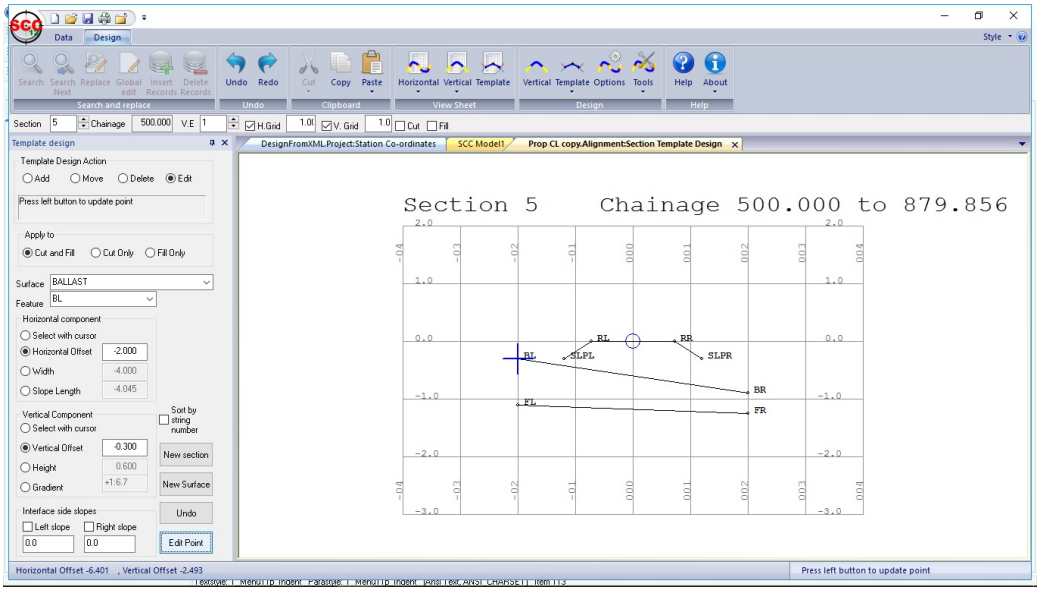
Select 'Edit'

Left click on 'BL' on Ballast Surface

Horz, Offset -2 and Vert. Offset -0.3

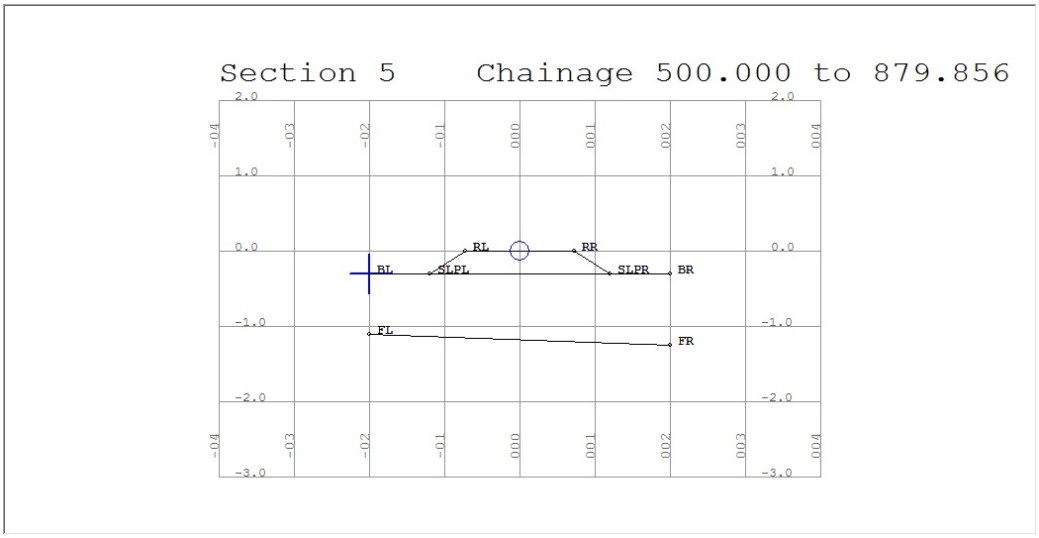
Press 'Edit Point'



Left click on 'BL' on Ballast Surface

Horz, Offset 2 and Vert. Offset -0.3

Press 'Edit Point'



Save Alignment

Template is visible on the model displaying the alignment

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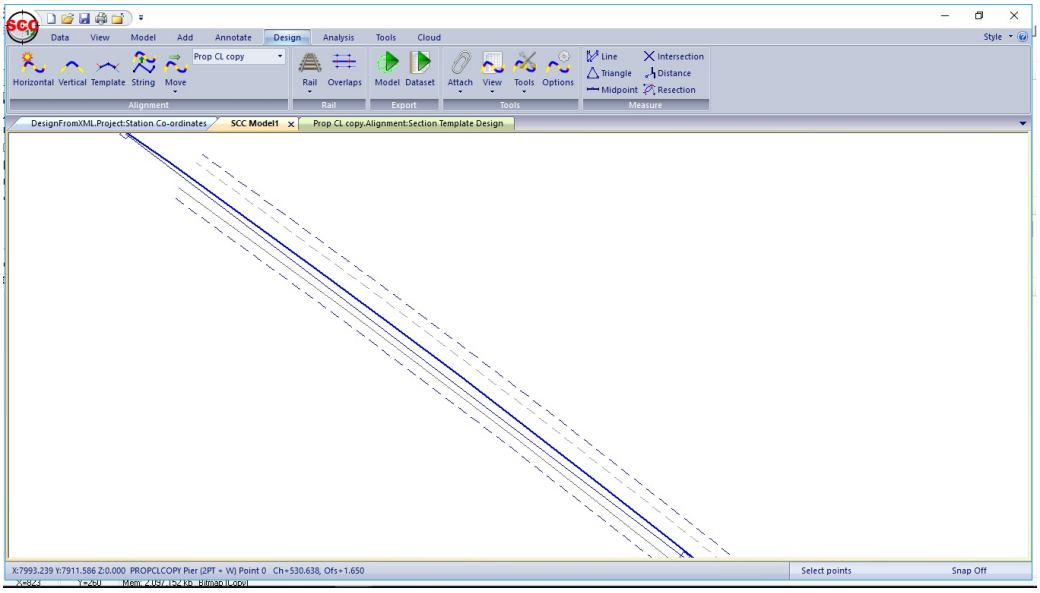
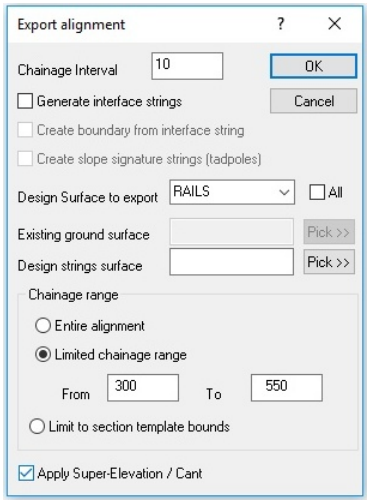


1.5.15 Export Rail Design

Go to 'DESIGN tab > Model' Export

Set up the following and press 'Ok':



Press 'Ok' to model attribute dialog

1.5.16 Triangulate Rail Model

Within 'MODEL tab > Edit'

