**Project Summary**

**Organization:** Hubei Electric Engineering Corporation  
**Location:** Wuhan, Hubei, China  
**Project Objective:**  
- Design and construct a CNY 172 million indoor secondary transformer substation in China’s Hubei Province to provide reliable power supply for more than 400,000 residents.  

**Products used:**  
AECOM Building Designer, AssetWise, Bentley Navigator, Bentley Raceway and Cable Management, Bentley Substation, ContextCapture, ProStructures, and ProjectWise

**Fast Facts**

- Using ProjectWise together with Bentley’s 3D modeling technology facilitated an integrated design process allowing multiple disciplines to work in parallel, avoiding collisions and saving time and costs.  
- Importing the 3D engineering model as an i-model into AssetWise provided the lifecycle BIM component, capturing substation data and asset information to support operation and maintenance.  
- Reality modeling with ContextCapture avoided the demolition of four surrounding houses within the project site.  
- Bentley Navigator Mobile enhanced decision making to reduce design time by 20 days and model review by 30 days.

**ROI**

- Bentley’s 3D integrated design solutions and collaboration technology optimized design accuracy and information mobility, saving more than 65 labor days and CNY 2 million in project costs.  
- Reality modeling with ContextCapture provided context for the planning and design of the station site and cable layout, bypassing the civil and residential infrastructure. Stated Wei, “Real 3D models set up precise environmental space for the substation and outgoing cable line design.”  

**Reliable Power Supply**

With more than 50 years of experience providing electric power engineering solutions, Hubei Electric Engineering Corporation (HEEC), a subsidiary of POWERCHINA Limited, was commissioned by the State Grid Corporation of China to design and build a large indoor substation in the congested capital city of Wuhan in China’s Hubei province. “[The newly completed] 220 kilovolt (kV) substation provides reliable power supply covering 16 square kilometers, improving the power grid structure of Dongxiu High-Tech Park and living quality of 400,000 residents in the surrounding area,” explained Wang Wei, team leader, Digital Center at HEEC.

The CNY 172 million substation project required the layout and design of a two-story facility housing three sets of 240 megawatt ampere transformers and an underground cable network comprising 220kV, 110kV, and 10kV outgoing power lines. The constraints of a compact building space and dense urban surroundings, combined with the complicated arrangement of numerous cables varying in voltages, necessitated precise design and engineering on a tight schedule. To ensure accurate information sharing and avoid risk of clashes among electrical, structural, irrigation works, heating, ventilation, and construction disciplines, HEEC relied on Bentley design and analysis technology to implement an integrated, collaborative 3D modeling approach.

**Reliability Modeling Provides Context for Precise Design**

HEEC needed to understand the context of the surrounding structures when designing the facility. To rationalize the station and outgoing cable layout with minimal impact to the local community and environment, HEEC used ContextCapture to capture existing site conditions. The team used unmanned aerial vehicles (UAVs) to capture images of the existing neighborhood and used ContextCapture to perform aerial triangulation calculations to generate a detailed reality model. The 3D reality model provided context for the planning and design of the station site and cable layout, bypassing the civil and residential infrastructure. Stated Wei, “Real 3D models set up precise environmental space for the substation and outgoing cable line design.”

Using ContextCapture to produce a 3D geo-referenced reality model facilitated precise design of the substation within the context of the city surroundings. This approach provided the planning team sufficient insight into how the substation would be built and the impact on the environment and residents, preventing HEEC from demolishing four nearby houses.

**Collaborative 3D Modeling**

HEEC utilized Bentley’s modeling and analysis technology to implement a collaborative 3D design approach, using ProjectWise® as the connected data environment to manage its workflow. The electrical team used Bentley Substation to perform the design of the main wiring, electrical equipment scheme, stress calculations and arrangement of wires, as well as for lighting protection and grounding, and with Bentley Raceway and Cable Management, detailed the cabling and routing layout. “Due to the compact building space, the cross span of the cable lay space was extremely complicated. We used Bentley Substation to determine the design and accurately plan each cable strike,” explained Wei. Bentley’s design applications efficiently displayed the cable space strike and path relative to the substation walls, beams, columns, and cable tunnel for optimal positioning.
Using AECOsim Building Designer and ProStructures, the project team designed the architectural and structural elements of the substation facility, including walls, doors, windows and floors, as well as sectional layouts of concrete beams and columns, reducing concrete volumes for optimal material use. The irrigation works and heating and ventilation systems also utilized AECOsim Building Designer to complete air conditioning, axial flow fan, and water and wastewater pipe designs. Integrating Bentley technology, HEEC leveraged the digital engineering models to optimize multi-discipline design, collaboration, and visualization potential that reduced rework, minimized clashes, and offered a connected data environment for project participants. ProjectWise provided the foundation for information sharing among the various disciplines for a fully collaborative BIM process.

Bentley Mobile Apps Accelerate Information Mobility

During construction, the project team applied Bentley mobile apps further leveraging the digital engineering models for enhanced decision making, reducing collisions, and improving design review efficiency. ProjectWise Explorer was deployed on iPads providing field personnel real-time access to model information and, combined with Navigator Mobile, provided the construction team clear insight with an immersive view of engineering models and equipment data.

Additionally, mobile applications were used to introduce cable details to the construction team and convert local models of the cable arrangements into 3D PDF files to guide the work of the construction team, reducing workload time by 15 days and minimizing on-site communication time. Having flexible platforms on mobile devices greatly improved vertical collaboration between design and construction and accelerated accurate information sharing to meet the tight project schedule.

Integrated Modeling Delivers Savings

Implementing an integrated BIM approach using Bentley’s 3D modeling and design applications, supported by ProjectWise to manage workflow, facilitated effective communication and enabled efficient planning and accurate design of the substation to overcome the engineering and collaboration challenges. The real 3D model set up the precise environmental space for the substation design and cable layout, and “[incorporating] the 3D model of the substation with the reality model of the surrounding area truly reproduced the actuality of the site,” commented Wei. These 3D digital designs saved 50 labor days and CNY 50,000 in design costs, and avoided rework in at least 10 instances during construction to save CNY 2 million. Converting the models into 3D PDFs and using Bentley’s mobile apps during construction saved additional time for the cable arrangement, enabling the refined layout of dozens of high-voltage cables, minimizing risk and ensuring safe and stable substation operations.

As a final and significant cost-efficient step in its BIM methodology, HEEC imported the engineering model in i-model format into AssetWise, enabling the extraction of substation data, technical specifications, and operation information to support substation management. With a connected data environment for all the substation asset information, HEEC will save significant costs throughout future operation and maintenance of the Miaoshan secondary transformer, while ensuring safe and reliable power supply.

“Bentley’s digital solution has been fully applied across disciplines and stages of the Miaoshan 220kV 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, Team Leader, Digital Center, Hubei Electric Engineering Corporation

When completed, the substation will optimize the High-Tech Zone’s power grid and provide a reliable power supply for more than 400,000 residents.