Power Rail Overhead Line

Håkan Norling - Professional Services
Richard W. Bradshaw – Development
Date
Power Rail Overhead Line

A product for the modeling of overhead lines for electrified railways, build on top of Power Rail Track technology and Power Platform.
Command Set

- **Network Model**
- **View**
- **Design**
- **Equipment**
- And **Rail Track** commands for
  - Viewing
  - Reviews
  - Drafting / **Plan & Profile Generator**
Network Model

A link / node geometric model based upon Power Rail Track geometric entities
Network Model

- An overhead line seed database
  - Components, Assemblies & Equipment

- A network model is created from Rail Track geometry
  - Horizontal
  - Vertical
  - Cant
  - Turnouts

- Creates a .nwm, .ohl & .ols
  - All tied together!
Do I really need vertical & cant alignments?

• No, but
  – If you want to create wire runs then you should have vertical and cant geometry
    • Contact wire is positioned normal to track plane, so it depends on cant
  – If you want to create structures and sub-structures then you should have vertical and cant geometry
Update Network Model

- Primarily minor horizontal changes
  - Radii changes
  - Spiral lengths
  - Moving tangents
- Add / updates to active vertical alignment
- Add / updates to active cant alignment
  - Unlike Rail Track, we only use the active alignments
- Updates to crossovers / turnouts
- Always investigate the details on the results dialog and the “dirty” graphics! (new!)
When the geometry changes, keep in mind...

- **Update Network Model** will be okay if you are looking at:
  - Minor changes in a horizontal alignment
  - Minor changes in a vertical alignment
  - Minor changes in a cant alignment
    - As always, you need to review / check and edit to ensure that you are getting what you are expecting!

- **Update Network Model** may not be okay if you are looking at:
  - Additional turnouts and crossovers have been added and you have created a user defined path through a crossover
Design Commands

A set of commands for creation and editing of an overhead line model (i.e. reference lines, overlaps, wire runs and structures)
Zones & Surfaces

• **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
    • Uses a selection set if defined *(new!)*
    • Or just digitize a shape

• **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.
  – Utilizes a terrain model for elevations or height above alignment
Design Rules

- Defined in an .xml file, which is user configurable and schema verified at start-up!
- One or more catenary systems
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 wire runs and structures will be placed.

- Placement is based upon design rules for a specific catenary system.
  - Look up tables
    - Up to 4 overlap tables (new!)
      - Lines could be 3 spans
      - Arcs could be 5 spans
    - User defined algorithms
Reference Line Placement

- Place *Multiples*
  - Up-station
  - Down-station (*new!*)

- Place *Single*
  - Single station
  - Two points
  - From graphics
  - Can be placed skewed (*new!*)
  - Can be placed beyond the end of an alignment (*new!*)

[Diagram showing software interface for reference line placement]
Reference Line Classifications

- *New* will honor the left & right extensions in **Options**
- *Existing* will use whatever you define!
  - Structures will be placed at the reference line ends!
Turnout Reference Lines

• Place reference lines relative to a turnout
  – Uses look tables related to the turnout’s style
  – User define lengths

• Note the style sheet with the .xdr!
Reference Line Editing

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

• Extend & Trim Reference Lines
Wire Runs

• **Wire runs** consist of
  – Contact wire
  – Carrier wire (optional) *(new!)*
  – Droppers (optional) *(new!)*

• Depends upon active vertical and cant alignments!

• Utilizes design rules
User Defined Paths

• User defined paths are used to create wire-runs through a crossover
  – Ideally these are created after you have trimmed / extended reference lines, so that you don’t select a user path
  – And after the track geometry has stopped moving (i.e. the track designer is not adding or deleting cross-overs!)
  – Paths can be transposed (new!)
    • Based upon how the first path is selected and added to the user path

• Also, remember to check on Ignore Overlaps, Create Single Wire Run on Create Wire Runs
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
  - *Survive reference line edits!*

- *Add and Delete Contact Points* *(new!)*
  - *Survive reference line edits!*
Wire Gradient

- Used to transition the contact and carrier wire from the normal height to a height exception, say transitioning under a bridge.
Structures

• Utilizes equipment defined as templates in the data base
  – Select by template type *(new!)*
    • Single track
    • Multiple track
    • Allows for better organization!
  – Templates
    • Components *(i.e. Nuts, bolts, brackets…)*
    • Assemblies *(i.e. 3d cells of poles, cantilevers, etc.)*
Wire Tensioning / Substructures

- Requires structures (i.e. end wire and mid wire structures are a child of the structure)
  - *Does not use reference lines!*
  - *Can be placed beyond alignment!*

![Wire Tensioning Screenshots]
Naming Utility

- Naming of
  - Zones
  - Surfaces
  - Reference Lines
  - Overlaps
  - Wire Runs
  - Structures
    - Schemes for
      - Sweden, UK and a generic / no frills scheme
  - Other Wires
  - Jumpers
  - Span Equipment
View and Reviewing Commands

A set of commands for plan, profile and cross section viewing and reporting
Viewing

• Plan
  – Reference lines, overlaps, wire runs, structures and sub-structures

• Profile
  – Wire runs & design checks

• Cross Sections
  – Structures
Plan Viewing

• Lots of new items!
  – Thank the America users!

• Stagger cell, versine arc, exceedence *(new!)*
Profile Viewing
Cross Sections

- Graphical data and
- Non-graphic data
Reporting

• As always XML / XSL based
• Exceedence reporting *(new!)*
Review Network Model

- Quick snap shot of everything in the model
  - Right click over object and Fit
- Also, all graphics have tool-tips
Equipment Commands

A set of commands for the creation and editing of components, assemblies, hierarchies and templates
Equipment

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

- Non-graphic data
  - Nuts, bolts, etc.
  - Materials
Assemblies

- Adds intelligence to cells
  - Attachments
  - Attributes
  - Components
Templates

- Combines components and assemblies
- Assigns attachment points
- Assigns constraints
- Optional equipment
How to get a return on my investment?

Lets look at what return is possible based upon various levels of investment…
How to get a return on my investment?

- Starting with
  - Rail Track geometry
    - Horizontal, Vertical, Cant and Turnouts
  - Design rules
    - At least one catenary system
By creating reference lines & zones, you get…

• Valid span lengths & wire run lengths
• Valid overlap span lengths
• Valid turnout span lengths
  – All based upon design rules for a specific catenary system
• Interference checking (i.e. zones)
• Interactive reference line editing, which allows for layout optimization
• Plan Display & Annotation
• Reporting
By creating wire runs, you get...

• Valid contact wire positions
  – Add jumpers and span equipment

• Plan Display & Annotation

• Profile Display & Annotation
  – Including design checking
    • Axial forces, mid-span encumbrance, wind blow off, etc. as defined by the design rules
  – Height & Stagger
  – Isolation / clearance checking

• Reporting
  – Span lengths, wire lengths, droppers, gradients, minimum & maximum exceedence for span lengths and wire heights, etc.
By adding structures, you get…

• 3D Model
  – Includes structures, mid wire & end wire tensioning, post restraints

• Plan Display & Annotation

• Cross Section Display & Annotation

• Reporting
  – Geometry
  – Quantities
    • Components
    • Assemblies
And finally a short demo…