Using 'All triangles intersecting line' as the Selection Method and 'Remove triangle' as the 'Action', edit the TIN

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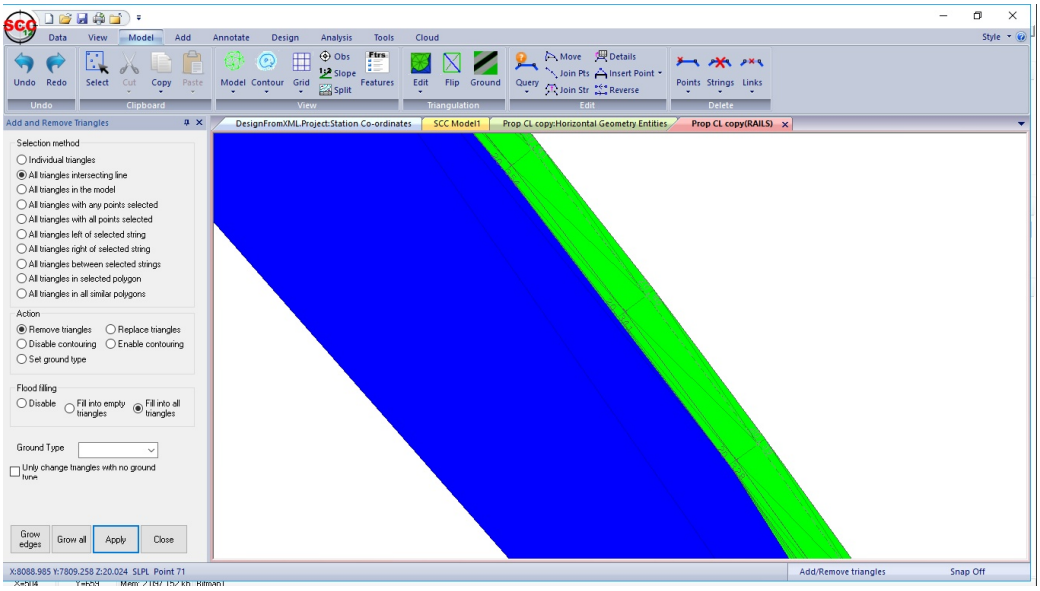
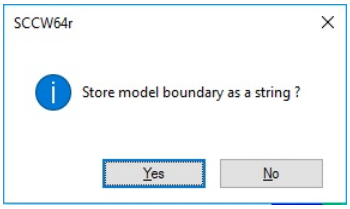


Select 'Apply'

Select 'Yes' to 'Store model boundary as a string'



Save Model as 'RAIL.Model'

1.5.17 Long Section With Cursor

Go to 'ANALYSIS tab > L. Sect button'

Left click mouse to pick first point of section and then again to pick second

Right click mouse to finish

A profile of the Rail surface is created

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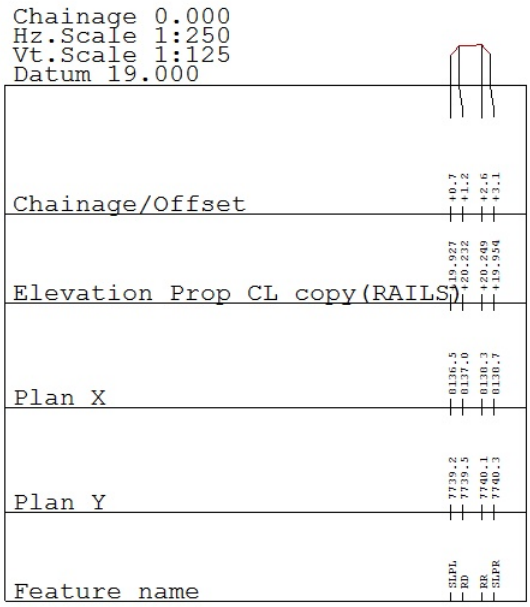
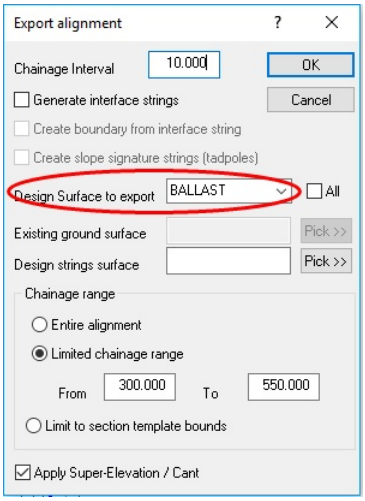


1.5.18 Export Ballast Design

Go to 'DESIGN tab > Model' Export

Set up the following and press 'Ok':



Press 'Ok' to model attribute dialog

1.5.19 Triangulate Ballast Model

Within 'MODEL tab > Edit'

Using 'All triangles intersecting line' as the Selection Method and 'Remove triangle' as the 'Action', edit the TIN

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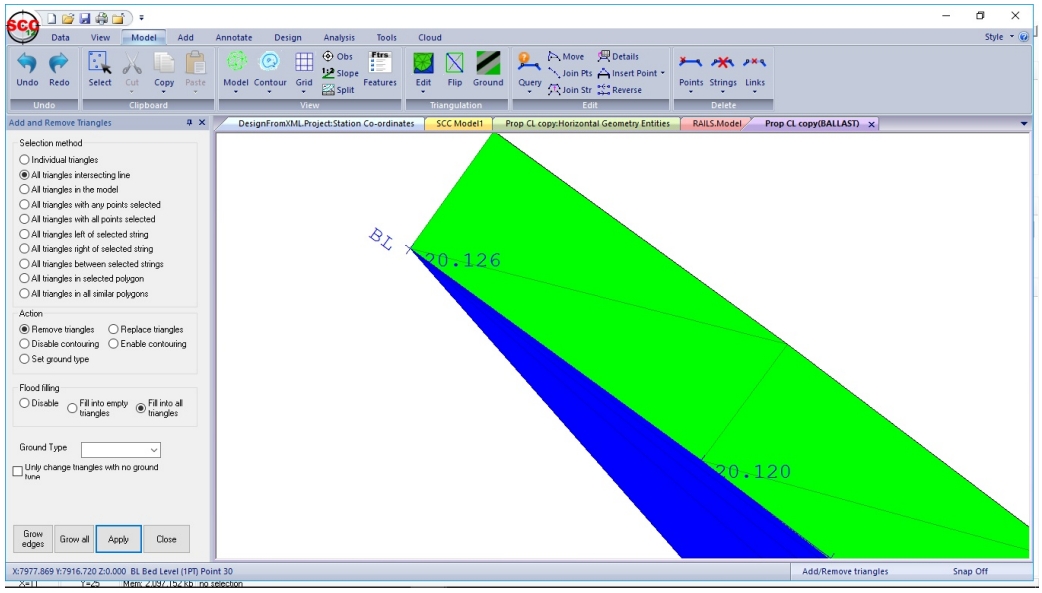
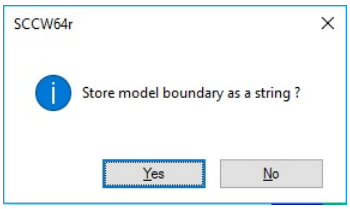


Select 'Apply'

Select 'Yes' to 'Store model boundary as a string'

