



InRoads®

Proven Technology for Designing and Sustaining Transportation Infrastructure

Bentley's InRoads gives engineers the flexibility to work the way they want with the power they need to complete their infrastructure projects. Leveraging Bentley's flagship product, MicroStation, InRoads provides complete drafting capabilities, powerful mapping tools, and design automation for civil transportation professionals. InRoads features constraint-driven, 3D parametric modeling with an innovative approach to designing civil components in a total-project context.



Provides divided highway design with independent horizontal and vertical control.



Includes excellent tools for commercial industrial land development as well as environmental remediation.

Civil Information Modeling

Today's engineers and designers face a paradigm shift. No longer are documents just for the current project or construction. An engineer must provide information and designs that can carry beyond construction into operations, maintenance, and rehabilitation – and back to design if necessary. InRoads uniquely supports this evolution of civil engineering information, encompassing the entire civil project lifecycle. The information-rich modeling of InRoads integrates with CAD, mapping, GIS, and even business tools like 3D PDFs, offering power that makes the most of the engineer's acquired knowledge while supporting traditional, proven methodologies.

Design Sophistication

InRoads is used for roads and highways, railways, and public works projects as well as commercial, industrial, and environmental land development. The software provides a greater level of design sophistication than standard tools through the application of design rules. Users are able to work in multiple views and dimensions. For roads and highways, Bentley's unique Roadway Designer provides an all-in-one visual tool for 3D parametric design of the complete road corridor. This and other fully developed capabilities produce impressive improvements in the areas of design productivity and project accuracy.

Project Versatility

Extremely versatile, InRoads is used for all types and phases of civil projects, large and small, by users of every level of expertise. The software integrates all aspects of the civil project, from corridor studies to final design and production of construction deliverables. It handles a wide variety of complex

tasks such as interchange design, roundabout design, site development, and production of construction staking reports.

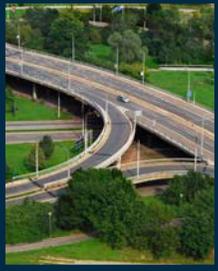
Flexible and Configurable

InRoads and MicroStation deliver all the drafting and drawing production capabilities needed to complete your project. And the strengths of InRoads are enhanced by Civil AccuDraw, the civil-specific version of MicroStation AccuDraw® – an intuitive, 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 station and offsets, bearings and distances, azimuths, and more.

Because workflows can vary widely depending on the scope of the project, InRoads offers users the flexibility to work in ways that best suit their specific needs. The software is fully configurable, enabling users to customize the InRoads environment to meet project standards or personal preferences. Roadway libraries streamline repetitive tasks across projects and promote rapid evaluation of design alternatives for critical decision making. InRoads automates the production of a complete array of design deliverables. Embedded project management capabilities help users stay on top of all project components and deliverables – capabilities that are tightly integrated with Bentley's ProjectWise® project collaboration system for connecting people and information across project teams.

Working With Field Data

InRoads enables users to work with survey, GPS, LiDAR, Point Cloud, and other forms of field data. The software's flexible data import tools allow users to import a broad array



InRoads features intelligent, intuitive 3D Civil Information Modeling for the full lifecycle of civil and transportation projects.

of existing topography information. Users can modify and process the data as needed, and when the design is complete, produce construction data for stakeout or automated machine guidance for site preparation.

Integrated Mapping

InRoads contains a comprehensive set of mapping and GIS data compilation and editing tools. These tools allow the engineer to combine engineering and GIS data for better decision processing in preliminary design, account for sensitive issues like wetland mitigation, and even publish maps for public approvals. The design process expands to enforce business and topological rules and adhere to administrative restrictions. By combining engineering and mapping tools, Bentley brings CAD and engineering design accuracy, ease-of-use, and efficiency to GIS. Overall, users make better-informed decisions through analysis, visualization, and presentation and better communicate through stunning maps and intelligent PDFs.

