



Bentley® Rail Track

Rail Infrastructure Design and Optimization

Bentley Rail Track is a comprehensive application for preliminary and detailed 3D design of rail infrastructure. The software offers a high degree of automation to established industry workflows and delivers significant productivity improvements and time savings for design and maintenance of rail projects.

Flexible, Versatile and Configurable Tools Drive Up Productivity

Sharing the same track geometry model as Power Rail Overhead Line – Bentley’s application for traction power supply design – and bringing into play all aspects of the alignment, Bentley Rail Track allows users to optimize horizontal and vertical track geometry to reduce project costs. Comprehensive functionality for turnout and switch placement with built-in design checks promotes adherence to project standards.

Bentley Rail Track can be configured to support a wide range of international standards, providing engineers and designers with the flexibility and control necessary to deal with real-life design scenarios on global rail infrastructure projects.

The software adapts readily 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.

Addressing horizontal and vertical track geometry – as well as yard, depot, station layouts, earthworks, and ballast – users can generate realistic 3D models for analysis and project visualization; create reports for cost estimates and setting-out; and produce fully annotated project drawings and deliverables for client approval and construction.

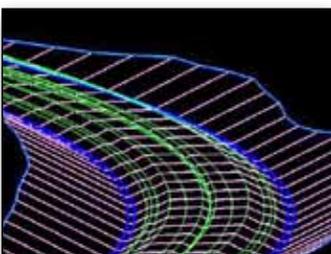
With Bentley Rail Track’s extensive toolset, users can create horizontal and vertical geometry complete with all railhardware; perform horizontal and vertical regression analysis,

cant, and superelevation design; and analyze geometry as concurrent, integrated activities. An intuitive graphical user interface provides easy access to an impressive set of interactive geometry tools for on-screen placement, modification, and extension of alignments.

The software delivers Civil AccuDraw, a civil-specific version of MicroStation® AccuDraw®, a precision drafting tool that anticipates the user’s intent, reducing the number of mouse clicks and other actions required to achieve drafting tasks. Civil AccuDraw streamlines the drafting process by supporting civil-specific drafting conventions, with options for stations and offsets, bearings and distances, azimuths, and more.

Bentley Rail Track offers unparalleled capabilities to create, maintain, and analyze geospatial information as part of the rail infrastructure asset lifecycle. The software facilitates integration of geospatial data within engineering workflows, allowing users to enforce industry and topological standards as well as define and observe the behavior of geographic objects. Bentley Rail Track provides engineering accuracy, CAD flexibility, and easy-to-use GIS tools in one, fully compatible environment.

In Bentley Rail Track, turnouts – including fundamental types based upon international standards – are stored in a user-definable library and placed dynamically. Toolbars can be customized, grouping commonly used tools for repetitive tasks



Adapts readily to any rail design and maintenance workflow.



Integrate cant and horizontal design to ensure compliance with design standards.



An extensive toolset enables users to perform regression and alignment analysis, horizontal design, and cant and superelevation design as concurrent, integrated activities.

or specific workflows, to more rapidly evaluate design alternatives. Advanced functionality, such as curvature diagrams, slew diagrams, interactive track editing, automated cant and superelevation analysis, and tight integration with Bentley® ProjectWise® – Bentley's project collaboration system for connecting people and information across project teams – completes this best-of-class application.

Field Data Import and Analysis for Faster Project Start Up

An all-in-one rail solution, Bentley Rail Track offers a full complement of functionality that enables users to work seamlessly with survey, GPS, LiDAR, and other forms of field data. The Text Import Wizard streamlines import of track geometry data for existing alignments, regardless of whether rail survey data is for rails or the track centerline. Built-in tools automatically sort and convert data to horizontal, vertical, and cant alignments for regression analysis and use downstream in the design process. When the design is complete, design data can be uploaded to data collectors for stakeout or machine guidance devices for site preparation.

Adaptable Alignment Tools Help Accelerate Design

Bentley Rail Track provides a complete set of coordinate geometry (COGO) and advanced alignment capabilities – true geometric tools that give users unlimited options to dynamically edit and manipulate geometry interactively via graphics or through precision key-ins. Users can place elements with varying degrees of freedom – from free, to floating, to fixed – and define vertical parabolas or circular vertical curves with vertical transitions to achieve successful results. To accommodate the various horizontal transitions required on rail projects, the software delivers comprehensive mathematical and associated cant transition algorithms. A check integrity function locates discontinuities and highlights potential issues, such as nontangential curves, for resolution or correction.

