

Working toget

Bentley Rail Track Update

BENTLEY USER GROUP DENMARK

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Recent Past and Near Future

- Today, I will discuss recent enhancements to Bentley Rail Track. Some of these enhancements you may be very familiar with and others you may not be aware of.
- Also, I will discuss the development of Power Rail Overhead Line that will be available later this year. You may be unaware of this product, but hopefully when it is released later this year, it will become another product that you will use on your projects!



New Product Power Rail Track V8i

- Similar to Power InRoads & Power GEOPAK
- Power Rail Track includes
 - Bentley Rail Track Suite functionality (everything!)
 - Data Acquisition
 - Мар

- Available in SELECTseries 2 (i.e. now!)



Roads and Bridges



Power Rail Track V8i

- Interface is customizable with *common* tools
- Single menu & task bars





Background

Just a bit of background on **Bentley Rail Track**



Bentley Rail Track is a Global Solution!

- Bentley Rail Track is suitable for designing
 - Light rail
 - Heavy rail
 - High-speed rail
 - Steel on steel or magnetic levitation systems
- Bentley Rail Track has been internationalized
 & localized
 - Available in English, German, Spanish, Chinese, Russia, Italian plus other languages
 - Deliver standard turnouts
 - Build in railway specific design checking



Bentley Rail Track offers...

- Horizontal & vertical alignment design
 - New design
 - Single and multi-element regression analysis for maintenance / renewals
- Cant / superelevation design
- Turnouts
 - Specialized geometry
- Also includes specialized toolsets for
 - Design checking
 - Field to design / Design to field
 - Machine to design to machine
 - Light rail manufacturing
 - Magnetic levitation



Alignment Enhancements

Horizontal and vertical alignment enhancements for rail design



View Options

- Update annotation as the geometry is created / edited
 - Based upon
 - Alignment's style
 - Persisted command's preferences
 - Allows different "type of alignments" to display differently
 - A road baseline would have:
 - Horizontal annotation
 - Stationing
 - Curve set annotation
 - A right of way take would have:
 - Horizontal annotation
 - A track would have:
 - Regression Points
 - Horizontal annotation
 - Stationing





Simplified Horizontal Elements

- Horizontal Elements without dialogs
 - Well, there is a Settings dialog, which defines the radius and optional spiral lengths!
 - This dialog is active even during graphics input
 - Add Fixed, Float and Free elements
 - Move
 - Edit
 - Delete



– MicroStation only functionality!





Horizontal Design Criteria

- Curve Set Based
 - Add PI & Insert PI
- Looks up radius based upon speed / maximum superelevation
 - ..\data\metric\Horizontal Design Checks.txt
 - Primarily road oriented but <u>this could be enhanced</u> <u>for rail</u>

E Design Criteria	* DESIGN SPEED	MAXIMUM E	MAXIMUM
Image: Weight of the state	20. 30. 40. 50. 55.	. 04 . 04 . 04 . 04 . 04 . 04	.17 .16 .15 .14 .13
Speed: 65	60.	.04	.12
Maximum e: 6.000 Preferences Minimum Radius: 1637.0000 Help	20. 30. 40.	.06 .06 .06	.17 .16 .15
	55. 60. 65.	.06 .06 .06	.14 .13 .12 .11



MINIMUM RADIUS

127. 302. 573. 955. 1186. 1528. 116. 273. 509. 849. 1061. 1348. 1637.

2083.

70.

.06

.10

Tracking...

Add PL...

Horizontal Table Editor

- Invokes Add, Insert, Move and Delete PI commands
- Redesign All
 - Based up Horizontal Design Criteria
 - Either invoke the *Horizontal Design Criteria* command or <Ctrl> right click and change the speed and / or maximum superelevation

| 🖌 Horizontal Ta | ble Editor | | | | |
|-----------------|-------------|--------------------|-----------|---------------------|-------|
| Curve Sets: | | | | | Undo |
| Northing | Easting | Leading Transition | Radius | Trailing Transition | |
| 1360809.925 | 1956506.741 | | | | Close |
| 1361269.563 | 1958508.700 | 0.0000 | 1145.9156 | 0.0000 | Help |
| 1360942.522 | 1959267.451 | 0.0000 | 402.0756 | 0.0000 | Пор |
| 1360996.754 | 1959484.216 | 0.0000 | 292.6403 | 0.0000 | |
| 1361063.027 | 1959555.156 | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |





Simplified Vertical Elements

- Vertical Elements without dialogs
 - Well, there is a Settings dialog, which defines the K or length of curve!
 - This dialog is active even during graphics input
 - Add Fixed, Float and Free elements
 - Move
 - Edit
 - Delete

- Simplified Vertical Element
- MicroStation only functionality!

| Market Settings | | |
|--------------------------------------|----------|-------|
| Dynamics | | Close |
| ✓ <u>Station</u> : | 25.0000 | Help |
| ✓ Elevation: | 0.100 | |
| ☑ <u>G</u> rade: | 0.200% | |
| Define Curve by
K = 1/(g2 - g1) ▼ | 120.0000 | |





Vertical Design Criteria

- Curve Set Based
 - Add PI & Insert PI
- Looks up K based upon speed / lower or upper limits
 - ..\data\imperial\Vertical Design Checks.txt
 - Primarily road oriented but <u>this could be enhanced</u> <u>for rail</u>

| Design Criteria | | | | | | | | | | | | |
|--|--------------|------|---------------|------------|--------------|------------|--------------|-------------|--------------|-------------|-----------------|-------------|
| ☑ Use Design Criteria | Apply | | | | | | | | | | | |
| "Vertical Design Checks" File Name: | Close | | | | | | | | | | | |
| D:\BSW\out\InRoads\Bentley\InRoads Group V8.11\data\im | Close | | | | | | | | | | | |
| Speed: | Browse | | | | | | | | | | | |
| | Preferences | GN | Crest | - Upper | Crest | - Lower | Sag | - Upper | Sag | - Lower | Passing | Sight Dist. |
| Lower - | | f | Stop
 Dist | K
Value | Stop
Dist | K
Value | Stop
Dist | K
Valuei | Stop
Dist | K
Valuel | Minimum
Dist | K
Value |
| | <u>H</u> elp | | 125 | | 125 | 10 | 125 | | 125 | | | |
| | | .40 | 150 | 20 | 125. | 20 | 150 | 20. | 150 | 20. | 950 | 300 |
| | 30. | .35 | 200. | 30. | 200. | 30. | 200. | 40. | 200. | 40. | 1100. | 400. |
| | 35. | . 34 | 250. | 50. | 225 | 40. | 250. | 50. | 250 | 50. | 1300. | 550. |
| | 40. | . 32 | 325. | 80. | 275. | 60. | 325. | 70. | 275. | 60. | 1500. | 730. |
| | 45. | . 31 | 400. | 120. | 325. | 80. | 400. | 90. | 325. | 70. | 1650. | 890. |
| | 50. | . 30 | 475. | 160. | 400. | 110. | 475. | 110. | 400. | 90. | 1800. | 1050. |
| | 55.
60 | . 30 | 550. | 220. | 400. | 100. | 550.
650 | 160 | 450. | 120. | 1950. | 1420 |
| | 65 | .29 | 725 | 400 | 550 | 230 | 725 | 180 | 550 | 130 | 2300 | 1720 |
| | 70. | .28 | 850. | 540. | 625. | 290. | 850. | 220. | 625. | 150. | 2500. | 2030. |



Bentley

Vertical Table Editor

- Two modes
 - Compute Interactively
 - Or wait and *Solve* for unknown values

| Curve Jeta. | | | | Solve | • | |
|-------------|-----------|--------------|-----------|-------------|--------|---------|
| Station | Elevation | Ahead Slope | Length | | | |
| 100+00.00 | 921.10 | 2.000% | | Undo | | |
| 116+00.00 | ? | -2.000% | 500.00 | Close | | |
| 133+00.00 | ? | 2.500% | 500.00 | Close | | |
| 146+00.00 | ? | -1.000% | 500.00 | Help | | L. |
| 152+00.00 | ? | 2.000% | 0.00 | | | |
| 152+50.00 | 2 | (| | | | |
| | | | | | | |
| | | Currue Cater | | | | <i></i> |
| | | Station | Elevation | Abead Slope | Length | Solve |
| | | 100+00.00 | 921 10 | 2 000% | congin | Undo |
| | | 116+00.00 | 953 10 | -2.000% | 500.00 | |
| | | 133+00.00 | 919 10 | 2.000% | 500.00 | Close |
| | | 146+00.00 | 951.60 | -1.000% | 500.00 | Hole |
| | | 152+00.00 | 945.60 | 2 000% | 0.00 | Theip |
| | | | 040.00 | 2.000% | 0.00 | |
| | | 152+50.00 | 946.60 | | | |





Vertical Table Editor

- Invokes Add, Insert, Move and Delete PI commands
- Redesign All
 - Based upon Vertical Design Criteria
 - Either invoke the Vertical Design Criteria command or <Ctrl> right click and change the speed and limits

| Vertical Tab | le Editor | | | |
|--------------|-----------|-------------|--------|-------|
| Curve Sets: | | | | Solve |
| Station | Elevation | Ahead Slope | Length | |
| 100+00.00 | 921.10 | 2.000% | | Undo |
| 116+00.00 | 953.10 | -2.000% | 760.00 | G |
| 133+00.00 | 919.10 | 2.500% | 540.00 | Close |
| 146+00.00 | 951.60 | -1.000% | 665.00 | Help |
| 152+00.00 | 945.60 | | | |

| | Add Before |
|---|-----------------------|
| | Add After |
| | Delete |
| | Tracking |
| | Review |
| | Add PI |
| | Insert PL |
| | Move PL |
| | Delete PI |
| | Redesign All |
| ~ | Define by Length |
| | Define by K |
| | Compute Interactively |
| | 20 |
| | 25 |
| | 30 |
| | 35 |
| | 40 |
| | 45 |
| | 50 |
| | 55 |
| 1 | 60 |
| | 65 |
| | 70 |
| | Upper |
| 1 | Lower |



Vertical Healing

- Synchronize / update the vertical alignment when the horizontal alignment has changed
 - The coordinate position of vertical PI's will be held!
 - The user is responsible for potential overlaps
 - The user is responsible for resolving verticals that are beyond the limits of the horizontal
 - Set in *File > Project Options > Geometry*, but it is one of those settings that you should set and remain set!
 - This is one implementation, others would have been possible!



Regression Workflow...

