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Bentley[®]
Advancing Infrastructure

Utilities

Reality Modeling for Going Digital Strategy

Reality modeling provides accurate, affordable, real-world digital context to utilities

Stakeholders in utilities require the most up-to-date site information throughout their assets' lifecycles allowing them to make informed decisions. With reality modeling technologies and solutions, utilities owner-operators can monitor onsite asset conditions while reducing costs, saving time, and lowering risks of injuries to workers.

Reality modeling is the process of capturing existing site conditions using photographs and point clouds to create high-fidelity, georeferenced, 3D models. Assets can be easily documented and 3D-registered infrastructure can be linked to operations and engineering data. These capabilities provide a complete, up-to-date representation of the asset as a single, digital source, which can be easily shared and streamed in other software applications for better asset management. All involved parties—from remotely located stakeholders, to engineers in the office, to workers in the field—can be connected and assist in the asset design, construction, operation, and inspection workflows.

Reality modeling enables users to design in digital context

- Understand existing conditions
- Save design time and shorten project schedules
- Carry out construction simulations to evaluate potential impacts
- Uncover financial implications early
- Optimize information sharing
- Improve collaborative design workflow

Reality modeling offers continuous survey capabilities during construction

- Ease collaboration between stakeholders
- Give accurate global perspectives of the job site
- Provide up-to-date construction documentation
- Allow the calculation of cut/fill quantities as often as necessary
- Improve safety
- Lower cost of as-built survey

Reality modeling helps utilities optimize maintenance and service

- Ensure workers have access to real-world digital context of their assets
- Improve safety
- Ease collaboration between stakeholders
- Lower cost of asset inspection
- Develop more repeatable inspection processes
- Provide easier access to hard-to-inspect locations

Reality modeling is going mainstream and has been used in the following utilities projects.

Pacific Gas and Electric Company

San Francisco, California, United States

Reality Modeling in Bentley Substation

Pacific Gas and Electric Company (PG&E) owns and operates more than 1,000 transmission and distribution substations, spanning two-thirds of California. With 95 percent of its USD 1 billion substation budget spent on brownfield locations, PG&E had been manually converting existing 2D drawings to 3D models for use on retrofit projects. That time-consuming process has been replaced by reality modeling based on image capture and processing.

The Substation Engineering Department has reduced the cost of substation modeling by 50 percent with the use of UAV imagery and processing with ContextCapture. Taking one-third less time than previously used methods to create, the highly accurate 3D reality models are referenced into Bentley Substation to model the existing substation in 3D for use in substation design. Using ProjectWise to share the models among design teams, PG&E now has one source of information in a centralized location.

Project Playbook: Bentley Substation, ContextCapture, Descartes, MicroStation®, ProjectWise®