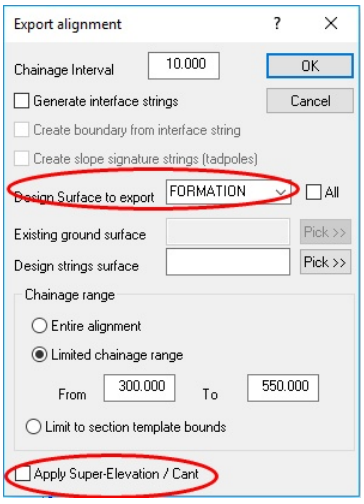


Save Model as 'BALLAST.Model'

1.5.20 Export Formation Design

Go to 'DESIGN tab > Model' Export

Set up the following and press 'Ok':



Note: Cant is not applied on Formation Level. Untick 'Apply Super-Elevation /Cant'

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1.5.21 Triangulate Formation Model

Within 'MODEL tab > Edit'

Using 'All triangles intersecting line' as the Selection Method and 'Remove triangle' as the 'Action', edit the TIN

Select 'Apply'

Select 'Yes' to 'Store model boundary as a string'

Save Model as 'FORMATION.Model'

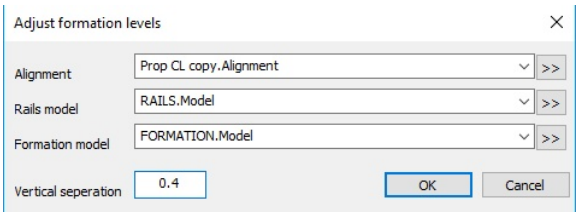
Three Triangulated Model have been created.

1.5.22 Check & Adjust Formation Levels

In order to maintain fixed depth levels between low rail and Formation, the 'Check and adjust formation levels' tool can be utilised.

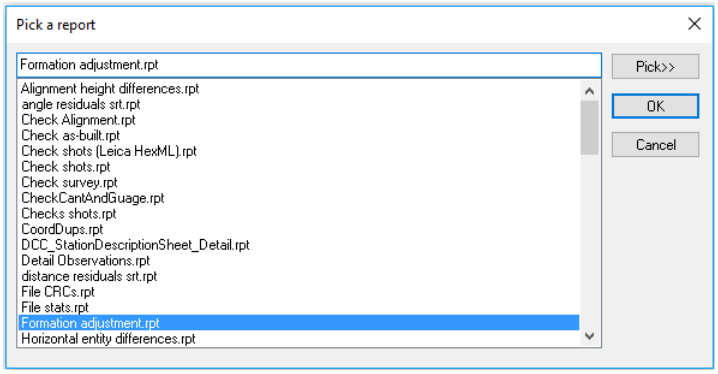
Go to 'DESIGN tab > Rail > Check and adjust formation levels'

Set up the following including required vertical seperation and press 'Ok'



Select 'Ok' to model attribute dialog

Pick 'Formation adjustment.rpt' file and press 'Ok'



The report details the Level adjustment, the exact difference in height between formation and low rail, and the chainage is note

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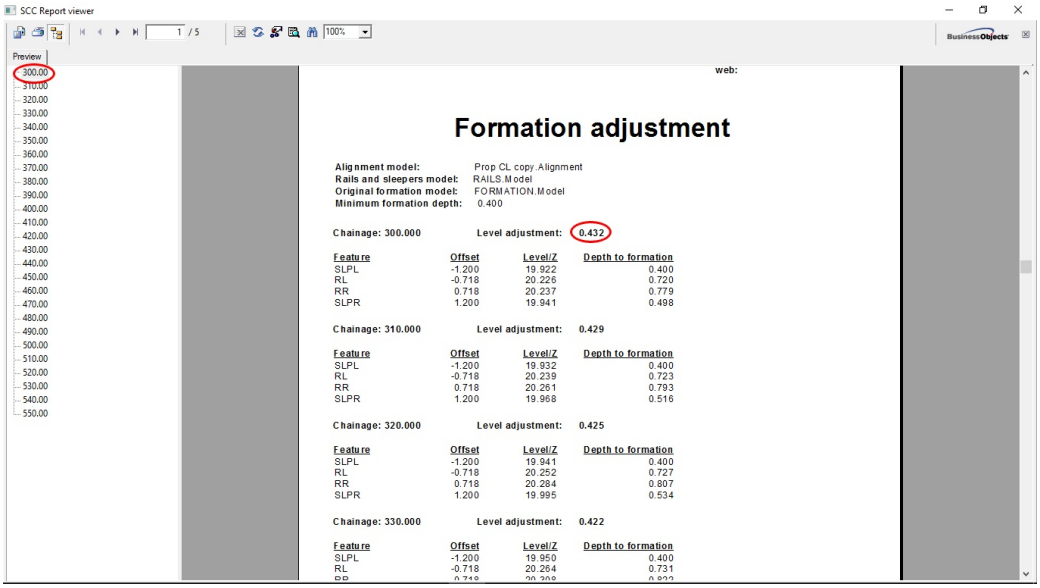
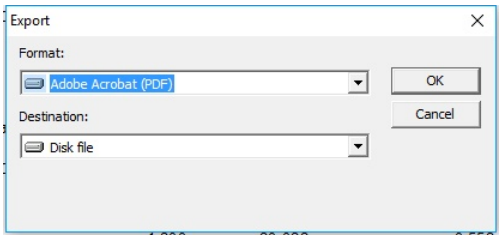


The report can be exported to various formats



A new Adjusted Formation Model has been created.

Edit the TIN as above.

Save as 'AdjustedFormation.Model'

1.5.23 Combining Models & Alignment for QA puposes

As a QA check, models can be combined and section generated.

Within 'RAILS.Model', go to 'DESIGN tab > Attach drop down > Model'

Select 'BALLAST.Model' and then repeat, to select 'AdjustedFormation.Model'