- Pre-regression data validation
- Point selection and sorting
 - Survey data ordering is not required
- Curvature diagrams
 - Indicates approximate locations of specific elements and their types
 - Indicates questionable data
 - Inclusion of cant enhances the field data!
- Edit / review
 - Select / Regress, which is *heads-up* selection / auto element type determination!
 - Reduces potential user errors & time
 - Quick Regression
- Slew diagrams and reporting





Quick Regression

- **Quick** horizontal regression
 - A first pass automatic regression
 - Includes lines, circular arcs and spirals
 - Resolves long straights into multiple straights
- **Quick** vertical regression
 - Similar to horizontal
 - Includes a standard lift & a lines only option

| | | | | | _ | Close | | |
|-----------|--------------|--------------|--------------|--------|---|--------------------|--------|--|
| Name | Northing | Easting | Include in A | Status | ^ | Select Ophy | | |
| ESB00602 | 1491080.8970 | 6715742.9200 | Yes | Normal | | <u>select Only</u> | | |
| ESB00604 | 1491085.9550 | 6715723.5740 | Yes | Normal | | Select & Regress | | |
| ESB00606 | 1491091.0240 | 6715704.2230 | Yes | Normal | | | | |
| ESB00608 | 1491096.0950 | 6715684.8830 | Yes | Normal | | Quick | | |
| ESB006100 | 1491101.1590 | 6715665.5380 | Yes | Normal | | Report | | |
| ESB006120 | 1491106.2190 | 6715646.1870 | Yes | Normal | | | | |
| ESB006140 | 1491111.2770 | 6715626.8440 | Yes | Normal | | Help | | |
| SB00616 | 1491116.3440 | 6715607.4990 | Yes | Normal | | | | |
| SB00618 | 1491121.4080 | 6715588.1570 | Yes | Normal | | Will Ouick | | |
| ESB00620 | 1491126.4730 | 6715568.8230 | Yes | Normal | - | Quick | | |
| | | III | | | • | Tolerance: | 0.0500 | |
| • | | | | | | | | |





Single Element Regression Enhancement

- <u>Single element regression</u> with <u>multiple</u> alignments
 - Single element regress 2 or more alignments at once
 - Regressed elements will be parallel / concentric to each other
 - Different offsets for each set of elements
- Enabled by right-clicking in Edit / Review
 Regression Points list-view
- Automatically occurs with Select & Regress
 option



Cant / Superelevation Design

Specialized geometry for track cant / superelevation



Cant / Superelevation

- Standard *international* railway terminology
 - Equilibrium cant, applied cant, cant deficiency, etc.
 - Imperial or metric units
- Calculations
 - Standard equilibrium equations that can be found in well known literature

| 🖉 Design Calcu | lators | | | | . 🗆 <mark>- X</mark> | | 1 | | |
|-------------------------|------------------------|---------|------------|---------------|----------------------|------|-----------|---------|--------------|
| Cant Calculator | Table Lookups | | | | | | | | |
| Compute: | Cart | | | | OK | 1 | | | |
| Define By: | Applied Constant | | · | | UK | | | | |
| Design Speed (| kmph): | 160 (| 1000 | | Help | | | | |
| Equilibrium Con: | stant: | 11.8 | 000 | Ot | her Rules | | | | |
| Applied Constar | nt: | 7.10 | 00 | | | | | | |
| Radius: | | 0.000 | 00 | 1750.0000 | | | | | |
| Length: | | 140.0 | 0000 | | | | | | |
| Transition: | Cosine | | • | | | | | | |
| Compound Trar | nsition Rate From: |) St | art | Stop | | | | | |
| 🔽 Always Rour | nd Applied Cant | | | | | | | | |
| Results | | | | | | | | 1 | |
| Eq <u>u</u> ilibrium Ca | nt (mm): | 0.00 | 00 | 172.6171 | | | • | J | OK |
| Applied <u>C</u> ant (| (mm): | 0.00 | 00 | 105.0000 | | | • | J | <u>H</u> elp |
| Cant Deficiend | cy (mm): | 0.00 | 00 | 67.6171 | | | 107 |] | Other Rules |
| Non-compens | ating Lateral Accelera | tion (m | /s"s): | 0 4427 | | | 107 |]
1 | |
| Applied Rate of | of Change (mm/s): | 33.3 | 333 | 0.1127 | | | 000 | 2000.00 | 000 |
| Deficiency Ra | te of Change (mm/s): | 21.4 | 558 | | | | 000 | 3000.00 | 000 |
| Applied Cant (| <u>G</u> radient: | 666.0 | 5667 | | | | 0.0000 | 1 | |
| Desirable Len | gth @ [35 mm/s ▼ | 133.3 | 3333 | | | | Start | Stop | |
| Minimum Leng | uth@ 55 mm/s ▼ | 84.84 | 485 | | | | orgin | 0.00 | |
| | | | | | | | | | |
| | Preferences | | Cancel | ר | | 1 | 000 | 6.5508 | |
| | The <u>i</u> cicited | | Concor | | | | 000 | 5.8800 | |
| | | | Cant Defi | ciency (in): | | 0.(| 0000 | 0.6708 | |
| | | | Non-comp | pensating Lat | eral Accelerat | tion | (ft/s*s): | | |
| | | | Applied P | ate of Chang | a (ia /a): | 0.0 | 0000 | 0.1624 | |
| | | | Deficience | v Bate of Cha | e (in/s). | | 1007 |]
1 | |
| | | | Applied C | ant Gradient | ngo (mo). | U. | 4 0000 |]
1 | |
| | | | Ls = 1.63 | * Eu * V | | 14 | 4.0380 |]
] | |
| | | | Ls = 62 * | Ea · | | 26 | 4 5600 |] | |
| | | | | - | | 30 | | J | |
| | | | | | | _ | | | |
| | | | | | Preferences | | Cancel | | |
| | | | | | | - | | | |



Integrated into Horizontal Design

- Radius & spiral lengths based upon cant
 - Cant & Speed are persisted with the horizontal elements
 - Suggests spiral lengths
 - Imperial & metric are slightly different
 - Enables design optimization
 - Mix transitions types

| Alternate Solution | 1750.0000 | Close
Design <u>C</u> alc.
<u>H</u> elp |
|--------------------|-----------|---|
|--------------------|-----------|---|

| Cant Calculator | Table Lookups | | |
|----------------------------|-----------------------|---------------|-------------|
| Compute: | Cant | • | • ОК |
| Define <u>B</u> y: | Applied Constant | | Help |
| <u>D</u> esign Speed (k | :mph): | 160.0000 | Other Bules |
| Equilibriu <u>m</u> Cons | tant: | 11.8000 | |
| Applied Con <u>s</u> tan | t: | 7.1000 | |
| Radius: | | 0.0000 | 1750.0000 |
| Length: | | 140.0000 | |
| Transition: | Cosine | | • |
| Compound Tran | sition Rate From: | Start | Stop |
| Results
Equilibrium Car | t (mm): | 0.0000 | 172.6171 |
| Applied <u>C</u> ant (n | nm): | 0.0000 | 105.0000 |
| Ca <u>n</u> t Deficienc | y (mm): | 0.0000 | 67.6171 |
| Non-compensa | ting Lateral Accelera | tion (m/s*s): | |
| | | 0.0000 | 0.4427 |
| Applied Rate of | f Change (mm/s): | 33.3333 | |
| Deficiency Rat | e of Change (mm/s): | 21.4658 | |
| Applied Cant G | radient: | 666.6667 | |
| Desirable Leng | th @ 35 mm/s 🔻 | 133.3333 | |
| Minimum Lengt | h@ 55 mm/s ▼ | 84.8485 | |
| | | L | |



Cant Alignment Editor

- Creation based upon
 - Equilibrium equations
 - Alternate speed
 - User defined tables

