

Modeling with Bentley Rail

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Roadway Designer for Track

Utilizing Roadway Design for modeling track and earthwork.



Earthwork Modeling & Templates

- Components
 - Closed shapes that represent "man-made" materials
 - Ballast
 - Subballast
 - Sleepers / ties
 - Other materials
- End conditions
 - Ditches
 - Cut / fill slopes
 - Similar to roads!



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Earthwork Modeling & Roadway Designer

- Utilize alignment model
 - Horizontal
 - Vertical
 - Cant, which is railway superelevation!
- Define model specifics
 - Typical sections
 - Point controls
 - Cant
 - Shoulder widening
 - Minimum ballast depth
 - Etc.





Easily create new single track model...









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Or Even *Adding* **Track to a Corridor!**

• Parallel existing horizontal, vertical and cant





So lets look at some examples

How to model track with Roadway Designer



Single Track

- Characteristics
 - Single track
 - Ballast surface rotates with superelevation
 - Sub-grade <u>widens</u> to accommodate high side superelevation, but cross-slopes remain constant



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Ballast Rotation

- Ballast Rotation with Superelevation
 - PGL
 - Vertical alignment constraint
 - Cant
 - L rail cant
 - R rail cant
 - Horizontal & slope constraint







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Sub-grade Widening

- Sub-grade shoulder widening (high side super)
 - R subballast B
 - Horizontal constraint
 - R subballast T
 - Two slope constraints
 - R ballast B
 - Two slope constraints







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Point Controls

- Within *Roadway Designer* add the *Point Controls* for
 - Cant
 - Center, left rail and right rail

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Curve Widening

- Curve widening will be applied to
 - R subballast B
 - L subballast B
- Based upon a widening table
 - And widening the outside shoulder!

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Final Point Controls

 After applying cant point controls and curve widening point controls, we will have the following:

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Within Roadway Designer...

- So a single template can model
 - Ballast rotation
 - Including the transition from tangent to circular arc
 - Left or right hand curves
 - Shoulder widening for "high side super"



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And ECXAttributes

A means to share data without a specific application!





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Lets extend our solution

Building on top of the rail superelevation solution by adding more constraints into the template.





Parametric & Other Constraints

- One point under each rail for minimum depth
- Constraints
 - Parametric Constraints for
 - Depth
 - Sub-grade widths
 - Horizontal
 - Vertical Minimum



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Parametric Constraints

- Parametric Constraints
 - Min ballast depth
 - Default to 450mm, but user can over-ride
 - L subballast width & R subballast width
 - Default to 3 m, but again it can be over-ridden



And lets extend it some more

Building upon our previous solutions to arrive at a more advanced solution



Multiple Track Alignments

- Constraints
 - Horizontal & slope constraints for superelevation
 - Minimum vertical depth under each rail to sub-grade
 - Note "end of sleeper ballast build-up"



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Adding Multi-alignment Point Controls

- Points Controls
 - Right track *superelevation*
 - Left track superelevation
 - Minimum vertical depth
 - Sub-grade widths

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If you need some help

- ..\samples\rail modeling
 - .itl and associated .pdf (linked to the .itl)



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Swept Path Modeling

New functionality for the modeling of vehicle swept paths



Swept Path Modeling

- New functionality for the creation of swept path / vehicle envelopes
 - Results can be
 - Horizontal project only
 - Interactive or
 - 3D mesh
 - Up to 3 vehicles in tandem
 - Uses horizontal, vertical and cant geometries

Horizontal Alignment:	Track 1		+	Apply
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Interval:	10.0000			
Front Vehicle Name:	Vehicle H1	•		Preferences
Middle Vehicle Name:	Vehicle H2			Close
Rear Vehicle Name:	Vehicle H3			Help
Surface Name:	Default			







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And Combining Track & Overhead Line

- Creating the track model (geometry + surface) with **Bentley Rail Track**
- Creating the overhead line model, which is associated to the track geometry, with Bentley Overhead Line



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