



SCC Training: Point Cloud Module

Atlas Computers Ltd

15 Moyville Lawns

Taylor's Lane

Rathfarnham

Dublin 16

Republic of Ireland

Ph: +353(0) 1 4958714/5/6

Fax: +353(0) 1 4958717

***Email: sales@atlascomputers.ie
support@atlascomputers.ie***

www.atlascomputers.ie

All rights reserved. No parts of this work may be reproduced in any form or by any means - graphic, electronic, or mechanical, including photocopying, recording, taping, or information storage and retrieval systems - without the written permission of the publisher.

Products that are referred to in this document may be either trademarks and/or registered trademarks of the respective owners. The publisher and the author make no claim to these trademarks.

While every precaution has been taken in the preparation of this document, the publisher and the author assume no responsibility for errors or omissions, or for damages resulting from the use of information contained in this document or from the use of programs and source code that may accompany it. In no event shall the publisher and the author be liable for any loss of profit or any other commercial damage caused or alleged to have been caused directly or indirectly by this document.

Printed: March 2017

SCC created by

Atlas Computers Ltd

Document written by

Atlas Computers Ltd

Date

01/03/2017

Reference Number

1010

Revision Number

1

SCC Version

12

The content of this document is provided for guidance purposes only. While every effort is made in ensuring the correctness of information presented, the document is provided 'as is', without representation, condition, or warranty of any kind, either express or implied, including, but not limited to, fitness for use or a particular purpose.

Atlas Computers Ltd shall not be responsible under any circumstances for any indirect consequential loss or damage (including but not limited to loss of contracts or profits) however caused or arising.

Table of Contents

| | | |
|------------|--|-----------|
| 1 | Rail Moudule | 1 |
| 1.1 | Rail Traverse | 1 |
| 1.2 | Rail Analysis | 8 |
| 1.2.1 | Rail Overlap | 8 |
| 1.2.2 | Cant & Gauge Reporting | 12 |
| 1.2.3 | Lift & Slue Reporting | 13 |
| 1.3 | 2nd Rail | 13 |
| 1.4 | Import Amberg Data | 14 |
| 1.5 | Design From XML | 16 |
| 1.5.1 | Create A Project Directory | 16 |
| 1.5.2 | Modelling LandXML file | 17 |
| 1.5.3 | Attach Design Alignment | 17 |
| 1.5.4 | View Design Information | 18 |
| 1.5.5 | Creating Design Gauge & Cant | 19 |
| 1.5.6 | Applying Sleeper Vertical & Horizontal Offset | 21 |
| 1.5.7 | Add Ballast Layer | 22 |
| 1.5.8 | Removing Sleepers From Ballast Surface | 23 |
| 1.5.9 | Editing Ballast Surface | 23 |
| 1.5.10 | Add Formation Layer | 24 |
| 1.5.11 | Removing Sleepers From Formation Surface | 25 |
| 1.5.12 | Editing Formation Surface | 26 |
| 1.5.13 | Adding Ramp at Chainage 380 to 480 | 26 |
| 1.5.14 | Inputting Ramp Design on Ballast layer | 27 |
| 1.5.15 | Export Rail Design | 30 |
| 1.5.16 | Triangulate Rail Model | 30 |
| 1.5.17 | Long Section With Cursor | 31 |
| 1.5.18 | Export Ballast Design | 32 |
| 1.5.19 | Triangulate Ballast Model | 32 |
| 1.5.20 | Export Formation Design | 33 |
| 1.5.21 | Triangulate Formation Model | 34 |
| 1.5.22 | Check & Adjust Formation Levels | 34 |
| 1.5.23 | Combining Models & Alignment for QA puposes | 35 |
| 1.5.24 | Exporting XML For Machine Control | 37 |
| 1.6 | Computing Platform Edge Using Bance Gauge | 37 |
| 1.7 | Wriggle Survey Processing | 39 |

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.

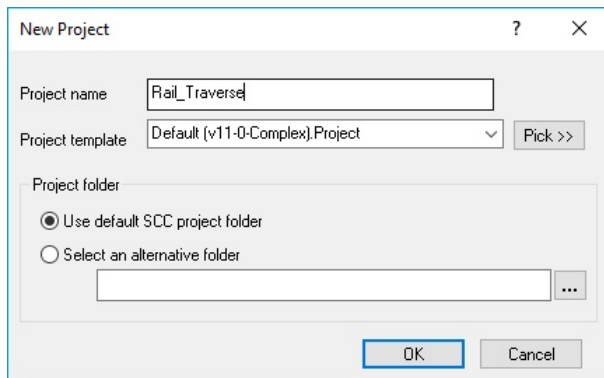
Creating A Project Directory

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'

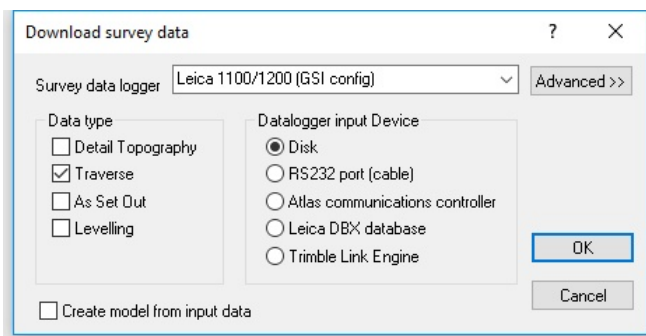
Select 'OK'



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

Leica data input (1100/1200/Wildsoft/LisCADD) ? X

Format file: Rail-dw.GSI.Contin Save OK Cancel

Input data fields

| | 41 (Record Type) | Obs Type | 42 | 43 | 44 | |
|---|------------------|---------------|----------|----------|----------|-----|
| 1 | * | Detail | Not Used | Not Used | Not Used | Not |
| 2 | Dimensions | Detail | Not Used | Not Used | Not Used | Not |
| 3 | Line of Sight | Detail | Not Used | Not Used | Not Used | Par |
| 4 | Parallel | Copy Parallel | Not Used | Not Used | Feature | Par |
| 5 | Remark | Detail | Remark | Not Used | Not Used | Not |
| 6 | Tape | Tape | Not Used | Not Used | Not Used | Par |

Add Delete Use any other 41 block as feature names

Point duplication

Disable duplicate points
 Enable for multiple code lines with 'Duplicate' tag code
 Enable for all multiple code lines

Codes precede observation
 Offsets follow observation

Include all observations in traverse sheet
 Only include observations with this feature code
 Include all observations with alpha-numeric point number
 Only include CHK,FLY,BS,FS,SS, FSTN observations in traverse
 Include observations to any previously occupied or sighted stations
 Traverse codes precede observation
 Split multiple level runs into separate files

Store station co-ordinates
 Ignore all topo X,Y,X data (81,82,83)
 Use topo X,Y,Z in preference of Ha,Va,Sd
 Use instrument height field (88) to indicate new setup
 Use point number field (11) for sighted station
 Use enhanced coding extensions
 Process dimensions as enhanced codes
 Default units are millimeters
 Allow space separated GSI fields
 Treat 1m slope distances as zero distance

Hidden point feature code

Start of comment / extra text

Error Checking

Go to the 'TRAVERSE tab > Adjust > Reduce'

Set up the following:

Traverse reduction options X

Reduce face left / face right
 Reduce multiple rounds
 Search for reversed rounds
 Report only, do not store results
 Store differences as obs residuals
 Store reduction standard deviations as standard errors
 Turn off out of tolerance obs

Output results to Crystal reports

Highlighting tolerances

dHoriz.Angle

dVert.Angle

dSlope.Dist

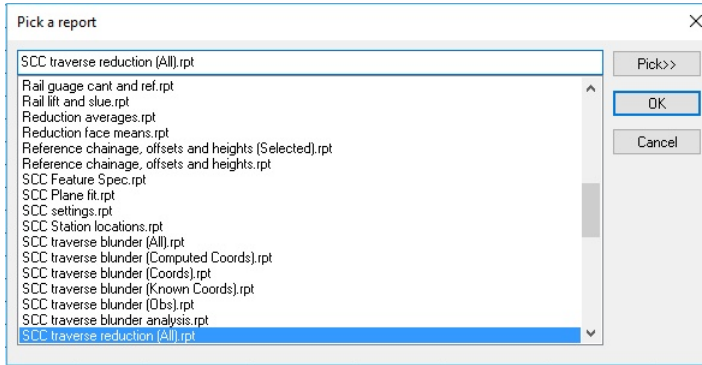
Use LU reduction method and output

OK Cancel

Press 'Ok'

Reduction Report

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



Examine Report:

| Line | To Stn | RodHt | ha | va | sd | face |
|----------------|--------|---------------|------------|-----------|----------|------|
| :L00016 110017 | CST 04 | 1.6480 | 275 14 00 | 269 56 15 | 122.2010 | 2 |
| :L00015 110016 | CST 04 | 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:

| 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 |
| 21 | 1 | 8 | CST02 | CST03 | SS | Yes | 1.5510 | 1.6480 | 105 13 17 | 090 05 42 | 51.601 | 0.0000 | No | No | L00027 110028 |

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 |
| 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 |
| 21 | 1 | 8 | CST02 | CST03 | SS | Yes | 1.5510 | 1.6480 | 105 13 17 | 090 05 42 | 51.601 | 0.0000 | No | No | L00027 110028 |

Re-run Reduction:

Go to the 'TRAVERSE tab > Adjust > Reduce'

Set up the following:

Traverse reduction options

Reduce face left / face right Output results to Crystal reports

Reduce multiple rounds

Search for reversed rounds

Report only, do not store results

Store differences as obs residuals

Store reduction standard deviations as standard errors

Use LU reduction method and output

Turn off out of tolerance obs

Highlighting tolerances

dHoriz.Angle: 000 00 05

dVert.Angle: 000 00 10

dSlope.Distance: 0.010

OK Cancel

Press 'Ok'

Reduction Report

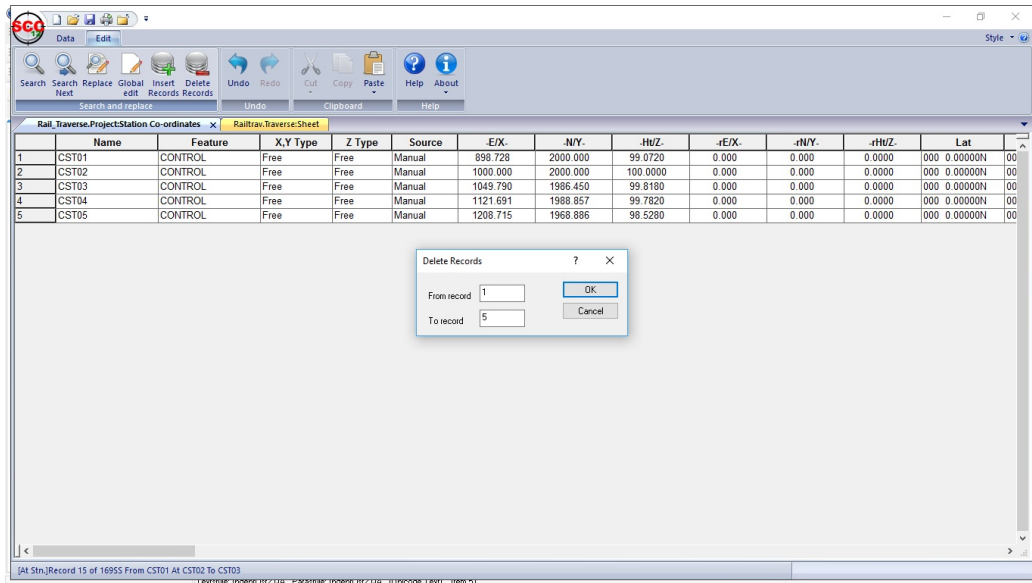
From the Pick A Report dialog, select 'SCC Traverse reduction (All).rpt' and Press 'Ok'

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

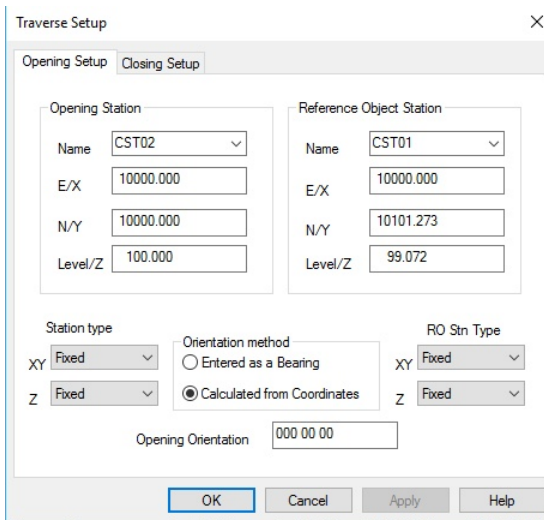
Select 'EDIT tab > Delete Records' set up the following:



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'

Traverse Adjustment ? X

Adjustment method

Bowditch / Compass Rule

Least Squares / Variation of Coordinates

Exclude fixed bearing observations for opening and closing set-ups

Force station constraints

Compute provisional values only

No plan adjustment

Least squares height adjustment

No height adjustment

Default/manual weighting

Height accuracy (mm)

Distance weighting (mm per KM)

Output report filename

Horizontal accuracy (secs)

Distance accuracy (mm)

Scale accuracy (ppm)

Convergence tolerance

Maximum iterations

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':

Corrections ? X

Refraction, 'k', and curvature

No corrections

Earth curvature only

Earth curvature, standard 'k'

Earth curvature, calculated 'k'

Standard value for 'k'

Radius of the Earth

Local Scale Factor

None applied

User defined scale factor

Transverse Mercator, User defined

TM, Ireland (Airy modified)

TM, England (Airy)

ITM, Ireland (GRS80)

Local map scale factor

Scale factor along C.M.