| T. Station Spe Radius Length Transition Eq. Cant App. Ca Cant Def App. Rate (Design Checks T 123+066.207 160 0.0000 95.5101 Cosine 0.0 0.0 16.3 Help S 123+161.718 160 5000.0000 600.2887 Circular 60.4 35.0 25.4 0.0 16.3 Help S 123+762.006 160 5000.0000 233.5793 Cosine 60.4 35.0 25.4 0.0 25.4 16.2 16.2 16.3 16.2 16.3 16.2 16.3 16.2 16.3 1 | | Apply
Close | | | | | | |] <u>+</u>
] | 10 - EP ▼
10 - EP ▼ | Variante
Variante | ri <u>z</u> ontal Alignment:
nt Alignment: |
|--|----------|----------------|-----------------|-------------------|---------------|---------|----------|------------|-----------------|------------------------|----------------------|---|
| T 123+066.207 160 0.0000 95.5101 Cosine 0.0 0.0 16.3 Help S 123+161.718 160 5000.0000 600.2887 Circular 60.4 35.0 25.4 0.0 25.4 0.0 C 123+762.006 160 -5000.0000 2052.6546 Circular 86.3 50.0 25.4 0.0 25.4 16.2 25.4 <th>:s</th> <th>Design Checks</th> <th></th> <th>App. Rate (</th> <th> Cant Def</th> <th>App. Ca</th> <th>Eq. Cant</th> <th>Transition</th> <th>Length</th> <th>Radius</th> <th>Spe</th> <th>. Station</th> | :s | Design Checks | | App. Rate (| Cant Def | App. Ca | Eq. Cant | Transition | Length | Radius | Spe | . Station |
| S 123+161.718 160 5000.0000 600.2887 Circular 60.4 35.0 25.4 0.0 C 123+762.006 160 5000.0000 233.5733 Cosine 60.4 35.0 25.4 0.0 S 123+762.006 160 -3500.0000 2052.6546 Circular 86.3 50.0 C 126+048.240 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 126+186.199 160 0.0000 564.0611 Linear 0.0 0.0 T 126+750.260 160 0.0000 738.1605 Circular 86.3 50.0 C 129+437.225 160 3500.0000 738.1605 Circular 86.3 50.0 C 129+437.225 160 -3500.0000 153.49369 Circular 86.3 50.0 S 129+575.194 160 0.0000 3138.9481 Linear 0.0 0.0 S 129+575.194 160 0.0000 3138.9481 Linear 0.0 0.0 J 132+714.142 160 0.0000 95.5101 Cosine 0.0 | | Help | _ | 16.3 | 0.0 | 0.0 | 0.0 | Cosine | 95.5101 | 0.0000 | 160 | . 123+066.207 |
| C 123+762.006 160 5000.0000 233.5793 Cosine 60.4 35.0 S 123+955.586 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 126+048.240 160 -3500.0000 137.9591 Cosine 86.3 50.0 T 126+750.260 160 0.0000 564.0611 Linear 0.0 0.0 S 126+888.220 160 3500.0000 738.1605 Circular 86.3 50.0 S 127+626.380 160 3500.0000 738.1605 Circular 86.3 50.0 S 127+526.380 160 3500.0000 137.9591 Cosine 86.3 50.0 S 129+575.194 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 129+575.194 160 0.0000 3138.9481 Linear 0.0 0.0 T 132+714.142 160 0.0000 95.5101 Cosine 0.0 0.0 Define All Add Edit Delete Design Speed (kmph): 160.0000 Equilibrium Constant: | _ | P | | 0.0 | 25.4 | 35.0 | 60.4 | Circular | 600.2887 | 5000.0000 | 160 | . 123+161.718 |
| S 123+995.586 160 -3500.0000 2052.6546 Circular 86.3 50.0 C 126+048.240 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 126+186.199 160 0.0000 564.0611 Linear 0.0 0.0 T 126+750.260 160 0.0000 137.9591 Cosine 86.3 50.0 S 126+88.220 160 3500.0000 738.1605 Circular 86.3 50.0 S 127+902.298 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 129+437.235 160 -3500.0000 137.9591 Cosine 86.3 50.0 C 129+437.235 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 129+575.194 160 0.0000 3138.9481 Linear 0.0 0.0 S 129+575.194 160 0.0000 35.011 Cosine 0.0 0.0 Define All Add Edit Delete Design Speed (kmph): 160.0000 Equilibrium Constant: 7. | | | _ | 16.2 | 25.4 | 35.0 | 60.4 | Cosine | 233.5793 | 5000.0000 | 160 | . 123+762.006 |
| C 126+048.240 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 126+186.199 160 0.0000 564.0611 Linear 0.0 0.0 T 126+750.260 160 0.0000 738.1605 Circular 86.3 50.0 C 127+626.380 160 3500.0000 275.9176 Cosine 86.3 50.0 S 127+902.298 160 -3500.0000 137.9591 Cosine 86.3 50.0 C 127+626.380 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 129+437.235 160 -3500.0000 137.9591 Cosine 86.3 50.0 C 127+62.78.194 160 0.0000 3138.9481 Linear 0.0 0.0 S 129+575.194 160 0.0000 3138.9481 Linear 0.0 0.0 T 132+714.142 160 0.0000 95.5101 Cosine 0.0 0.0 Define All Add Edit Delete Design Speed (kmph): 160.0000 Quilibrium Constant: 7.1000 </td <td>- 0</td> <td>_</td> <td>nt</td> <td>ant Alignment</td> <td>Define C</td> <td>50.0</td> <td>86.3</td> <td>Circular</td> <td>2052.6546</td> <td>-3500.0000</td> <td>160</td> <td> 123+995.586</td> | - 0 | _ | nt | ant Alignment | Define C | 50.0 | 86.3 | Circular | 2052.6546 | -3500.0000 | 160 | 123+995.586 |
| S 126+186.199 160 0.0000 564.0611 Linear 0.0 0.0 T 126+750.260 160 0.0000 137.9551 Cosine 0.0 0.0 S 126+888.220 160 3500.0000 738.1605 Circular 86.3 50.0 S 127+902.288 160 -3500.0000 1534.9369 Circular 86.3 50.0 S 127+902.288 160 -3500.0000 1534.9369 Circular 86.3 50.0 C 129+437.235 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 127+902.298 160 0.0000 3138.9481 Linear 0.0 0.0 C 129+437.235 160 0.0000 3138.9481 Linear 0.0 0.0 S 127+914.142 160 0.0000 95.5101 Cosine 0.0 0.0 Define All Add Edit Delete Design Speed (kmph): 160.0000 Equilibrium Constart: 7.1000 V Use Cant from Horizontal Alignment Applied Constant: 7.1000 | | | | | | 50.0 | 86.3 | Cosine | 137.9591 | -3500.0000 | 160 | 126+048.240 |
| T 126+750.260 160 0.0000 137.9591 Cosine 0.0 0.0 S 126+888.220 160 3500.0000 738.1605 Groular 86.3 50.0 S 127+626.380 160 3500.0000 738.1605 Cosine 86.3 50.0 S 127+626.380 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 127+437.235 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 129+437.235 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 129+4575.194 160 0.0000 3138.9481 Linear 0.0 0.0 S 129+471.142 160 0.0000 95.5101 Cosine 0.0 0.0 L Add Edit Delete Design Speed (kmph): 160.0000 Equilibrium Constant: 7.1000 V Use Cant from Horizontal Alignment Quilibrium Constant: 7.1000 V Use Cant from Horizontal Alignment | 0 | í | | : | Cant Method | 0.0 | 0.0 | Linear | 564.0611 | 0.0000 | 160 | 126+186.199 |
| S 126+888.220 160 3500.0000 738.1605 Circular 86.3 50.0 C 127+626.380 160 -3500.0000 1534.9369 Circular 86.3 50.0 S 127+327.258 160 -3500.0000 133.9591 Cosine 86.3 50.0 S 129+372.255 160 -3500.0000 133.9591 Cosine 86.3 50.0 S 129+372.255 160 -3500.0000 133.9591 Cosine 86.3 50.0 S 129+372.51.14 160 0.0000 3138.9481 Linear 0.0 0.0 T 132+714.142 160 0.0000 95.5101 Cosine 0.0 0.0 Define All Add Edit Delete Design Speed (kmph): 160.0000 Equilibrium Constant: 11.8000 Applied Constant: 7.1000 Vise Cant from Horizontal Alignment Apply Mainline Cant through Jumouts Station Statine | | | tions | quilibrium Equat | O Use E | 0.0 | 0.0 | Cosine | 137.9591 | 0.0000 | 160 | . 126+750.260 |
| C 127+626.380 160 3500.0000 275.9176 Cosine 86.3 50.0 S 127+902.288 160 -3500.0000 1534.9369 Circular 86.3 50.0 C 129+437.235 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 129+437.235 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 129+575.194 160 0.0000 3138.9481 Linear 0.0 0.0 Define All Add Edit Delete Design Speed (kmph): 160.0000 Equilibrium Constant: 11.8000 Applied Constant: 7.1000 Use Cant from Horizontal Alignment | Ca | | Speed | temate Design | O Use A | 50.0 | 86.3 | Circular | 738.1605 | 3500.0000 | 160 | 126+888.220 |
| S 127+902.298 160 -3500.0000 1534.9369 Circular 86.3 50.0 C 129+437.235 160 -3500.0000 137.9591 Cosine 86.3 50.0 S 129+575.194 160 0.0000 3138.9481 Linear 0.0 0.0 T 132+714.142 160 0.0000 95.5101 Cosine 0.0 0.0 Define All Add Edit Delete Design Speed (kmph): 160.0000 Equilibrium Constant: 11.8000 Applied Constant: 7.1000 Use Cant from Horizontal Alignment | H | (| | | | 50.0 | 86.3 | Cosine | 275.9176 | 3500.0000 | 160 | . 127+626.380 |
| C 129+437.235 160 -3500.0000 137.9591 Cosine 86.3 50.0
S 129+575.194 160 0.0000 3138.9481 Linear 0.0 0.0
Define All Add Edit Delete Design Speed (kmph): 160.0000
Equilibrium Constant: 11.8000
Applied Constant: 7.1000
V Use Cant from Horizontal Alignment
Apply Mainline Cant through Turnouts | <u> </u> | U | able | p Cant from Tab | O Looku | 50.0 | 86.3 | Circular | 1534.9369 | -3500.0000 | 160 | . 127+902.298 |
| S 129+575.194 160 0.0000 3138.9481 Linear 0.0 0.0 T 132+714.142 160 0.0000 95.5101 Cosine 0.0 0.0 Define All Add Edit Delete Design Speed (kmph): 160.0000 Equilibrium Constant: 11.8000 Applied Constant: 7.1000 Image: Constant Constant: 0.0000 Image: Constant Constant Constant: 11.8000 Applied Constant: 7.1000 Image: Constant Consta | | ble | Cant Tab | n, Speed and Ca | Station | 50.0 | 86.3 | Cosine | 137.9591 | -3500.0000 | 160 | . 129+437.235 |
| Define All Add Edit Delete Design Speed (kmph): 160.0000 | | | | | | 0.0 | 0.0 | Linear | 3138.9481 | 0.0000 | 160 | 129+575.194 |
| Define All Add Edit Delete Design Speed (kmph): 160.0000 Equilibrium Constant: 11.8000 Applied Constant: 7.1000 Use Cant from Horizontal Alignment Apply Mainline Cant through Jumouts | | | | | | 0.0 | 0.0 | Cosine | 95.5101 | 0.0000 | 160 | . 132+714.142 |
| Equilibrium Constant: 11.8000
Applied Constant: 7.1000
Use Cant from Horizontal Alignment
Apply Mainline Cant through <u>T</u> urnouts | |) | 60.0000 | d (kmph): 16 | Design Spee | te | Dele | Edit | <u>A</u> dd | All | Define | |
| Applied Constant: 7.1000 Image: Use Cant from Horizontal Alignment Image: Apply Mainline Cant through Turnouts | | | 1.8000 | onstant: 11 | Equilibrium C | | | | | | | |
| Use Cant from Horizontal Alignment
Apply Mainline Cant through <u>T</u> urnouts | | | .1000 | tant: 7. | Applied Cons | | | | | | | |
| Apply Mainline Cant through <u>T</u> umouts | | ient | al Alignm | from Horizontal | Use Cant | | | | | | | |
| | | mouts | ugh <u>T</u> ur | inline Cant throu | 🔲 Apply Ma | | | | | | | |
| Compute Stepped Linear Cant | | | r Cant | Stepped Linear | Compute | | | | | | | |

| Edit Cant | | | |
|---------------------------------|-----------------|-----------|------------------|
| Cant Design
<u>S</u> tation: | 126+750.260 | -+- | Appl |
| <u>D</u> esign Speed (kmph): | 160.0000 | | Clos |
| Equilibrium Constant: | 11.8000 | | <u>H</u> elj |
| Define <u>B</u> y: | Start | Stop | |
| Applied Cant 🔹 | 0.0000 | 50.0000 | |
| Compound Transition Rate From: | Start | Stop | Selec |
| Applied Cant (mm): | 0.0000 | 0.0000 | <u>First</u> |
| Cant Deficiency (mm): | 0.0000 | 0.0000 | < Pre <u>v</u> i |
| Radius: | 0.0000 | 3500.0000 | Next |
| Length: | 137.9591 | | |
| Cant Calculation Results | 0.0000 | 00 2000 | _ <u>_</u> |
| Equilibrium Canic (mm). | 0.0000 | 00.3000 | |
| Applied Cant (mm): | 0.0000 | 50.0000 | |
| Cant Deficiency (mm): | 0.0000 | 36.3086 | |
| Non-compensated Lateral Accele | ration (m/s*s): | | |
| | 0.0000 | 0.2377 | |
| Applied Rate Change (mm/s): | 16.1078 | | |
| Deficiency Rate Change (mm/s): | 11.6970 | | |
| Applied Cast Gradient: | 1379 5914 | | |

Roads and Bridges



Other Cant Rules

• Integrating other rules into the system

| Add Free Horizontal Curve | | |
|--|---|--------------|
| Transitions and Parameters
Leading: Clothoid ▼ 0.0000 | + | Apply |
| Radi <u>u</u> s: 0.0000 | + | Close |
| Trailing: Clothoid ▼ 0.0000 | + | Design Calc |
| Alternate Solution | | <u>H</u> elp |
| Delete Existing Elements Between First and Second | | |

| Cant Calculator Table | Lookups | | | |
|------------------------|----------------|---------------|--------------|--|
| Compute: Cant | | ОК | | |
| Define By: Applie | d Constant | • | <u>H</u> elp | |
| Design Speed (kmph): | | 160.0000 | Other Rules | |
| Equilibrium Constant: | | 11.8000 |] | |
| Applied Constant: | | 7.1000 |] | |
| Radius: | | 0.0000 | 1200.0000 | |
| Length: | | 200.0000 |] | |
| Transition: Cloth | oid | • | | |
| Compound Transition F | ate From: | Start | Stop | |
| Always Round Appli | ed Cant | | | |
| Results | | | | |
| Equilibrium Cant (mm): | | 0.0000 | 251.7333 | |
| Applied Cant (mm): | | 0.0000 | 150.0000 | |
| Cant Deficiency (mm): | | 0.0000 | 101.7333 | |
| Non-compensating La | teral Accelera | tion (m/s*s): | | |
| A 1 1 B 1 (C) | | 0.0000 | 0.6661 | |
| Applied Rate of Chang | ge (mm/s): | 33.3333 |] | |
| Deficiency Rate of Ch | ange (mm/s): | 22.6074 | | |
| Applied Cant Gradient | : | 1333.3333 | | |
| Desirable Length @ | 35 mm/s 🔻 | 190.4762 |] | |
| Minimum Length @ | 55 mm/s 🔻 | 121.2121 |] | |

| 📷 Italian Railway Cant R | ules | × |
|--------------------------|-----------|--------|
| Maximum Speed (kmph): | 160 - | ок |
| Minimum Speed (kmph): | 80 - | Cancel |
| Minimum Radius: | 1121.5842 | Help |
| Maximum Cant (mm) | 177.3333 | |
| Radius: | 1200.0000 | |
| Computed Cant (mm): | 165.0000 | |
| Transition Length: | 396.0000 | |

| Speed (kmph): | 120.0000 | ОК |
|---------------------|-----------|--------|
| Minimum Radius: | 675.0000 | Cancel |
| Limiting Cant (mm): | 160.0000 | Help |
| Radius: | 1200.0000 | |
| Computed Cant (mm): | 90.0000 | |
| Transition Length: | 162.0000 | |