Go to 'DESIGN tab > Attach drop down > Alignment' and select Alignment file

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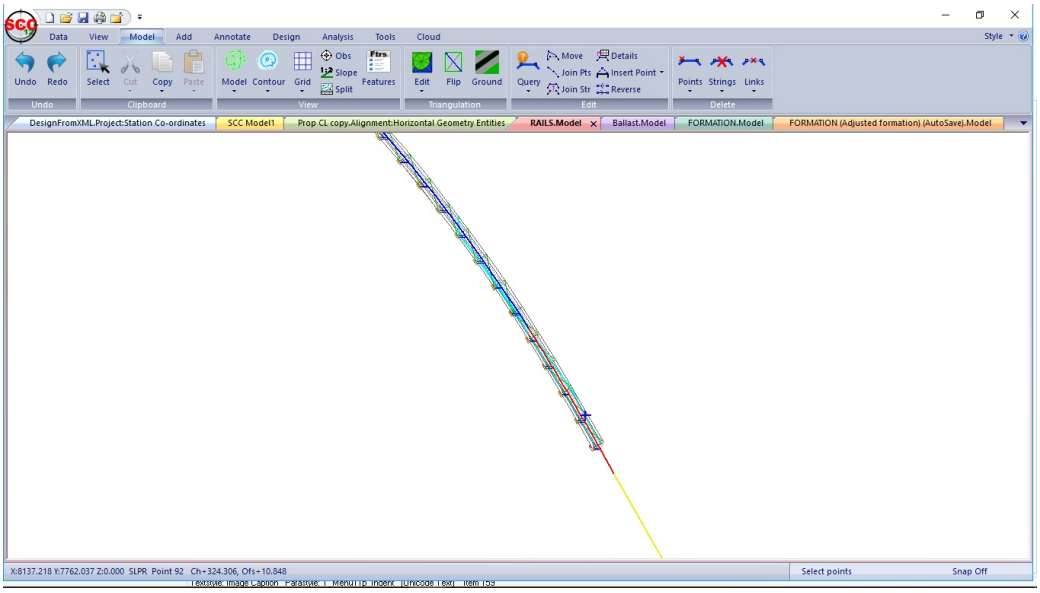
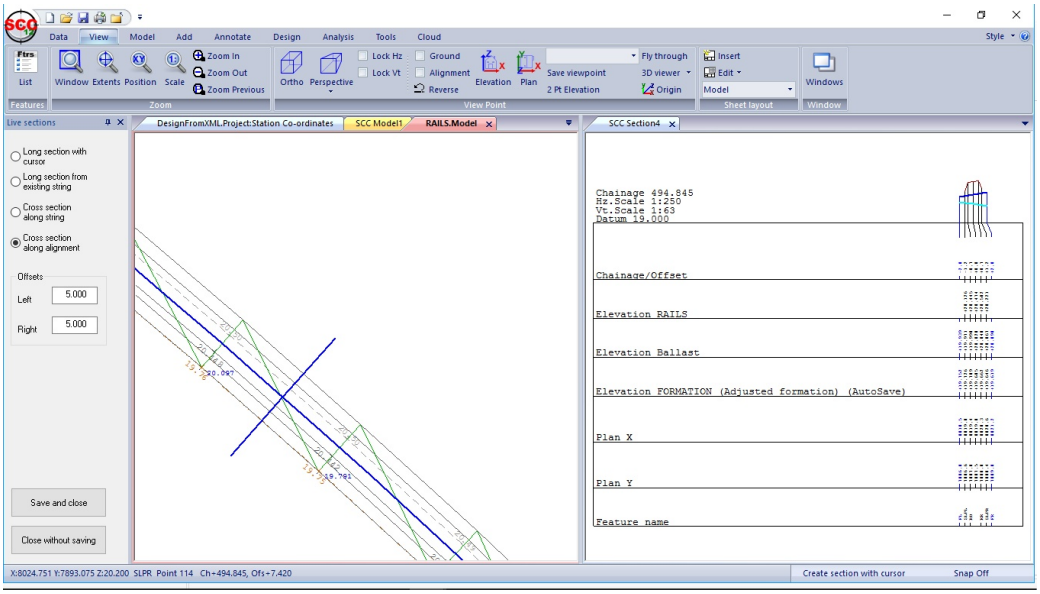


Go to 'ANALYSIS tab > L.Sect drop down > Live Section'

Set 'Cross section along alignment' and offset left/right 5.

Move cursor along along alignment, left click to generate live section in sub divided screen



Close without saving

Go to 'DESIGN tab > Attach drop down > Edit/Detach'

Highlight Ballast and Formation Model, select 'Detach' and 'Ok'

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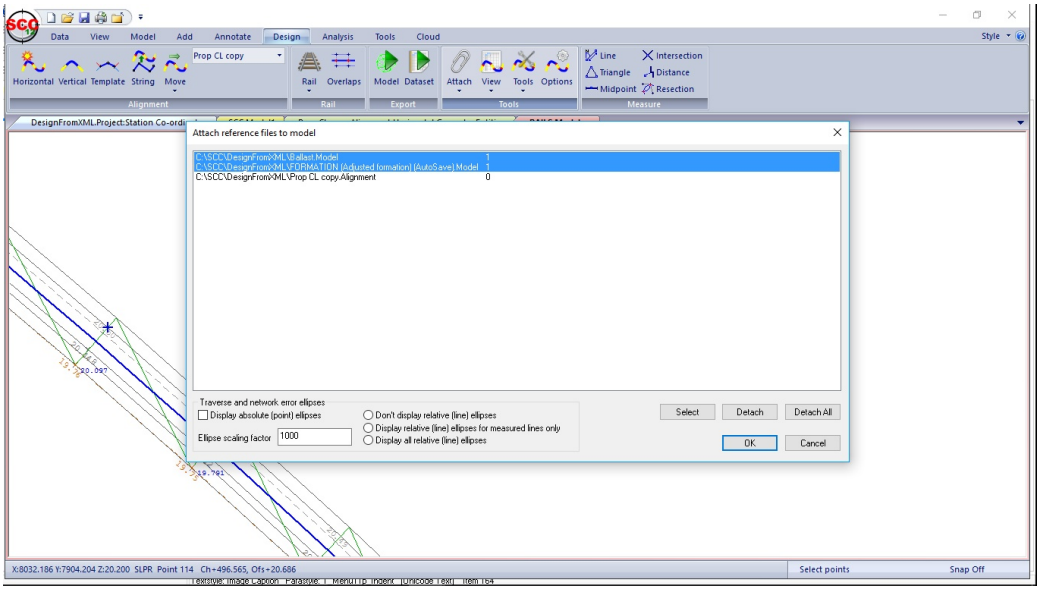
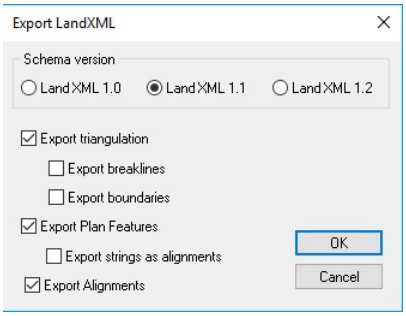


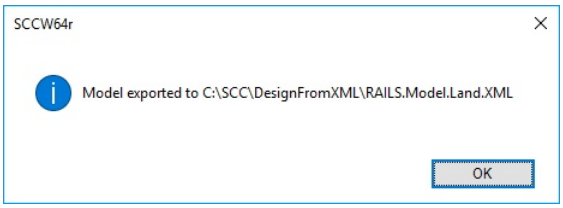
1.5.24 Exporting XML For Machine Control

Within the 'Rails.Model' which has the Alignment file attached, go to 'DATA tab > Export drop down > LandXML'

Set up the following and press 'Ok'



Select 'Ok' to model export dialog



Close 'Rails.Model' and open 'BALLAST.Model', attach alignment file and repeat export steps

Similarly, repeat for 'AdjustedFormation.Model'

1.6 Computing Platform Edge Using Bance Gauge

The following outlines the steps to compute platform edge using Bance Gauge.

