OpenRail Designer CONNECT Edition
From Planning to Performance

OpenRail Designer CONNECT Edition is an innovative application for preliminary and detailed design of rail infrastructure of all sizes. The application is an all-in-one solution and handles a wide variety of complex tasks such as yard/station design, tunnels, corridor modeling, turnout and switch placement, overhead line electrification, site development, sanitary and stormwater network design, subsurface utilities, and production of construction staking reports.

OpenRail Designer can be configured to support a wide range of international standards providing you the flexibility and control necessary to deal with real-life design scenarios on global rail infrastructure projects. The application adapts to virtually any rail design and maintenance workflow and is suitable for light rail, metros (transit) heavy rail, high-speed rail, and MAG_LEV projects.

The CONNECT Edition
The SELECT® CONNECT Edition includes SELECT CONNECT *services*, new Azure-based services that provide comprehensive **learning, mobility,** and **collaboration** benefits to every Bentley application subscriber. *Adaptive Learning Services* helps users master use of Bentley applications through CONNECT Advisor, a new in-application service that provides contextual and personalized learning. *Personal Mobility Services* provides unlimited access to Bentley apps, ensuring users have access to the right project information when and where they need it. *ProjectWise® Connection Services* allow users to securely share application and project information, to manage and resolve issues, and to create, send, and receive transmittals, submittals, and RFIs.

Designing in Reality Context
OpenRail Designer excels at data acquisition enabling users to consume multiple data types to effectively understand site and existing conditions. From photogrammetry and total station surveys to GPS LiDAR, point clouds and reality meshes, the application can upload, analyze, and manipulate field data, while ensuring the provenance of the original data. You can rapidly capture the "as-built" condition of an existing site or asset using Bentley's ContextCapture to quickly produce 3D models from photographs.

Rapidly Model Design Intent
OpenRail Designer's design intent capabilities help you build associations and relationships among civil elements to ensure the design project is reflective of engineering intent to improve design efficiency. The software also delivers
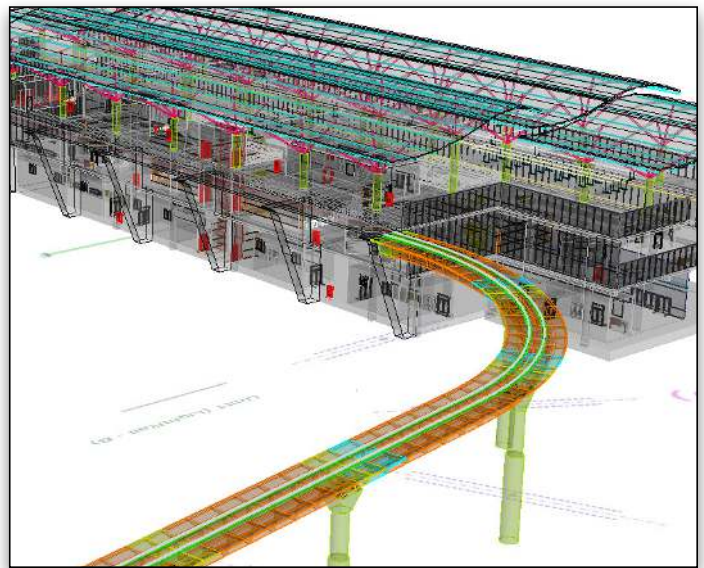
Integrate data from a variety of disciplines to improve collaboration between team members, offices, and workflows to ensure the latest model in used in all phases of the design.

comprehensive mathematical and associated cant transition algorithms to accommodate the horizontal transitions required on rail projects. A check integrity report locates discontinuities and highlights potential issues, such as nontangential curves, for resolution or correction. OpenRail Designer also includes civil cells — preconfigured commonly used 2D and 3D geometric layouts, such as siding or yard layouts — while maintaining all design, constraint, and relational intelligence. Civil cells can then be used repeatedly in designs ensuring standards are implemented, while accelerating design production.