Turnouts

Specialized geometry that conforms to well defined bending rules



Turnouts

- Single, double and slips
 - Tangential and non-tangential turnouts
- Multiple bending / flexing methods to satisfy various industry standards!
 - Germany / Austrian
 - Swiss
 - UK





Turnout Library

- Typical Turnout Library Editor
 - Creation of typical turnouts (standards)
 - The software delivers various country standards
 - Danish Railways
 - Dutch Railways / ProRail
 - German (heavy & light rail)
 - Indian Railways
 - Russian Railways
 - Spanish (heavy & light rail)
 - Swiss Railways
 - UK (113A's & NR60's)
 - AREMA
 - Or we will help you to create them



Turnout Connection Editor

- Used for more advanced geometric constructions
 - Crossovers
 - Sidings
- Editing an existing construction
 - Change type
 - Dynamically move
- Maintains *rules* and *relationships*!

| Beginning Elem | ient | | _ | | | | Apply |
|---|---|------------------------|--|--|-----------------------------------|----------|---------------|
| Turnout Name: | T1 • | • + | Station: | 1+200.0 | 00 | + | |
| Tum <u>o</u> ut Type: | Single | - | Tip <u>R</u> adius: | 0.0000 | | | Llose |
| Turnout St <u>y</u> le: | GW 54E1 R465 1: • | - | Heel Radius: | 0.0000 | | | Save |
| A <u>c</u> tive Heel: | 1st • | - | Standard Sleeper | r Set: | None | • | Save <u>A</u> |
| | · | | Sleeper Set Leng | <u>i</u> th: | 0.0000 | | Undo |
| | | | Distance to Last | Sleeper: | 0.0000 | | Report |
| onnecting Elem | ent: | | | | | | <u>H</u> elp |
| Type Fre | e Length | Fre | e Parameter | Т | Tar Applie | d | |
| Inear 🖂 | 17.8080 | | N 85^14'10.8 | 9" E |] | | |
| inding Connection | 17.8080
pn: <u>© T</u> urnout
t | © E | N 85^14'10.8
lement | 9" E | ⊙ Free E <u>x</u> | jt . | |
| inding Connection
Ending Element
Turmout Name: | 17.8080
on: <u>© T</u> urnout
t
T2 | © E | N 85^14'10.8
ement | 9" E
ation
1+294.8 | © Free E <u>x</u>
40 | іt
_+ | |
| inding Connection
Ending Element
Turnout Na <u>m</u> e:
Turn <u>o</u> ut Type: | 17:8080 | © E
• <u>+</u> | N 85 [^] 14'10.8
ement © Station:
Tip Radius: | 9" E
ation
1+294.8
0.0000 | ○ Free Ex
40 | it
 | |
| inding Connectic
Ending Element
Tumout Name:
Tumout Type:
Tumout Style: | 17:8080
pn: | © E
• <u>+</u>
• | N 85 [^] 14'10.8
ement © Station:
Tip <u>R</u> adius:
Heel Radjus: | 9" E
ation
1+294.8
0.0000
0.0000 | © Free Ex | it | |
| inding Connection
Ending Element
Tumout Name:
Tumout Type:
Tumout Style:
Agtive Heel: | 17:8080
pn: © Iumout
t
T2
Single
GW 54E1 R465 1: •
1st | © E
• <u>+</u>
• | N 85 ¹ 4'10.8
ement © Sta
V Station:
Tip <u>B</u> adius:
Heel Radjus:
Standard Sleeger | 9" E
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1+294.8
0.0000
0.0000
r Set: | © Free Ex
40 | it
+ | |
| Ending Connection
Ending Element
Turnout Name:
Turnout Type:
Turnout Style:
Agtive Heel: | 17:8080
pn: © <u>T</u> urnout
t
<u>Single</u>
<u>GW 54E1 R465 1:</u>
1st | © E
• <u>+</u>
• | N 85 ^{14'10.8'}
ement O Sta
Station:
Tip <u>B</u> adius:
Heel Radius:
Standard Sleeger
Sleeper Set Leng | 9" E
ation
1+294.8
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0.0000
r Set:
ath: | © Free Ex
40
None
0.0000 | it
+ | |

• Do you see the GUI changes?



Design Checking

Detailed design checking based upon simple built-in rules to specific / comprehensive railway rules.



Built in Design Checking

- Cant Alignment Editor includes basic parameters for design checking
- Visual checking with *Display Turnouts*

| Cant Alignment Editor | | | | |
|--|---|---------------|-----------|-------------|
| Horizontal Alignment: 251 | Ap | ply | | |
| Cant Alignment: 01 | Cie | ose | | |
| T Station S Radius Length Trans Eq. C | . App Cant App. R 🔺 Design C | Checks | | |
| C 53+148.249 155 1050.00 143.000 Clothoid 270.0 | 160.0 110.0 48.2 H | elp | | |
| S 53+291.249 155 0.0000 285.962 Linear 0.0 | | | | |
| S 53+720.212 155 -1050.0 257.011Circular 270.0 | 160.0 110.0 0.0 | | | |
| C 53+977.223 155 -1050.0 143.000Clothoid 270.0 | 160.0 110.0 48.2 | | | |
| S 54+120.223 155 0.0000 1120.18Linear 0.0 | 0.0 0.0 0.0 | | | |
| S., 55+392.412 155 -1600.0., 283.000Circular 177.2 | <u>105 0 72 2 0 0</u> | | | |
| C 55+675.412 155 -1600.0 152.000Clothoid 177.2 | Cant Design Checks | | | X |
| S 55+827.412 155 0.0000 157.734Linear 0.0 | | Minimum | Maximum | OK |
| S 56+137.147 155 1600.00 706.063 Circular 177.2 | Design Speed (kmph): | 0.0000 | 180.0000 | |
| · | Applied Cant (mm): | 10.0000 | 150.0000 | Cancel |
| Define All | Cant Deficiency (mm): | 0.0000 | 100.0000 | Preferences |
| | Non-compensating Lateral Acceleration (m/ | /s*s): 0.0000 | 1.0000 | Help |
| | Applied Rate of Change (mm/s): | 0.0000 | 40.0000 | |
| | Deficiency Rate of Change (mm/s): | 0.0000 | 35.0000 | |
| | Applied Cant Gradient: | 0.0000 | 2000.0000 | |

| Юы | ient | Prefix | Suffix | Precision | Format | Name | Арріу |
|--------|-------------------|--------|--------|-----------|----------|-------|-------------|
| Tur | nout | | Connec | 1100000 | - onna | | Close |
| | cant Turnout | | | | | | |
| X In ۱ | Vertical Curve | | | | | | Preferences |
| ⊠ Ono | han Turnout | | | | | | Help |
| X 0v | erlapping Turnout | | | | | | Those |
| 🛛 Nai | me & Description | | | | | Rails | |
| ⊠.1\$ | Station | | | 0.123 | S+SSS.SS | | |
| X .1 F | Point | | | | | | |
| .0 9 | Station | | | 0.123 | S+SSS.SS | | |
| I .0 F | Point | | | | | | |
| 2 F | Point | | | | | | |
| .3 F | Point | | | | | | |
| | C Nose & Crossing | | | | | | |
| 🛛 Shi | unt Point | | | | | | |
| Eau | uivalent Radii | | | 0.1 | | | |

Drop Station Equation Names

More Comprehensive Design Checks

- Includes
 - CEN Standards
 - Austrian Rail
 - Danish Rail
 - will be updated in SELECTseries 3
 - German Rail
 - Italian Rail
 - ProRail / Dutch Rail
 - Russian
 - Transrapid (maglev)
- Execute as you design or as a post-design process
 - Interactive + passive
 - Ideal for checking a consultant's design
- Written to match a railway's requirements

| Design encers | | | | | |
|--|---|---------------------|--|--|--|
| German Rail Italian
General Roads CEN S | Rail Russian Rail Trar
tandards Austrian Rail Da | nsrapid Interactive | | | |
| Traffic Category: | lib 🗸 | Apply | | | |
| Geometry Project: | Achsen - APS 👻 | | | | |
| Horizontal Alignment: | 251 🔹 | + | | | |
| Vertical Alignment: | 01 🔹 | + Hala | | | |
| Cant: | 01 🔹 | <u> </u> | | | |
| Min. Speed (kmph): | 160.0000 | | | | |
| Max. Speed (kmph): | 200.0000 | | | | |
| Traffic Subcategory: | 🔘 Freight 🛛 💿 Passenger | | | | |
| Gauge: | 1.435 1.668 | | | | |
| Upgraded Alignment | | | | | |
| Passengers May Be Standing | | | | | |
| Non-ballasted Track | | | | | |
| | | | | | |
| Pi | eferences Close | | | | |

Roads and Bridges



Design Checking

- Not just warnings!
 - Now it also indicates if the geometry is *acceptable!*
 - Good for QC

| 🐂 Design Checks | | | | | |
|-----------------------------------|----------------------|----------------|----------------------------|-----------------------|-----------------------------------|
| German Rail It
General Roads C | alian Ra
:EN Star | il R
ndards | ussian Rail
Austrian Ra | Transrap
il Danish | id Interactive
Rail Dutch Rail |
| Туре: | H | orizonta | al Alignment | • | Apply |
| Geometry Project: | D | efault | | • | Browse |
| Horizontal Alignme | nt: D | efault | | • + | Edit |
| Vertical Alignment | D | efault | | • | Halp |
| | | | | | |
| Include Childre | n | | | | |
| Definition: | 🔘 Si | ngle Cla | assification | Multiple | le Classifications |
| Cl <u>a</u> ssification: | GS-1 | M Free | way | T | r |
| <u>T</u> errain: | Leve | I | | | |
| <u>D</u> esign Speed: | 50 | | | | · |
| Classification <u>File</u> : | sers\ | Richard | l.Bradshaw\[|)ocuments | \specific limits.txt |
| Design C <u>r</u> iteria File | Roa | ls Grou | ip V8.11∖data | a\imperial\[| Design Criteria.txt |
| | Pref | erences | s) Cle | ose | |

Checking stopping sight distances for alignment 'Default'

10+550.0000

Classification: GS-1M Freeway Terrain: Rolling Speed: 60 Warning: Desirable minimum stopping sight distance exceeded! Desirable minimum stopping sight distance: 205.0000 Desirable minimum length should be: 499.1020 Actual length: 300.0000

11+050.0000 Classification: GS-1M Freeway Terrain: Rolling Speed: 60 Acceptable: Actual length is greater than desirable minimum stopping sight distance. Desirable minimum stopping sight distance: 205.0000 Actual length: 300.0000

| Alignment: | Default | | | + | | ОК |
|-------------------------|---------|------------|-------------------|--------|-------|----------------|
| Start Statio <u>n</u> : | 8+00.0 | 0 | | + | (| Cancel |
| Stop Station: | 8+00.0 | 0 | | + | | Add |
| <u>Classification</u> | GS-7M | Street wit | n Shoulder | •] | | |
| Terrain: | Level | | | - | | Update |
| Design <u>S</u> pee | d: 30 | | | | | <u>D</u> elete |
| | | | | | | <u>H</u> elp |
| Alignment | Start S | Stop | Classification | | Te | Sp |
| Default | 0+00.00 | 2+00.00 | GS-7M Street with | n Shou | Level | 30 |
| Default | 2+00.00 | 4+00.00 | GS-7M Street with | n Curb | Level | 30 |
| Default | 4+00.00 | 8+00.00 | GS-7M Street with | n Shou | Level | 30 |
| | | | | | | |



User Interface

User interface enhancements.