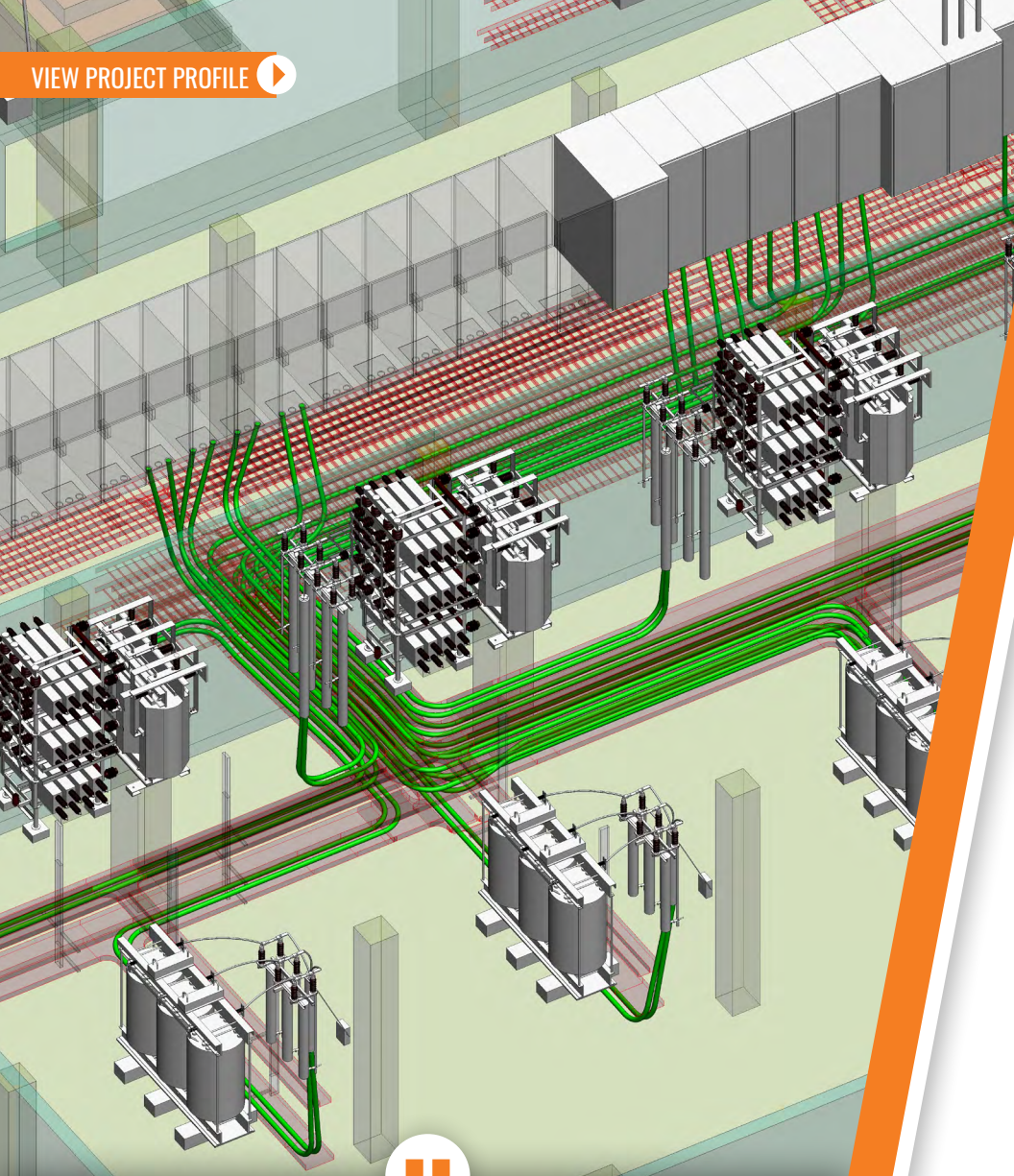


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Having a complete 3D model at the time of constructability review allows us to measure electrical and physical clearance in real time, which helps eliminate costly conflicts during construction phases.

With today's increasing substation complexity and decreasing substation footprint, having a 3D model is a must.

— Ralph Hansen, Construction Supervisor, Pacific Gas and Electric Company



Bentley's digital solution has been fully applied across disciplines and stages of the Miaoshan 220-kilovolt Secondary Transformer Substation project, bringing both social and economic benefits. The solution is a significant improvement to design efficiency and quality, and provides strong technical support for construction, operation, and maintenance.

— Wang Wei, Digital Center Team Leader, Hubei Electric Engineering Corporation

Hubei Electric Engineering Corporation, Subsidiary of POWERCHINA Limited

Wuhan, Hubei, China

Miaoshan 220kV Secondary Transformer Substation

Hubei Electric Engineering Corporation (HEEC), a subsidiary of POWERCHINA Limited, designed a CNY 172 million indoor secondary transformer station to meet Year 2030 energy demands in excess of 400,000 kilovolts (kV) in the Wuhan East Lake High Tech Zone, Hubei province, China. The scope of the work involved the layout and design of a three-story facility housing three sets of 240-megavolt ampere transformers and providing 220kV, 110kV, and 10kV outgoing lines that consider the constraints of the dense urban location.

HEEC designed the substation and facilitated project collaboration using Bentley Substation, OpenBuildings Designer, Bentley Raceway and Cable Management, ContextCapture, ProStructures, and ProjectWise. ProjectWise allowed the multi-discipline team to work in a unified model space, increasing efficiency and helping to solve clashes in the complex indoor layout. Avoiding rework in at least 10 instances saved CNY 2 million. When completed, this substation will optimize the High Tech Zone's power grid and improve the quality of life for more than 400,000 people.

Project Playbook: Bentley Raceway and Cable Management, Bentley Substation, ContextCapture, OpenBuildings™ Designer, ProjectWise, ProStructures

Hubei Electric Power Survey and Design Institute

Macheng, Hubei, China

Macheng Caijiazhai Wind Farm Project

The CNY 435 million Macheng Caijiazhai Wind Farm Project in China's Hubei province is generating 49.5 of the planned 80 megawatt capacity for supplying power to Macheng City. As the general contractor, Hubei Electric Power Survey and Design Institute was responsible for designing and constructing the wind generating sets, pylons and bases, booster station, and associated equipment.