Integrate Multiple Disciplines
OpenRail Designer provides a comprehensive modeling environment for the project delivery of rail and road networks, unifying design and construction. Users can easily integrate data from different disciplines to improve collaboration and ensure the latest model is used in all phases of the design. Working in the live model reduces risk by utilizing the data interactively and working among rail, road, bridge, drainage, subsurface utilities, geotechnical and other design teams to help identify conflicts earlier in the process and eliminate construction errors and delays. Employing a comprehensive modeling environment allows users to share data that is relevant to the project and to enrich project understanding, identify potential risk, and make better engineering decisions in the design phase.

Adapt to Change

Bentley understands the demands on engineers and designers to produce models that provide information beyond documentation and construction, into operations, maintenance, and rehabilitation – and back to design if necessary. Using a model-centric approach, designs are dynamically updated throughout the model, guaranteeing that the current design is readily available for all team members. A federated modeling approach helps you make better-informed decisions earlier in the design process with more complete conceptual designs; eliminate errors and omissions in the documentation process by having fully synchronized documentation from the model; explore and analyze many options to maximize the performance of the asset in the real world; and to reuse information to improve construction and operations of the asset.

Improve Project Deliverables

OpenRail Designer automates the production of a complete array of design deliverables. To automate the drawing process, the application instantaneously synchronizes the model to produce high-quality documentation that is the result of the drawing composition process. Since all deliverables adhere to the same project standards and come from the same model, you can be confident of your deliverables. OpenRail Designer provides design, volume, and cross section data in XML industry-standard format for data exchange and reporting. Project data can be used in multiple formats, including Excel spreadsheets, HTML or text files, PDFs, printable documents, and other output. Reporting capabilities automate the production of a variety of standard reports, including horizontal and vertical alignments, quantity takeoffs, clearance reports, stakeout, legal descriptions, surfaces, and more. The application outputs standard formats for Trimble, Topcon, and Leica for machine-controlled grading and machine guidance.

Visualizing Designs

Experience designs in real time with OpenRail Designer constraint-driven templates, context sensitive, intuitive interface, and dynamic 3D modeling. You can virtually drive through the 3D corridor model and visually inspect it for any design deficiencies or physical conflicts. In 3D QA, you can fully view rail features from all angles to identify gaps or misalignments, look for utility conflicts, and check clearances. You can also visually evaluate rail and sleeper placement, overhead line structures, signal sighting, station designs as well as try out multiple aesthetic treatments to reach the desired result. OpenRail Designer seamlessly integrates with LumenRT to create models and high-impact visuals and animations to effectively communicate the project to stakeholders for project approvals.

Incorporate real-world conditions into the design environment for better decision making.

OpenRail Designer CONNECT Edition At-A-Glance

Integrated CAD Capabilities

- Integrate data with OpenRail ConceptStation, MicroStation, ProjectWise, OpenBridge Modeler, AECOsim Building Designer, and other Bentley applications
- Support for managed workspaces
- Works across references files
- Include other engineering data (e.g. drainage) as referencing it to the DGN model
- Utilize an unlimited number of federated reference files
- Create and edit CAD elements
- Read and write to DGN and DWG files
- Supports design history
- Apply digital signatures using industry-standard encryption
- Secure digital rights definition for reviewing, printing, and editing
- Supports multiple raster formats
- Supports PostScript and HPGL2/RTL printing
- Use AccuDraw® and AccuSnap™ navigation tools
- Track annotation

Reality Modeling

- Reality mesh support
- Display of very large, photo-textured reality meshes produced using ContextCapture
- Editing of meshes (remove facets, fill holes)
- Automatic ground extraction
- Breakline extraction
- Efficient 3D modeling using sections and templates
- Mesh classification to enrich mesh with data from many sources
- Orthoimage extraction on any axis
- Generation and manipulation of cross sections
- Production of 3D PDFs and iModels
- Read/write standard data formats for:
  - » 2D/3D CAD graphics
  - » ASCII/text data
  - » LandXML
  - » LiDAR data: ASCII and LAS
  - » USGS digital elevation models
  - » Photogrammetric data
  - » Raster files