User Interface Enhancements

- Smaller dialogs
- Moved buttons to right-click popup menus
- And to avoid user panic, an Alert has been added!
 - After getting this Alert for awhile, check the button in the lower left!





• +

Cant Alignment Editor

Track 2

Cant

Horizontal Alignment:

Cant Alignment:

Configurable List View & Dialog Resizing

- Right click in title and select data of interest
 - Check Integrity
 - Review / Edit Regression Points
 - Cant Alignment Editor

| | T Station Sp Radius Transi Eq. C App Cant Design Checks. |
|--|--|
| | POB 10+000.000 160 0.0000 Linear 0.0 0.0 0.0 Help |
| | TS 10+284.904 160 -0.0000 Clothoid 0.0 0.0 0.0 |
| | SC 10+500.904 160 -2200.00Circular 137.3 85.0 52.3 |
| | CS 11+703.117 160 -2200.00Clothoid 137.3 85.0 52.3 |
| | ST 11+919.117 160 0.0000 Linear 0.0 0.0 0.0 |
| 🚰 Check Horizontal Integrity | POE 12+147.807 160 0.0000 Linear 0.0 0.0 0.0 |
| | |
| Type Station Northing Easting Direction @ Nort Easti Direction Len Rad Constant Inte Inte Ee | Define All Add Edit Delete Report |
| Linear 0+100.00 1360809.92 1956506.7 N 77 [*] 04'09.6113611 195814 N 77 [*] 04'09.61678.9 OK OK | |
| Circular 1+778.97 1361185.63 1958143.1 N 77 [°] 04′09.6113611 195885 S 66 [°] 40′57.8 724.951145.9 OK OK OK | |
| Linear 2+503.93 1361121.10 1958853.1 S 66 ⁴ 0'57.83 13609 195914 S 66 ⁴ 0'57.8 314.16 OK OK OK Move | Back |
| Circular 2+818.09 1360996.74 1959141.6 S 66°40'57.83 13609 N 75°41'12.8264.07402.0 OK OK OK Move F | orward |
| Linear 3+082.16 1360976.39 1959400.1 N 75"41"12.8013609 195940 N 75"41"12.89.3740 OK Non-c OK | |
| Circular 3+091.541360978.701959409.2N 76*27*37.7813610195954N 46*56*52.4150.73292.6 Non-cOK OK | elp |
| Linear 3+242.2/ 1361049.3/ 1993940.5 N 46 56 52.4013610 1993955 N 46 56 52.420.000 OK OK | |
| Check Horizontal Integrity | |
| | |
| Type Statio Northing Eastin Direction @ Start Le R Int Int E | Apply |
| Linear 0+100.01360809.92 1956506N 77^04'09.61" 1678 OK OK | Close |
| Circula1+778.91361185.63 1958143N 77 [^] 04'09.61" 724 1145OK OK OK | |
| Linear 2+503.9 1361121.10 1958853S 66^40'57.83" E 314 OK OK OK | Move Back |
| Circula2+818.01360996.74 1959141S 66°40'57.83" E 264402OK OK OK | Nove Forward |
| Linear 3+082.11360976.391959400N 75"41"12.80"9.37OK NonOK | |
| Select Science State Sta | Help |
| Linear 3+242.21361049.3/ 1999540N 46 56 52.40" 20.0 OK OK | |
| | |
| Select Det Convigue Next Level | |
| Zolov Tilsr (Tiaking) Taking Taking | |
| | |

_ D _X

Apply

Close

Bentley[.]
Less Clutter

- Moved buttons to *right click* context sensitive pop-up menus
- Eliminated tabbed dialogs
 - Everything is together in one dialog but still without excess clutter!

| Type
Linear | nt
F <u>r</u> ee <u>L</u> ength
I678.9730 | Direction
N 77^04'09.61" E | Select | Apply
Close
Save | | |
|--|---|---|--------|---|---|---|
| onnecting Eleme
Type Free
Circular Circular Circ | nt:
Length F
724.9587
314.1614
264.0728
9.3740 | ree Parameter
1145.9156
S 66°40'57.83" E
-402.0756
N 75°41'12.80" E | Tar | Save As
<u>U</u> ndo
Report
<u>H</u> elp | | Add Before
Add After
Edit
Delete
Import
Free All
Free Lengths Only
Fix All |
| Ending Element
Type
Linear | Free Length | Direction
N 46^56'52.40'' E | Select | | • | Singular Value Decomposition |



Tree / Leaf User Interface

- Converted most commands to tree / leaf
 - Allows greater consistency
 - Allows for potential enhancements
 - Allows for display / annotation during edits!
- You may / will need to look at preferences!

| View Stationing | Data: | | | | | | | | | | | | | |
|-------------------|------------------------------------|-------------|--------|------------|--------------|-------------|------|---------------------|------------|--|--------|-----------|------|-----|
| - General | Object | Placement | Prefix | Suffix | Precision | Format | Name | | | | | | | |
| Regular Stations | Station | In | | | 0.123 | S+SSS.SS | | | | | | | | |
| Cardinal Stations | Northing | | | | 0.123 | | | | | | | | | |
| Pls | Easting | | | | 0.123 | | | | | | | | | |
| Station Equations | | | | | | | | | | | | | | |
| Event Points | | | | | | | | | | | | | | |
| Transition Radii | | | | | | | | | | | | | | |
| Vertical Stations | _ | | _ | | | | | | | | | | | |
| | Omit POB and PC | E | Swa | ip Point / | Abbreviation | and Station | | | | | | | | |
| | Display On: Mu | tiple Lines | Sing | le Line | | | | | | | | | | |
| | Leaders: | | | 🖌 Verti | cal Change | In Plan | | | | | | | | |
| | Object Ler | ngth Ang | le | | | | | | | | | | | |
| | Leader Line | | | 🔄 Ve | rtical Chang | e In Plan | Dat | a: | | | | | | |
| | Segment 1 0.1 | 000 901 | 00'00 | | General | | _ | Object | | Prefix | Suffix | Precision | Name | ┛━┛ |
| | Segment 2 0.0 | 500 200 | 00.00 | | Symbol | | 57 | lext | | | | 0.400 | | |
| | | | | | Vertical Pla | 5 | | PVC-PVI Leng | gth | LVC | | 0.123 | | |
| | | | Apply | | Paraholae | | | PVI-PVI Leng | gin | _ | | 0.123 | _ | |
| | | | | · · · | Circular Cu | rves | | Middle Ordina | igin
to | MO | | 0.123 | | |
| | | | | | | | | r = (a2a1)/l | le | MO | | 0.123 | | |
| | | | | | | | | k = 1 / (a 2 - a 1) | | к | | 0.125 | | |
| | | | | | | | | N - D (g2 g l) | | is in the second | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

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Just more examples...

- View Horizontal & Vertical Regression Points

 Additional content
 - Other points of interest
 - Combined horizontal & vertical slews

| Data: | | | | | | | |
|---|------------------------------|--|---------------------------------|------------|---------------------------|--|---|
| Object Prefix Suffix Precision Name | Apply | Data: | Pre | fix Suffix | Precision | Name | Apply |
| Speed Holk Sank Headow S Fixed Symbol | Close
Preferences
Help | Stagest ☑ Fixed Symb ☑ Fixed Text ☑ Normal Sym ☑ Ignored Sym | nbol | | | | Close
Pre <u>f</u> erences
<u>H</u> elp |
| ☐ Ignored Text ☑ Other Symbol ☑ Unacceptable Symbol ☑ Sorted Line | | Other Symbol Other Text Other Text Unaccepta Unaccepta Sorted Line | ble Symbol | | | | |
| ☑ Name Image: Second sec | | Name Horizontal Vertical Sle Slew Indica | Slew h=
w v=
tor | mm
mm | 0 | | |
| Acceptable Slew: 0.1000 Annotate as: Single Line Scale: 1.00000 @ Multiple Lines Minor Right to Left Annotate in: Millimeters Symbology from Point Style | • | Acceptable Sle | w: 0.1000
1.00000
to Left |) | Annotate a
Annotate ir | Single Line Multiple Lines Millimeters | • |



Just more examples...

| Eurve Set Annotation | | | | | | | | | | | | | | | | | |
|-----------------------|-----------------|----------|-----------|------------|--------|-----------|-------------|--------|-------------|----------|-----------|----------|-----------------------|--------|---------|-----------|-----------------|
| Curve Set Apportation | Data: | | | | | | | | | | | | | | | | |
| General | Object | Column | Bow | Prefix | Suffix | Precision | Format | N | ame | | | | | | | | |
| | X Line | | | | | | | Pr | rop Horizor | ntal | | | | | | | |
| | Point | | | | | | | | | | | | | | | | |
| | Text | | | | | | | Pr | rop Horizor | atal | | | | | | | |
| | Curve Number | 1 | 1 | C# | | | | | | | | | | | | | |
| | Station | 1 | 2 | Sta- | | 0.123 | 0 4000 00 | | | | | | | | | | |
| | Nothing | 1 | 5 | N- | | 0.123 | 31333.33 | | | | | | | | | | |
| | | 1 | 6 | E- | | 0.123 | | | | | | | | | | | |
| | | 1 | 0 | D_ | - | 0.123 | | | | | | | | | | | |
| | | 1 | 3 | n= | m | 0 | 4440 | | | | | | | | | | |
| | Degree or Curve | 1 | 4 | Dc= | | 0.1 | | 55.55 | | | | | | | | | |
| | | 1 | 3 | Deta= | | 0.1 | ada mm | SS.SS | | | | | | | | | |
| | Delta Right | | | Delta= | | 0.400 | | | | | | | | | | | |
| | Arc Length | 1 | 8 | | m | 0.123 | | | | | | | | | | | |
| | Spiral Lengt | Station | Offset / | Annotatio | on | | | | | | | | | 1 | | | |
| | Constant | _ | | | | | | | | | | | | 1 | | | |
| | Superelevat (| 🔄 Statio | on Offset | Annotation | n | Data: | 1 | 1- | 1 | 1 | 1- | 1- | - Lu - L - L | | | | |
| | X Speed | G | ieneral | | | Object | Colu | nn Row | Prefix | Suffix | Precision | Format | Name | | | | |
| | I langent Le | ···· 🌳 🗚 | nnotatior | 1 | | Text | | | | | | | | | | | |
| | K External Dis | | | | | | 1 | 4 | | | | | | | | | |
| | | | | | | Descrip | tion 1 | 5 | | | | | | | | | |
| | | | | | | L Style | 1 | 6 | | | | | | | | | |
| | | | | | | Station | 1 | 1 | | | 0.123 | S+SSS.SS | S | | | | |
| | | | | | | Offset L | eft 1 | 2 | Off | L | 0.123 | | | | | | |
| | | | | | | Offset F | light | | Off | R | | | | | | | |
| | | | | | | Northing | 1 | 6 | N | | 0.123 | | | | | | |
| | | | | | | Easting | 1 | 7 | E | | 0.123 | | | | | | |
| | | | | | | Elevatio | n 1 | 3 | E | | 0.123 | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | Leaders: | 1. | | | | | | | | | | |
| | | | | | | Object | Leng | th A | Mark View | / Closed | d Areas | | | | | | |
| | | | | | | Leader | Line | | | | | | _ | | | | |
| | | | | | | Segmer | nt 1 1.00 | 00 9 | 🛛 📥 Vie | ew Close | ed Areas | | Data: | | | | |
| | | | | | | Segmer | nt 2 1.00 | 00 | | Gener | al | | Object | Prefix | Suffix | Precision | Name |
| | | | | | | | | | · - · - • • | Annota | ation | | Text | | | | Annotation-Plan |
| | | | | | | | | | | | | | Name Name | | | | |
| | | | | | | | | | | | | | Description | | | | |
| | | | | | | | | | | | | | Area in Square Meters | | m2 | 0 | |
| | | | | | | | | | | | | | Area in Hectares | | ha | 0.123 | |
| | | | | | | | | | | | | | Perimeter in Meters | | m | 0.123 | |
| | | | | | | | | | | | | | Area in Square Feet | | ft2 | 0.12 | |
| | | | | | | | | | | | | | Area in Acres | | ас | 0.12 | |
| | | | | | | | | | | | | | Perimeter in Feet | | ft | 0.12 | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | - |
| | | | | | | | | | | | | | Apply | Prete | arences | Clos | e <u>H</u> elp |
| | | | | | | | | | | _ | | | | _ | | | |

