



TRC Implements Collaborative 3D Modeling to Deliver New South Street Substation

Bentley Substation Eliminated Construction Delays, Cost Overruns with Integrated Master Design Model

Project Summary

Organization: TRC

Solution:

Utilities Transmission and Distribution

Location:

Providence, Rhode Island,
United States

Project Objectives:

- Provide design and engineering services to rebuild and replace National Grid's nearly 100-year-old South Street Substation.
- Integrate existing conditions with the new construction while keeping the original substation operational.
- Produce 2D design deliverables to the client and complete the project on time and within budget.

Products Used:

Bentley Substation, Descartes, MicroStation®, ProjectWise®

Fast Facts

- Rebuilding and replacing National Grid's South Street Substation ensures reliable energy supply and supports economic development in Providence.
- The project was in a congested, highly visible area with a complicated design.
- TRC implemented a 3D collaborative modeling strategy and incorporated more than 2,000 files in different formats into an integrated design of the substation with Bentley Substation.

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- Bentley Substation optimized design, allowing critical subcontractor information from different design platforms to be integrated into a single master design model that was used for cross-discipline checking and clash detection.
- The fully integrated 3D model enabled the team to resolve issues prior to fabrication and construction, eliminating on-site construction delays and cost overruns.

Upgrading Aging Infrastructure

As part of its commitment to continue to deliver safe, reliable electricity to Providence, Rhode Island, and to accommodate electrical needs of future downtown development, National Grid initiated a project to replace the current South Street Substation, which was originally built in the 1920s. The project included rebuilding the 115/11.5/23-kilovolt indoor substation and relocating it to a prominent, congested area of Providence. TRC, an engineering, environmental consulting, and construction management firm, was awarded the engineering, procurement, and construction (EPC) contract. The contract required that three 115-kilovolt overhead supply lines be removed and converted to underground cable circuits, 27 existing 23-kilovolt and 11-kilovolt feeders be rerouted from the old facility to the new substation, and 47 sets of cables and 60 pieces of switchgear be rewired.

The new South Street Substation presented numerous design and coordination challenges amid an aggressive timeline and tight budget. Faced with these factors and the requirement to integrate existing conditions with the new construction while keeping the original substation operational, TRC needed collaborative, interoperable technology to optimize information sharing and integration among subcontractors, different disciplines, and various locations, and meet client demands to deliver 2D design files.

Collaborative Technology Facilitates Integrated Design

Given the many unique challenges that could be detrimental to both the budget and the schedule, TRC decided to implement collaborative 3D modeling using Bentley software to deliver the project. As a large, complex EPC project, TRC had numerous architectural, structural, and mechanical subcontractor files in CAD, Revit, and other file formats, as well as its own 3D files from the TRC civil group, to incorporate into the substation design. Using ProjectWise and Bentley Substation, TRC utilized resources from several offices and collaborated on over 2,000 CAD files and files in third-party formats.

With ProjectWise as the connected data environment for file sharing and secure storage, TRC had an indisputable record of all information received from the subcontractors, establishing a single source of truth for all project data. Bentley Substation allowed TRC to incorporate the critical information from the files within various 3D design platforms to achieve a fully integrated design model that was used for cross-discipline checking. Bentley's collaborative project management and modeling technology facilitated seamless information sharing, regardless of location, and the creation of a comprehensive 3D design, while still enabling TRC to meet National Grid's requirement for deliverables as a 2D MicroStation file.

Furthermore, using Bentley's electric substation modeling software facilitated design integration and provided significant insight to optimize the substation design. The models enabled TRC to perform full 3D walkthroughs of the station with the client, providing a visual representation that enhanced client understanding for a more efficient and effective review of the interior and exterior designs. The 3D models were also used in architectural renderings for the planning board and for public comment. TRC achieved a fully integrated design with Bentley's collaborative, interoperable design applications.

Intelligent 3D Modeling Reaps Benefits

Bentley Substation enabled TRC to create a coordinated, intelligent model that maximized efficiencies beyond the design phase. The ability to integrate critical subcontractor information in AutoCAD and Civil 3D allowed reviews that encompassed the entire design, facilitating a proactive strategy to identify issues prior to construction. Specifically, the project team identified a misalignment by integrating design files from the busway contractor into the Bentley Substation master 3D model, which was corrected by the subcontractor prior to fabrication. Given the complexity of design and congested bus duct area, "it is very unlikely this issue would have been identified prior to the bus duct being installed if we were using 2D files for design review," stated Jason Poissonnier, ProjectWise Administrator for TRC.

“The ability to incorporate different types of design files from subcontractors into the 3D model made the design reviews truly all-encompassing and resulted in identifying many areas in the needed redesign, thereby avoiding costly changes later during construction.”

*– Jason Poissonnier,
ProjectWise Administrator, TRC*

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Having a fully integrated 3D model optimized cross-discipline reviews and clash detection that revealed several areas requiring redesign due to interferences. Resolving these issues during the design phase saved significant time otherwise spent on reengineering a solution or waiting for a redesigned assembly on site during fabrication, installation, or construction. Working in the virtual modeling environment enabled a proactive design approach, eliminating construction delays and costly overruns to ensure the project was delivered timely and within budget. Bentley's interoperable technology provided all the advantages of integrated, intelligent 3D design, while still enabling TRC to meet client requirements for 2D MicroStation deliverables.

Innovative Technology Solutions for the Future

The successful delivery of the new South Street Substation represents National Grid's ability to provide critical upgrades to their infrastructure in a congested urban area to increase reliability and capacity for their customers. The new substation will prepare and promote the planned city growth and future I-195 redevelopment initiatives because a reliable energy source is essential for economic development in Providence. The new equipment and upgraded power lines feeding the station will meet the anticipated growth in residential and commercial electricity demands.



Bentley's collaborative modeling technology facilitated seamless creation of a comprehensive 3D design.