Integrated Cant Design Improves Project Compliance

The integration of cant and superelevation with the horizontal design process provides users with immediate visual confirmation of compliance to design standards. The software possesses the innate ability to compute equilibrium cant, applied cant, cant deficiency, rate of change of applied cant, rate of change of cant

deficiency, and cant gradient. The computed transition lengths and applied cant can then be adjusted to optimize the alignment to all cant criteria, including the deployment of virtual transitions where required.

Standard Turnout, Switch and Crossing Library to Promote Standardization

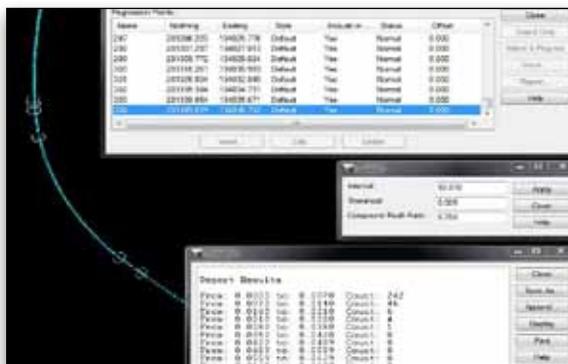
Bentley Rail Track provides comprehensive functionality for placement of turnouts, switches, and crossings as parametric components. Users can quickly place turnouts using the standards libraries provided. Included are standards for:

- Austria
- Germany (heavy and light rail)
- Holland
- India
- Italy
- Russia
- South Africa
- Spain
- Switzerland
- United Kingdom (113As and NR60s)
- United States and Canada (AREMA)

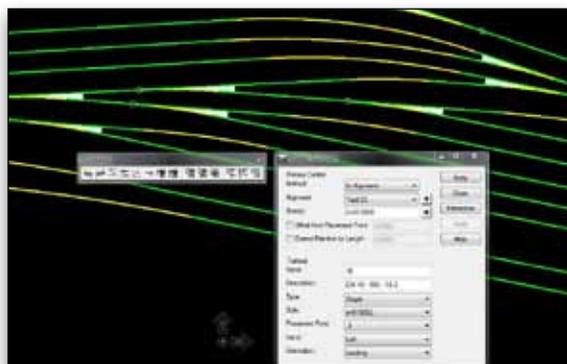
Users can create complex geometries based upon bending and flexing rules. Alternatively, users can create their own turnout designs and save them to libraries for future use. The software handles turnouts, single and double slips, and diamond crossings. The Connection Editor is used for more advanced geometric connections such as crossovers and sidings. Designs can be edited at any stage in the process, changing the turnout type or position dynamically. At the same time, the software maintains defined design rules and relationships – automatically “healing” turnouts and thereby increasing productivity while saving time, lowering the margin for error, and promoting design ingenuity.

Regression Analysis for Efficient Matching of Track Geometry

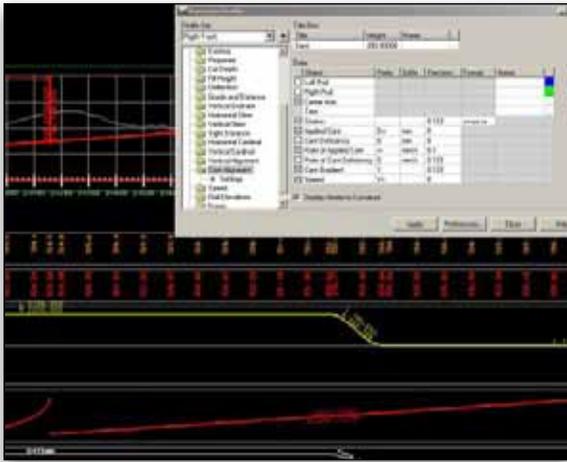
Bentley Rail Track's single and multiple element regression analysis employs a rigorous least squares method to calculate best-fit alignments. Regression tools provide users with a quick and easy way to match existing track geometry more precisely. Regression analysis is an essential step in any track maintenance or upgrade project, and Bentley Rail Track helps optimize the new design alignments by limiting slews and lifts. Bentley Rail Track also includes powerful, but easy-to-use, curvature diagrams to help users identify curves, tangents, and spirals – ensuring the regression tools provide the



Compute least squares regression analysis for best-fit alignments.



Place turnouts quickly using libraries of standard turnouts from many countries.



Validate designs visually and numerically using plan and profile annotation.

results required for track re-alignment. Regression points can be derived from the centerline or rail survey (including cant data), and can be weighted by users for fixity during analysis to maintain critical points or ensure minimum clearance is achieved. Analysis results are quickly viewed and points can be added or deleted from the regression analysis, providing users complete control throughout the engineering process.