Feature-Based Surface Modeling

InRoads enables users to create intelligent models containing not only terrain data but also roadway or site features. Features are visually distinguished by structure, appearance, and symbology. The software uses triangulated surfaces to represent terrain – for both existing ground and proposed design. Intelligent digital terrain modeling (DTM) lets users incorporate features such as roadway centerlines, pavement edges, or ditches in the surface model. These can be random features for non-uniformly occurring points or breaklines that represent features connected in linear segments— as in the case of ridges, edges of pavement, and curbs. Interior

voids or holes represent building footprints, lakes, and so on.

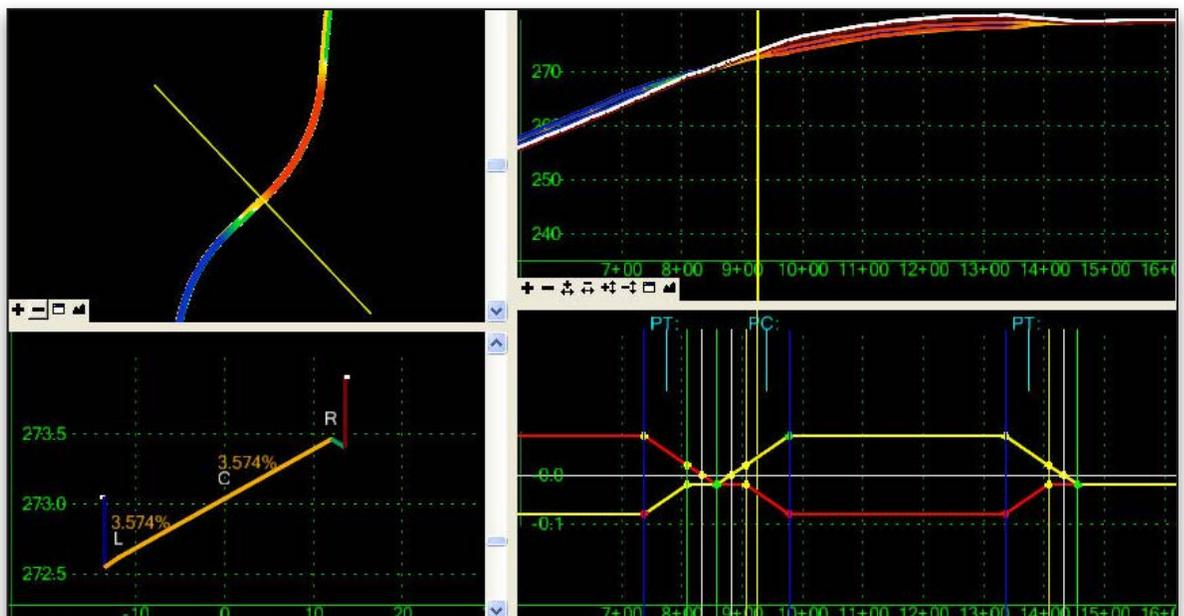
Exterior-boundary features can be placed around surface areas to maintain cut-and-fill lines in proposed designs. In addition, other topography features are represented in the 3D model, including utilities (both above and below ground), buildings/pads, or any topological data collected.

Flexible Geometry Creation

The full complement of coordinate geometry (COGO) and advanced alignment design capabilities of InRoads enable fast creation of precision horizontal and vertical alignments as the three-dimensional roadway is developed. Elevation profiles display surface information as well as vertical alignments associated with horizontal alignments. A combined, true 3D alignment constructed from the horizontal and vertical definitions can be displayed in the plan view. The software supports unrestricted viewing with unlimited geometry editing and manipulation either graphically or with precision key-in. A check integrity capability locates and allows removal of discontinuities and highlights other potential issues, such as non-tangential curves for resolution/correction.

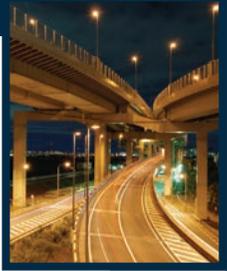
In-Context Road Design

InRoads offers in-context, smart design of 3D road corridors with Roadway Designer. This tool streamlines the complex development of every aspect of the roadway in a single, parametric presentation. Users can move rapidly along a corridor at controlled intervals, viewing and dynamically designing all roadway components in concert. The software automatically computes dynamic volumes to balance cut and fill.



