Huadong Engineering Corporation Developed
Accurate 3D Model of the Qianhai Cooperation Zone

Bentley’s BIM Advancements Improved Collaboration Among Users, Saving CNY 21 Million in Averted Rework

Keeping Up with Development
In Shenzhen, Guangdong, China, the Qianhai Cooperation Zone is undergoing intense development, with nearly CNY 390 billion of dense construction covering an area of 14.92 square kilometers. The government wants this area to become a world-class modern service industry cooperation zone with a complete infrastructure to support the growth of a modern service industry—from institutional mechanisms and legal resources to a reasonable structure. The estimated USD 58.59 billion infrastructure project will include more than 180 kilometers of roads and 32 kilometers of rail lines aboveground and belowground. These resources, once completed, will help the government attract businesses with global influence—and ultimately make this area an important base for world trade.

Huadong Engineering Corporation (PowerChina), which is responsible for the infrastructure and other major projects, used Bentley applications to survey the area, model the complex geographic area, and build a 3D engineering design information model and construction information model for the new infrastructure. These models would help make full use of advanced network communication across all project team members.

Addressing Project Complexities
The project posed many challenges for the engineering team. First, the scale of the existing development is equivalent to the size of London, England and represented more than two times the development volume of Manhattan, New York. In addition, the new infrastructure needed to work around a complex, existing underground space; as a result, the engineering team needed to design an interconnected underground walkway network, a three-dimensional and efficient underground drive system, diversified compound underground public service facilities, and green and low-carbon underground municipal infrastructure.

Complicating matters further, Qianhai is in the sea reclamation area. As a result, there is a deep underground silt layer and scattered filling stones. These challenging geological conditions made underground planning, design, and development extremely difficult.

Building 3D Models with Bentley Software
PowerChina used Bentley applications to produce three 3D models of the entire area. The first was a geographical survey and mapping model. The second was a geological 3D model and planning information model. The third was a complete Qianhai municipal engineering design information model and construction information model, developed on a construction and management platform that used BIM methodology. Together, these digital engineering models provided users with an overall view of the zone, easily available and accessible for all team members.

Putting Bentley’s Innovative 3D Modeling Applications to Work
The project team used Bentley’s ProjectWise® to develop a powerful BIM construction management platform, which was combined with mobile internet and Internet of Things (IoT) technology to build a collaborative work platform for participating parties. This platform included a BIM information monitoring command center, a BIM collaborative management system, and a mobile APP real-time master control system based on “data cloud” technology. The team used this system to share the data of participating engineers and related projects among the 19 main contractors, team members, and project stakeholders.

First, they built a reality 3D model for the entire geographic area under development. The engineering team used Bentley’s ContextCapture and OpenRoads Designer, along with UAV aerial photography, to capture accurate geographic data. Team members then superimposed a 3D reality mesh and various 3D design models onto it. The result was the creation of a BIM-GIS integrated, “electronic sandbox” model for the entire Qianhai area. The design team used this model to sort out issues, pre-check designs, and deal with errors, omissions, collisions, deficiencies, and other issues.

The project team also created a geological database of the Qianhai area and used it to create a multi-discipline, 3D, digital collaborative design for aboveground and underground spaces using AECOsim Building Designer, ProjectWise, and other applications.
software. Together, these technologies enabled designers to conduct collision checks, compare and optimize solutions, perform engineering quantity accounting, address space interface, and review design outcomes and planning schemes.

**Achieving Desired Outcomes**

PowerChina’s use of BIM advancements and 3D models enabled the team to proactively address numerous challenges and realize quantifiable results. For example, the engineering team carried out collision detection using the 3D model created with MicroStation, AECOsim Building Designer, Power Inroads, Bentley Substation, Bentley Raceway and Cable Management, and other applications. This practice greatly reduced the number of errors, omissions, collisions, and deficiencies, as well as reduced engineering rework and construction costs. At the same time, ProjectWise reduced communication time for participating parties and facilitated efficient cooperation. Finally, Navigator allowed the team to perform technical disclosures at the engineering site and guide construction, which minimized on-site rework and further cut costs. Altogether, the 3D collaborative design helped save more than CNY 21 million in averted rework.

ContextCapture, OpenRoads Designer, LumenRT, and PlantFactory provided a more efficient way of planning for the demolition of buildings near construction sites. The applications helped with finalizing construction site layouts and determining greening schemes, saving more than 50 resource days cumulatively. In addition, more than 30 issues regarding underground space models could be addressed quickly and efficiently, saving CNY 3 million. The team could also address more than 100 pipe-related problems, saving about CNY 2 million. Also, the ground road 3D model was used to identify more than 20 engineering problems, avoiding rework valued at about CNY 1.5 million. The models also acted as the reference basis for many design schemes, enabling the identification of scheme defects that would have cost CNY 10 million to remediate.

Looking ahead, PowerChina expects that these technologies will allow them to design infrastructure that reduces carbon dioxide emissions by 30 percent, and increase public transportation share rates by 90 percent. The technologies will also improve performance of ongoing reconnaissance five times faster compared to traditional methods, saving 1,000 resource hours and CNY 5 million cumulatively.

“Through the introduction of Bentley’s 3D digital platform, we eliminated problems associated with technical and management planning of the Qianhai project. Errors were identified early by using construction simulations. We achieved digital engineering construction, laying a foundation for building ‘smart Qianhai’.”

– Scott Clardy, Configuration Manager, AmerenUE Callaway Nuclear Plant

Bentley applications helped develop information models on a construction and management platform that used BIM methodology, providing users with an easily available and accessible view of the zone.