Easting of central meridian

Minimum survey easting

Maximum survey easting

Centring errors

Do not compute centring errors

Compute but do not apply

Compute and apply

Horizontal (Instrument) Horizontal (Target) Vertical (Instrument)

Horizontal Angle correction Vertical Angle correction

Apply temperature and pressure Apply mean sea level correction

Re-adjust and review report

Level Data

Open 'Levels.Traverse'

| | At Stn. | To Stn. | Obs. Type | -Ht Diff. | -Err. | -Hor Dist. | -Err. | -PPM. | Remark | -rHt. | -rD. |
|---|---------|---------|---------------------|-----------|--------|------------|--------|--------|--------|--------|--------|
| 1 | CST01 | CST02 | Fixed Ht. diff only | 0.5291 | 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:

Traverse Adjustment

Adjustment method

Bowditch / Compass Rule

Least Squares / Variation of Coordinates

Exclude fixed bearing observations for opening and closing set-ups

Force station constraints

Compute provisional values only

No plan adjustment

Least squares height adjustment

No height adjustment

Default/manual weighting

Height accuracy (mm)

Distance weighting (mm per KM)

Output report filename

Horizontal accuracy (secs)

Distance accuracy (mm)

Scale accuracy (ppm)

Convergence tolerance

Maximum iterations

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. | -H/Z. | -rE/X. | -rN/Y. | -rH/Z. | Lat |
|---|-------|---------|-------------|-----------|--------|------------|------------|---------|--------|--------|--------|-----------------|
| 1 | CST01 | CONTROL | Fixed | Constrain | Manual | 516619.711 | 257842.745 | 18.8059 | 0.010 | 0.010 | 0.0050 | 000 0.00000N 00 |
| 2 | CST02 | CONTROL | Fixed | Constrain | Manual | 516720.982 | 257842.743 | 19.7350 | 0.010 | 0.010 | 0.0050 | 000 0.00000N 00 |
| 3 | CST03 | CONTROL | Constrained | Constrain | Manual | 516770.773 | 257829.199 | 19.5551 | 0.010 | 0.010 | 0.0050 | 000 0.00000N 00 |
| 4 | CST04 | CONTROL | Constrained | Constrain | Manual | 516842.671 | 257831.599 | 19.5191 | 0.010 | 0.010 | 0.0050 | 000 0.00000N 00 |
| 5 | CST05 | CONTROL | Constrained | Constrain | Manual | 516929.693 | 257811.629 | 18.2616 | 0.010 | 0.010 | 0.0050 | 000 0.00000N 00 |

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'

Traverse Adjustment ? X

Adjustment method

Bowditch / Compass Rule

Least Squares / Variation of Coordinates

Exclude fixed bearing observations for opening and closing set-ups

Force station constraints

Compute provisional values only

No plan adjustment

Least squares height adjustment

No height adjustment

Default/manual weighting

Height accuracy (mm)

Distance weighting (mm per KM)

Output report filename

Horizontal accuracy (secs)

Distance accuracy (mm)

Scale accuracy (ppm)

Convergence tolerance

Maximum iterations

OK Cancel

Press 'Ok' and Review Report

Select 'Yes, Use Adjustment Values'

Traverse Station Update ? X

Do you wish to update the station Coordinate file with the results of this adjustment ?

Yes, Use adjusted values

Yes, Use provisional values

No

Save computed co-ordinates as

Free stations

Provisional stations

Fixed stations

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;

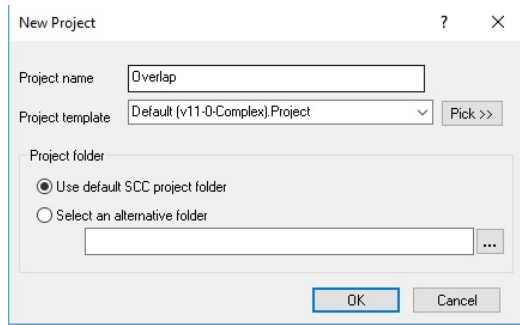
Creating A Project Directory

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'

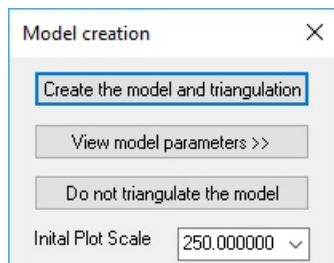


Create Model

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'

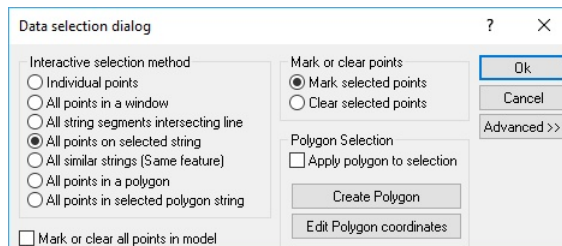


Select 'Ok' to model attribute dialog

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:

Process overlapping strings

Feature for joined string

Horizontal tolerance

Vertical tolerance

Maximum distance between survey points

Report only, do no change model

Interpolate all points on all strings

Use active alignment for reference

Keep generated alignment

Do not compare points on same string

Report string to string differences

Report string to mean differences

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

Create interface alignment

Alignment name

Create alignment from straights and fillet arcs

Fillet radius

Add side slopes to polygon edge

Cut gradient

Create alignment from straights and arc fits

Minimum chord to arc distance

Maximum chord to arc distance

Minimum horizontal arc radius

Maximum horizontal arc radius

Minimum vertical arc radius

Maximum vertical arc radius

Compress geometry

Horizontal tolerance

Vertical tolerance

Starting chainage

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

Pick a report

String Overlaps (Diffs).rpt

SCC traverse blunder (Obs).rpt

SCC traverse blunder analysis.rpt

SCC traverse reduction (All).rpt

SCC traverse reduction (All, errors only).rpt

SCC traverse reduction (Faces only).rpt

SCC traverse reduction (Means only).rpt

SCC traverse reduction.rpt

Script from log file.rpt

Section heights (all).rpt

Section heights (displayed).rpt

Section radial comparisons (with X,Y).rpt

Section radial comparisons.rpt

Setout Sections.rpt

Setup Misclosures and checks.rpt

Setup Misclosures.rpt

String Overlaps (all).rpt

String Overlaps (Diffs).rpt

Review Report

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

Process overlapping strings

Feature for joined string

Horizontal tolerance

Vertical tolerance

Maximum distance between survey points

Report only, do not change model

Interpolate all points on all strings

Use active alignment for reference

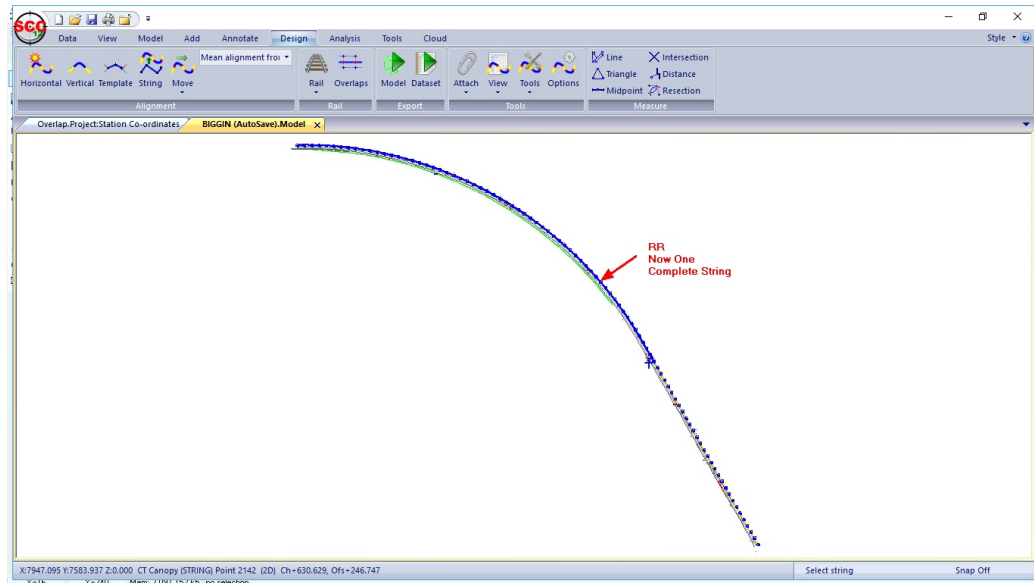
Keep generated alignment

Do not compare points on same string

Report string to string differences

Report string to mean differences

On completion note the RR string is one complete string



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'

 A screenshot of the "Report Rail cant and gauge" dialog box. It contains the following fields and options:

- Left Rail String: RL (30)
- Right Rail String: RR (34)
- Ref. Rail String: RR (40)
- Chainages: From 0.000, To 894.076, Interval 10.000
- Radio buttons: Cut sections for analysis, Use survey points
- Gauge: 1.43
- Tolerance: 0.003
- Buttons: OK, Cancel

Pick 'Rail gauge and cant.rpt'

 A screenshot of the "Pick a report" dialog box. It shows a list of report files with "Rail gauge and cant.rpt" selected at the bottom. The list includes:

- Rail gauge and cant.rpt
- DCC_StationDescriptionSheet_Detail.rpt
- Detail Observations.rpt
- distance residuals srt.rpt
- File CRCs.rpt
- File stats.rpt
- Formation adjustment.rpt
- Horizontal entity differences.rpt
- Log File (Actions only).rpt
- Log File (Actions, notes, warnings, and errors).rpt
- Log File (Actions, vars only).rpt
- Log File (All).rpt
- Log File, current document (Actions, notes, warnings, and errors).rpt
- Log File, last option (Actions, notes, warnings, and errors).rpt
- Platform Gauge Survey (Coords).rpt
- Platform Gauge Survey.rpt
- Rail gauge and cant (4 dp).rpt
- Rail gauge and cant.rpt

 Buttons: Pick>>, OK, Cancel.

Review Report

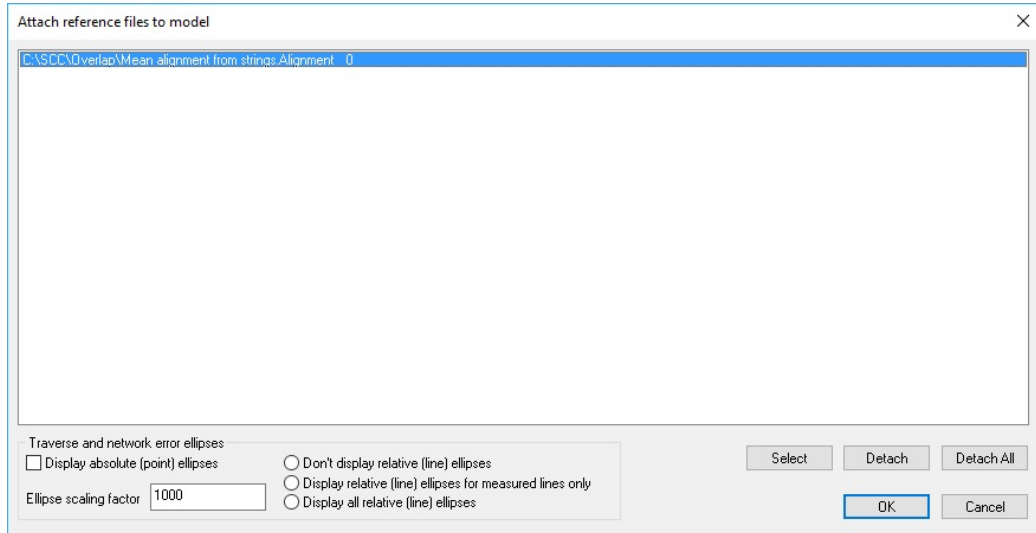
1.2.3 Lift & Slue Reporting

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'



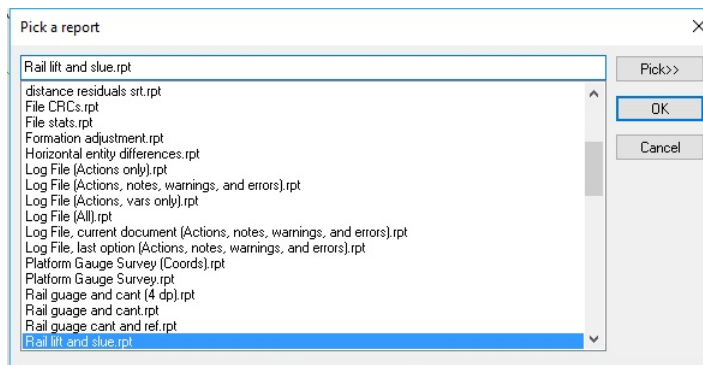
Attach Design Alignment

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

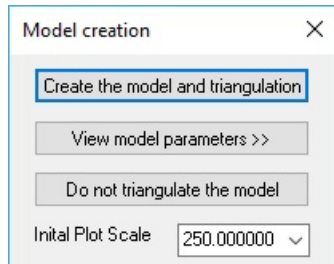
1.3 2nd Rail

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'