Design interactively in plan, profile, cross section, and superelevation using Roadway Designer.

Roadway Designer's interactive, 3D modeling capabilities combine parametric, constraint-driven tools with engineering theorem, keeping engineers in total control over all software decisions.



Roadway Designer displays four-port views of the design – plan, profile, cross section, and superelevation. Users see immediate visual feedback in all views as the work progresses. The roadway is easily modified by direct manipulation of parametric graphical components or by precision input in context-sensitive dialog boxes. Roadway Designer's unique capabilities enable users to target known existing features. This allows the model to conform to on-ground demands. Color coding shows potential problem areas as the design develops. Users can test design decisions in Roadway Designer before applying them.

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 corridor using predefined

typical sections. The software automatically ensures conformance to standards as it speeds the corridor development process. When widening roads, Roadway Designer automatically creates transitions in numbers and widths of lanes in accordance with user design criteria. Users can interactively edit superelevation on the fly. End conditions can be computed at any point in the process.

Users can easily modify and create design-intelligent components—without programming – and apply design constraints that offer sleek control of the 3D parametric modeling process. Components can be open or closed shapes and include curb and gutter sections, sidewalks, asphalt layers, aggregate layers, medians, barriers, slopes, and ditches. Roadway Designer automatically creates surfaces for use in creating cross sections, performing volume calculations, and aiding visualization and rendering. Users can also merge components to create a single design surface or create a model of the entire corridor.



Designed with InRoads, this project by Creighton Manning Engineers features intelligent 3D modeling, machine controlled grading and stakeless construction and inspection.

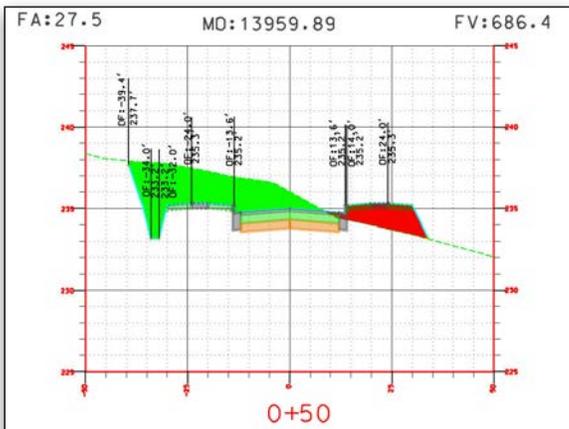
Visual Design Verification

Design verification has never been easier. InRoads allows users to virtually drive through the 3D corridor model and visually inspect it for any design deficiencies or physical conflicts. In 3D QA, engineers can fully view road features from all angles to identify gaps or misalignments, look for utility conflicts, and check clearances. They can also visually evaluate sight distance, pavement marking, and signing as well as try out multiple aesthetic treatments to reach the desired result. Using InRoads with MicroStation's rendering features – for example, color fill, shading, lighting, and backgrounds – improves the design at any phase and adds a level of assurance in project constructability.

Comprehensive Results Evaluation

InRoads provides flexible creation of cross sections from any baseline. Custom cross sections can be cut at skewed angles or broken-back sections, singly or in multiple groupings. The software automatically annotates each cross section as determined by the user or standard. A full array of civil components can be included in the cross section, including surface features, storm and sanitary structures, roadway components, and notations such as limits or stationing.

Users can choose from a variety of volume calculations that greatly enhance accuracy over traditional methods. Sophisticated end-area volume calculations let users determine the level of accuracy based on the frequency that cross sections are cut. Using this method, InRoads also recognizes components in the cross section and accurately computes component volumes. The software offers the flexibility to process volumes based on straight-line or curved



Use end-area volume calculations to allow for compaction factors, removal of undesirable material, and correction for curvature.

System Requirements

Processors:

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

Operating Systems:

Microsoft Windows 7, Windows 7 x64, Windows Vista, Windows Vista x64, Windows XP Professional (SP3 or later)

Memory:

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

Disk Space:

405 MB free disk space required

Input Device(s):

Mouse or digitizing tablet (Digitizing tablet requires vendor-supplied WINTAB driver or Bentley's Digitizer Tablet Interface, the latter included with InRoads installation.)