- ECW (unlimited), PDF, IMG, JPEG 2000, BIL, DOQ, FLI, SPOT CAP, and Digital Image Map
- TIFF (1-to 32-bit), GEOTIFF, iTIFF, COT, CIT, RLE, CALS, PCX,
- IMG, BUM, TG4, INT, RGB, TGA, JPEG, RLC, RS, HMR,
- BMP, and IKONOS 3 (Red), and 4 (NIR) bands from GeoEye
- Compression schemes: Deflate, Pack-Bits, CCITT3, CCITT4
  » Contour maps
- Import and analyze point-cloud data
- Merge surfaces automatically
- Update surface data dynamically

Point-cloud Processing
- Fast display and visualization of billions of points
- Drape and snap elements
- Classification editing
- Smart Snap
- Batch tile export
- Pointools, POD, LAS, and XYZ file export
- Extraction of planar and cylindrical elements
- Linear feature extraction
- Re-color points for flexible presentation
- Class management for any type of presentation style
- Definition of custom classes
- Point-cloud colorization from orthophotos
- Clip and section manager
- Support of geographic coordinate systems

Scalable Terrain Modeling
- Creation of scalable terrain models (STMs)
- High-performance display of very large digital terrain models (DTMs)
- Display modes for smooth shading, smooth shading with shadows, aspect angle, elevation, slope, contours
- High-resolution image draping on STM
- STM update and synchronization with DGN files, civil DTMs, point-cloud data, and XYZ files
- Calculate view shed from point or path

Geotechnical Integration
- Directly interface with gINT database
- Visualize and annotate borings in 2D
- Visualize and annotate borings with separate strata in 3D
- Create subsurface terrains from boring data

Terrain Modeling
- Create intelligent, data-rich and lightweight terrain models
- No need for secondary terrain analysis to represent the terrain display. Includes context sensitive re-symbolization for triangles, contours, linear features, slope vectors, color code for slopes, elevation banding, and aspect
- Create terrain models from a variety of import sources
  » Reality models
  » 3D graphical data automatically using graphicalfilters
  » ASCII/text data
  » Legacy data formats of InRoads, GEOPAK, and MX
  » Point clouds
  » LandXML
  » LiDAR data: ASCII and LAS
  » USGS digital elevation model data
  » Aerial data
  » Raster files
- Ensure live, federated, and intelligent terrain models when stored as a DGN element
- Maintain terrain models through the preservation of relationships to source data
- Ensure correct entry with undo/redo capabilities
- Standardize displays via element templates
- Use across multiple disciplines via reference files in a

comprehensive modeling environment
- Re-symbolization of display across multiple disciplines using a comprehensive modeling environment
- Control maximum length of triangles
- Control boundary conditions
- Create complex and clipped terrain models
- Interrogate the intelligent data rich 3D models
- Support for different features types including but not limited to boundaries, holes, voids, breaklines, inferred breaklines, and random points
- Model intelligent 3D real-world civil features (ditches, curbs, trees, and culverts)
- Context-sensitive intelligent editing of features
- Dynamic editing for
  » Extend, trim, and intersect features
  » Insert, move, and delete vertices
  » Delete, partially delete, break, or join features
- Manage large LiDAR datasets
- Exclude non-DTM features from triangulation
- Control density of points on linear features for optimal surface presentation
- Display cut and fill delineation
- View and edit feature properties
- Contour smoothing
- Major, minor, and depression contours
- Automatic and manual contour labelling

Rail Modeling
Specialist Rail Geometry
- Support for rail geometry definitions: Clothoid, Cubic Parabola, Bi-quadratic Parabola, Bloss, Sinusoid, and Cosine
- Support for rail transitions defined transition length or the spiral constant