Light Rail Support for Greater Control During Fabrication and Construction

Bentley Rail Track accommodates the requirements of light rail design, fabrication, and construction. The software enables users to create detailed light rail elements – rails, joints, switch points, crossing points, and distance keepers – and produce all drawings, reports, and specifications needed for fabrication of jointed rail, pre-bent rail, and multiple rail types.

Feature-Based Modeling Ensuring Accurate Representation of Existing Infrastructure

The software enables users to create intelligent, 3D topographic models containing track information, terrain data, railbed, and related site features. The model may also contain other corridor features – roadways, utilities, drainage, etc. Intelligent features are visually distinguished by structure, style, and graphical symbology. Surface models are formed using proven and tested triangulation methods and may represent existing topography, design, or a combination thereof. Intelligent modeling allows users to incorporate features such as rails, ballast edges, drainage, and other topology into the model. Features may be non uniformly occurring points or breaklines that represent connected linear segments – ridges, edges of ballast and roadways for example. Interior voids (holes) may represent building footprints, lakes, or areas of null information. Models may be bounded by an exterior boundary feature formulating the exact edge of modeled or collected data.

Powerful 3D Modeling for Streamlined Corridor Design and Improved Decisions

Bentley Rail Track offers in-context, smart design of 3D rail corridors with Roadway Designer. Roadway Designer streamlines the complex development of virtually every aspect of a corridor in a single, parametric presentation. Users can travel along a corridor viewing and dynamically designing closed shapes that represent

“man-made” materials – such as ballast, sub-ballast, sleepers, and related structures – in concert. The software automatically produces dynamic volumes to aid in balancing cut-and-fill.

Roadway Designer displays four-port views of the design in plan, profile, cross section, and cant or superelevation. As work progresses, users experience immediate visual feedback in all views. Rail corridors are easily modified by direct manipulation of parametric graphical components or by precision input in context-sensitive dialog boxes. The unique features of Roadway Designer allow users to target known existing features, enabling models to conform to on-ground demands. As designs develop, color-coding displays potential problem areas. Roadway Designer enables users to test design decisions before they are applied.

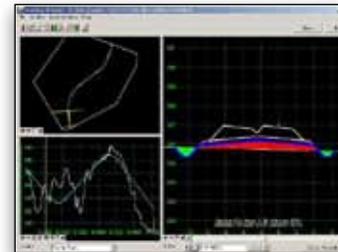
Roadway Designer offers state-of-the-art design automation.

From horizontal alignment, vertical alignment, and surface information, the software generates 3D models of the full track corridor using user-defined typical sections including earthworks or end conditions. The software automatically ensures conformance to standards as it speeds the corridor development process. When widening sub-ballast and sub-grade, Roadway Designer automatically creates transitions according to user design criteria. Users can interactively edit cant and superelevation on the fly.

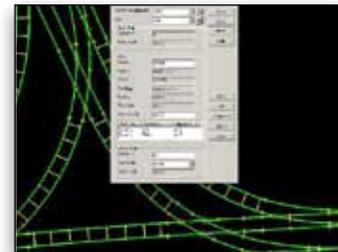
Users easily modify and create intelligent design components – no programming required – and apply design constraints for sleek control of the 3D parametric modeling process. Components can be open- or closed-shape and include multiple construction layers, barriers, slopes, and ditches. Roadway Designer automatically creates surfaces for generating cross sections, performing volume calculations, and aiding visualization and rendering. Users can also merge components to create a single surface, or create a surface of the entire rail corridor.

Visual Design Verification to Identify Deficiencies or Physical Conflicts

Design verification has never been easier. Bentley Rail Track allows users to virtually drive through the 3D model and visually inspect for any design deficiencies or physical conflicts. In 3D QA, engineers can fully view track features from all angles to identify gaps or misalignments, look for utility conflicts, and check clearances. They can also visually evaluate sight distances, signaling, and other track-side infrastructure, as well as try out multiple aesthetic treatments to reach desired results. Using Bentley Rail Track rendering features – such as color fill, shading, lighting, and backgrounds – improves the design at any phase and adds a level of assurance in project constructability.



Optimize design of ballast, formation, roadway, and earthworks.



Streamline light rail design, fabrication, and construction.



Pinpoint areas of non-conformance with design checks.