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Just more examples...





Completing in SELECTseries 3

| iew vertical Annotation | Data: | | | | | | | | | | | | | | | | | |
|-------------------------|------------------|----------|------------|-----------|------------|--------------|-------------|---------------|------------|--------------|--------------------|---------|---------|--------|---------------|--------------|-----------------|------------------|
| General | Object | Row | Prefix | Suffix | Precision | Format | Name | | | | | | | | | | | |
| Points | ☑ Tangents | | | | | | Prop Vertic | al 🛄 | | | | | | | | | | |
| Curves | Tangent Annot | ation | | | | | Prop Vertic | al 🛄 | | | | | | | | | | |
| Tangents | Short Tangent | | | | | | Prop Vertic | al 🛄 | | | | | | | | | | |
| | Offset Tangent | : | | | | | Prop Vertic | al 🛄 | | | | | | | | | | |
| | Grade | 3 | G= | _ | 0.123 | 50% | | | | | | | | | | | | |
| | Horizontal Lep | | | - | 0 102 | | | | | | | | | | | | | |
| | Slope Length | View Ve | ertical Ar | notation | 1 | | | | | | | | | | | | | |
| | PVI-PVI Leng | A View 1 | Vertical A | opotation | Data: | | | | | | | | | | | | | |
| | | G | eneral | notation | Object | | Row | Prefix Suffix | Precision | Format | Name | | 1 | | | | | |
| | Tangent Annotati | | oints | | | | 1 | | | | | | | | | | | |
| | 0// | | > PVC | | Station | 1 | 1 | PVC | 0.123 | S+SSS.SS | Prop V | ertical | | | | | | |
| | Unset Tangent's | | PVI | | Elevat | ion | -1 | Elev | 0.123 | | | | | | | | | |
| | Display Short | | PVT | | | | | | | | | | | | | | | |
| | | | PVCC | | Point Anno | tation Locat | on: 🕞 | | | | | | | | | | | |
| | | - | PVRC | | | | Vi | ew Vertical A | Innotation | | | | | | | | | |
| | | | High | | Rotate | Symbol with | Gr | | | | | | | | | | | |
| | | | Low | | | | | View Vertical | Annotation | Data: | | | | | | | | |
| | | | Event | | | | | General | | Object | | Row | Prefix | Suffix | Precision | Format | Name | |
| | | | POVE | | | | | 🗎 Points | | Curve 🛛 | | | | | | | Prop Vertical | |
| | | | Interva | | | | | Curves | | Curve Ar | notation | | | | | | | |
| | | G | interva | 3 | | | | Tangents | | ⊠ Witness | | | | | | | Prop Vertical | |
| | | - T | angents | | | | | | | 🛛 Leader | | | | | | | Prop Vertical | |
| | | | | | | | | | | I Terminat | or | | | | | | | |
| | | | | | | | | | | 🛛 Туре | | 17 | Туре | | | | | |
| | | | | | | | | | | Direction | | 16 | Dir | | | | | |
| | | | | | | | | | | 🛛 Length | | 15 | LVC | m | 0.123 | | | |
| | | | | | | | | | | PVI Stati | on | 14 | PVI | | 0.123 | S+SSS.SS | | |
| | | | | | Landami | | | | | PVI Elev | ation | 13 | Elev | | 0.123 | | | |
| | | | | | Leaders. | l. | _ | | | PVC-PVI | Length | 12 | L1 | m | 0.123 | | | |
| | | | | | | Leng | <u>n</u> | | | PVI-PVT | Length | 11 | L2 | m | 0.123 | | | |
| | | | | | | r Line | | | | Entrance | Grade | 10 | G1 | | 0.123 | 50% | | |
| | | | | | | m 2 0.100 | | | | Exit Grad | e | 9 | G2 | | 0.123 | 50% | | |
| | | | | | | an 2 0.100 | | | | Rate | | 7 | R | | 0.123 | | | |
| | | | | | | | | | | ×κ | | 6 | K | | 0.123 | | | |
| | | | | | | | | | | Middle O | rdinate | 5 | e | m | 0.123 | | | |
| | | | | | | | | | | ∐ Sight (sa | g) | 4 | SD | m | 0.123 | | | |
| | | | | | | | | | | Sight (cre | est) | 3 | SD | m | 0.123 | | | |
| | | | | | | | | | | Radius | | 2 | R = | m | 0.123 | | | |
| | | | | | | | | | | Curve Annota | ation <u>L</u> oca | ation: | Inside | | ✓ <u>Anno</u> | tate at Top | of Grid 🔲 Apper | nd <u>I</u> ndex |
| | | | | | | | | | | Witness Line | Minimum | Length: | 400.000 | | 0 | Des Transfer | | L. IZ |

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Swept Envelope Analysis

New functionality for the creation of vehicle swept envelopes



Before Going Any Further, A Definition

- From the British Railways Track, Volume 9, Track Terminology book:
 - Swept Path The plan area occupied by a rail vehicle as it moves along a track. The width of the swept path at any point is the same as the width of the swept envelope at that point.
 - Swept Envelope The kinematic envelope enlarged to allow for the effects of vertical and horizontal curvature, including end throw and centre throw of vehicles and cant applied to the track.
 - Kinematic Envelope The cross-sectional profile if a rail vehicle enlarged to include the effects of dynamic sway and vertical movement caused by speed, track curvature and cant, track position tolerances, rail wear, rail head/wheel flange clearances, tilt, vehicle wear and suspension performance at the particular location under consideration. Abbreviated to KE.



Swept Envelope Analysis

- New functionality for the creation of swept path / vehicle envelopes
 - Results can be
 - Horizontal projection only
 - Interactive or
 - 3D mesh
 - Up to 3 vehicles in tandem



- Uses horizontal, vertical and cant geometries

| Variante 6 - APS +4 🔻 | Apply |
|-----------------------|--|
| | Horizontal Projection |
| -1351.821 + | Interactive |
| 121810.668 | Vehicle Library Editor |
| 10.0000 | Preferences |
| Equip. Diag. 2.1 AF 💌 | Thereferices |
| Equip. Diag. 2.1 AF 👻 | Close |
| Equip. Diag. 2.1 AF 💌 | <u>H</u> elp |
| Default 👻 | |
| | Variante 6 - APS + · · · · • • • • • • • • • • • • • • • |



Vehicle Library

- Manages an XML based file of vehicles
 - ..\Bentley Rail Track V8.11\data\metric\swept envelope vehicles.xml
- A selective / interactive import from .dgn
 - Bogie points
 - Optional articulation points
 - Front, middle & rear sections

| Vehicle Library Editor | New Vehicle |
|---|---|
| Vehicles
Name: Equip. Diag. 2.8 AREMA V
Description: Outline diagram for single loads
Style: Default V
Sections
Section: Section 1 V
Description:
Style: Default V | Name: Vehicle 1
Description: Close
Style: Default Glose
Style: Default Help
Impot
Front Atticulation
Front Bogie
Rear Bogie
Section Shape
Section Shape
Section Shape
Rear Articulation
Front Bogie
Rear Articulation
Rear Bogie
Rear Articulation |



Short AVI





Network Solution

New functionality that allows the user to create alignments including turnouts that have simple relationships.



Network Solution

- Primarily written for customers in The Netherlands, but it can adapt to others!
- Utilizes *existing solvers*
 - Multi-Element Connection
 - Turnout Connection
 Or
 - Components

| Network Solution | | | |
|--|----------------------------------|---------------------|------------------|
| Network Solution Defini
C:\Users\Richard.Brac | tion File Name:
Ishaw\Documen | ts\Network Solution | Browse
Apply |
| Bandwidths
Track Points: | Left
-1.0000 | Right 1.0000 | Copy from Active |
| Non-track Points: | -2.5000 | 2.5000 | Toggle Fixity |
| | | | Commit |
| V Multi-Element Conne | ection Editor Solv | /er | Close
Help |





Network Solution & Turnouts

Relating one cross-over to another cross-over

Settings /XY /Degrees /Metric /Arc

Begin Points E1 1000.0000 1000.0000 E2 2000.0000 1500.0000 E3 2500.0000 1500.0000 End Points begin alignment /name= Track 1 /Station= 1+000. liñe /length= 250. /start= E1 /direction= 90. spiral /length= 100. /radius= -500. anc /length= ~500. spiral /length= 100. line /length= 250. spiral /length= 100. /length= ~500. /radius= 500. arc spiral /length= 100. /length= ~500. /end= E3 /direction= 100. line end alignment begin alignment /name= Track 2 /Station= 1+000. parallelTo /OffsetFrom= Track 1 /Offset= -4.5 end alignment # create back to back cross-overs begin alignment /name= T3-T4 turnout /name= T3 /Style= GW 54E1 R465 1:12 /Mainline= Track 1 /Station= 1+400. /Leading /Left /Fixed arc /length= ~15. /radius= ~-550. turnout /mame= T4 /Style= GW 54E1 R465 1:12 /Mainline= Track 2 /Station= 1+500. /Trailing /Left /Free end alignment begin alignment /name= T5-T6 turnout /name= T5 /Style= GW 54E1 R465 1:12 /Mainline= Track 🕻 /LengthFrom= T4 /FromToe= 15.) /Leading /Right /Fixed /length= ~15. /radius= ~-500. arc turnout /name= T6 /Style= GW 54E1 R465 1:12 /Mainline= Track 1 /LengthFrom- T5 lee1= 60. /Trailing /Right /Free end alignment



Demo

- ..\Documents\Copenhagen\Network Solution\Test case 7.txt
- ..\Documents\Copenhagen\Network Solution\Test case 10 (Arcadis example w turnouts).txt



Power Rail Overhead Line

This will be a *new* product for the creation of overhead line equipment for electrified railways.