Turnouts
- Single, Double, Diamond Crossings, Single Slip, Double Slip
- Built in Libraries; Austria, Germany (heavy and light rail), Holland,
- India, Italy, Russia, South Africa, Spain, Switzerland, United
- Kingdom, United States, and Canada
- Custom libraries can be defined
- Turnout application on curves, turnout bending
- Rule based application, automatic healing of geometry and connections
- Easy design of complex connections and geometries with civil geometry

Regression
- Least squares method to calculate best-fit alignments
- Dynamic regression analysis
- Automatic sorting of point readings
- Horizontal and vertical regression
- Curvature diagram to help users identify curves, tangents, and spirals
- Convert rail readings to centreline, calculate existing vertical and cant
- Easy selection tools for regression points both on plan and curvature view
- Automatic placement of spirals

Speed Tables
- Speed tables, speed assignment for different sections of the track
- Speed transitions
- Alternative speed selection; commuter rail, freight rail, express…
- Automatic or manual creation, based on geometry and design standards

Cant
- Cant calculation; equilibrium cant, applied cant, cant deficiency, rate of change of applied cant, rate of change of cant deficiency, and cant gradient

- Cant diagram
- Automatic identification of design problems
- Virtual transitions

Rail/Sleeper Calculation
- Precise rail calculations based on curvature and cant
- Track widening application
- Rail joints
- Sleeper placement, long sleepers on turnout areas

Swept Envelope Analysis
- Custom train definitions, with articulation and bogie definitions
- Swept envelope using curvature and cant values
- 3D representation of envelope for clash detection
- 2D projection of swept envelope

Overhead Line Electrification
- Design rules and geometry based calculations to determine foundation locations
- Span equation and span lookup tables
- 3, 4, 5 span overlap definitions. Insulated, uninsulated overlaps and natural sections
- Simple and stitched wire runs. Precise contact, catenary and dropper wire height and length calculations
- Cant and geometry based stagger calculations
- Return and feeder wire placement
- Parametric 3D cells for structure calculations
- Moment calculations for mast and foundation selection
- Foundations, masts, single or multiple cantilever sets, and portal definitions
- Automated placement of additional OLE equipment; end wire tensioning, mid wire tensioning, jumpers, anchorage…
- Full 3D model with structures and wires
- Schematic 2D representation of OLE system
- Profile drawings and quantity reports
- Cross sections with dimension and quantity annotation for manufacturing

Rail Signals
- Rail signal library with asset tags
- 2D and 3D representation of signals
- Signal sighting analysis

Core Modeling
- Model multiple design scenarios
- Edit designs dynamically
- Automatic model updates driven by design intent
- Design time visualization with automatic material assignments
- Undo/redo capabilities
- Interactively interrogate federated 3D models with dynamic cross sections
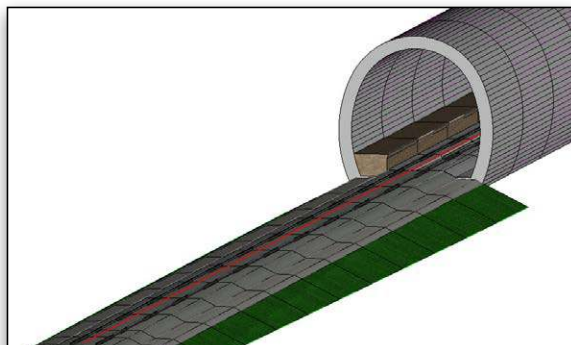
Model with design intent using OpenRail Designer's new and innovative technology that captures, stores, and maintains design associations and relationships.