Low mountain ridges and steep slopes posed a challenge for locating the wind generating sets, designing the booster station access road, and transporting large-scale equipment. The institute used Bentley technology to create a landform reality model to resolve locations and routes. Hybrid models combining the reality model and 3D design models of the project informed construction, saving more than CNY 200,000 and shortening the construction period by 20 days.

Project Playbook: AssetWise® ALIM, Bentley Substation, ContextCapture, LumenRT, OpenBuildings Designer, OpenRoads™, ProjectWise, ProStructures



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We used the hybrid model consisting of landform reality model and 3D models of booster station and fan to demonstrate the final panorama. In conjunction with the decomposition of the model's details and simulation of construction and transportation, we enabled the management team to have a full understanding of the whole project's construction process before starting the project's construction.

— Hubei Electric Power Survey and Design Institute



POWERCHINA Hubei Electric Engineering Co., Ltd.

Miluo City, Hunan, China

Technology Application in Miluo Western 220kV Substation Project

The Miluo Western 220-kilovolt substation will enhance power reliability to 150,000 users in Hunan, China. The substation is the State Grid's first 3D pilot project that employed 3D design standards during construction. For the CNY 113.2 million project, POWERCHINA Hubei Electric Engineering needed to implement 3D digital collaborative design and provide digital twin models to the State Grid for substation operation and maintenance within a 10-month timeline.

POWERCHINA used ContextCapture to create the digital context. Including landscaping, waterways, and houses in the model helped to support substation planning. The team used Bentley Substation and OpenBuildings to optimize design and collaboration. SYNCHRO for 4D reduced construction helped visualize and track progress. By adopting digital twins, the team improved construction coordination to complete the project in nine months, saving CNY 1.5 million.

Project Playbook: Bentley Raceway and Cable Management, Bentley Substation, ContextCapture, LumenRT, MicroStation, Navigator, OpenBridge™, OpenBuildings Designer, OpenPlant™, ProjectWise, Promis.e®, ProSteel®, ProStructures, STAAD®, SYNCHRO™

Pacific Gas and Electric Company

Fresno, California, United States

Construction Sequencing for Brownfield Substations

Pacific Gas and Electric Company (PG&E) operates the Ashlan substation, providing power to over 30,000 customers. A USD 31 million project was initiated to reconfigure a 230-kilovolt section. The project required expanding the substation, placing the microwave tower for the best signal, and adhering to a tight timeline. The team had to maintain an uninterrupted power supply as well as a safe working distance between the existing energized equipment and new elements.

The project team used Bentley Substation to model the greenfield design, ContextCapture to create a 3D reality mesh of the existing brownfield conditions, and SYNCHRO to visualize the construction sequence. Using these applications, PG&E captured accurate measurements to optimally place the microwave tower. SYNCHRO's simulation and visualization features identified a dead-end structure that needed removal prior to on-site construction works, saving three to four days and USD 350,000 to USD 400,000 while eliminating on-site risks.

Project Playbook: Bentley Substation, ContextCapture, Pointools, ProjectWise, SYNCHRO





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Vilnius, Lithuania

Balsiai Power Lines

Lithuania's overhead power transmission lines generate energy to over 1.5 million customers and are subject to atmospheric conditions that require regular inspection to ensure reliability. Approximately 36,000 kilometers of overhead lines are inspected annually by crews conducting manual, visual surveys that are time consuming, subjective, and costly. To determine a more efficient and cost-effective assessment method, the project team initiated a pilot project to digitalize the inspection process.

The team used unmanned aerial vehicles to capture 295 photographs in one day, using ContextCapture to generate accurate 3D reality meshes for 860 meters of a 10-kilovolt power network line. Integrating detection devices to identify power network poles, insulators, and other components helped establish a digital twin to monitor the lines and determine defects and damages. Combining artificial intelligence with Bentley's 3D digital modeling application automated data synchronization and workflows to significantly improve electricity grid maintenance.

Project Playbook: ContextCapture



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About Bentley Systems

Bentley Systems is a leading global provider of software solutions to engineers, architects, geospatial professionals, constructors, and owner-operators for the design, construction, and operations of infrastructure. Bentley's MicroStation-based engineering and BIM applications, and its digital twin cloud services, advance the project delivery (ProjectWise) and the asset performance (AssetWise) of transportation and other public works, utilities, industrial and resources plants, and commercial and institutional facilities.

Bentley Systems employs more than 3,500 colleagues and generates annual revenues of more than \$700 million in 172 countries. From inception in 1984, the company has remained majority-owned by its five founding Bentley brothers.

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.