

Bentley[®]
Advancing Infrastructure



Project Summary

Organization

China Railway Changjiang
Transport Design Group Co., Ltd.

Solution

Bridges

Location

Chongqing, China

Project Objectives

- To apply intelligent 3D BIM methodologies to streamline workflows and generate a single data source for lifecycle bridge management.
- To simulate construction progress and achieve high-precision construction quality control.

Project Playbook

ContextCapture, LumenRT,
MicroStation[®], OpenBridge
Modeler[®], OpenRoads[™],
ConceptStation, ProStructures,
RM Bridge

Fast Facts

- The six-lane, 1,436-meter Taihong Yangtze River Bridge will cross the Yangtze River in Chongqing.
- The team proposed methods for intelligent information management and collaboration.
- Simulated construction monitoring and digital workflows streamlined communication and planning.

ROI

- ContextCapture and MicroStation reduced bridge design time by 300 hours, helping complete design 30 days early and save CNY 500,000.
- Establishing digital construction management saved CNY 1.8 million in management costs and shortened construction by 47 days.
- The virtual 3D model ensures quality and safety throughout the project and will promote the industrialization of Chongqing's bridge infrastructure industry.

Chongqing and Guizhou Organizations Advance Construction of Taihong Yangtze River Bridge

Bentley's Interoperable Reality Modeling Applications Help to Save CNY 1.8 Million in Construction Management Costs

New Bridge Completes Economy Boosting Expressway

The Taihong Yangtze River Bridge is a CNY 900 million construction project along the 77-kilometer highway network linking the Nanchuan District and Lianjiang New Area in China's Chongqing municipality. The 1,436-meter-long bridge crosses the Yangtze River and is the final component of the expressway, which is expected to reduce travel time between the two districts to 50 minutes and boost Chongqing's economic development.

The bridge features a two-way, six-lane roadway with a width of 39.6 meters. Designed as a suspension bridge, it includes an 808-meter steel box beam with a complex structure required to sustain a high-load capacity amid complicated terrain. The scale and complexity of the project necessitated pushing the boundaries of engineering data to ensure construction quality and safety.

Manual Processes Undermine Dynamic Bridge Construction

Recognizing that bridge construction is a dynamic process, the project owner hired China Railway Changjiang Transport Design Group (CRCTDG). Working with Guizhou Communications Construction Group and Guizhou Bridge



CRCTDG selected ContextCapture to process unmanned aerial survey data and establish a highly precise 3D model.

Construction Group, as well as numerous other components and contributors in various disciplines, CRCTDG had to determine how they could use the engineering information to increase the performance, quality, safety, scheduling, and cost of each stage of the lifecycle. They also realized that they needed to digitalize engineering workflows and avoid irreversible and costly errors. CRCTDG knew that traditional manual and paper-based data exchange and construction methods would not be sufficient to achieve the accuracy and public safety that they targeted.

"Traditional infrastructure-related data mainly uses estimation statistics, manual compilation and reports, and document transmission," explained Fengmin Chen, head of CRCTDG's BIM technology department.

They explored using 3D BIM methodologies and reality modeling to perform construction simulation and enable seamless, real-time data exchange and intelligent information management. More specifically, during the design stage, they sought to achieve parametric modeling, improve design efficiency, integrate multidiscipline data, and generate a unique data source. CRCTDG desired digital pre-assembly of steel box beams during construction and 3D laser scanning to monitor construction progress for high-precision quality control. However, they faced data collection, integration, and coordination challenges associated with incorporating digital survey methods and BIM modeling. They also needed to overcome software incompatibility to simulate construction and establish a digital foundation for lifecycle operations and management.

Leveraging Bentley Applications for Construction Management

CRCTDG selected ContextCapture to process unmanned aerial survey data and establish a highly precise 3D model. They also used the application to create a terrain model of the bridge site, display contours as lines or triangular meshes, and produce effective elevation and slope analysis. The use of high-precision orthophoto maps, point clouds, or reality scanning technologies generated terrain models of the bridge site and greatly improved the efficiency and accuracy of the

“CRCTDG has made the Taihong Yangtze River Bridge project an essential case for digital design and construction with its forward-looking research and exploration of the application of Bentley software.”

*– Fengmin Chen,
Head of BIM Technology
Department, China Railway
Changjiang Transport
Design Group Co., Ltd.*

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work. MicroStation was used to streamline and integrate models from multiple software applications, providing a single data source throughout the entire project lifecycle. They performed 3D laser scanning of the complicated terrain via unmanned aerial vehicles for rapid and detailed data collection.

Using ContextCapture, they processed the point clouds and survey data to generate geological models of the bridge site. These digital survey and 3D modeling methods also helped them obtain accurate 3D measurements of the steel box girder components to simulate assembly, helping intelligently manufacture the steel box beam. They continually collected point cloud data throughout the bridge construction process to visually monitor progress. “Reality scanning technologies are used to regularly collect site data during construction to record project construction at different construction periods,” commented Chen. Using LumenRT, CRCTDG integrated the reality and BIM models to simulate the construction process and monitor progress, optimizing construction through effective planning.

With Bentley’s open applications, CRCTDG established digital workflows and a construction management platform that eliminated information silos caused by traditional construction methods. The interoperability of MicroStation helped streamline and integrate models from multiple applications, providing a single data source throughout the project lifecycle. By employing iModels, they enabled digital delivery and a cloud-based platform, resulting in mobile review and enhanced cost control. The digital workflow allowed them to combine construction process data with the BIM model to achieve high-precision construction quality control and create a unified, intelligent bridge model that can be used through operations and maintenance.

Industrializing Chongqing’s Bridge Infrastructure Industry

By establishing a 3D BIM-based construction management platform to monitor construction of the Taihong Yangtze River Bridge, CRCTDG improved construction management quality and efficiency, eliminated the information silos and bottlenecks of conventional construction, and established lifecycle BIM operations and maintenance. Having a visual representation of the project provided all participants with an experience that simulated being on site, regardless of their location. The improved visualization helped reduce the time spent traveling to the site by 23 days, as well as optimized planning and scheduling. Through parametric modeling and automated processes, they improved design efficiencies, reducing bridge design time by 300 hours and saving CNY 500,000. Establishing digital workflows streamlined communication and collaboration to help complete the bridge design 30 days ahead of schedule.

Bentley’s solutions provided dynamic digital management of construction planning and resource allocation to effectively carry out progress control and lower construction costs. Working in the digitally simulated construction environment, as well as predicting and overcoming potential problems in advance, saved nearly CNY 1.8 million in construction management costs and shortened the construction period by 47 days. Applying BIM modeling methods, CRCTDG established a 3D digital context to clearly communicate the development process and manage engineering information throughout the entire project lifecycle, ensuring quality and safety. The complete visual model lays the foundation for the intelligent manufacturing and construction management of similar large steel bridge projects. “[Using Bentley applications], lean construction, precise management, and control of modern infrastructure have been truly enabled, which promotes industrialization of the infrastructure industry,” said Chen.



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