- Manage 2D/3D models and display representation
- Rule-based superelevation control of the model
- Use enhanced clipping and point controls
- Integrate and utilize CAD graphical elements in the model
- Create model reports dynamically
- Generate plan ready cross sections
- Utilize WYSIWYG features – control display of cross sections by simply turning on/off reference files
- Adheres to regional design standards

Dynamic Geometric Design
- Interactive geometry tools
- Enhanced integration with AccuDraw® and AccuSnap™ through CivilAccudraw
- Multiple vertical geometries supported per alignment
- Design time standards input and feedback with errors and warnings in Civil Message Center
- Store rules and relationships between geometric elements
- Create horizontal/vertical by PI method or by elements
- Offset tools for easy creation of complex yard layouts
- Create circular and parabolic vertical curves
- Create arc and chord horizontal curves
- Support for multiple spiral definitions including chlothoid, bloss, cosine, sinusoid, biquadratic parabola, cubic parabolas
- Support complex geometry: SCSCS, SCCS, etc.
- Support tangential and non-tangential curves
- Edit elements associatively and dynamically
- Define curves by radius, degree of curvature, and pass-through points
- Edit, delete, and join elements
- Support delta angles greater than 180°
- Annotate alignments and points with object attribution, geometric properties, stationing, dynamically and automatically
- Additional annotation tools for one-off object labeling
- Review and report geometry in variety of customizable formats
- Perform design checks dynamically or in batch processes
- Display 3D geometry

Template Libraries
- Support for surface and linear templates
- Include components, end conditions, and features
- Create components for real-world objects such as lanes, curbs, walls, ditches, and barriers
- Define parametric components graphically
- Apply constraints to components
- Place component points as free, partially constrained, or fully constrained
- Set constraints as horizontal, vertical, sloped, projected, vectors, offsets, and elevations
- Constrain end conditions partially or fully
- Set end conditions to trace existing surfaces such as rock
- Drag-and-drop assembly of templates from components and end conditions
- Perform graphical tests to verify design

Corridor Modeling
- Edit designs dynamically
- Blend horizontal and vertical geometry with 3D topography and typical sections
- Assign component control points to existing or designed features and geometry, controlling horizontal and/or vertical location
- Assign automatic overrides
- View plan, 3D model, profile, and cross section interactively
- Provides heads-up dynamic, interactive parametric design
- Level of detail user definable output
- Surface priority definable by target aliasing
- Transition among disparate templates

- Apply exceptions for bridges, voids, and special end conditions
- Clip model capability
- Edit stations dynamically
- Apply superelevation text tables, customizable calculations, or AASHTO standards
- Allows dynamic editing of superelevation
- Assists problem resolution through intelligent color coding of transitions, and super runout
- Component meshes provide direct volumetrics from the 3D model based on level of detail
- Reflect edits automatically in quantities and volumes
- Control component display via rules

Subsurface Utilities
- 3D modeling
- Create 3D utility model relative to topography and alignments
- Support interconnected network of pipes, curved pipes, channels, culverts, manholes, pumps, catch basins, and inlets
- Create associative and dynamic model-based designs
- Create storm, sanitary, or combined hydraulic networks
- Build utility models directly from survey data
- Identify graphics as utilities and drape relative to DTM
- Display all network and utility objects in sections and profiles
- Display as realistic 3D models for effective collaboration
- Identify conflicts among utility elements as well as among utilities and other 3D data
- Label all attributions in any view or include in user-defined reports
- Create user-defined attributes for any required data
- Draw 3D models of utility structures as full 3D shapes for easy clash detection
- Hydraulic design and analysis
- Analyze and design using industry-standard theorems such as Mannings, Colebrook-White, Bernouli, and continuity equations
- Analyze and design based upon HEC 22, FHWA, HDS 5, 10, 13, Rational Method, Wallingford Procedure, and regression equations
- Analyze and design using steady state gradually varied flow, and run simulations using unsteady state time-varying flow
- Compute Tc using methods such as TR-55, HEC-22, and Kinematic Wave
- Compute losses using methods such as SCS CN, Green and Ampt, Horton, Initial, and Constant Rate
- Compute runoff using methods such as Rational, Modified Rational, ILSAX, SCS, and Unit Hydrograph
- Use demand and demographic tables
- Supports infiltration, population, peaking factors, and land usage
- Compute or specify flows
- Define custom intensity-duration-frequency tables
- Generate drainage queries and customized reports
- Color code based upon queries or styles
- Calculate pond volumes
- Create input and output hydrographs
- Design inlet and outlet control structures
- Use PondMaker for inflow/ storage/outflow optimization

