Aurecon Implements Collaborative 3D Modeling Approach at Zillmere Substation

Bentley Substation Optimized Design Accuracy to Ensure Seamless Integration with Existing Infrastructure

Refurbishing Aging Infrastructure

Energex builds, operates, and maintains electricity distribution networks serving Brisbane and other major urban areas in Australia. A provider of distribution services to almost 14 million domestic and business connections, Energex delivers electricity to approximately 3.4 million people in South East Queensland, Australia. According to a condition-based risk management assessment, Energex determined that the Zillmere Substation, currently supplying electricity to more than 13,000 homes and businesses in the surrounding Brisbane area, required refurbishment. The company is upgrading the 57-year-old facility to replace existing in-service equipment that had deteriorated, necessitating excessive maintenance on some of the 33-kilovolt (kV) circuit breakers and isolators.

Energex retained Aurecon to undertake primary plant design for the equipment that had reached retirement age. The project required Aurecon to produce detailed design documentation and bills of material for the replacement of 5 x 33 kV outdoor breakers, including foundations, 5 x 33 kV bus disconnectors and supporting structures, lighting masts, and the AC board, as well as for the installation of a new marshaling box.

Faced with integrating new replacement equipment with existing aging infrastructure, Aurecon needed collaborative technology to optimize communication between the different disciplines and locations, and with the client, while meeting client demands to deliver 2D design drawings. Aurecon relied on Bentley Substation to develop a 3D model based on as-built renderings to ensure deliverables allowed the client to complete construction with efficiency.

3D Modeling Facilitates Accurate Deliverables

With existing design templates already in MicroStation, Energex originally assigned the project to have drawings updated and completed in MicroStation and produced as 2D deliverables in accordance with their standards and specifications. However, with existing drawings in non-editable formats, Aurecon completed the designs using 3D modeling in Bentley Substation. By editing within the application, accuracy of drawings and bills of material were optimized and designs were integrated with existing substation equipment not earmarked for replacement. The team developed as-built 3D renderings from LiDAR scans of the substation site and combined them with the Bentley Substation model. Then, the team produced a virtual model at their Cape Town virtual reality facility, enabling a virtual site visit from almost 12,000 kilometers away, to resolve any potential issues prior to producing 2D client construction drawings.

Implementing a design strategy based on 3D modeling provided significant insight regarding the integration of the new equipment into the substation, and it ensured that the new replacement equipment was designed and fabricated to work with the existing equipment.

The comprehensive 3D model alerted Aurecon about the slope of the existing outdoor busbars, which were not 100 percent parallel to the ground or 100 percent plumb. As a result, it allowed them to guarantee the required lengths and bends of the parts were accurate and could be manufactured prior to installation on site.

Furthermore, because none of the substation equipment being designed had been previously modeled in 3D, the team had to develop project specific equipment cells. Using Bentley Substation not only ensured that the cells were developed in accordance with client format and information requirements, but also saved time verifying accuracy of material specifications and compiling precise bills of material for Energex. From the 3D substation model, Aurecon was able to automatically produce accurate 2D construction drawings to meet client-specific deliverables.

A Connected Environment

Working in Bentley Substation and ProjectWise provided a connected environment for project engineers in Australia and South Africa to collaborate and discuss the project through virtual site assessments and weekly telecom meetings for more effective quality reviews. Specifically, the 3D model of
the substation was shared with civil services to design the plinths for the equipment footings, and all services models were then integrated with the design model and registered in ProjectWise. The ability to share the model allowed Aurecon to obtain feedback from its peers and the client, based on a visual inspection of the developed design rather than waiting for the construction period to address design issues and constraints that could contribute to rework and additional expense. Working in a common design platform, the team was able to streamline workflows and ensure consistency, improving design efficiency and accuracy, illustrating the complex details of all the equipment requiring replacement, for seamless integration of the new equipment with the existing substation.

Bentley’s interoperable technology enabled Aurecon to implement an integrated 3D modeling approach that optimized collaboration and communication among different disciplines, locations, partners, and the client for a truly proactive solution that produced accurate 2D deliverables.

**Innovative Solutions for the Future**

Using Bentley Substation for the Zillmere substation project provided Aurecon the digital innovation to facilitate accurate design through effective, visual communication and illustration. The project demonstrated that working in a common design environment optimizes engineering by bringing together dispersed team members and stakeholders to produce a comprehensive 3D model.

The utilization of Bentley Substation ensured design quality, efficiency, and accuracy to overcome challenges and ensure seamless integration of new equipment with the aging transmission and distribution infrastructure.

The project-specific templates developed in Bentley Substation will unquestionably add value to similar projects in the future, where Aurecon can reuse the equipment cells already established. Augmenting collaboration and coordination through intelligent modeling, Bentley Substation ensures quality and accuracy, maintaining consistency across 2D deliverables and reports.

Aurecon is embracing the ever-changing engineering environment by investing in Bentley’s innovative technology solutions, promoting collaboration and relationship building between engineers and clients for a truly integrated design approach.

“Bentley Substation allowed us the opportunity to be proactive, accurate, innovative, and collaborative on a common design base between South Africa and Australia with a feeling of accomplishment.”

– Riaan Dippenaar

Project Engineer,

Aurecon Cape Town

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Aurecon created detailed designs of the 33kV circuit breakers and isolators with Bentley Substation.