Open Existing Project & Dataset

From the Main Screen, SCC button 'Open'

Go to 'C:\SCC\rail-day\Bance Gauge'

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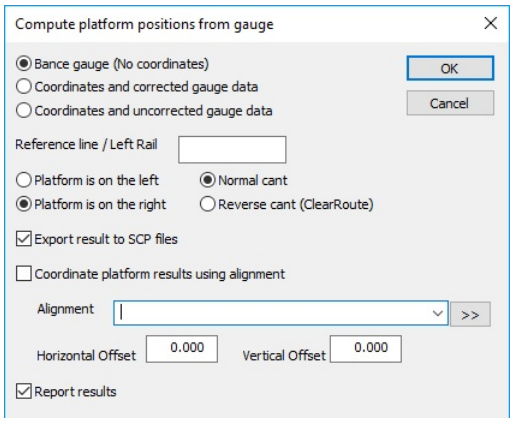
Open 'Platform.Project' and 'Bance Gauge test1.Survey'

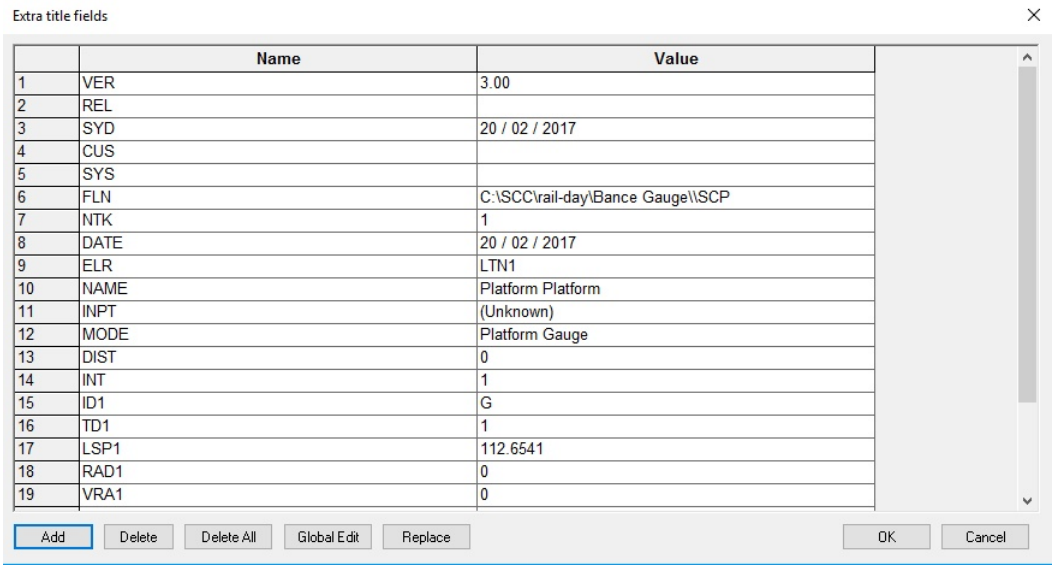
Compute Platform Position from Bance Gauge

Go to 'SURVEY tab > Tools > Compute Platform Position From Bance Gauge'

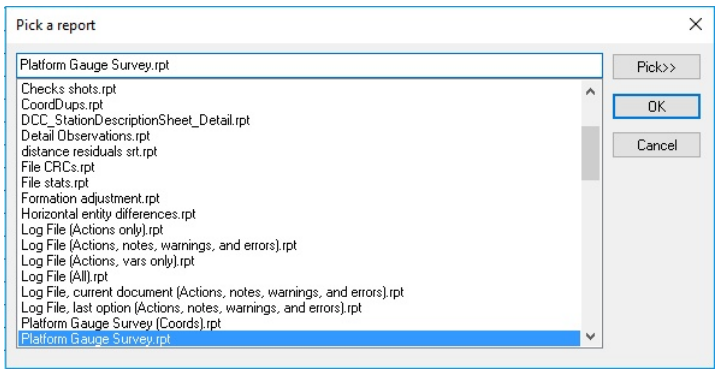
Set up the following and press 'Ok'



Select 'OK' to 'Extra Title Fields' dialog



Select 'PlatformGaugeSurvey.rpt' from Pick a Report dialog and press 'Ok'



Review report

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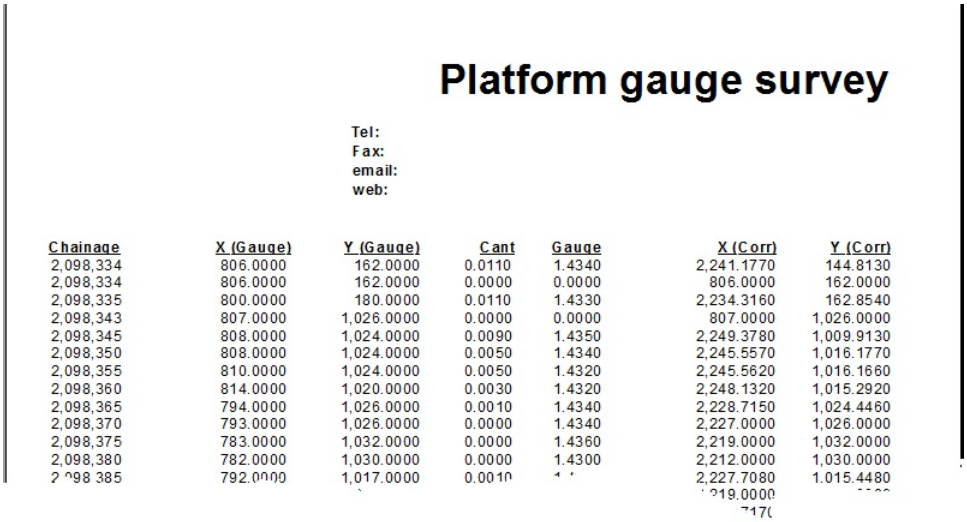
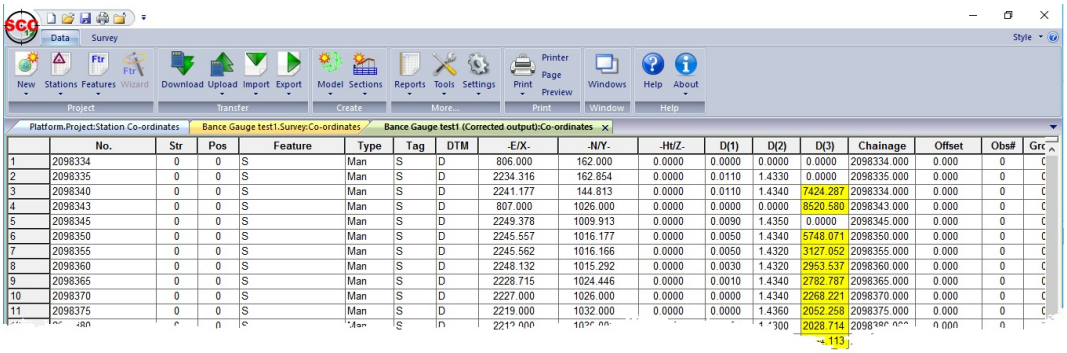


Platform gauge survey

Tel:
Fax:
email:
web:

Chainage	X (Gauge)	Y (Gauge)	Cant	Gauge	X (Corr)	Y (Corr)
2,098,334	806.0000	162.0000	0.0110	1.4340	2,241.1770	144.8130
2,098,334	806.0000	162.0000	0.0000	0.0000	806.0000	162.0000
2,098,335	800.0000	180.0000	0.0110	1.4330	2,234.3160	162.8540
2,098,343	807.0000	1,026.0000	0.0000	0.0000	807.0000	1,026.0000
2,098,345	808.0000	1,024.0000	0.0090	1.4350	2,249.3780	1,009.9130
2,098,350	808.0000	1,024.0000	0.0050	1.4340	2,245.5570	1,016.1770
2,098,355	810.0000	1,024.0000	0.0050	1.4320	2,245.5620	1,016.1660
2,098,360	814.0000	1,020.0000	0.0030	1.4320	2,248.1320	1,015.2920
2,098,365	794.0000	1,026.0000	0.0010	1.4340	2,228.7150	1,024.4460
2,098,370	793.0000	1,026.0000	0.0000	1.4340	2,227.0000	1,026.0000
2,098,375	783.0000	1,032.0000	0.0000	1.4360	2,219.0000	1,032.0000
2,098,380	782.0000	1,030.0000	0.0000	1.4300	2,212.0000	1,030.0000
2,098,385	792.0000	1,017.0000	0.0010		2,227.7080	1,015.4480
					2,219.0000	
					7170	



	No.	Str	Pos	Feature	Type	Tag	DTM	-E/X-	-N/Y-	-Ht/Z-	D(1)	D(2)	D(3)	Chainage	Offset	Obs#	Grc
1	2098334	0	0	S	Man	S	D	806.000	162.000	0.0000	0.0000	0.0000	0.0000	2098334.000	0.000	0	
2	2098335	0	0	S	Man	S	D	2234.316	162.854	0.0000	0.0110	1.4330	0.0000	2098335.000	0.000	0	
3	2098340	0	0	S	Man	S	D	2241.177	144.813	0.0000	0.0110	1.4340	7424.287	2098334.000	0.000	0	
4	2098343	0	0	S	Man	S	D	807.000	1026.000	0.0000	0.0000	0.0000	8520.580	2098343.000	0.000	0	
5	2098345	0	0	S	Man	S	D	2249.378	1009.913	0.0000	0.0090	1.4350	0.0000	2098345.000	0.000	0	
6	2098350	0	0	S	Man	S	D	2245.557	1016.177	0.0000	0.0050	1.4340	5748.071	2098350.000	0.000	0	
7	2098355	0	0	S	Man	S	D	2245.562	1016.166	0.0000	0.0050	1.4320	3127.052	2098355.000	0.000	0	
8	2098360	0	0	S	Man	S	D	2248.132	1015.292	0.0000	0.0030	1.4320	2953.537	2098360.000	0.000	0	
9	2098365	0	0	S	Man	S	D	2228.715	1024.446	0.0000	0.0010	1.4340	2782.787	2098365.000	0.000	0	
10	2098370	0	0	S	Man	S	D	2227.000	1026.000	0.0000	0.0000	1.4340	2268.221	2098370.000	0.000	0	
11	2098375	0	0	S	Man	S	D	2219.000	1032.000	0.0000	0.0000	1.4360	2052.258	2098375.000	0.000	0	
								2212.000				1.4300	2028.714		0.000		

1.7 Wriggle Survey Processing

Wriggle survey functionality which can be accessed as follows;

'DATA tab > Import > ASCII Wriggle Survey' from a project

'SURVEY tab > Tools > Compute Wriggle Survey' from the survey coordinates view'

''SURVEY tab > Tools > String using Chainage > Offset from the survey coordinates view'

This is used in conjunction with an alignment to group point data into rings.

To process the sample files 9961065.ASC, 200_UPLINE-.CAN, 200_UPLINE-.HOR and , 200_UPLINE-.VER do the following;

Creating A Project Directory

From the Main Screen, select 'DATA tab > New'

Enter in a Project/Job name 'Wriggle'

Select a Project Template from the list 'Default v11 Complex.Project'

Select 'OK'

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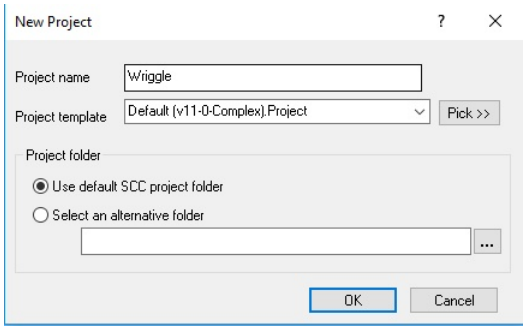
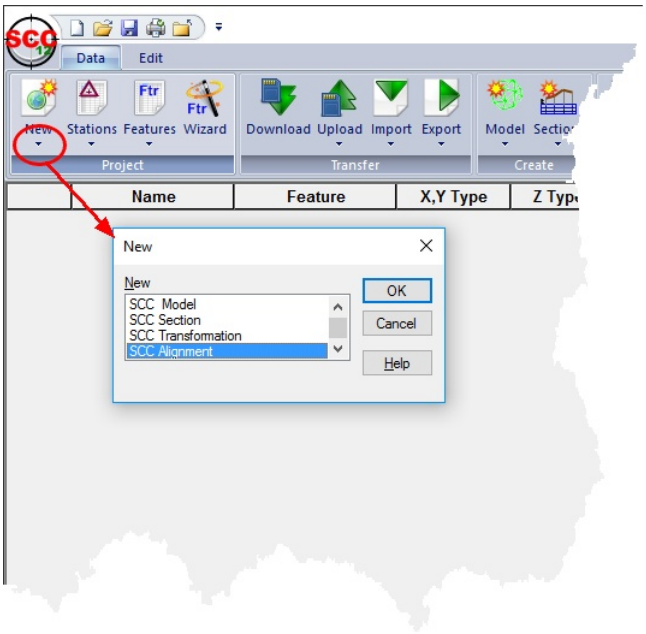


Create an alignment from the 200_UPLINE files

'DATA tab > New drop down > New document > SCC Alignment'



'DATA tab > Import drop down > ACT horizontal entity file, picking '200_UPLINE-.HOR'

'DATA tab > Import drop down > ACT vertical entity file, picking '200_UPLINE-.VER'

'DATA tab > Import drop down > ACT cant file, picking '200_UPLINE-.CAN'

From the Main Screen, SCC button 'Save As' 200_UPLINE.Alignment'

'SCC button > Close'

Import the ASCII survey file

'DATA tab > Import drop down > ASCII Wriggle Survey, picking '9961065.ASC'

SCC button 'Save'

Compute the wriggle survey

'SURVEY tab > Tools > Compute Wriggle Survey', using parameters shown and pick 'WriggleSurvey.RPT' as the report file