System Requirements

Prerequisites

MicroStation V8i (Version 08.11.05),
AutoCAD 2008, 2009 or 2010

Processor

Intel Pentium-based or AMD
Athlon-based PC or workstation

Operating System

Microsoft Windows XP Professional
(SP2 or higher), Windows XP Profes-
sional x64, Microsoft Windows Vista
or Windows Vista x64, Microsoft
Windows 7 or Windows 7 x64

Memory

1 GB minimum, 2 GB recommended
(more memory typically results in
better performance)

Disk Space

1 GB minimum free hard disk space
(which includes 400 MB install
footprint for complete installation)

Find out about Bentley at www.bentley.com

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Global Office Listings

www.bentley.com/contact

Users can quickly place turnouts from standards libraries. Alternatively, users can create and add their own designs to the libraries.

Design Validation, Annotation and Reporting to Reduce Checking Cycles

Bentley Rail Track includes built-in design checks to highlight areas of non-conformance to the selected design standard. Functionality ranging from simple checks against parameters – including design speed, applied cant, and cant deficiency in the Cant Alignment Editor – to more comprehensive checks against specific country standards enables users to identify and resolve problems early in the design process.

Users can also create a dynamic Swept Envelope Analysis using track geometry and a library of 3D vehicle objects. Used extensively in light rail and metro projects, this tool ensures clearance to surrounding infrastructure and between vehicles on adjacent tracks.

In addition, designs can be visually validated using curvature, lift, and slew diagrams, as well as numerically using plan and profile annotation. Bentley Rail Track uses XML/XSL technology to report all geometry (horizontal, vertical, and cant) and modeling results – delivering greater format flexibility when creating reports.

Storm and Sanitary Network Design Tools for Fast, Accurate Computations

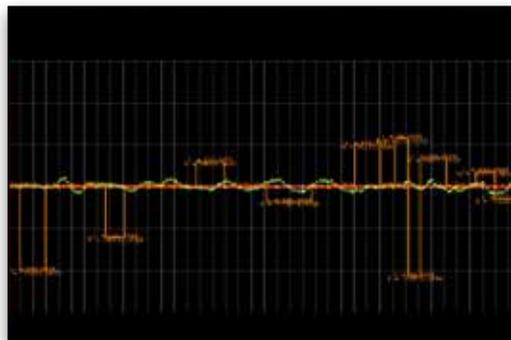
Bentley Rail Track provides a comprehensive toolset for surface and wastewater collection systems, allowing users to interactively create a 3D associative model relative to the existing ground, design models, and track geometry. Users can manipulate networks in plan or profile views, displaying the Bentley Rail Track drainage model, as well as other utilities modeled in the software. This allows users to plan for clash avoidance and identify potential problem

areas before they occur. Users can model, analyze, and design complete storm water and sanitary sewer networks, replete with inlets culverts, channels, catch basins, manholes, pumps, and pipes.

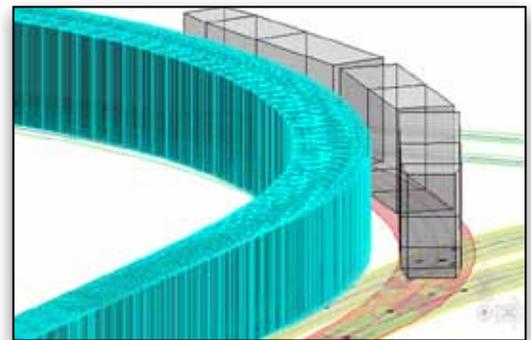
A robust set of computation tools account for the full array of surface runoff conditions and perform design checks to ensure conformance with minimum and maximum requirements using industry standard hydraulic methods for system design and analysis. Rational, Modified Rational and Soil Conservation Service Unit hydrograph modeling and pond-routing routines calculate hydrologic impacts for pond sizing and outflow characteristics. Users can create the full set of hydrographs, drawings, and reports.

Intelligent Project Deliverables to Support and Enhance Workflows

Bentley Rail Track provides design, volumes, and cross section data in the XML industry standard format for data exchange and reporting. Project data can be delivered in a variety of formats, including Excel spreadsheets, HTML or text files, PDFs, printable documents, and other output. Reporting tools automate the production of numerous standard reports – including horizontal and vertical alignments, curvature diagrams and/or slew diagrams, quantity takeoffs, clearance reports, stakeout, surfaces, and more. The software outputs standard formats for Trimble, Topcon, and Leica for machine-controlled grading and machine guidance, as well as Plasser & Theurer (ALC and WinALC systems) and Matisa tampers (the PALAS system) for construction.



Validate designs visually with curvature, lift, and slew diagrams.



Dynamic Swept Envelope Analysis ensures clearance to surrounding infrastructure and between vehicles on adjacent tracks.