



IMAGE COURTESY OF IMAO

Bentley®
Advancing Infrastructure

Mapping and Surveying

Reality Modeling for Going Digital Strategy

Reality modeling makes mapping and surveying faster and safer.

Reality modeling is the process of capturing existing site conditions to provide real-world digital context. Rapidly changing environments and difficulty accessing clear survey lines can make it challenging and dangerous to gather accurate spatial data with traditional surveying and mapping methods. Adopting reality modeling can improve margins by offering users engineering-ready reality meshes, orthophotos, digital surface models, and point clouds faster than before.

ContextCapture, Bentley's reality modeling software, automatically generates high-fidelity 3D reality models from simple photographs and/or point clouds. These photos can be taken from a variety of devices and techniques, including aerial LiDAR, drone photography, hand-held cameras, laser scanners, and smart phones. The process brings new opportunities to optimize workflows to win projects.

Users can implement high-definition photography and, when needed, the additional accuracy of point clouds, to gather the information needed to create high-fidelity georeferenced 3D models, reducing health and safety risks for works at dangerous sites. These 3D reality models are quickly generated for users to incorporate into their design, construction, and operation workflows.

Provide digital context during design workflows

Reality modeling accelerates the decision-making process with advanced knowledge and insight into existing site conditions.

- Carry out construction simulations to evaluate potential impacts
- Uncover financial implications early
- Optimize information sharing
- Improve collaboration

Accelerate project delivery during construction workflows

Reality modeling gives an accurate perspective of the job site, allows monitoring and evaluating of progress, and enables verification of a job performance with the design.

- Ease collaboration between stakeholders
- Provide up-to-date construction documentation and inspection
- Allow the calculation of cut/fill quantities as often as necessary
- Improve safety
- Lower costs of as-built survey

Improve the operations and maintenance of assets

Reality modeling helps to better manage assets through easily documenting assets in 3D and linking 3D-registered equipment to operations and engineering data.

- Optimize maintenance and service activities
- Lower cost of asset inspection
- Reduce safety risks
- Develop more repeatable inspection processes
- Provide easier access of hard-to-inspect locations
- Safeguard against asset downtime

Bentley's reality modeling solutions allow you to securely manage, share, and stream 3D reality models across project teams and software applications, increasing team productivity and collaboration.

Reality modeling is going mainstream and the following innovative mapping and surveying projects have credited it for their success.

Pennsylvania State University, Department of Architectural Engineering

University Park, Pennsylvania, United States

Virtual Penn State Campus

The University Park campus located in State College, Pennsylvania is Penn State University's largest of 24 campuses, featuring almost 1,000 buildings and structures with numerous assets contained within each facility. To more efficiently meet campus operations and maintenance demands, the university developed a reality model of the campus that integrates geospatial and asset work order data.

Using Bentley software, the team generated a detailed, geospatially accurate 3D reality mesh of the campus and surrounding area from 2,500 aerial images in less than two days. They integrated geospatial and asset work order data from the university's own geospatial information system and computerized maintenance management system with the reality mesh. As the collaborative storage interface, ProjectWise provided web-based access to the model, which eliminated the need for computer storage space and model transfer time, and also improved information sharing among stakeholders to optimize campus facility and asset management.

Project Playbook: ContextCapture, MicroStation, ProjectWise



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The Virtual Penn State initiative, which used Bentley's ContextCapture, iModel capabilities, and ProjectWise to create an accurate and complete model of campus and overlay CMMS data, has provided both initial and potential benefits for maintenance activities for the Office of Physical Plant. An immediate benefit of the initiative was the ability to visualize accurate locations of work orders, which can increase response and performance by combining technician trips to work orders. Future benefits include the availability of the virtual model to perform façade inspections and develop work orders from the campus model, based on critical repairs that influence life-safety.

— Craig R. Dubler, Facility Asset Management (FAM) Program Manager,
Pennsylvania State University

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Self-driving cars are no longer a futuristic idea. Major auto manufacturers have already released, or are soon to release, self-driving features that give the car some ability to drive itself. Through the 3D mesh generated using Bentley ContextCapture Center software, Sanborn's Advanced Technology group has been able to showcase the quality of the HD Map data, including true-ground-absolute accuracy than those found in current conventional resources, to its partner automotive firms. The automation of producing 3D models for city-sized projects by ContextCapture made the project much faster than previously possible.

— Sharad V. Oberoi, Director of IT & Software Engineering, Sanborn Map Company

Sanborn Map Company, Inc.

Santa Clara County, California, United States

*Sanborn3D HD Maps for Autonomous Driving:
Santa Clara*

Operating self-driving vehicles safely will require the cars to have purpose-built, map-based data sets that contain detailed mapping information with absolute, precise accuracy compared to the results from current geospatial positioning system resources. To address this need, the Sanborn Map Company developed proprietary HD mapping technology that created high-precision, 3D maps of California's Santa Clara area, specifically for use in autonomous vehicle models. The company needed a way to showcase the quality of its mapping data to its partner automotive firms.

The team used ContextCapture to generate a 3D reality mesh from oblique imagery of Santa Clara County, and integrated its HD map data to create a virtual simulation tool for testing autonomous cars. ContextCapture automated the process of creating a high-quality model that, using traditional methods, would have required a team of 3D modelers working for six months at an estimated cost of USD 100,000.