Equipment

- Components (i.e. nuts and bolts)
- Assemblies (i.e. cantilevers)
 3D Cells
- Hierarchies
- Templates





Network Model

- A network model is created from Bentley Rail
 Track geometry
 - Horizontal
 - Vertical
 - Cant
 - Turnouts
- Update vertical & cant
 - And update the model!

| 🔓 Update Network Model | |
|---------------------------------|--------------|
| Geometry Project: Railway Model | Apply |
| | Close |
| | <u>H</u> elp |





Zones

- A *zone* is an area where you can not place overhead line structures
 - A road crossing
 - A utility crossing
 - Other objects that you need to avoid

| urtace: | Existing ground | • | Apply |
|---|---|-----|-------------------|
| Feature | | | Close |
| N <u>a</u> me: | Zione 1 | + + | 0050 |
| Description: | | | Ne <u>w</u> Style |
| Feature Style: | Breakline | • | <u>H</u> elp |
| Point Type: | Breakline | • | |
| Duplicate Names: | | _ | |
| Append | Replace Repare | | |
| C. Epond | | | |
| Exclude from T | riangulation | | |
| Exclude from T | internation | | |
| Exclude from T Triangulate Surfa | | | |
| Exclude from T Triangulate Surfa Dynamics Settings Northing/Eastir | inangulation
ace
s and Intervals
19. 0.0000 | 1 | |
| Exclude from T
Triangulate Surfa
Dynamics Settings
Northing/Eastin
Beyation: | inangulation
acce
s and Intervals
19. 0.0000
0.0000 |] | |
| Exclude from T Triangulate Surfa Dynamics Settings V Northing/Eastir Elevation: Distance: | iniangulation
ace
s and Intervals
0.0000
0.0000 |] | |
| Exclude from T Triangulate Surfa Dynamics Settings Northing/Eastir Elevation: Distance: Discion: | iriangulation
ace
s and Intervals
0.0000
0.0000
0.0000
0.0000 |] | |



Surfaces

• A *surface* is an obstruction, like a bridge above the track, where a wire run may need to be lowered to provide clearance between the wire and the structure.

| | Existing ground | • | Apply |
|---|---|-------------|--------------|
| Feature | | | Close |
| N <u>a</u> me: | OHL Surface 1 | ▼ + | |
| Description: | | | New Style |
| Feature Style: | Breakline | • | <u>H</u> elp |
| P <u>o</u> int Type: | Breakline | • | |
| Duplicate Name | s: | _ | |
| Append | Replace Rename | | |
| Exclude from | Triangulation | | |
| _ | uface | | |
| Triangulate Su | JII ace | | |
| Triangulate Su
Dynamics Settir | ngs and Intervals | | |
| Triangulate Su
Dynamics Settir
<u>Northing/Eas</u> | ngs and Intervals
sting: 0.0000 |] | |
| Triangulate Su
Dynamics Settir
<u>Northing/Eas</u>
Ele <u>v</u> ation: | ngs and Intervals
sting: 0.0000
0.0000 |] | |
| □ Trjangulate Su Dynamics Settir ☑ Northing/East □ Elevation: □ Distance: | Indee
Ings and Intervals
sting: 0.0000
0.0000
0.0000 |] | |
| Trjangulate Su
Dynamics Settir
Northing/East
Elevation:
Distance:
Direction: | Indee Ings and Intervals Ing: 0.0000 0.0000 0.0000 0.0000 0^0000.0" |]
]
] | |



Overlaps & Reference Lines

- Overlaps are where wire runs go in and out of service, one wire ends and a new wire starts
- Reference lines are working lines upon which structures will be placed
 - Placement is based upon design rules for a specific catenary system
 - Look up tables
 - User defined algorithms
 - Placement may need to be adjusted to avoid obstructions
 - Placement is interactive

| | Table | Radius | B1 | B2 | b1 | b3 | b4 | b5 |
|----------|------------|----------------------|--------|-----|-----------|------|-----------|-----|
| \times | Tabell 7.7 | \times NF \times | -0.3 | 0.3 | -0.3 🛛 | -0.1 | 0.1 | 0.3 |
| | Tabell 7.7 | 20000 | -0.3 | 0.3 | -0.3 | -0.1 | 0.1 | 0.3 |
| | Tabell 7.7 | × × 10000 × | -0.3 × | 0.3 | -0.3 × | -0.2 | <u> </u> | 0.2 |
| | Tabell 7.7 | 9000 | -0.3 | 0.3 | -0.3 | -0.2 | 0.1 | 0.2 |
| | Tabell 7.7 | 8000 | -0.3 | 0.3 | -0.3 × | -0.2 | 0.1 | 0.2 |





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Turnout Reference Lines

- Place reference lines relative to a turnout
 - Uses look tables related to the turnout's style
 - User define lengths

| TurnOut | | | $\sim \sim \sim$ | $\sim \sim \sim$ | | | |
|---|--|---|------------------|----------------------------|----------------------------------|--------------|--|
| $\sim\sim\sim\sim$ | Name | Position | OffsetTo | Position | \sim | | |
| | UIC 60 - 760 1:15 | 800 | 34.87 | $\sim \sim$ | $\overline{\mathbf{v}}$ | | |
| TurnOut | | | $\sim \sim \sim$ | | | | |
| | Name | Position | OffsetTo | Position | Z. | | |
| \square \square \square \square \square | UIC 60 - 760 1:15 | 900 | 36,98 | \times \times \times | \frown | | |
| TurnOut | | X X X X | X X X | $\mathbf{X}\mathbf{X}$ | $\overline{\mathbf{X}}$ | | |
| $(X \times X)$ | Name | Position | OffsetTo | Position | | | |
| кХХХ | UIC 60 - 760 1:15 | 1000 | Turnout Ref | Turnout Reference Lines | | | |
| TurnOut | $\overline{X} \times \overline{X} \times \overline{X}$ | $\times \times \times \rangle$ | Design Rules: | Sweden | • | Apply | |
| $X \to X$ | Name | Position | Catenary System | : ST 7.1/7.1 | • | Close | |
| $(X \times X)$ | UIC 60 - 760 1:15 | 1100 🔨 🔿 | Control Tracks | | | Preferences | |
| · · · · · · · · · · · · · · · · · · · | | ~ | Leftmost: | Right Track | ▼ +
▼ + | <u>H</u> elp | |
| | | | Position 1: | -6.0000 | | | |



Position 2 -

Distance:

1000

30.0000

Reference Line Editing

- Adjustment of reference lines
 - Normally by small amounts
 - Adjusting span lengths
 - Updates entire model
 - Reference lines
 - Overlaps
 - Wire Runs
 - Span Bonding
 - Structures
 - Other wires
 - And all annotation

| C Edit Reference | | | | | | | |
|--------------------|-----------------------------|---------|--|--|--|--|--|
| Reference Line 1: | + Undo | | | | | | |
| Reference Line 2: | RL10120 🔹 | + Close | | | | | |
| Interval: | 1.0000 | Help | | | | | |
| Equ | ial Span Lengths | | | | | | |
| | Slide Back | | | | | | |
| | Slide Forward | | | | | | |
| Suggest Slid | e Back / Forward Interval | | | | | | |
| Number of Affected | Number of Affected Spans: 5 | | | | | | |
| Decre | ase Span Lengths | | | | | | |
| Incre | ase Span Lengths | | | | | | |



Wire Runs

- Wire runs consist of
 - Contact wire
 - Carrier wire
 - Droppers
- Utilizes design rules

| 🐚 Wire Run | | | - • • × |
|------------------|----------------------|---|---------|
| Design Rules: | Sweden - |] | Apply |
| Catenary System: | ST 7.1/7.1 - |] | Paths |
| Classification: | New | j | Close |
| Paths: | Right Track 🔹 | + | Hele |
| Compute From: | Overlap to Overlap 🔻 |] | пер |
| Start Location | | | |
| Northing: | 0.0000 | | |
| Easting: | 0.0000 | | |
| End Location | | | |
| Northing: | 0.0000 | + | |
| Easting: | 0.0000 | | |

Design Rule Set: Sweden Version: 1.1

| Name | Maximum
Span
Length | Maximum
Wire Run
Length | Maximum
Span
Difference | Nominal
Encumbrance | Minimum Mid
Span
Encumbrance | Minimum
Wire
Height | Maximum
Speed | Nominal
Wire
Height | Maximum
Wire
Height | Minimum
Span
Length | Mid
Span
Contact
Wire
Sag | Maximum
Dropper
Spacing | Distance
To First
Dropper | Number
Of
Droppers | Catenary
Wire Sag
Start
Position |
|------------------|---------------------------|-------------------------------|-------------------------------|------------------------|------------------------------------|---------------------------|------------------|---------------------------|---------------------------|---------------------------|---------------------------------------|-------------------------------|---------------------------------|--------------------------|--|
| S 4.9/5.9 | 60 | 1300 | 10 | 1.3 | 0.6 | 5.2 | 120 | 5.5 | 5.65 | 0 | 0.080 | 8 | 8 | Odd/Even | At
Cantilever |
| ST
7.1/7.1 | 60 | 1300 | 10 | 1.3 | 0.6 | 5.2 | 140 | 5.5 | 5.65 | 0 | 0.040 | 10 | | Odd/Even | At first
dropper
except in
curves |
| ST
9.8/9.8 | 60 | 1300 | 10 | 1.3 | 0.6 | 5.2 | 180 | 5.5 | 5.65 | 0 | 0.030 | 10 | | Odd/Even | At first
dropper
except in
curves |
| ST
9.8/11.8 | 60 | 1300 | 10 | 1.3 | 0.6 | 5.2 | 200 | 5.5 | 5.65 | 0 | 0.030 | 10 | | Odd/Even | At first
dropper
except in
curves |
| ST
15.0/15.0 | 65 | 1600 | 10 | 1.55 | 0.6 | 5.2 | 250 | 5.5 | 5.65 | 0 | 0.030 | 7 | 6 | Odd | At first dropper |
| SYT
15.0/15.0 | 65 | 1200 | 10 | 1.8 | 0.6 | 5.2 | 250 | 5.5 | 5.65 | 0 | 0 | 10 | 5 | Odd | At first
dropper |





Height & Stagger

- Height will adjust the vertical position of the wires
- *Stagger* will adjust the horizontal position of wires
 - Wires going in and out of service
 - Design checking

| 🔓 Height & Stagger | | | I | 🚡 Height & Stagger | | |
|--------------------------------------|-------------|-----------------------|---|--------------------------------------|------------|-----------------------------|
| Height Stagger | | | | Height Stagger | | |
| Wire Run:
Starting Contact Point: | WR10001 • + | Apply
Get Defaults | | Wire Run:
Starting Contact Point: | WR10001 | All to Left
All to Right |
| Ending Contact Point: | 1 + | Help | | Ending Contact Point: | 22 🔹 🕈 | Left than Right |
| Starting Height: | 5.6500 | | | Stagger: | 0.3000 | Bight than Left |
| Starting Encumbrance: | 1.3000 | | | | | |
| Ending Height: | 5.6500 | | | | | Help |
| Ending Encumbrance: | 1.3000 | | | | | |
| | Undo Close | | | | Undo Close | |



5.2000

Wire Gradient

 Used to transition the wire height from the normal height to a height exception, say transitioning under a bridge



🚰 Bentley[.]