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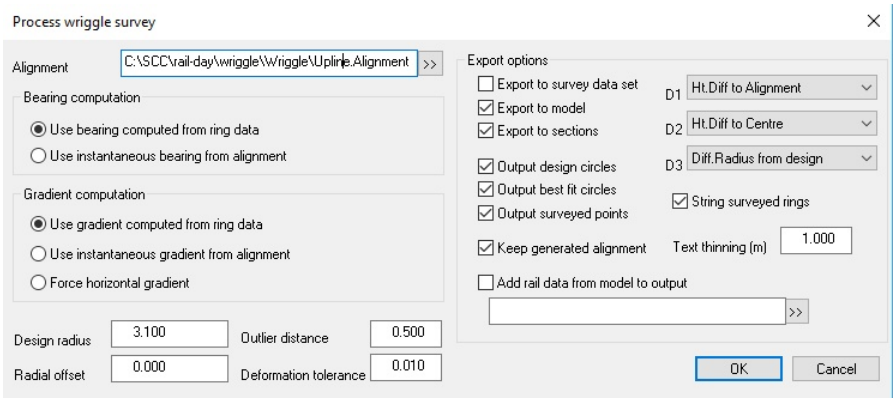
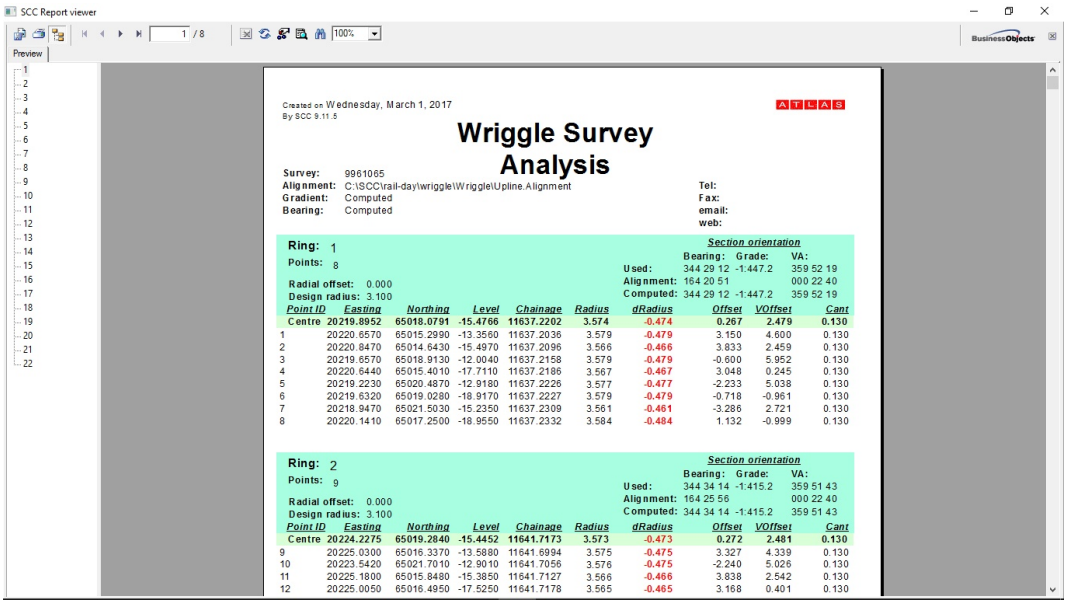


This will compute the wriggle survey and show the following report.

Note:

- that with bearing and gradient computed from ring data, the alignment is not used in the computations. It is still used in the report to show the difference between bearing and gradient values computed via linear regression and those computed for the alignment.
- Bearing and gradient computation determine whether the tunnel bearing and gradient is based on the alignment or the connected ring circles generated in processing
- Export options control whether in addition to the report you get a section file, model and/or survey data set on output, and whether they include the surveyed points, design circle radius and/or best fit circle radius.
- The design radius is the nominal radius of the tunnel
- The outlier distance is the distance from the design radius at which points are rejected as noise / not on the tunnel surface. The wriggle process is actually computed twice, first to remove outliers, second to get a clean result.
- The radial offset is a prism constant from observed point to tunnel face
- The deformation tolerance is the distance above which points in the survey are flagged as out of range / build tolerance / potential obstructions
- Adding an extra rail model to the output shows the rail position with respect to the tunnel



- the contact details in the report are taken from '**General Options** > **Module Licenses** >

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Edit user details'. The layout and content of the report can be modified to suit individual client needs independently of SCC using Crystal reports XI or later. Results from the SCC viewer can be saved into Microsoft Excel for further analysis by pressing the export button on the top left of the viewer. This also supports a wide range of other formats included Word, PDF and ODBC database tables.

When comparing the results with the output file provided, 9961065.out, SCC is producing identical radii, and horizontal and vertical offsets that agree to within 1mm. The easting and northing of the centres deviate by ~10mm to 30mm but looking at the radial residuals, e.g. the difference between the final computed radius and distance from computed centre to each point, which would imply that the SCC result is more accurate because the sum of the residuals in the SCC report is smaller than those in the output report provided, indicating a slightly better circle fit. For example on ring 1, both routines agree a radius of 3.574, and the residuals are as follows;

9961065.out				SCC	
Point	Radius	Residual		Radius	Residual
1099601	3.578	0.004		3.579	0.005
1099602	3.584	0.010		3.584	0.010
1099603	3.567	-0.007		3.567	-0.007
1099604	3.565	-0.009		3.566	-0.008
1099605	3.579	0.005		3.579	0.005
1099606	3.579	0.005		3.579	0.005
1099607	3.577	0.003		3.577	0.003
1099608	3.561	-0.013		3.571	-0.003
Sum of square of residuals					
		0.056			0.046

We can see from this that the SCC centre is a slightly better fit for the data provided.

Case Study Data

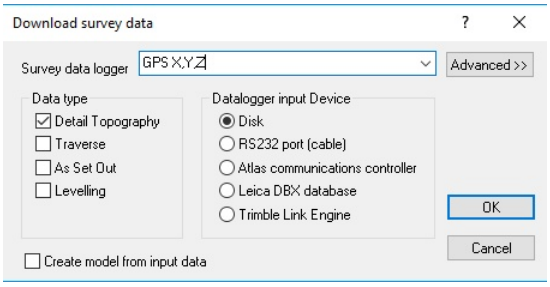
To process ascii compiler-1.csv, 300DOWNLINE-.HOR, 300DOWNLINE-.VER, and 300DOWNLINE-.CAN do the following

Downloading & Importing Data

Create a new project as described previously

Import the ACT alignment files into SCC as described previously

'DATA tab > Download' picking 'ascii compiler-1.csv' using the parameters shown below



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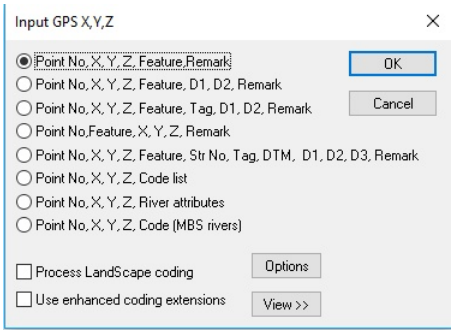
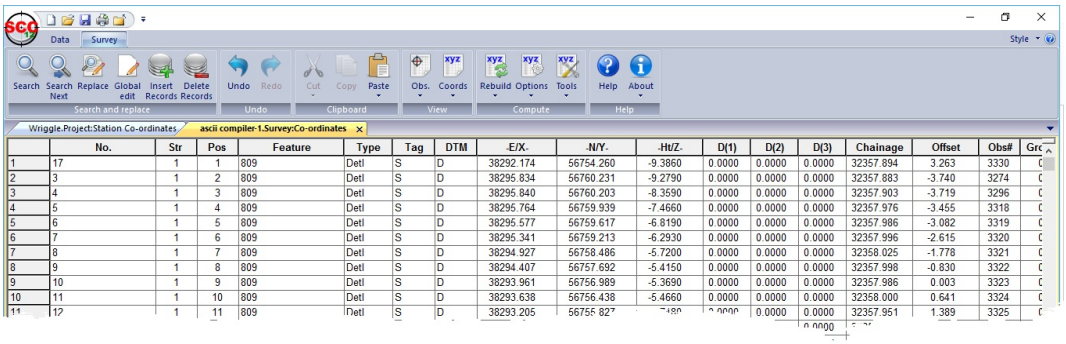
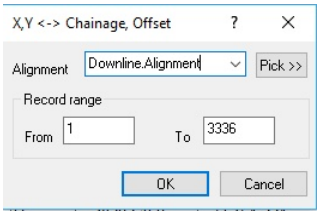




