



## Bentley MXROAD® Suite

Proven Technology for Designing and Sustaining Transportation Infrastructure

Bentley MXROAD Suite provides information-rich modeling integrated with CAD, mapping, GIS, and business tools such as PDFs, i-models, and hypermodels. The software features immersive, 3D parametric modeling with an innovative approach to designing civil components in a total-project context. MXROAD Suite is the design platform of choice of leading engineering design firms and global transportation agencies. Discover why transportation professionals around the world depend on MXROAD Suite.

### Powered by OpenRoads

OpenRoads is the underlying technology for Bentley civil engineering design products (GEOPAK, InRoads, MXROAD, and PowerCivil) that expands design boundaries by providing 3D modeling, design-time visualization, design intent, information mobility, and construction-driven engineering in a single application. OpenRoads technology preserves user equity in standards, deliverables, and legacy data while providing information modeling to drive intelligent infrastructure.

### Information Modeling

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 MXROAD Suite, the modeling process can start at the beginning of the project, resulting in intelligent 3D models that allow users to conduct preliminary analysis of the design and visualize the design real-time, ensuring accuracy and maintaining project costs. Model-centric, integrated designs ensure that any changes made in the design are dynamically updated throughout the model, guaranteeing that the current design is readily available for all team members.

Information modeling expands the boundaries of simple 2D or 3D geometric representations of a design by including the opportunity to capture and incorporate into the model all design-related information. The resulting intelligent model enables users to: make more informed and better high-impact decisions earlier in the design process with better, 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.

### Advanced Design

MXROAD Suite is used for roads and highways, railways, and public works projects as well as commercial, industrial, and environmental land development. Sophisticated design tools that use modeling process rules, relationships, and constraints enable the model to react to design changes and anticipate the engineer's design intent.

MXROAD Suite pushes the design envelope with the advent of civil cells – flexible, reusable design elements that can be as simple or complex as required. With civil cells users can preconfigure commonly used 2D and 3D geometric layouts while maintaining all design, constraint, and relational intelligence. Civil cells can then be repeatedly used in designs, ensuring standards are implemented, while accelerating design production.

### Ensure Engineering Intent

MXROAD Suite's design intent capabilities enable users to build associations and relationships between civil elements to ensure the design project is reflective of engineering intent. Object information (how, where, and by what method it was created) is stored with each object to insure the original intent is retained and honored in the design. If an element is modified, any related elements are automatically updated based on these stored relationships.

### Project Versatility

Extremely versatile, Power InRoads is used for all types and phases of civil projects, large and small, by users of every level of expertise. The software integrates every aspect 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, survey data reduction, site development, sanitary and stormwater network design, and production of construction staking reports.

### Flexible and Configurable

MXROAD Suite delivers all the drafting and drawing production capabilities of MicroStation® within a single application. The strengths of MXROAD Suite 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, MXROAD Suite offers users the flexibility to work in ways that best suit their



## *MXROAD Suite features intelligent, intuitive 3D information modeling for the full lifecycle of civil and transportation projects.*

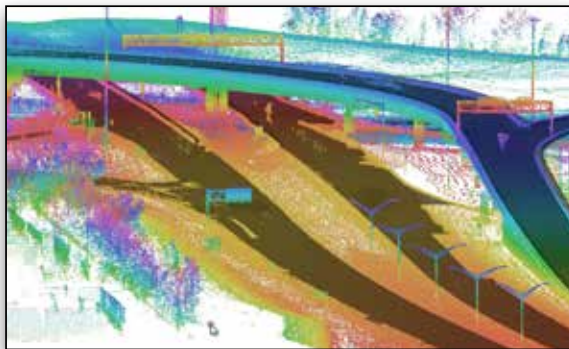
specific needs. The software is fully configurable, enabling users to customize the MXROAD Suite environment to meet project standards or personal preferences. Roadway libraries streamline repetitive tasks across projects and promote rapid evaluation of design alternatives for critical decision making. MXROAD Suite 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® system of collaboration servers and services for engineering information and project collaboration.