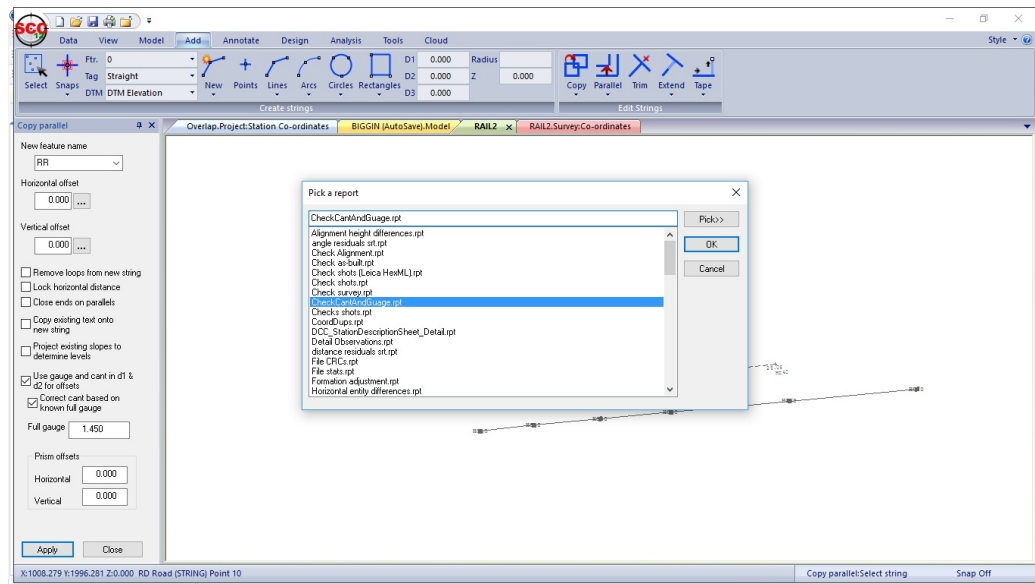
Select 'Ok' to model attribute dialog

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



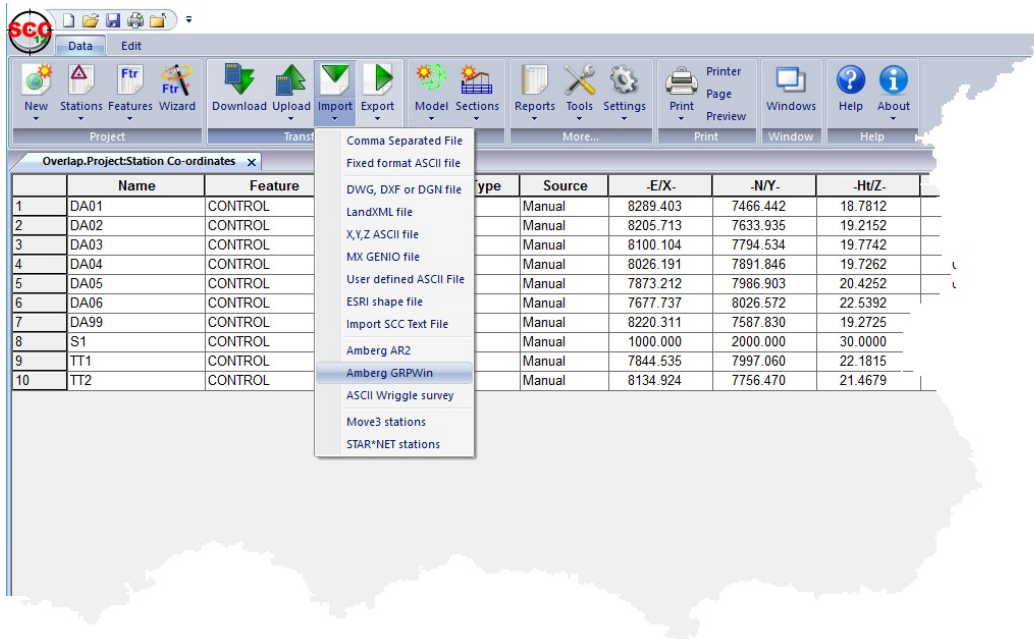
1.4 Import Amberg Data

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.

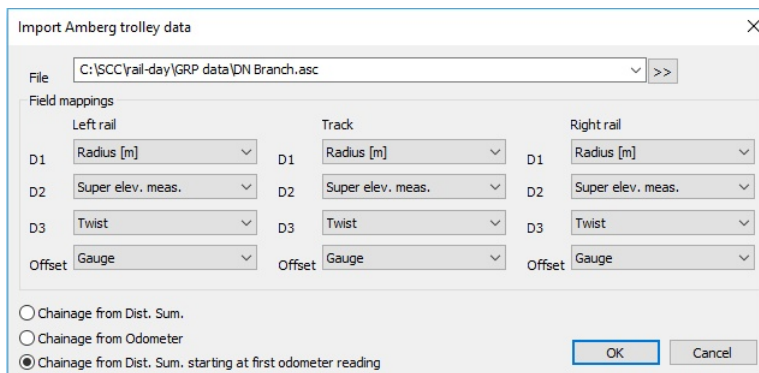
Close all dataset and models. Leave existing Project file open

Importing Amberg Trolley Data

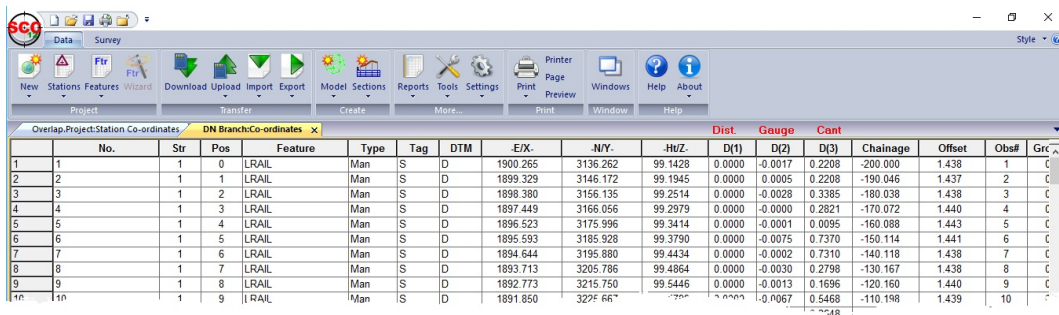
Go to 'DATA tab > Import drop down menu > Amberg GRPWin'



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

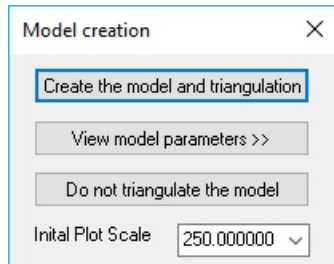


Create Model

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'



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

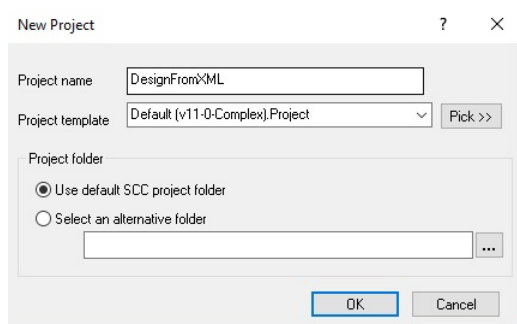
1.5.1 Create A Project Directory

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

Enter in a Project/Job name 'Design from XML'

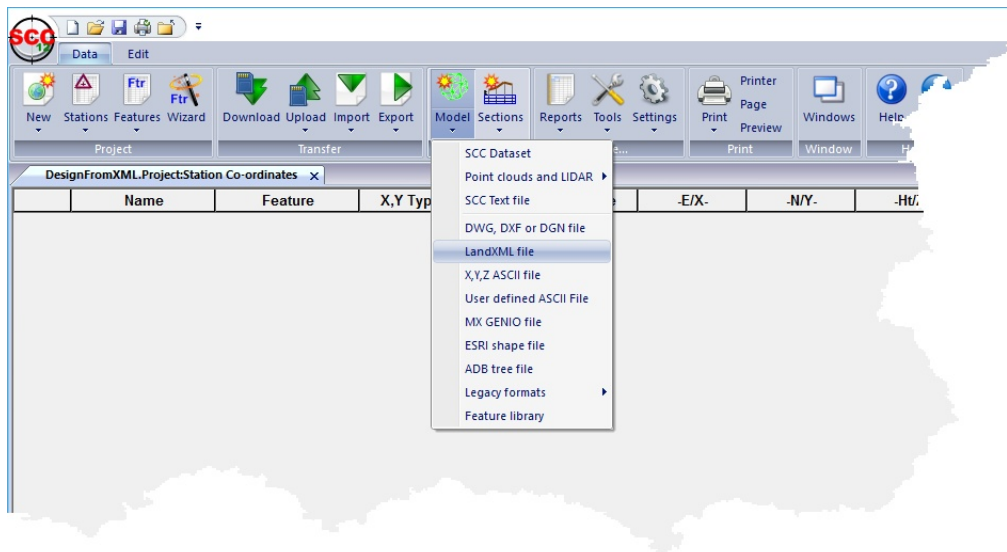
Select a Project Template from the list 'Default v11 Complex.Project'

Select 'OK'



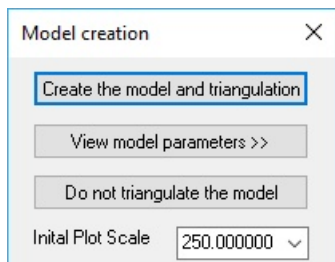
1.5.2 Modelling LandXML file

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



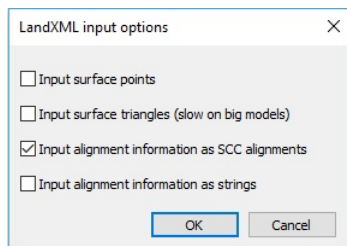
Go to '\\rail-day\Design XML\Biggins v1.1.xml' and Press 'Open'

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'



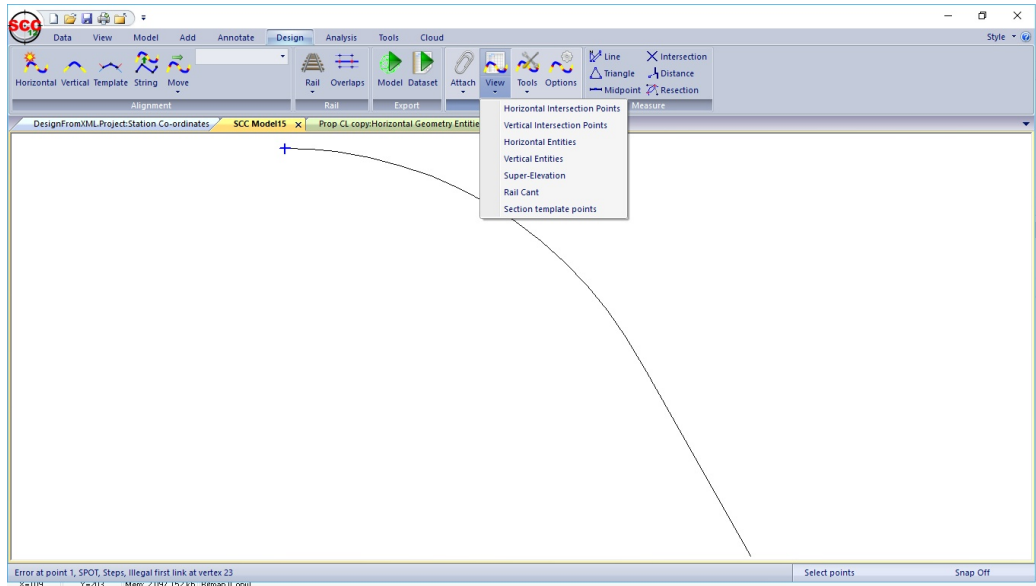
Select 'Home' within Model to Zoom Extent

1.5.3 Attach Design Alignment

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

Select 'Prop CL copy.Alignment'

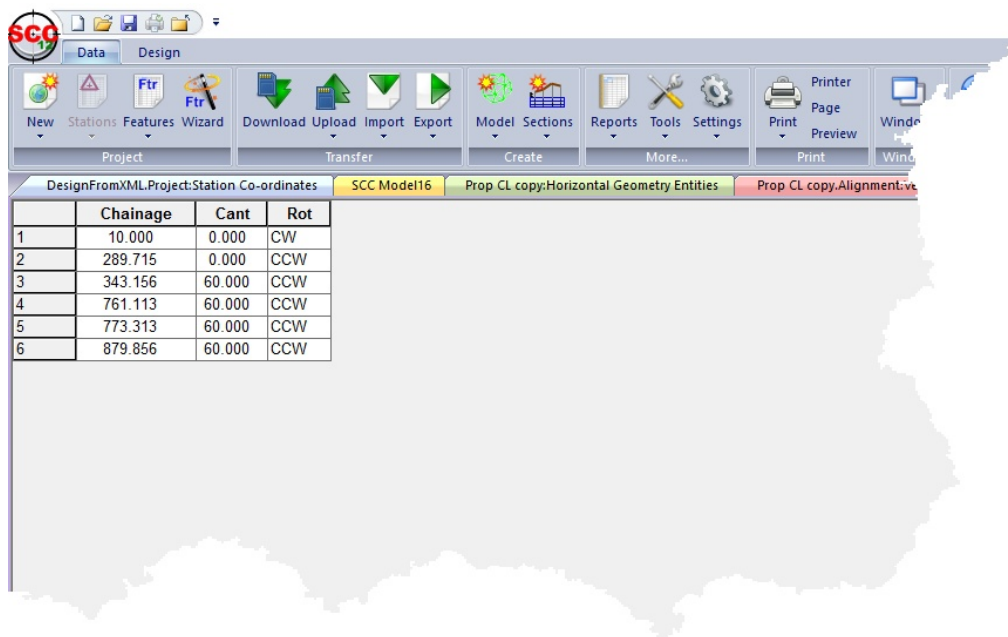
1.5.4 View Design Information



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'



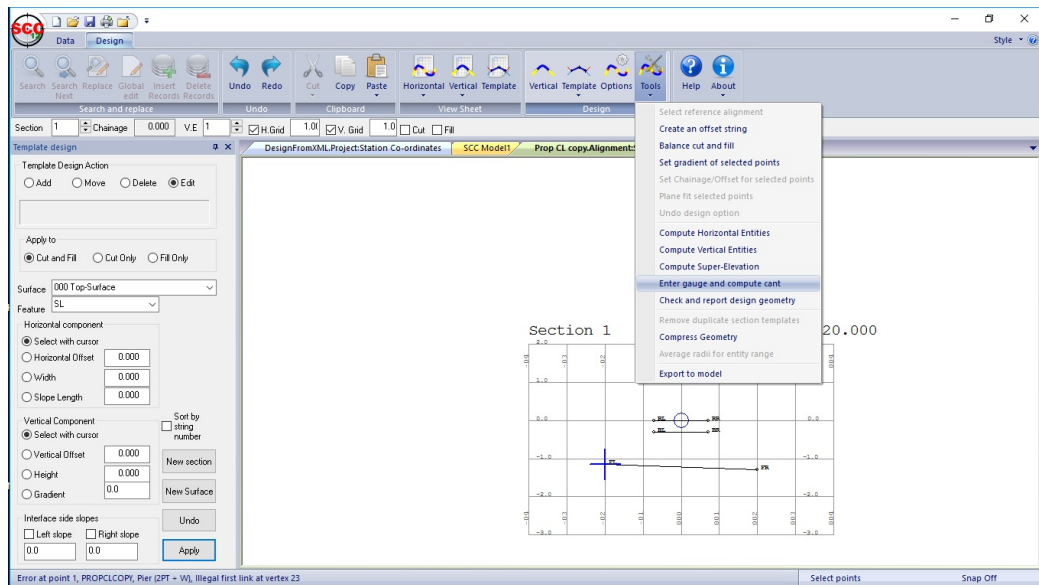
NOTE: If no Cant values were present in the XML file, values can be entered manually by viewing Rail Cant and then selecting 'DESIGN tab > Insert Records'. Cant is entered in mm. CW is Clockwise / CCW is Counter Clockwise.