Reporting and Project Deliverables
- Live documentation capable
- Automate project delivery process with drafting and drawing preparation tools
- User definable annotation tools for plan, profile, and section labelling
- Extract sections, drawings, and reports directly from completed 3D model
- Automate sheet generation for plans, profiles, and cross sections
- Select from more than 550 included report formats
- Modify included reports easily in any text or XML editor
- Provide standard reports for bridges, superelevation, clearances, data collection, geometry, sections, DTM, legal descriptions, design, visibility, and more

- Compute volumes by surface to surface (triangulated surface comparison)
- Compute volumes by 3D objects

Plan, Profiles and Cross Sections
- Create/generate plan, cross sections and profiles along alignments, graphics, or between points
- Create directly from 3D model and supports federated multi-discipline models
- Include vertical alignments and existing and proposed surfaces
- Automatic user-defined annotation of points and segments
- Additional annotation tools available for one-offs
- Cut cross sections orthogonally or at skew
- Create custom cross sections
- Dynamic update for cross sections and profiles via referencing

China Rail High Speed Rail Track

Quantity Management
- Extraction of quantity take-offs for estimating
- Element pay item attribution
- Report quantities by entire project or delineate by sheets, stations, area, or phase
- Generate linear, area, and volume quantities
- Modify sample reports or create custom reports through XML style sheets
- ODBC link capable for fully customizable reporting

Visualization
- Walk/drive through interactively or along a defined path or corridor
- Visualize paths through the project relative to design control by offsets and vehicle speeds
- Predefined materials applied to components enabling realistic rendering
- Position sun for geographically defined locations to ensure realistic shadow patterns
- Animate vehicles in traffic lanes without additional software
- Populate 3D objects along linear paths and within designated areas
- Apply traffic paint striping plans to the 3D model
- Use sample vehicle library and plantings
- Image draping on DTM or 3D objects
- MicroStation®-based rendering
- Real-life textures
- Lighting effects
- Elevation and perspectives
- Creation of fly-throughs and animations
- Creation of 3D PDFs
- Support for engineering data, point cloud, reality meshes
- Seamless integration with LumenRT for real-time, immersive presentations
- Solar and shading analysis

Publishing

- Export directly to machine guidance
- Supports iModel creation (includes 2D and 3D geometry and business data)
- Support industry standards, such as LandXML
- Export alignments, surfaces, and other pertinent design information to other systems via XML
- Generate PDFs and 3D PDFs
- Direct plotting
- Integrate with Google Earth™

Integration with Bentley Content Management and Publishing Solutions

- Component-level integration with ProjectWise® for collaborative design and engineering project management
- Integration with ProjectWise® InterPlot® for automated plot set generation and web-based access to plot archives
- Integration with Bentley® Navigator for design review, construction simulation, or automated clash resolution
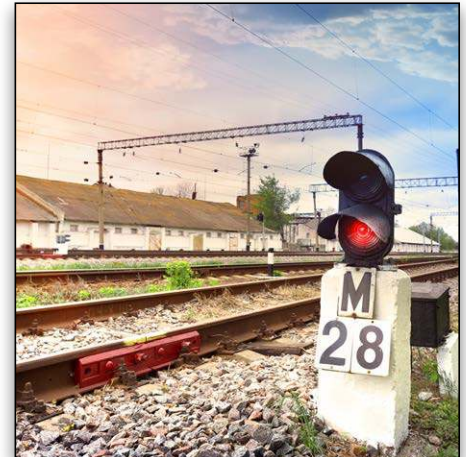
Use OpenRail Designer to help improve project deliverables by broadening the construction documentation and data production to meet project deliverables.

Bentley®
Advancing Infrastructure