Project Playbook: ContextCapture, Descartes

Tianjin Municipal Engineering Design & Research Institute

Shenzhen, Guangdong, China

Application of BIM in East Grade-separated Junction Engineering of Yangang, Shenzhen

In China's Guangdong province, the Shenzhen municipal government retained Tianjin Municipal Engineering Design & Research Institute to design a grade-separated junction for a multi-road crossing in Yangang. The complex intersection covered 236,000 square meters and required expertise in bridge and tunnel engineering, among six other disciplines. The Institute's approach for this CNY 1.19 billion project was to adopt collaborative BIM technology.

From initial reality modeling of the project site with ContextCapture to renderings with LumenRT for final design reviews, Bentley software provided a unified 3D design platform that allowed the Institute to work quickly and accurately. By establishing a standard for visual management, the Institute enabled every discipline to find and eliminate conflicts, which saved one month during preliminary design. The BIM process reduced costs by 12 percent.

Project Playbook: LumenRT, ConstructSim, ContextCapture, MicroStation, Navigator, OpenRoads Designer, ProjectWise



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Bentley's software for civil infrastructure has incomparable advantages in the design and construction of municipal roads and pipe rack engineering. It can provide one-stop solutions that express the design intention in a better manner, improve design efficiency, and reliably solve the problems faced in the construction process.

— Yanxiang Wang, Designer of Raw Water Engineering, Tianjin Municipal Engineering Design & Research Institute

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By using Bentley software and services all the disciplines of our institute can perform 3D design throughout the whole process. It not only improves the technological level and design quality of our institute, but also lays a solid foundation for the appreciation of our designs and the launch of the whole lifecycle.

— Yi Yang, Director of Digital Center, Guangdong Research Institute of Water Resource and Hydropower

Guangdong Hydropower Planning & Design Institute

Guangdong, China

Guangdong Pearl River Delta Water Resources Allocation Project

The Pearl River Delta Water Resources Allocation project is a CNY 34.7 billion urban water conservation and supply initiative in the Guangdong province of China. It includes 114.9 kilometers of water lines and shield tunnels running through four cities. Guangdong Research Institute of Water Resource and Hydropower is responsible for planning and designing the project, which is expected to resolve water shortage issues and improve water supply.

The project team used Bentley applications to generate and refine 3D reality models of the planned locations and to produce animations that provided stakeholders with an intuitive understanding of the project. The team used Bentley software for clash detection, which reduced design time by 1,500 hours and saved nearly CNY 250,000 in design costs. Streamlined workflows enabled the team to deliver the project 23 days ahead of schedule.

Project Playbook: AECOsim Building Designer, Bentley Raceway and Cable Management, ContextCapture, Descartes, LumenRT, Bentley Map, MicroStation, Navigator, OpenRoads, OpenRoads ConceptStation, OpenRoads Designer, OpenRoads Navigator, ProjectWise, Bentley Substation

Shanghai Hangyao Information Technology Co., Ltd.

Shanghai, China

Aerial Photography by Unmanned Aerial Vehicles for Shanghai Disney Resort

The Shanghai Disney Resort is located in the Pudong New Area of Shanghai and is the first Disneyland in mainland China. Prior to its official opening in June 2016, Shanghai Hangyao Information Technology used UAVs to capture aerial photography of the 9.78-square kilometer resort area and surrounding terrain to produce full-scale, live action 3D models. The survey and reality modeling provided a means for collecting overall information on the resort that will be used to optimize security, improve area construction, promote tourism, and serve as effective advertising.

The project team used ContextCapture to generate 3D reality information models from multiple data types. These accurate models helped streamline collaboration among the resort's construction, operations, and maintenance teams, improve communication among stakeholders, and made the model accessible by diverse users via a web-based application. Bentley's reality modeling technology enhanced modeling accuracy and efficiency by several times and reduced direct costs by millions of Yuan.

Project Playbook: ContextCapture



The 3D, live-action information models established by Bentley's ContextCapture not only objectively demonstrate the conditions of 3D models, but also contain rigorous mathematical relations.

— Yanning Wang, Deputy Managing Director and CTO, Shanghai Hangyao Information Technology Co., Ltd.



About Bentley Systems

Bentley Systems is a global leader in providing engineers, architects, geospatial professionals, constructors, and owner-operators with comprehensive software solutions for advancing the design, construction, and operations of infrastructure. Bentley users leverage information mobility across disciplines and throughout the infrastructure lifecycle to deliver better-performing projects and assets. Bentley solutions encompass MicroStation applications for information modeling, ProjectWise collaboration services to deliver integrated projects, and AssetWise operations services to achieve intelligent infrastructure – complemented by comprehensive managed services offered through customized Success Plans.

Founded in 1984, Bentley has more than 3,500 colleagues in over 50 countries, \$700 million in annual revenues, and since 2012 has invested more than \$1 billion in research, development, and acquisitions.

For additional information, visit www.bentley.com.

About ContextCapture

ContextCapture is Bentley's reality modeling software that can quickly produce 3D models of existing conditions for infrastructure projects of all types, derived from simple photographs and/or point cloud. Without the need for expensive or specialized equipment, ContextCapture enables users to quickly create and use these highly detailed 3D engineering-ready reality meshes to provide precise real-world context for design, construction, and operations decisions throughout the lifecycle of projects. Project teams can easily and consistently share reality modeling information, consumable and accessible, on desktop and mobile devices, in many formats, including native use within MicroStation for any engineering, operations, maintenance, or GIS workflow.

For additional information, visit www.bentley.com/ContextCapture.