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:

Compute rail grade and run-off

Default values
 Use last entered values Use values loaded from input file

Gauge Apply cant Report cant by chainage

Left rail
 Feature Offset

Right rail
 Feature Offset

Add sleepers to template Apply cant from edge of sleeper

Left sleeper
 Feature Offset

Right sleeper
 Feature Offset

Create Template OK Cancel

NOTE:

The dialog uses values from the input XML file

Enter the Cant Base

Apply cant will apply cant from 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

Prop CL copy.Alignment-Cant.rep - WordPad

File Edit View Insert Format Help

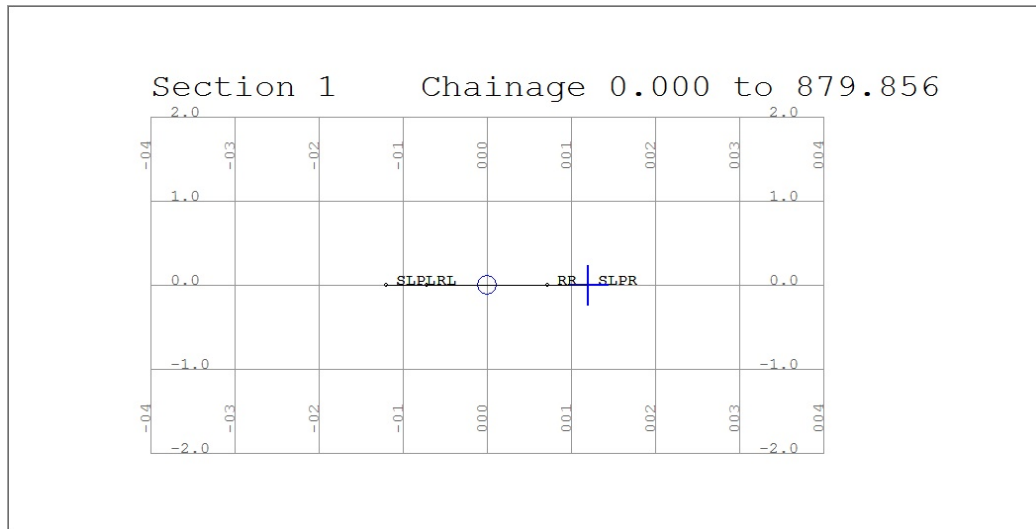
Rail cant check report
 Date: Mon Feb 20 08:56:40 2017
 Alignment: Prop CL copy.Alignment

Gauge: 1.507 Left Rail:RL Offset -0.718 Right Rail:RR Offset 0.718
 Cant applied from low sleeper Left Sleeper:SLPL Offset -1.200 Right Sleeper:SLPR Offset 1.200

| Chainage | CL Height | Rail L.Cant | Rail R.Cant | Rail L.Height | Rail R.Height | Sleeper L.Cant | Sleeper R.Cant | Sleeper L.Height | Sleeper R.Height | Direction |
|----------|-----------|-------------|-------------|---------------|---------------|----------------|----------------|------------------|------------------|------------|
| 10.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | Right (CW) |
| 20.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | Right (CW) |
| 30.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | Right (CW) |
| 40.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | Right (CW) |
| 50.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | Right (CW) |
| 60.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | Right (CW) |
| 70.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | Right (CW) |
| 80.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | +0.000 | +0.000 | 0.000 | 0.000 | Right (CW) |
| 90.000 | 19.798 | +0.000 | +0.000 | 19.798 | 19.798 | +0.000 | +0.000 | 19.798 | 19.798 | Right (CW) |
| 100.000 | 19.820 | +0.000 | +0.000 | 19.820 | 19.820 | +0.000 | +0.000 | 19.820 | 19.820 | Right (CW) |
| 110.000 | 19.842 | +0.000 | +0.000 | 19.842 | 19.842 | +0.000 | +0.000 | 19.842 | 19.842 | Right (CW) |
| 120.000 | 19.865 | +0.000 | +0.000 | 19.865 | 19.865 | +0.000 | +0.000 | 19.865 | 19.865 | Right (CW) |
| 130.000 | 19.887 | +0.000 | +0.000 | 19.887 | 19.887 | +0.000 | +0.000 | 19.887 | 19.887 | Right (CW) |
| 140.000 | 19.909 | +0.000 | +0.000 | 19.909 | 19.909 | +0.000 | +0.000 | 19.909 | 19.909 | Right (CW) |
| 150.000 | 19.931 | +0.000 | +0.000 | 19.931 | 19.931 | +0.000 | +0.000 | 19.931 | 19.931 | Right (CW) |
| 160.000 | 19.953 | +0.000 | +0.000 | 19.953 | 19.953 | +0.000 | +0.000 | 19.953 | 19.953 | Right (CW) |
| 170.000 | 19.975 | +0.000 | +0.000 | 19.975 | 19.975 | +0.000 | +0.000 | 19.975 | 19.975 | Right (CW) |

For Help, press F1

A Section Template is created.



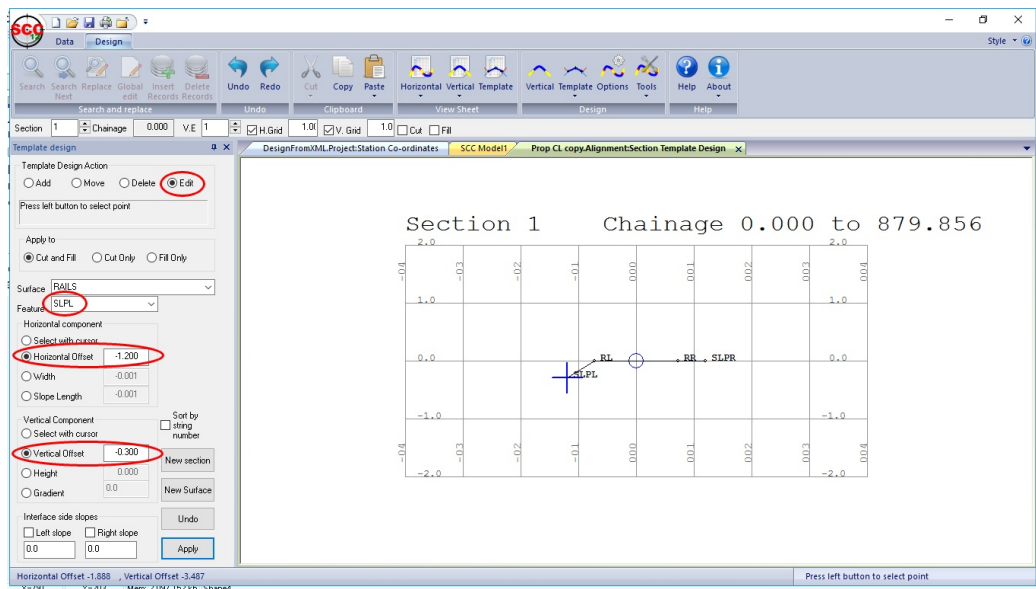
1.5.6 Applying Sleeper Vertical & Horizontal Offset

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

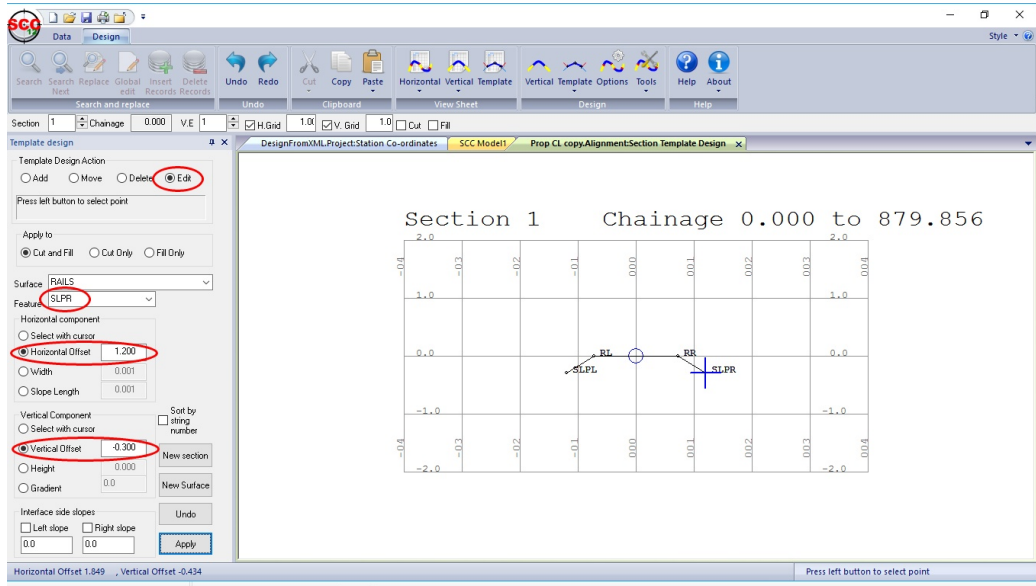
Press 'Apply'



Left click mouse on 'SLPL' on screen

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

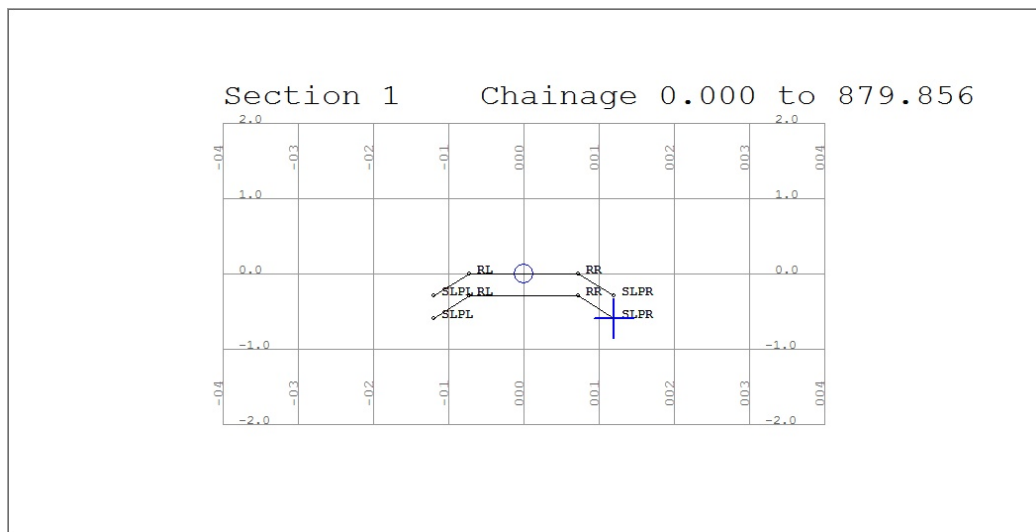
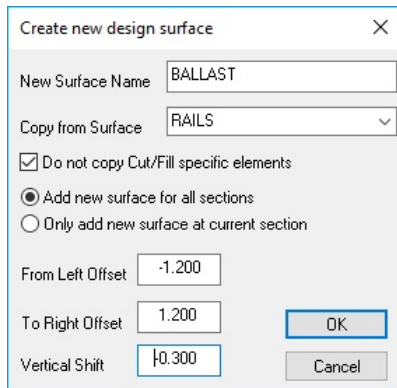
Press 'Apply'



1.5.7 Add Ballast Layer

Select 'New Surface'

Set up the following and Press 'OK'

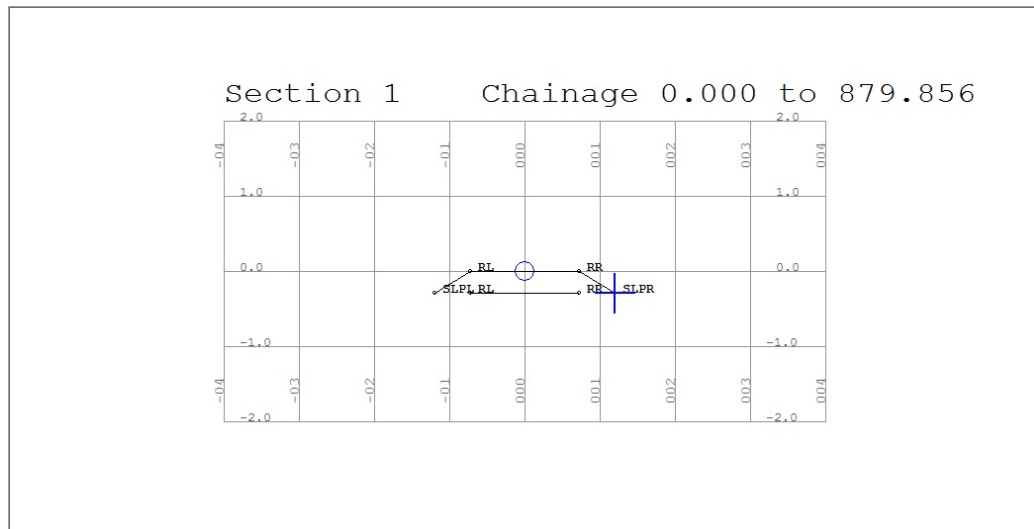
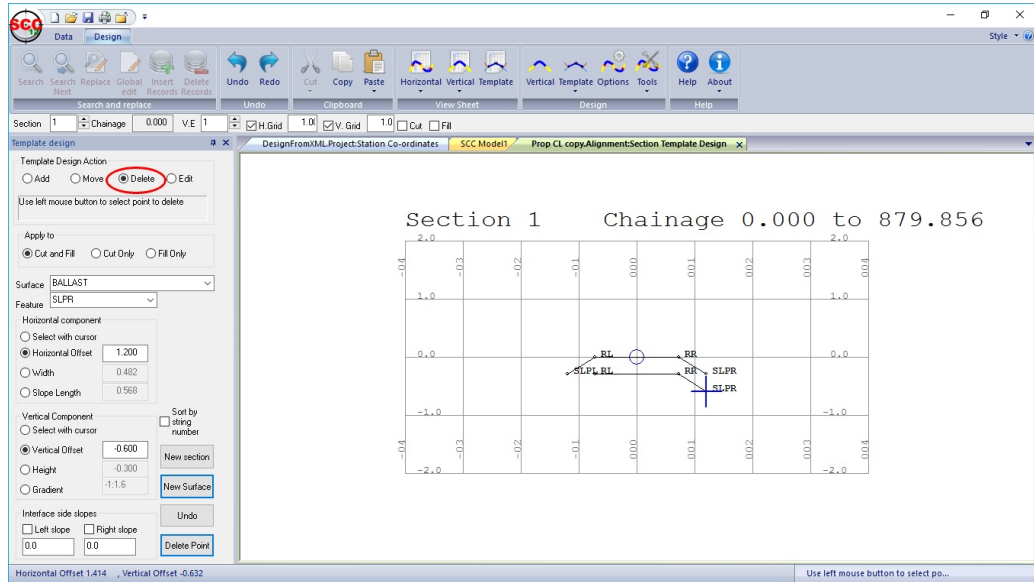