### **Complete Drafting, Visualization, and Publishing**

MXROAD Suite contains all the powerful creation, editing, viewing, visualization, and publishing capabilities of MicroStation, Bentley's flagship product, in a single, powerful civil design application. Whether placing simple CAD graphics, labeling and detailing plans for final production, or providing a walk-through of a rendered design model, MXROAD Suite does it all. The software also supports over 50 raster formats, including many geo-referenced formats, to aid engineers and designers in creating designs and solving engineering challenges. Because no project is complete until the results are published, MXROAD Suite includes capabilities to print and plot to popular devices, specify plot variables for size, scale and symbology, and publish to Adobe PDF – including 3D PDF.

### **Working With Field Data**

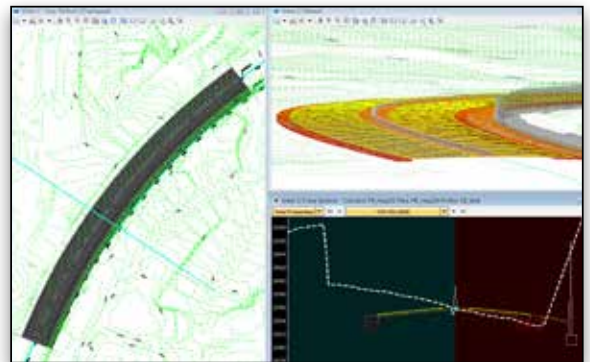
An all-in-one solution, MXROAD Suite excels at data acquisition enabling users to work with any field data available for their design or survey projects. From photogrammetry and total station surveys to GPS, LiDAR, and point clouds, the software can upload, analyze and manipulate field data, while ensuring the provenance of the original data. The software supports the leading devices and formats, handling a broad array of existing topography information. Adjustments are calculated using any of the industry-standard methods. Users can modify and process the data as needed and when the design is complete, upload design data to data collectors for stakeout or automated machine guidance for site preparation.



*MXROAD Suite can incorporate an unmatched range of point-cloud data of any scale to provide context for designs and accelerate the design process.*

### **Integrated Mapping**

MXROAD Suite 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.



*Combine plan, profile, and cross-section workflows with innovative 3D modeling technology and the result is immersive modeling.*

### **Feature-based Surface Modeling**

MXROAD Suite 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 MXROAD Suite 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

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



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 nontangential curves for resolution/correction.

### **In-context Road Design**

MXROAD Suite provides in-context, smart design of 3D road corridors with intelligent corridor modeling tools. The software 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.



*The Parsons Brinkerhoff and Arup joint venture used Bentley civil software to create 3D models to ensure design quality, support coordination among project teams, and provide accurate data for construction set-out.*

Use immersive modeling with parametric design tools to dynamically view the design in plan, profile, cross section, and super elevation. 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. The unique modeling capabilities of MXROAD Suite 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. MXROAD Suite 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, the software automatically creates transitions in numbers and widths of lanes in accordance with user design criteria. Users can interactively edit super elevation 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

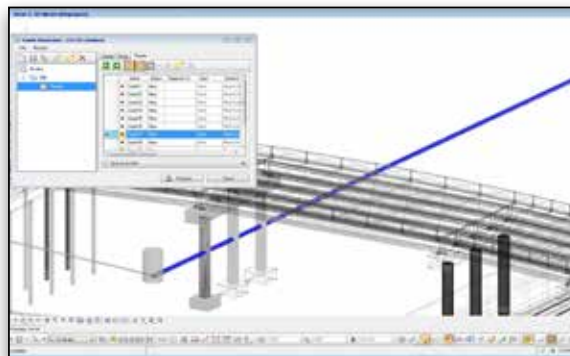
open or closed shapes and include curb and gutter sections, sidewalks, asphalt layers, aggregate layers, medians, barriers, slopes, and ditches. MXROAD Suite automatically creates surfaces for use in creating cross sections, performing volume calculations, and aiding visualization and rendering. Users can also merge components to create a single design surface or create a model of the entire corridor.

### **Advanced Pavement Rehabilitation and Renewal Modeling**

MXROAD Suite features intelligent parametric, intuitive 3D pavement layer design with overlay modeling that allows for the full lifecycle of civil and transportation projects. MXRenew and MXUrban provide interactive, 3D modeling capabilities that combine parametric, constraint-driven tools with engineering theorem, keeping engineers in total control over all software decisions while optimizing the design to reduce construction costs.

