MCC TianGong Group Optimizes Bridge Construction with Collaborative BIM Strategy

Bentley Solution Saves CNY 150,000 on Bageng Bridge Project

Geological and Technical Challenges

The Baise-Jingxi Expressway in Baise City, China plays an important role in the highway network in the Guangxi region, delivering improved traffic conditions and promoting economic development. Along the expressway, the Bageng Bridge provides a transportation route over a traversing railway line and through the area’s mountains. MCC TianGong Group (MCC) was retained as the main construction contractor for the CNY 140 million bridge project, which posed numerous engineering challenges.

Situated amid mountainous terrain with soft soil subgrade and high slopes prone to rock fragmentation, the narrow bridge construction site and railway traffic affected the prefabricating gridirons and scaffolding and presented safety risks for on-site workers. In addition to the geological challenges, MCC was faced with technical difficulties in coordinating and processing data and information among the multiple disciplines. The project team was distributed, while many worked at its main office, others were split across branch locations or at the project site. “To solve the difficulties, MCC developed a BIM team of designers and engineers and relied on Bentley software to provide information and support for construction management,” stated Kun Jiang, manager of technology center at MCC TianGong Tianjin Corporation Limited.

Fast Facts

- MCC provided construction management for the CNY 140 million Bageng Bridge project in Baise City, China.
- MCC performed earthworks analysis and generated a digital terrain model for early construction planning using OpenRoads technology.
- Bentley’s BIM technology enabled MCC to build a BridgeMaster model and simulate construction to overcome site constraints.

ROI

- MCC optimized construction in difficult terrain using Bentley technology, saving CNY 150,000.
- OpenRoads technology enabled MCC to reduce environmental impact and shorten construction time by two months.
- iModels and ProjectWise® accelerated real-time information sharing and facilitated dynamic management of the construction process.

3D Modeling Facilitates Safe Construction Solutions

Using OpenRoads technology, MCC generated a digital terrain model from site survey data and performed earthworks analyses, enabling construction planning at an early stage. With AECOsim Building Designer, the team used the model to simulate vehicle paths and the layout of temporary facilities, including the steel-bar processing and prefabrication field. Integrating the BridgeMaster bridge model, the team was able to set up a T-beam vertical lifting station and optimize its design.

Simulation of the vertical lifting station and erection of the precast beam, as well as construction of special equipment, were critical for safe bridge engineering. The project team avoided accidents due to the scale and height of the project by applying BIM strategies to simulate construction procedures. The team imported the structural model of the hanging baskets into STAAD, where they performed finite element and load analyses and studied stress and deformation for the main truss to ensure structural integrity. Using Bentley modeling capabilities, the team optimized the design of the anti-electric shed across the railway using concrete foundation, a steel support system, and an insulated roof to accommodate the hanging basket construction and train traffic. Modeling of the guardrail and safety ladder for the edge of the 30-meter high structures also reduced associated construction risks. Bentley’s integrated 3D design technology avoided repeat modeling, verified structural stability, and satisfied safety requirements.

ProjectWise Optimizes Collaborative Construction Management

MCC used ProjectWise as its collaborative platform to share documents and data among the multiple disciplines and configured personnel permissions to ensure secure access and standardized workflows. The team created a customized component library, enabling fast management of each construction part and establishing a construction process management file of components. Through ProjectWise, the information was viewed in real time and managing documents.
and uploading contracts, material quantities, and construction standards into the same platform was simple.

Integrating mobile applications and iModels enhanced and accelerated information sharing. Bridge models were loaded onto mobile devices for on-site comparison with actual construction scenes. Using hyperlinks on the models, on-site personnel could enter additional traceable information in the construction process, ranging from material type to construction time. With traceable data and information links accessible in real time via ProjectWise, the team achieved dynamic synchronization and management of the construction process, plus improved quality control.

**Integrated BIM Technology Delivers Savings**

Implementing a collaborative BIM approach with Bentley's integrated technology, the team modeled and simulated the entire construction process, chose the optimal construction scheme, and kept the project on schedule. Optimizing design of the construction scenario saved CNY 150,000 in construction costs and reduced construction time by 56 days. Bentley software improved engineering quality, enhanced productivity, saved time and money, minimized errors, and eliminated risks associated with elevated bridge engineering amid the terrain constraints.

In addition, the team's BridgeMaster model not only assisted in bridge modeling, but also provided accurate material takeoffs to avoid unnecessary and costly material loss. Using OpenRoads technology facilitated precise earthworks calculations, minimizing environmental impact and reducing overall project costs. When compared to traditional methods, MCC was able to optimize delivery of the Bageng Bridge project, managing time and costs through the application of BIM and ProjectWise for information management and sharing.

**Successful Delivery Drives Future for BIM**

Implementing a collaborative BIM approach to the Bageng Bridge project facilitated successful construction management, enabling process control. The BIM strategy also improved traceability of project information, accelerating project delivery and enhancing site performance for the infrastructure. Upon completion, the 3D models and documents will be transferred for the owner to use for complete lifecycle operations and management.

The application of BIM strategies in bridge engineering not only improved project management, but also increased MCC's reputation. MCC accumulated and analyzed the relevant processes for an optimal BIM methodology that will establish it as a standard for future projects based on the success of the Bageng Bridge project. MCC looks to continue using BIM strategies to complete more projects in their region.