1.5.8 Removing Sleepers From Ballast Surface

Select 'Delete'

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

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



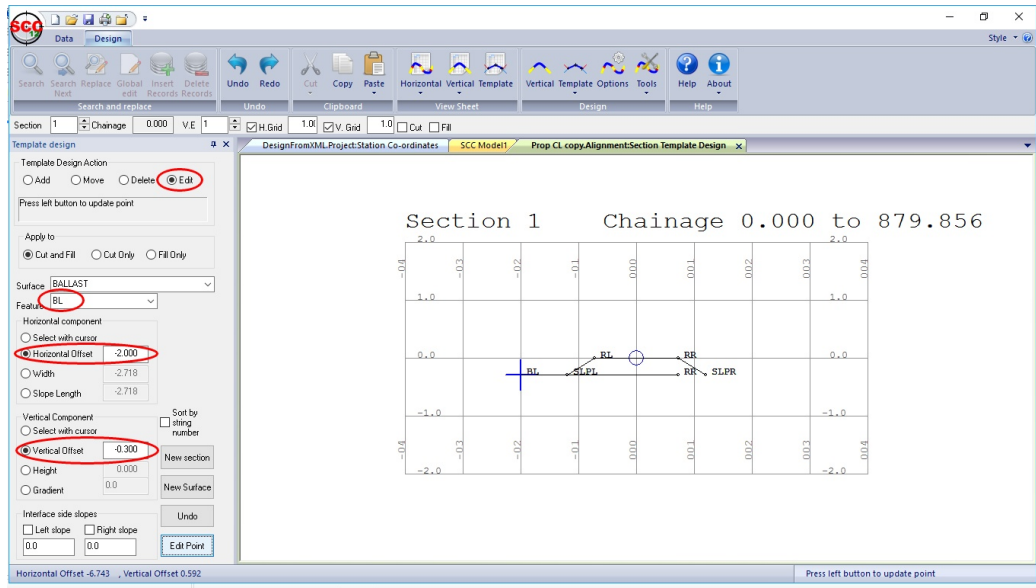
1.5.9 Editing Ballast Surface

Select 'Edit'

Left click mouse on 'BL' point

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

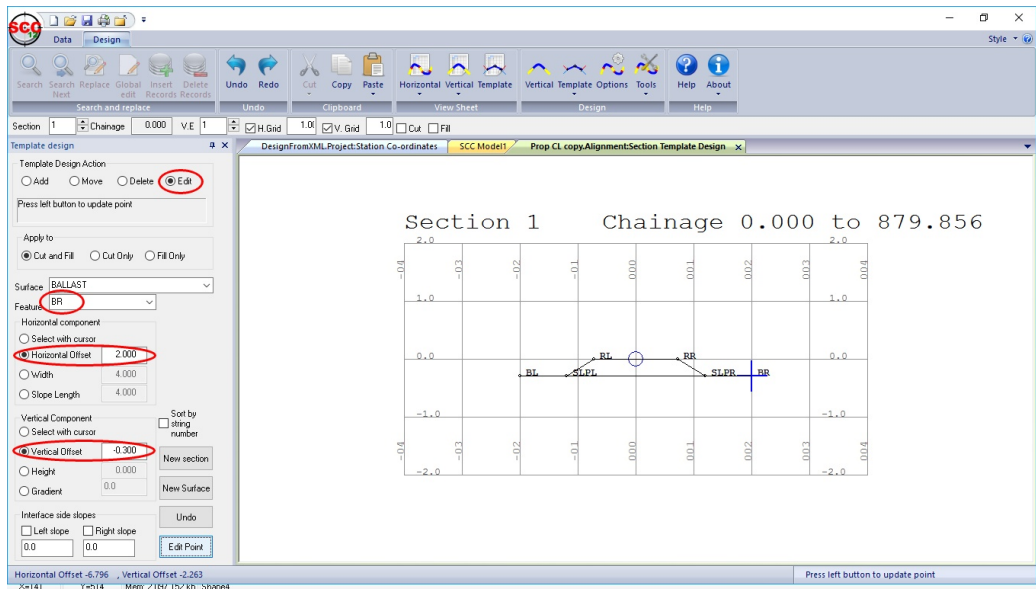
Press 'Edit Point'



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'

Create new design surface

New Surface Name: FORMATION

Copy from Surface: RAILS

Do not copy Cut/Fill specific elements

Add new surface for all sections

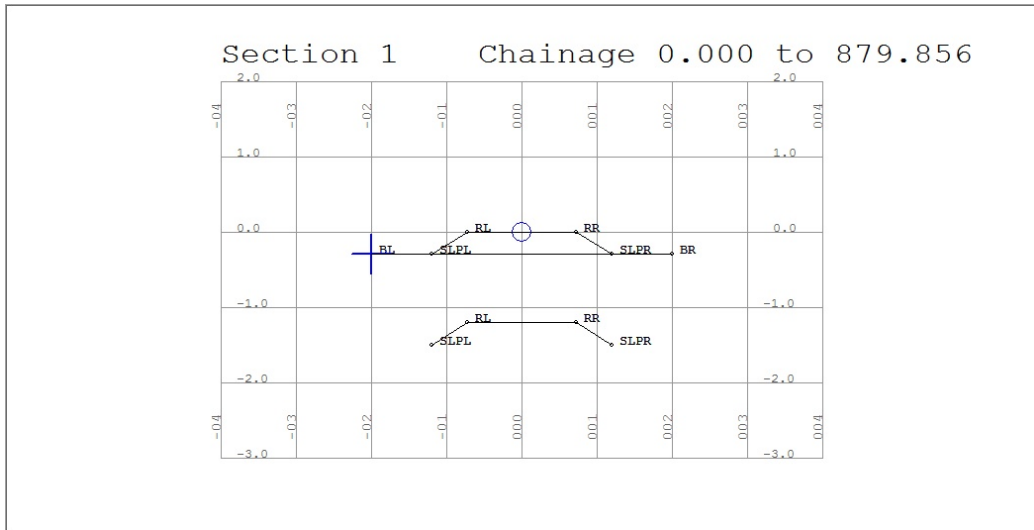
Only add new surface at current section

From Left Offset: -2.000

To Right Offset: 2.000

Vertical Shift: -1.4

OK Cancel



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'

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

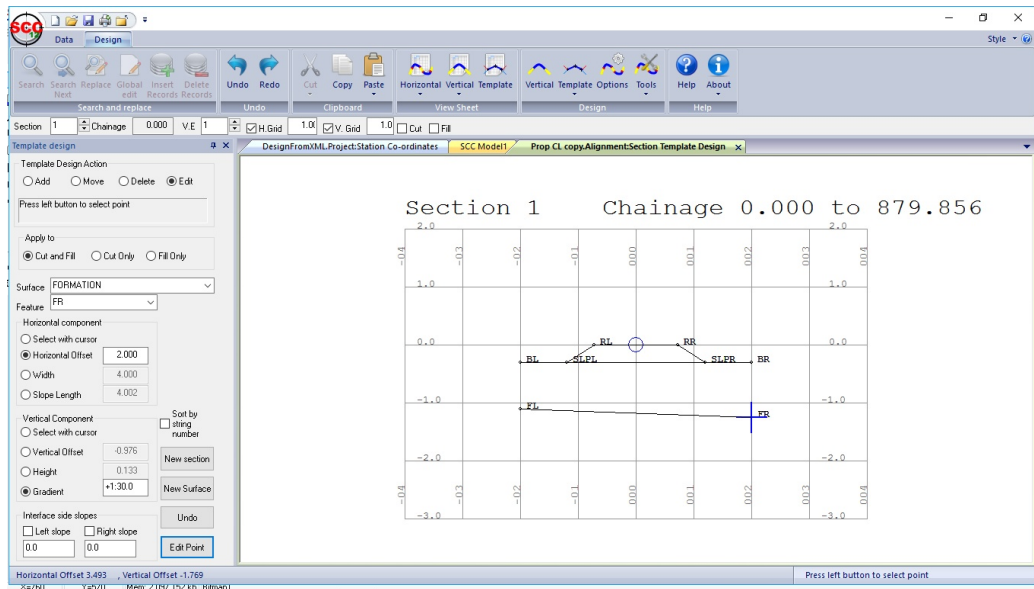
Press 'Edit Point'

Left click on 'RR' on Formation Surface

Enter New feature code 'FR'

Horz, Offset 2 and Gradient -1:30

Press 'Edit Point'

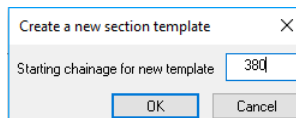


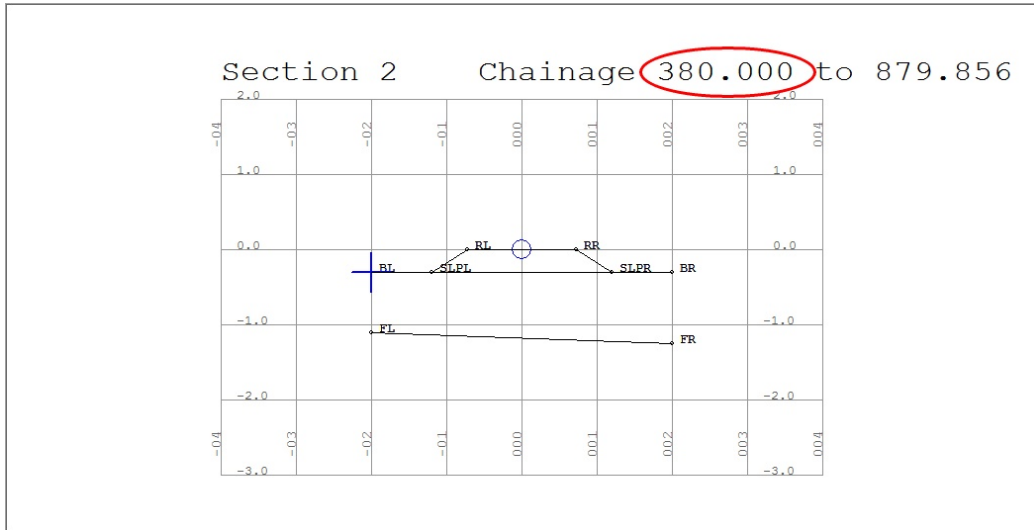
1.5.13 Adding Ramp at Chainage 380 to 480

Ramp down at Chainage 380 and ramp up at Chainage 480

Select 'New Section'

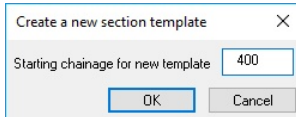
Enter Starting chainage for new template of 380 and press 'OK'





Select 'New Section'

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



1.5.14 Inputting Ramp Design on Ballast layer

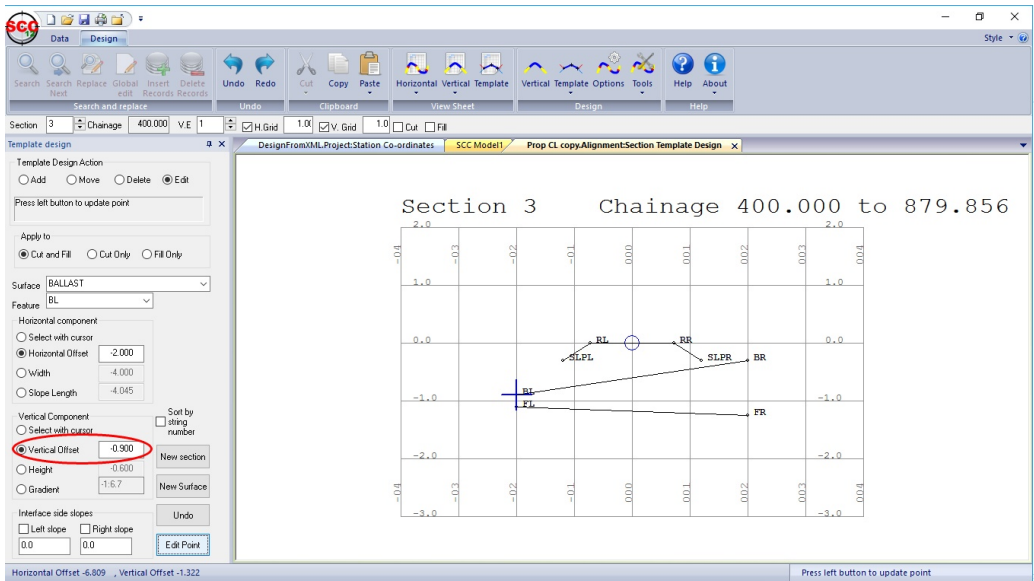
Section 3 Chainage 400

Select 'Edit'