### **Visual Design Verification**

Experience designs real-time with MXROAD Suite's constraint driven templates, context sensitive, intuitive interface, and dynamic 3D modeling. Visualize the design at any time and on demand within the modeling workflow. No translations, software, or special workflow process is needed. Users can 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 MXROAD Suite 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.



*Move dynamically along the 3D corridor for design verification, visual clash detection and modeling quality assurance.*

### **Comprehensive Results Evaluation**

MXROAD Suite provides flexible creation of cross sections from any baseline. View updates on the fly as the design is modified with dynamic cross sections. Grab a and move a particular point along the corridor and watch as updates are instantly reflected in the design. With Immersive modeling capabilities, readily view the ground



## System Requirements

### Processor

Intel® Pentium®-based or AMD Athlon®-based processor 3.0 GHz or greater

### Operating System

Microsoft Windows 8, Windows 8 x64, Windows 7, Windows 7 x64, Windows Vista, Windows Vista x64, Windows XP Professional (SP3 or later), Windows XP x64

### Memory

2 GB minimum, 4 GB recommended, (more memory typically results in better performance)

### Disk Space

2 GB minimum free disk space

### Input Device

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

## Find out about Bentley at: [www.bentley.com](http://www.bentley.com)

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changing to reflect the design changes. 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, MXROAD Suite 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 alignments. Calculation methods include Triangle Volume from Surfaces, Hybrid Triangle Volume by Station, and Volumes by Grid Approximations. MXROAD Suite handles multiple surface types – existing, designed, and substratum – and can ignore or void surfaces for calculation.

### Storm and Sanitary Network Design

A comprehensive application for surface and wastewater collection systems rounds out MXROAD Suite. The software provides the ability to interactively create a 3D associative model relative to the existing and design ground models as well as road and site geometry. Users can manipulate networks in plan or profile views, displaying not only the MXROAD Suite drainage model but also other utilities modeled in MXROAD Suite. This allows users to plan for clash avoidance and identify potential problem areas before they occur. Users can model, analyze, and design complete stormwater 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. Industry-standard hydraulic methods are used to analyze and design the systems. Rational, Modified Rational, and Soil

Conservation Service unit hydrograph modeling and pond-routing routines calculate hydrologic impacts for pond sizing and out-flow characteristics. Users can create the full set of hydrographs, drawings, and reports.

### Project Deliverables

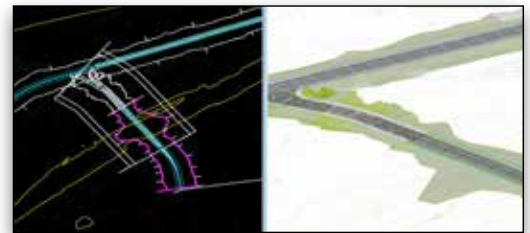
MXROAD Suite makes it easier for users to follow standards than to break them. The result is better quality, consistent documentation in less time, without headaches. In addition, its capability to instantaneously synchronize the model and the representative drawings simplifies and automates the drawing composition process. Since all deliverables adhere to the same project standards and come from the same model, the result is high-quality documentation in which the entire project team can be confident. MXROAD Suite 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. MXROAD Suite provides full support to create legal descriptions. The software outputs standard formats for Trimble, TOPCON, and Leica for machine-controlled grading and machine guidance.

### Accelerated Project Delivery

MXROAD Suite provides enables engineers and designers to work faster, smarter, and more efficiently to help accelerate project delivery with capabilities such as civil cells, design constraints and relationships, design time visualization, and dynamic model updates. Civil cells accelerate design production by using repurposed design layouts. Design, constraint, and relational intelligence are maintained between elements to ensure design standards. The software helps reduce production time with dynamic cross section updates reflected throughout the design and modeling process. Dynamic updating ensures that the design automatically stays up to date and eliminates time spent making design edits on older versions of the project.



*Empowers simple and complex bridge modeling integrated with roadway design.*



*Accelerates design production through repurposing of commonly used 2D and 3D geometric configurations as civil cells.*