	No.	Str	Pos	Feature	Type	Tag	DTM	-E/X-	-N/Y-	-Ht/Z-	D(1)	D(2)	D(3)	Chainage	Offset	Obs#
1	17	1	1	809	Detl	S	D	38292.174	56754.260	-9.3860	0.0000	0.0000	0.0000	32357.894	3.263	3330
2	3	1	2	809	Detl	S	D	38295.834	56760.231	-9.2790	0.0000	0.0000	0.0000	32357.883	-3.740	3274
3	4	1	3	809	Detl	S	D	38295.840	56760.203	-8.3590	0.0000	0.0000	0.0000	32357.903	-3.719	3296
4	5	1	4	809	Detl	S	D	38295.764	56759.939	-7.4660	0.0000	0.0000	0.0000	32357.976	-3.455	3318
5	6	1	5	809	Detl	S	D	38295.577	56759.617	-6.8190	0.0000	0.0000	0.0000	32357.986	-3.082	3319
6	7	1	6	809	Detl	S	D	38295.341	56759.213	-6.2930	0.0000	0.0000	0.0000	32357.996	-2.615	3320
7	8	1	7	809	Detl	S	D	38294.927	56758.486	-5.7200	0.0000	0.0000	0.0000	32358.025	-1.778	3321
8	9	1	8	809	Detl	S	D	38294.407	56757.692	-5.4150	0.0000	0.0000	0.0000	32357.998	-0.830	3322
9	10	1	9	809	Detl	S	D	38293.961	56756.989	-5.3690	0.0000	0.0000	0.0000	32357.986	0.003	3323
10	11	1	10	809	Detl	S	D	38293.638	56756.438	-5.4660	0.0000	0.0000	0.0000	32358.000	0.641	3324
11	12	1	11	809	Detl	S	D	38293.205	56755.827			0.0000	0.0000	32357.951	1.389	3325

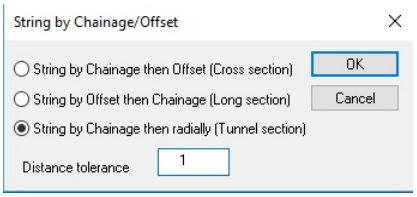
Computing Chainage Offset from X,Y

To group the data into rings, select 'SURVEY tab > Tools > Compute Chainage,Offset from X,Y'



String using Chainage Offset

Select 'SURVEY tab > Tools >String using Chainage & Offset'



'SCC button > Save'

Compute the wriggle survey

'SURVEY tab > Tools > Compute Wriggle Survey', using parameters shown and pick 'WriggleSurvey.RPT' as the report file

Compute the wriggle survey as described previously, picking the 300 downline alignment file to get the following report

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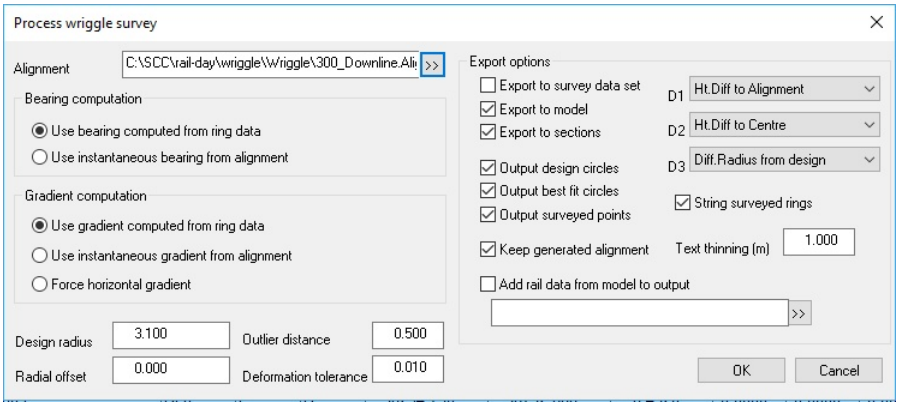

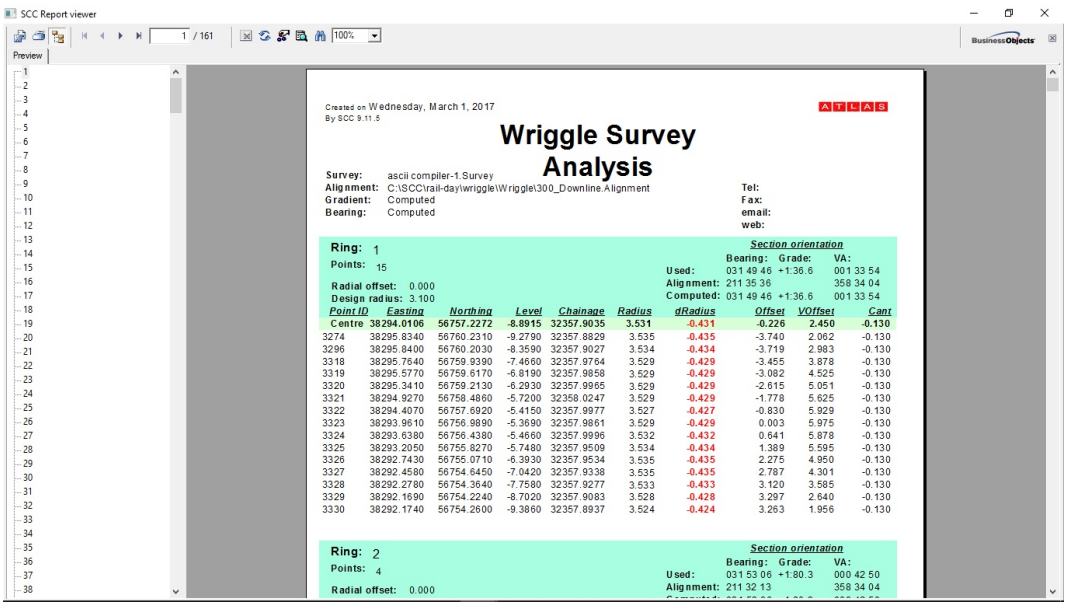

Notes from the results;

The computed bearing and gradient shown by SCC are ~180 degrees off the alignment value for the same section. This could be corrected using the alignment if required. Without an alignment the orientation of the section is arbitrary and can flip by 180 degrees, which also reverses the gradient.

It doesn't affect the centre, radius or offset values.

Comparing the results to those supplied in 320 wriggle analysis.xls all the radii in SCC are exactly 50mm smaller which appears to correspond to the BFC from DTA radial value and Lining radial value in the xls file. Horizontal and vertical offsets appear to agree to with about 2mm but centres are differ by ~50-60mm. This could possibly be related to radial offsets. Re-computing using alignment bearing and gradients does not appear to make a significant difference to this, though further investigation is probably required.

The xls provided appears to have a limit of size points per ring, though this could just be a reporting anomaly.

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