Left click on 'BL' on Ballast Surface

Horz, Offset -2 and Vert. Offset -0.9

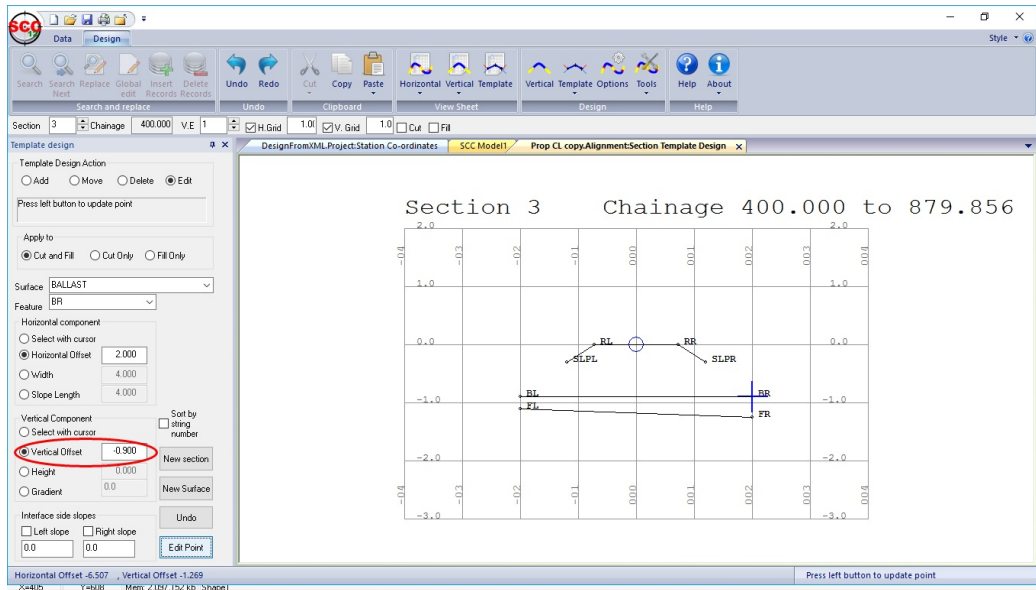
Press 'Edit Point'



Left click on 'BR' on Ballast Surface

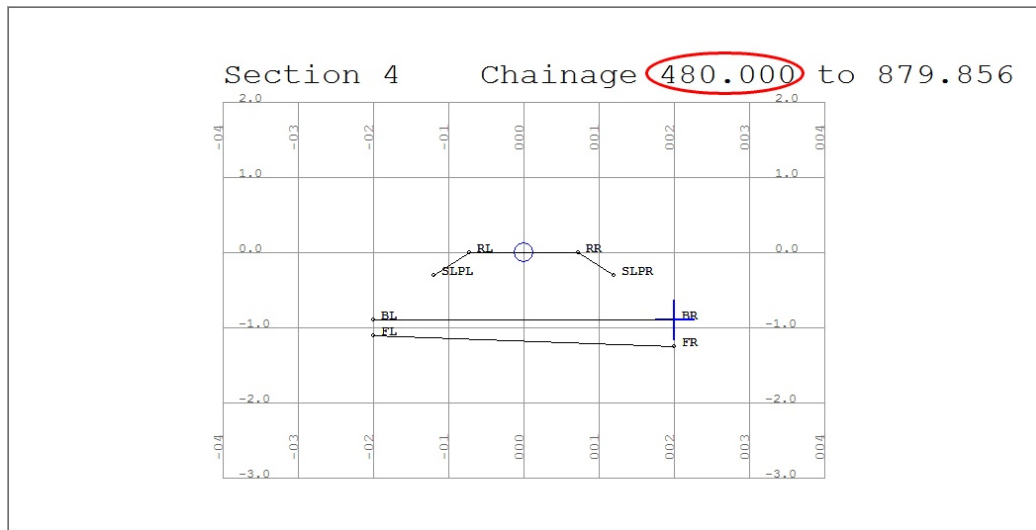
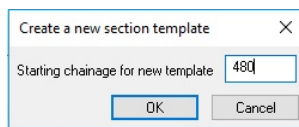
Horz, Offset 2 and Vert. Offset -0.9

Press 'Edit Point'



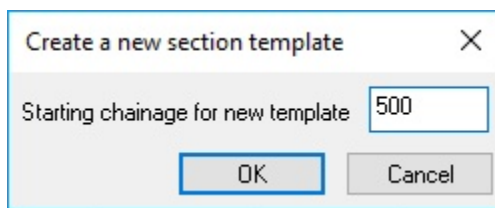
Select 'New Section'

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'



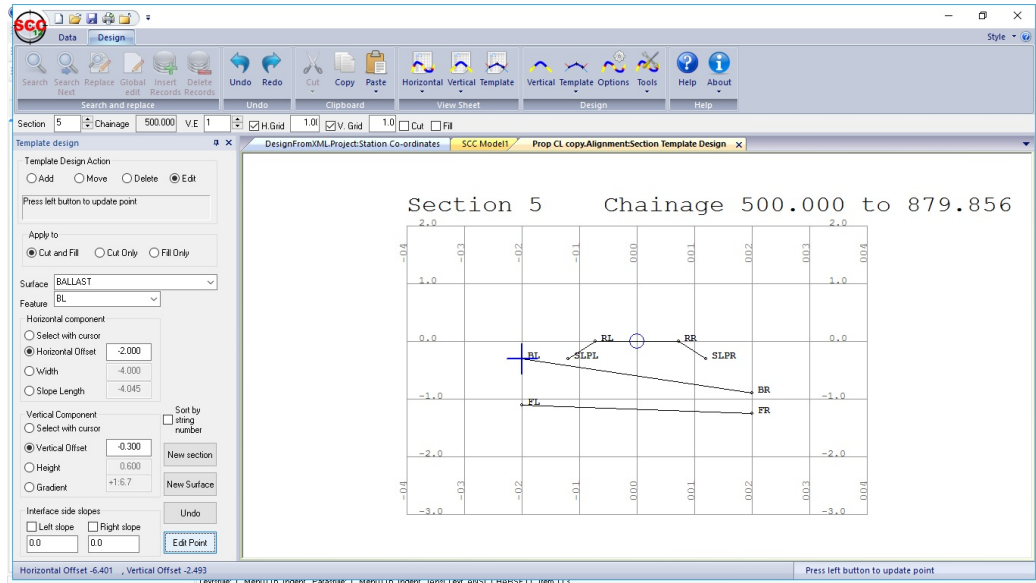
Section 5 Chainage 500

Select 'Edit'

Left click on 'BL' on Ballast Surface

Horz. Offset -2 and Vert. Offset -0.3

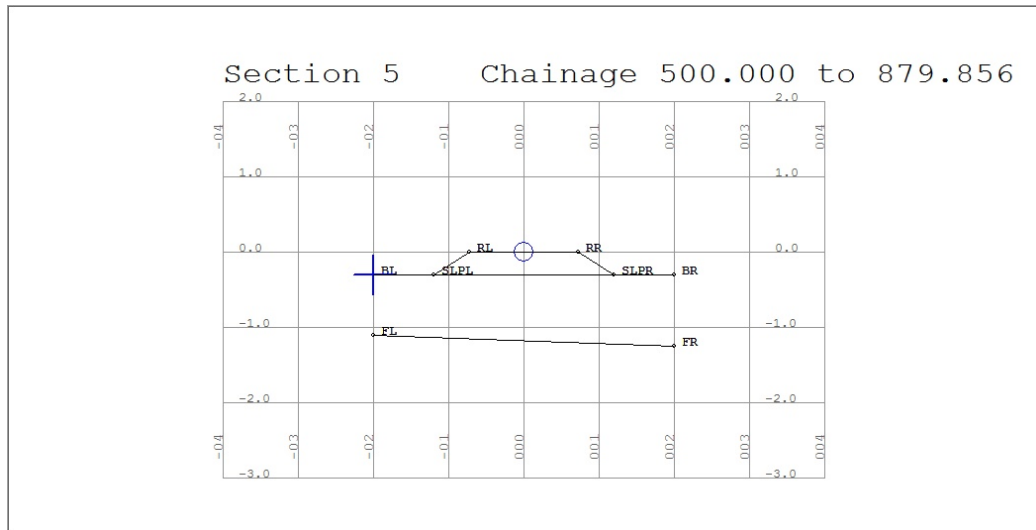
Press 'Edit Point'



Left click on 'BL' on Ballast Surface

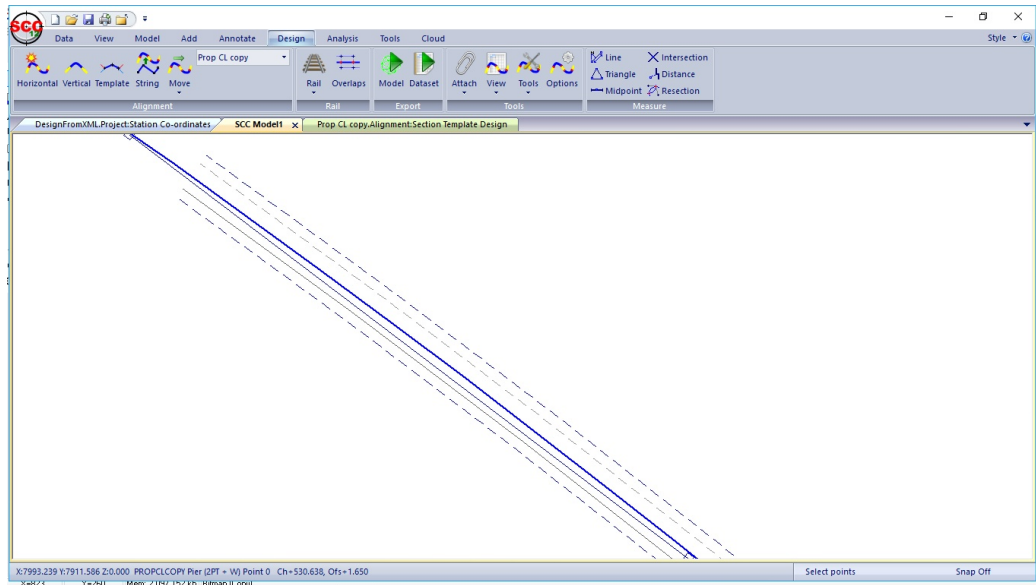
Horz. Offset 2 and Vert. Offset -0.3

Press 'Edit Point'



Save Alignment

Template is visible on the model displaying the alignment



1.5.15 Export Rail Design

Go to 'DESIGN tab > Model' Export

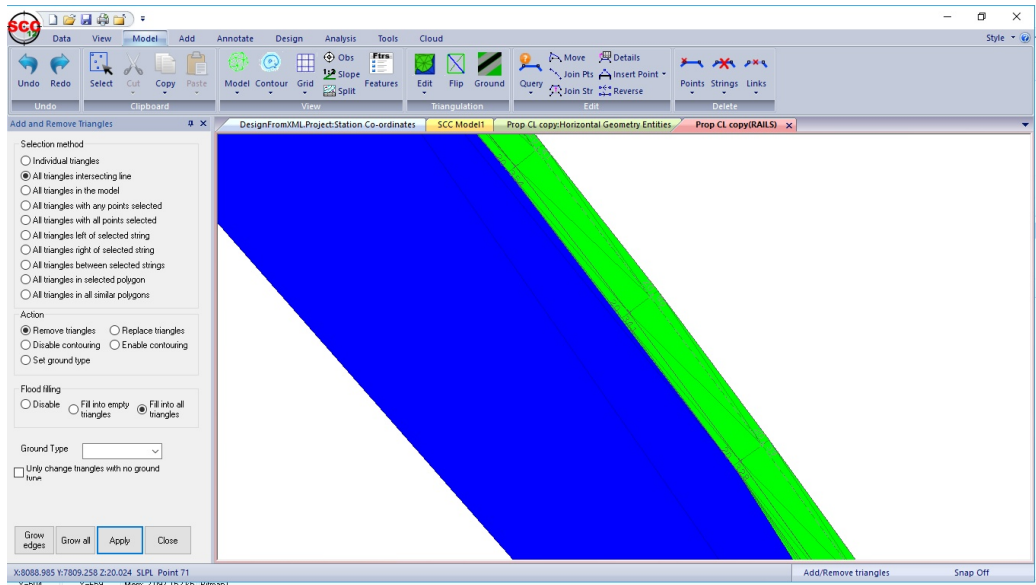
Set up the following and press 'Ok':

Press 'Ok' to model attribute dialog

1.5.16 Triangulate Rail Model

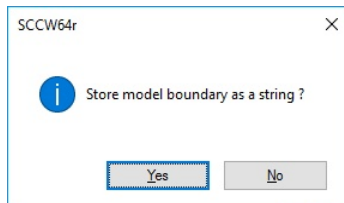
Within 'MODEL tab > Edit'

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



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

Chainage 0.000
 Hz.Scale 1:250
 Vt.Scale 1:125
 Datum 19.000

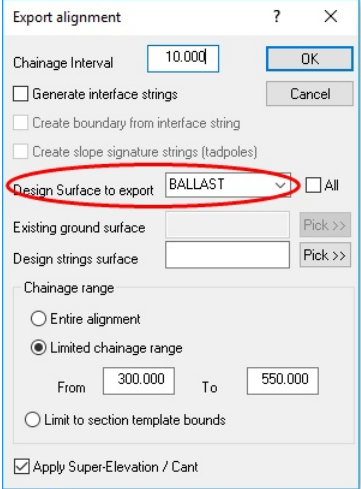


| Chainage/Offset | Elevation Prop CL copy (RAILS) | Plan X | Plan Y | Feature name |
|-----------------|--------------------------------|--------|--------|--------------|
| 10.7 | 0.937 | 0115.5 | 7739.2 | 31PL |
| 11.2 | 0.932 | 0117.0 | 7739.3 | 32 |
| 12.0 | 0.928 | 0118.3 | 7740.1 | 33PR |
| 12.5 | 0.924 | 0119.7 | 7740.3 | 34PR |

1.5.18 Export Ballast Design

Go to 'DESIGN tab > Model' Export

Set up the following and press 'Ok':



Export alignment ? X

Chainage Interval: 10.000 [OK] [Cancel]

Generate interface strings

Create boundary from interface string

Create slope signature strings (tadpoles)