Find out about Bentley at www.bentley.com

Contact Bentley

1-800-BENTLEY (1-800-236-8539)
Outside the US +1 610-458-5000

Global Office Listings

www.bentley.com/contact

alignments. Calculation methods include Triangle Volume from Surfaces, Hybrid Triangle Volume by Station and Volumes by Grid Approximations. InRoads handles multiple surface types—existing, designed, and substratum—and can ignore or void surfaces for calculation.

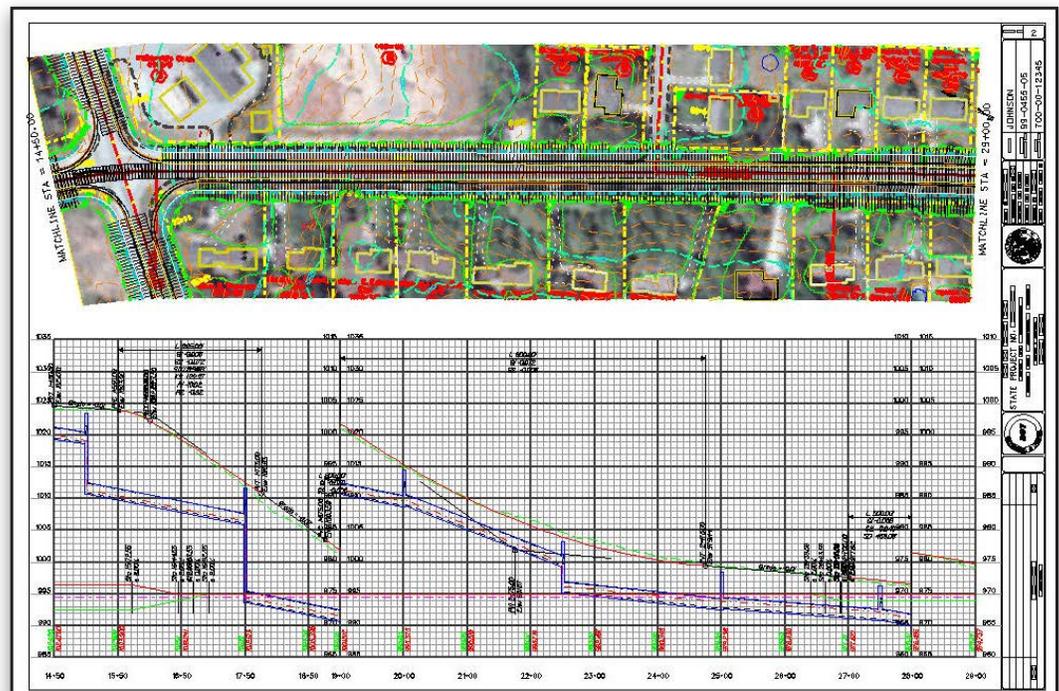
Site Design

For site design, InRoads includes Bentley's dynamic Site Modeler, enabling engineers and designers to interactively create and manipulate models relative to one another. The dynamic setting allows users to move, rotate, and edit individual models and see the impact to adjacent models or to the entire project model. Additional site design tools are tailored to the specific requirements of site engineers, offering interactive site feature modeling within the intelligent terrain model. This allows users to manage every aspect of the land development process. The software accounts for lots, parcels, boundaries, property takes, right-of-ways, and other aspects

of land ownership. It automates design for a full range of site features—including ponds, drainage ditches, building pads, and cul-de-sacs. Sophisticated surface-to-surface analysis helps users accurately balance earthworks and pinpoint best case construction scenarios.

Project Deliverables

InRoads provides design, volume, and cross section data in XML industry-standard format for data exchange. Project data can be used in multiple formats, including Excel spreadsheets, HTML or text files, PDFs, printable documents, and other output. Reporting tools automate the production of a variety of standard reports, including horizontal and vertical alignments, quantity takeoffs, clearance reports, stakeout, legal descriptions, surfaces, and more. InRoads provides full support to create legal descriptions. The software outputs standard formats for Trimble, TOPCON, and Leica for machine-controlled grading and machine guidance.



Produce a full array of contract deliverables.