Structures

- Utilizes equipment defined in a data base
 - Components (i.e. Nuts, bolts, brackets...)
 - Assemblies (i.e. 3d cells of poles, cantilevers, etc.)
 - Templates
 - Combination of components and assemblies

| [Create Stru | ctures | | |
|--------------------|-------------------|---------------------------|--|
| Template: | Template 1 | Apply | |
| Classification: | New | Close | |
| Wire Run: | WR10001 | | |
| Cantilever: | Single | ■ Incip | |
| Offset: | 3.5000 | | |
| Available Refer | ence Lines | | |
| Name | Description Style | ^ | |
| RL10001 | | | |
| RL10002 | | E | |
| RL10003 | | | |
| RL10005 | | | |
| RL10006 | | | |
| RL10007 | | | |
| RL10008 | | | |
| RL10009
RL10010 | | Select | |
| | | * Select | |
| L | | | |



Span Bonding

• Creates span bonding between adjacent wires





Naming Utility

- Naming of
 - Reference Lines
 - Wire Runs
 - Span Bondings
 - Other Wires
 - Structures
 - Lots of customer variation

| 🚡 Assign IDs | | | |
|------------------|----------------------|------------------|------------------|
| Reference Lines | Wire Runs Span | Bondings Other W | lires Structures |
| | Left Side | Right Side | Apply |
| Prefix: | | | Help |
| 🔽 Include Kilom | eter Station | | |
| Separator: | / | | |
| Pole Number: | 101 | | |
| Suffix: | | A | |
| 🔽 Restart Pole 1 | Numbering with Kilor | meter Change | |
| Example: | 10/101 | 10/101A | |
| | | | |
| | Preferences. | Close | |



Plan Viewing



Bentley

Profile Viewing

| C View Profile | | | × | | | |
|--|--|--|---|--|--|--------------|
| View Profile View Profile Profile Design Checks | Wire Runs
All
Single:
WR10001
Update
Profiles per
Vertical St
Bottom
Distance:
Object
Default
Railway
Existing | Example Example Data: Object Pr Wires Profile Grade Line Catenary Point Catenary Point | X Suffix Precision Name Image: Suffix Precision Name Image: Suffix Data: Object Image: Suffix Data: Object Image: Suffix Precision Name Image: Suffix Data: Object Image: Suffix Data: Object Image: Suffix Image: Suffix Image: Suffix Image: Suffix Image: Suffix Image: Suffix | e | Name Substration State S | |
| | | Bottom
Droppet
Span Le | Starting Offset: | 0.123
mbrance 0.123
nce 0.12
R 0.123
L 0.123
0.123
0.123 | | |
| | | | | Apply Pr | re <u>f</u> erences) Close | <u>H</u> elp |

🔁 Bentley

Example of View Profile Annotation



| Axial Force | | 26.3N | 97.3N | 153.8N | 177.5N |
|---|---------|----------------|------------------|----------------|---------|
| Gradient | -0.250% | 0.000% | 0.000% | 0.000% | 0.0007 |
| Midspan Encumbrance
Isolation Distance | 0.343m | 0. 525m | 0. 343m | 0.343m | 0.343n |
| Wind Blowoff R | | -0.155m | Ø.124 m | | 0.207n |
| Wind Blowoff L | | -0.245m | - Ø. 124m | | -0.207n |
| Sag | 0.957m | 0.775m | 0.957m | 0. 957m | 0.957n |





Cross Sections

- Graphical data and
- Non-graphic data



| | | | | 1 1 | | | |
|-----------------------|-------------|-------|-------------|---------------------|-----------|----------------------------|-------|
| Assembly | Description | Count | Structure | Single Track Post 5 | Component | Description | Count |
| EAT1-D | | 1 | Chainage | 7+026.571 | 1600-104 | EAT1-D cantilever assembly | 1 |
| steady arm 0.9m - pus | h | 1 | Orientation | N 17°33'27.78" E | 1501-003 | concrete footing, pole | 1 |
| foundation - pole | | 1 | | | | | |
| Pole 8m | | 1 | Wire | NW | | | |
| | | | Height | 5.50 | | | |
| | | | Stagger | 0.40 | | | |
| | | | Encumbrance | 1.30 | | | |
| | | | | | | | |



Reporting

As always XML / XSL based

| Bentley Civil Report Browser - C//Users/RICHAR-1.BRA/AppData | Local\Temp\RPT1F | E3.xml | | 9 | | | | | | | |
|--|---------------------------------------|---|--------------------------------|---------------------------------------|-----------|----------|-------------|-----------|----------------|-----------|--------|
| Eile Iools Help | | | | | | 4 | | | | | |
| D:\BSW'out\inRoads\Bentley\inRoads Group V8.11\XML Data\en\ | NO. | | | | | | | | | | |
| Bindge A | 1000 | Dropper Sp | | | | | | | | | |
| Cart Cart | DX DX DX | 0 | | | | | | | | | |
| Conta Stone Optimization | | Report Crea | ted: 7/25/2010 | | | | | | | | |
| Cutos sope opunization | | lime: | 10.26am | | 1 | | | | | | |
| DataColection | Dre | Jact Variable | | | | | | | | | |
| Evaluation | FIG | ject. Valiable | | | | | | | | | |
| Geometry | Descrip | tion: | | | | | | | | | |
| in rs | City M. | C:\Users\Richard Bradshaw\ | Documents\Vectura\Sp | rint 1 Demo/Variable | A. 1917 | | | | | | |
| images | File is | Centers\Variable nwm | | | | | | | | | |
| intersectingAlignmentStations | Last Rev | ised: Richard Bradshaw 7/26/2010 | 10:16:16 AM | | | | | | | | |
| LandXML | loos | d Grid | te: All units in this report a | re in meters unless specified | | | | | | | |
| LegalDescription | F | actor: 1.00000000 | | otherwise. | | | | | | | |
| Uprehaimanutacturing | 1 X X X | <u> </u> | <u> </u> | A A A A A A A A A A A A A A A A A A A | | | | | | | |
| Mapureck II | $ \sim \times \sim$ | Besian P | ule: Swadan | | | | | | | | |
| Obsolete | X X X | Catanan S | ule. Sweden | | | | | | | | |
| OverheadLine | | Catenary Sy | stem: 5 4.3/5.3 | New Yorks | | | | | | | |
| A Contacts xsl | Wire Run | Span Number Length To Fi | rst Number @ Sp | acing Length Io L | ast | | | | | | |
| -A DesignChecks.xd | WR1001 | 1 8.000 | 6 @ 7.33 | 8.000 | | | | | | | |
| -A) DesignRulesCatenary.xal | WR1001 | 2 8.000 | 5 @ 7.40 | 8.000 | | | | | | | |
| - Ag DesignRulesSpanStaggerLookup.xal | WR1001 | 3 8.000 | 6 @ 7.33 | 8.000 | | | | | | | |
| All DesignRulesStaggerOverlapLookup.xol | WR1001 | 4 8 000 | 6.00733 | 8 000 | | | | | | | |
| | WR1001 | 5 8 000 | 6 (0 7 33 | 8 000 | | | | | | | |
| A listation Distances val | INID 1001 | 6 9.000 | 6 63 7 24 | 0.000 | | | | | | | |
| All OtherWays val | VVR1001 | 6 8.000 | 6 (2 1.3 1 | 0.000 | | | | | | | |
| All ReferenceLines xsl | WR1001 | 7 8.000 | 5 @ 7.71 | 8.000 | | | | | | | |
| -A SpanBondings xal | WR R Be | ntley Civil Report Browser - C:\Users\R | CHAR-LERA\AppData\ | ocal\Temp\RPT1FE3.xml | 1 | | | | | | 0 |
| -A) SpanLengthsxal | WR | - | | | | | | | | | |
| - Al Structures xsl | WR the | Tools Help | | | | | | | | | |
| -All Stuctures Types&Cantilevers.xsl | WR DIS | SW\out\InRoads\Bentley\InRoads Group \ | /8.11\XML Data\en\ | Wine Day WD4004 | 0.00 | 0.2.12 | C 201 20 20 | - 10 C | C 20 20 | N N | X X |
| Al WreRuns xal | WR IST | | | Wire Run: WK1001 | | | | | | | |
| HoadwayDesign | WD | noge | | Design Rule: | | | | | | | |
| Cohenda | WP 50 | lastance | | Sweden | | | | | | | |
| Stakeout | | coss Slope Optimization | | Catenary System: | | | | | | | |
| StationOffset - | VVIG SC | lustom | | 5 4.3/3.3 | V | | | (| | | |
| | | ateCollection | | Span Number | Axial | Gradient | Midspan | Isolation | Wind Planaff P | Wind | Sag |
| | i i i i i i i i i i i i i i i i i i i | Ivaluation | | | Force | | Encumurance | Distance | DIOWOII N | BIOWOII L | |
| | | Seometry | | ムノホム | | -0.250% | 0.253m | | -0.243m | 0.043m | 1.047m |
| | | 25 | | 2 | 22.264N | 0.000% | 0.483m | | -0.146m | -0.254m | 0.817m |
| | | nages | | 3 | 81.261N | 0.000% | 0.253m | | | | 1.047m |
| | | and YMI | | 4.7 | 127.826N | 0.000% | 0.253m | | | | 1.047m |
| | | enalDescription | | 5 | 147.488N | 0.000% | 0.253m | | | | 1.047m |
| | 100 | ight Rai Manufacturing | 1.00 | 6 | 149 9051 | 0.000% | 0.256m | | 0.617m | .0.438m | 1.044m |
| | 1 1 | ApCheck | | | 35.0341 | 0.0005 | 0.434- | | 0.751- | 0.367- | 0.000- |
| | in s | Ming | | CX LXX | 30.02414 | 0.00076 | 0.43410 | | 0.7510 | -0.30/m | 0.000m |
| | | Ibsolete | | 8 | 415.385N | 0.000% | 0.440m | | 0.44/m | -0.388m | 0.890m |
| | | NorheadLine | | 9 | 400.804N | 0.000% | 0.440m | | 0.447m | -0.388m | 0.860m |
| | - 4 | Contacts xal | | 10 | 401.041N | 0.000% | 0.439m | | 0.448m | -0.388m | 0.861m |
| | 4 | Design Checks and | | 11 | 401.252N | 0.000% | 0.438m | | 0.449m | -0.388m | 0.862m |
| | | Design Fuest, are any as | | 12 | 401.482N | 0.000% | 0.437m | | 0.450m | -0.388m | 0.863m |
| | | Design Rules Stanger Lookup Mi | | 13 | 394 425N | 0.000% | 0.497m | | 0.391m | -0 393m | 0.803m |
| | | Droppers xal | | 14 | 318 5161 | 0.000% | 0.720m | | 0.026m | -0.674m | 0.580m |
| | Ā | DroppersLengths xal | | A | 200 6711 | 0.2008 | 0.664.m | | 0.0200 | 0.009-0 | 0.746m |
| | I -A | A IsolationDistances xal | • | 15 | 330.67114 | 0.230% | 0.554m | | 0.034m | -0.690m | 0.740m |



- - ×

Demo...

..\Documents\Vectura\Sprint Demo's\7.1k





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