Design Surface to export: BALLAST [v] All

Existing ground surface: [Pick >>]

Design strings surface: [Pick >>]

Chainage range

Entire alignment

Limited chainage range

From: 300.000 To: 550.000

Limit to section template bounds

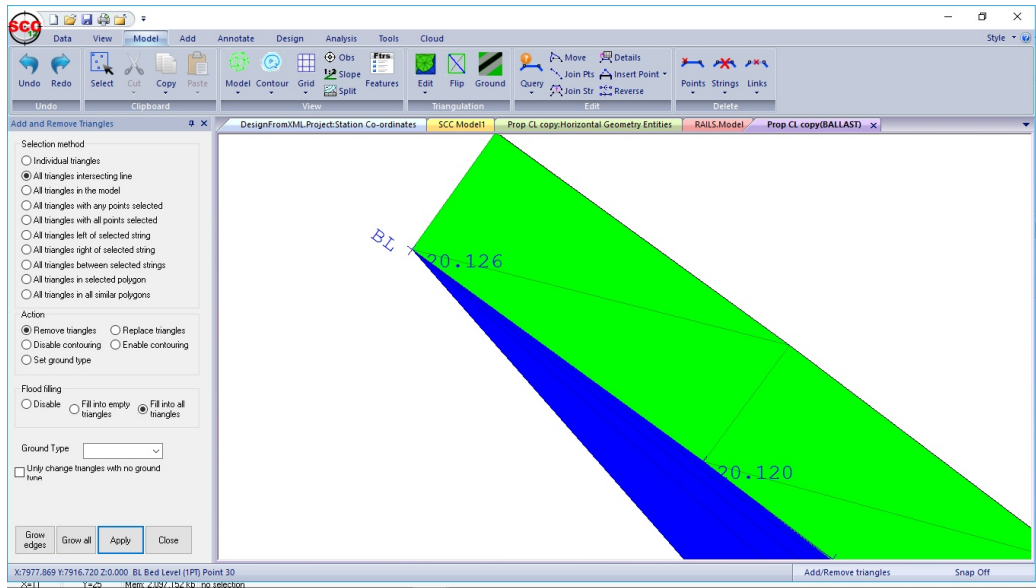
Apply Super-Elevation / Cant

Press 'Ok' to model attribute dialog

1.5.19 Triangulate Ballast Model

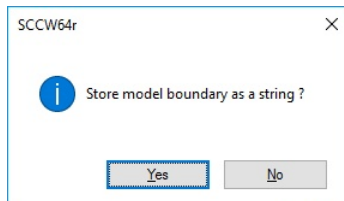
Within 'MODEL tab > Edit'

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



Select 'Apply'

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

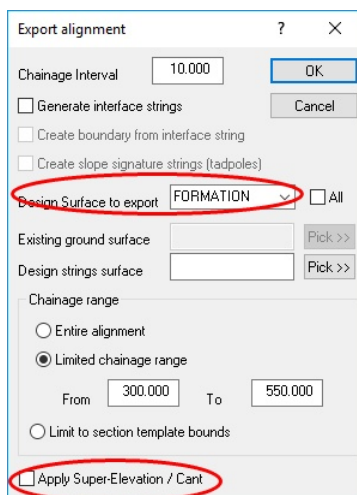


Save Model as 'BALLAST.Model'

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'

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.

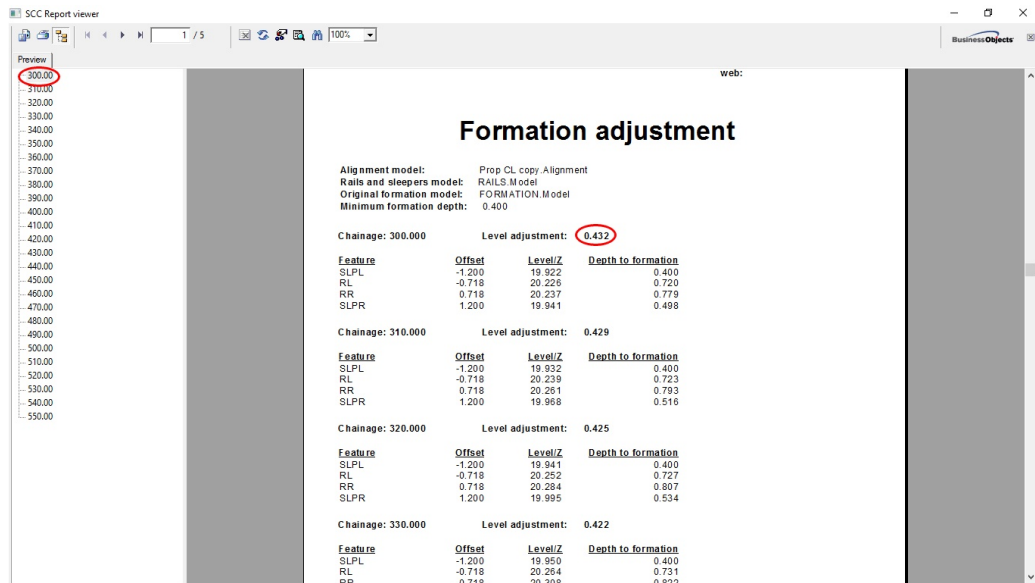
Go to 'DESIGN tab > Rail > Check and adjust formation levels'

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

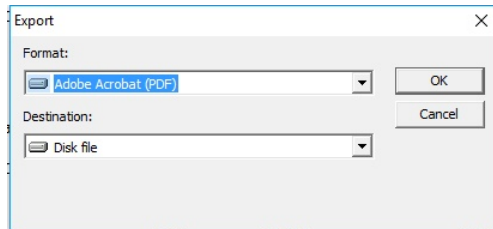
Select 'Ok' to model attribute dialog

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



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'

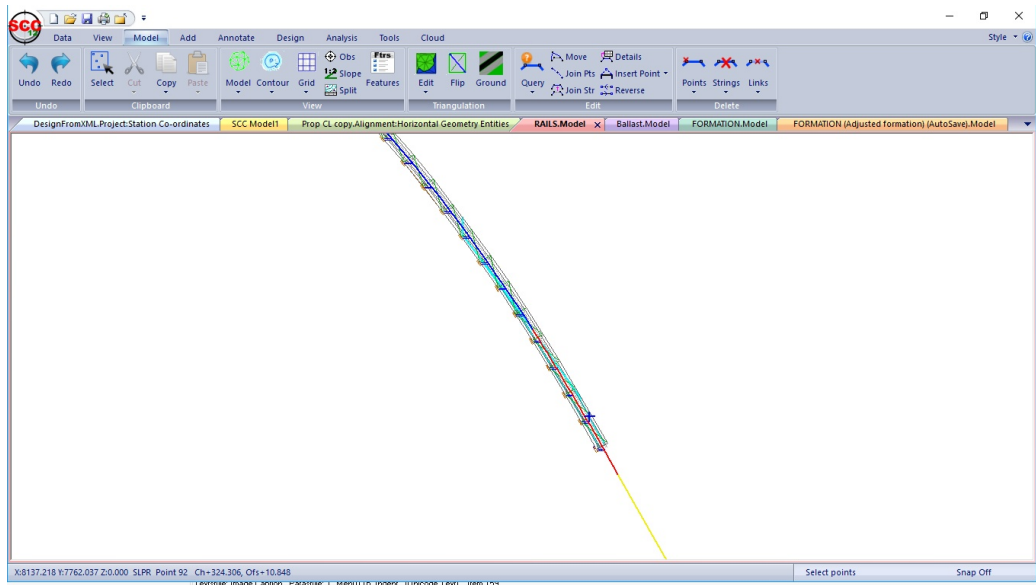
1.5.23 Combining Models & Alignment for QA purposes

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'

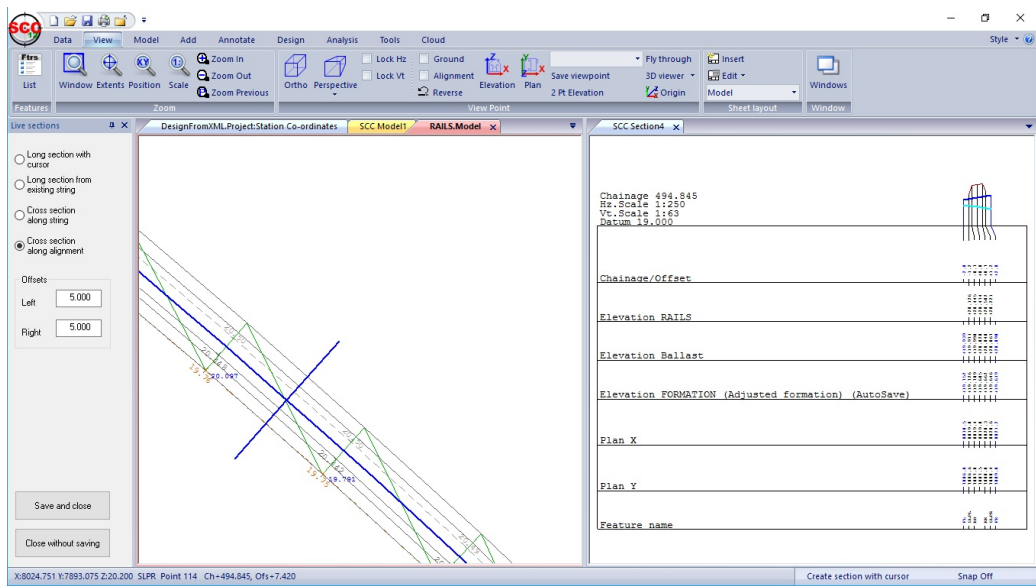
Go to 'DESIGN tab > Attach drop down > Alignment' and select Alignment file



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

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

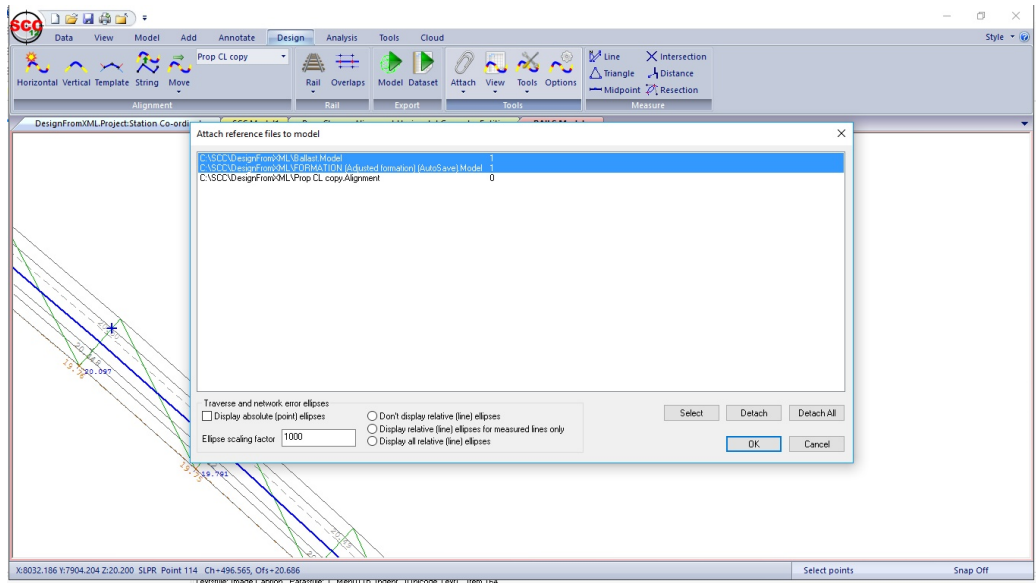
Move cursor along alignment, left click to generate live section in sub divided screen



Close without saving

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

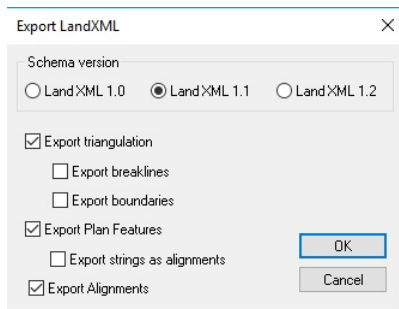
Highlight Ballast and Formation Model, select 'Detach' and 'Ok'



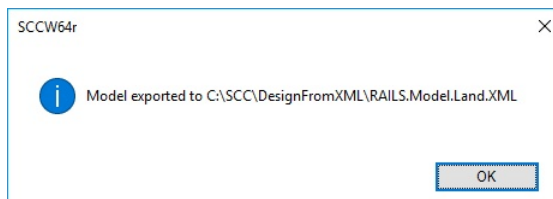
1.5.24 Exporting XML For Machine Control

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'

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'

Compute platform positions from gauge

Bance gauge (No coordinates) OK
 Coordinates and corrected gauge data Cancel
 Coordinates and uncorrected gauge data

Reference line / Left Rail

Platform is on the left Normal cant
 Platform is on the right Reverse cant (ClearRoute)

Export result to SCP files

Coordinate platform results using alignment

Alignment >>

Horizontal Offset Vertical Offset

Report results

Select 'OK' to 'Extra Title Fields' dialog

Extra title fields

| | Name | Value |
|----|------|---------------------------------|
| 1 | VER | 3.00 |
| 2 | REL | |
| 3 | SYD | 20 / 02 / 2017 |
| 4 | CUS | |
| 5 | SYS | |
| 6 | FLN | C:\SCC\rail-day\Bance Gauge\SCP |
| 7 | NTK | 1 |
| 8 | DATE | 20 / 02 / 2017 |
| 9 | ELR | LTN1 |
| 10 | NAME | Platform Platform |
| 11 | INPT | (Unknown) |
| 12 | MODE | Platform Gauge |
| 13 | DIST | 0 |
| 14 | INT | 1 |
| 15 | ID1 | G |
| 16 | TD1 | 1 |
| 17 | LSP1 | 112.6541 |
| 18 | RAD1 | 0 |
| 19 | VRA1 | 0 |

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

Pick a report

Platform Gauge Survey.rpt

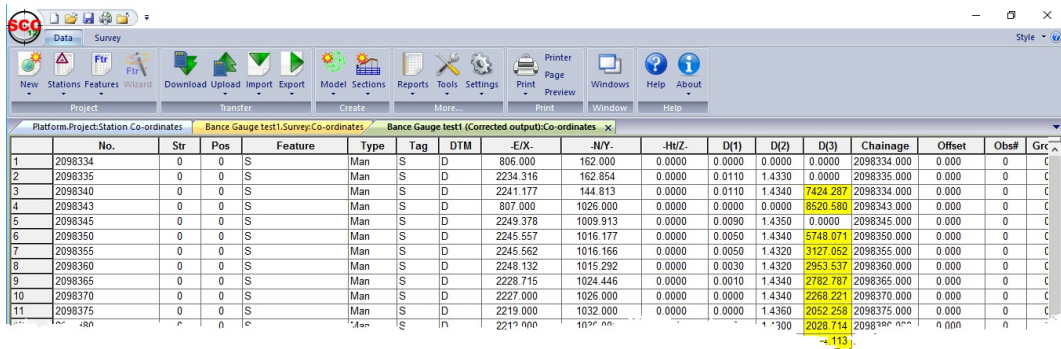
Checks shots.rpt
 CoordDups.rpt
 DCC_StationDescriptionSheet_Detail.rpt
 Detail_Observations.rpt
 distance_residuals_srt.rpt
 File CRCs.rpt
 File stats.rpt
 Formation adjustment.rpt
 Horizontal entity differences.rpt
 Log File (Actions only).rpt
 Log File (Actions, notes, warnings, and errors).rpt
 Log File (Actions, vars only).rpt
 Log File (All).rpt
 Log File, current document (Actions, notes, warnings, and errors).rpt
 Log File, last option (Actions, notes, warnings, and errors).rpt
 Platform Gauge Survey (Coords).rpt
 Platform Gauge Survey.rpt

Review report

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 | 1.4300 | 2,227.7080 | 1,015.4480 |
| | | | | | 219.0000 | 117 |



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;

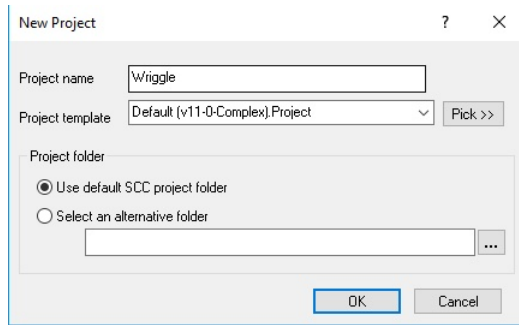
Creating A Project Directory

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

Enter in a Project/Job name 'Wriggle'

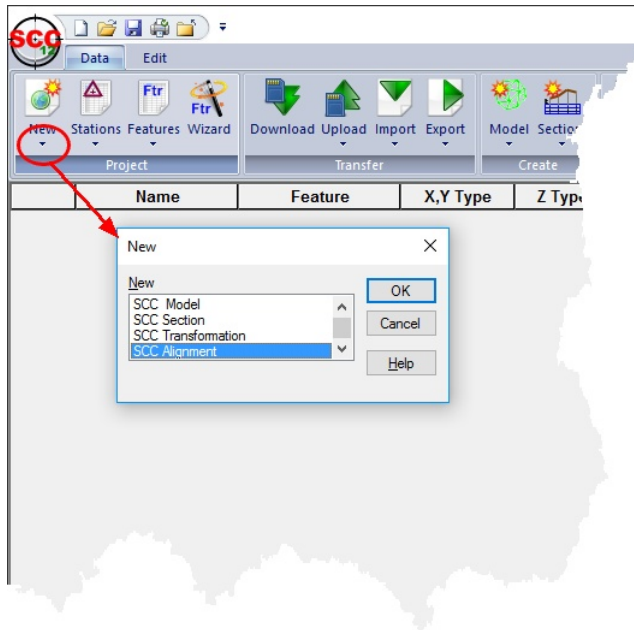
Select a Project Template from the list 'Default v11 Complex.Project'

Select 'OK'



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

Process wriggle survey

Alignment: C:\SCC\rail-day\wriggle\Wriggle\Upline.Alignment >>

Bearing computation

Use bearing computed from ring data
 Use instantaneous bearing from alignment

Gradient computation

Use gradient computed from ring data
 Use instantaneous gradient from alignment
 Force horizontal gradient

Design radius: 3.100 Outlier distance: 0.500
 Radial offset: 0.000 Deformation tolerance: 0.010

Export options

Export to survey data set
 Export to model
 Export to sections
 Output design circles
 Output best fit circles
 Output surveyed points
 Keep generated alignment Text thinning (m): 1.000
 Add rail data from model to output

D1: Ht.Diff to Alignment
 D2: Ht.Diff to Centre
 D3: Diff.Radius from design

String surveyed rings

OK Cancel

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

SCC Report viewer

Created on Wednesday, March 1, 2017
 By SCC 9.11.5

Wriggle Survey Analysis

Survey: 9961065 Tel:
 Alignment: C:\SCC\rail-day\wriggle\Wriggle\Upline.Alignment Fax:
 Gradient: Computed email:
 Bearing: Computed web:

Ring: 1 Section orientation
 Points: 8 Bearing: Grade: VA:
 Used: 344 29 12 -1.447.2 359 52 19
 Radial offset: 0.000 Alignment: 164 20 51 000 22 40
 Design radius: 3.100 Computed: 344 29 12 -1.447.2 359 52 19

| Point ID | Easting | Northing | Level | Chainage | Radius | dRadius | Offset | VOffset | Cent |
|----------|------------|------------|----------|------------|--------|---------|--------|---------|-------|
| Centre | 20219.8952 | 65018.0791 | -15.4766 | 11637.2202 | 3.574 | -0.474 | 0.267 | 2.479 | 0.130 |
| 1 | 20220.8570 | 65015.2990 | -13.3590 | 11637.2036 | 3.579 | -0.479 | 3.150 | 4.000 | 0.130 |
| 2 | 20220.8470 | 65014.6430 | -15.4970 | 11637.2096 | 3.566 | -0.466 | 3.833 | 2.459 | 0.130 |
| 3 | 20219.8570 | 65018.9130 | -12.0040 | 11637.2158 | 3.579 | -0.479 | -0.600 | 5.952 | 0.130 |
| 4 | 20220.6440 | 65015.4010 | -17.7110 | 11637.2186 | 3.567 | -0.467 | 3.048 | 0.245 | 0.130 |
| 5 | 20219.2230 | 65020.4870 | -12.9180 | 11637.2226 | 3.577 | -0.477 | -2.233 | 5.038 | 0.130 |
| 6 | 20219.6320 | 65019.0280 | -18.9170 | 11637.2227 | 3.579 | -0.479 | -0.718 | -0.961 | 0.130 |
| 7 | 20218.9470 | 65021.5030 | -15.2350 | 11637.2309 | 3.561 | -0.461 | -3.286 | 2.721 | 0.130 |
| 8 | 20220.1410 | 65017.2500 | -18.9550 | 11637.2332 | 3.584 | -0.484 | 1.132 | -0.999 | 0.130 |

Ring: 2 Section orientation
 Points: 9 Bearing: Grade: VA:
 Used: 344 34 14 -1.415.2 359 51 43
 Radial offset: 0.000 Alignment: 164 25 56 000 22 40
 Design radius: 3.100 Computed: 344 34 14 -1.415.2 359 51 43

| Point ID | Easting | Northing | Level | Chainage | Radius | dRadius | Offset | VOffset | Cent |
|----------|------------|------------|----------|------------|--------|---------|--------|---------|-------|
| Centre | 20224.2275 | 65019.2840 | -15.4452 | 11641.7173 | 3.573 | -0.473 | 0.272 | 2.481 | 0.130 |
| 9 | 20225.0300 | 65016.3370 | -13.5880 | 11641.6994 | 3.575 | -0.475 | 3.327 | 4.339 | 0.130 |
| 10 | 20223.5420 | 65021.7010 | -12.9010 | 11641.7056 | 3.576 | -0.475 | -2.240 | 5.026 | 0.130 |
| 11 | 20225.1800 | 65015.8480 | -15.3850 | 11641.7127 | 3.566 | -0.466 | 3.838 | 2.542 | 0.130 |
| 12 | 20225.9050 | 65016.4950 | -17.5250 | 11641.7178 | 3.565 | -0.465 | 3.168 | 0.401 | 0.130 |

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

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

Download survey data

Survey data logger: GPS X,Y,Z

Data type:

- Detail Topography
- Traverse
- As Set Out
- Levelling

Datalogger input Device:

- Disk
- RS232 port (cable)
- Atlas communications controller
- Leica DBX database
- Trimble Link Engine

Create model from input data

OK Cancel

Input GPS X,Y,Z

Point No., X, Y, Z, Feature, Remark
 Point No., X, Y, Z, Feature, D1, D2, Remark
 Point No., X, Y, Z, Feature, Tag, D1, D2, Remark
 Point No., Feature, X, Y, Z, Remark
 Point No., X, Y, Z, Feature, Str No, Tag, DTM, D1, D2, D3, Remark
 Point No., X, Y, Z, Code list
 Point No., X, Y, Z, River attributes
 Point No., X, Y, Z, Code (MBS rivers)

Process LandScape coding Options
 Use enhanced coding extensions View >>

OK Cancel

SCC

Survey

Search Search Replace Global edit Insert Delete Undo Redo Cut Copy Paste Obs. Coords Rebuild Options Tools Help About

Search and replace Undo Clipboard View Compute Help

Wriggle Project Station Co-ordinates ascii compiler-1 Survey Co-ordinates

| | No. | Str | Pos | Feature | Type | Tag | DTM | E/X | N/Y | Ht/Z | D(1) | D(2) | D(3) | Chainage | Offset | Obs# | Gr |
|----|-----|-----|-----|---------|------|-----|-----|-----------|-----------|---------|--------|--------|--------|-----------|--------|------|----|
| 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 | C |
| 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 | C |
| 3 | 4 | 1 | 3 | 809 | Detl | S | D | 38295.840 | 56760.203 | -8.3690 | 0.0000 | 0.0000 | 0.0000 | 32357.903 | -3.719 | 3296 | C |
| 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 | C |
| 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 | C |
| 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 | C |
| 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 | C |
| 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 | C |
| 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 | C |
| 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 | C |
| 11 | 12 | 1 | 11 | 809 | Detl | S | D | 38293.205 | 56755.827 | -5.4880 | 0.0000 | 0.0000 | 0.0000 | 32357.951 | 1.389 | 3325 | C |

Computing Chainage Offset from X,Y

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

X,Y <-> Chainage, Offset

Alignment: Downline Alignment Pick >>

Record range:
From: 1 To: 3336

OK Cancel

String using Chainage Offset

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

String by Chainage/Offset

String by Chainage then Offset (Cross section)
 String by Offset then Chainage (Long section)
 String by Chainage then radially (Tunnel section)

Distance tolerance: 1

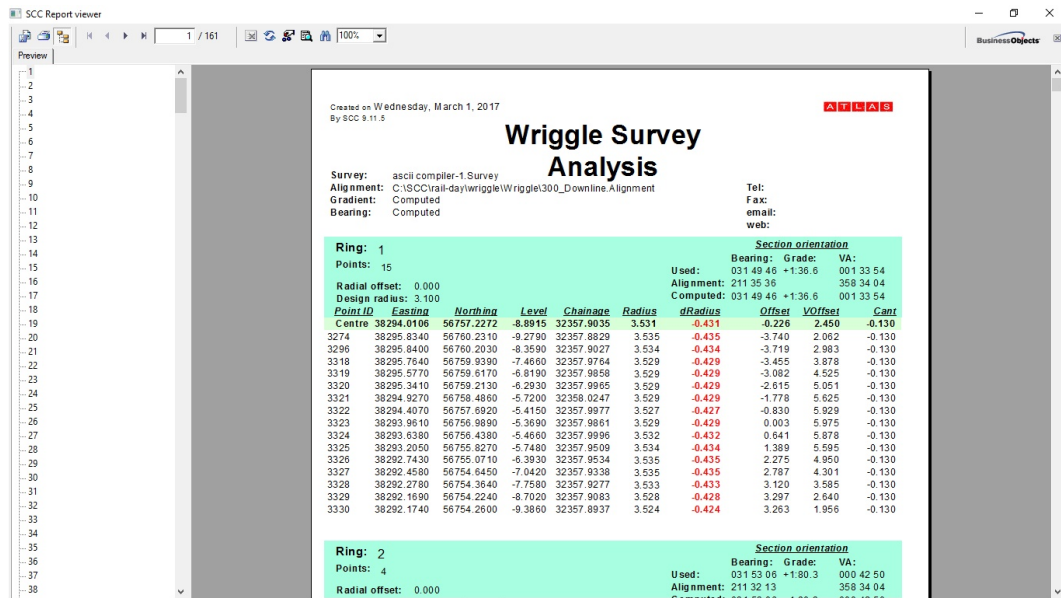
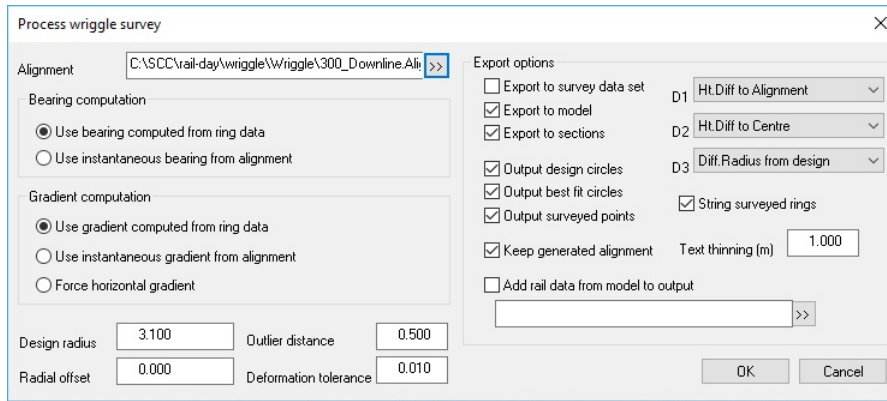
OK Cancel

'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



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 within 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.