



China Railway First Survey and Design Institute Completes a High-speed Railway in Half the Time

Bentley Applications Unify Contributions from 19 Disciplines and Eliminate Bottlenecks

GOING DIGITAL FOR THE FIRST TIME

The 255.75-kilometer Xi'an-Shiyan High-Speed Railway project is an important part of the Wuhan-Xi'an high-speed railway under development in the Hubei and Shaanxi provinces of China. Once completed, the Xi'an-Shiyan segment will strengthen the connection between city clusters in the Guanzhong Plain and the middle reaches of the Yangtze River. Additionally, it will promote poverty alleviation and rural revitalization in the Qinba mountainous area as part of the Yangtze River Economic Belt, and other national development strategies.

China Railway First Survey and Design Institute Group (FSDI) was selected to design the project. Since its creation in 1953, the company has completed more than 460,000 kilometers of railway research, survey, and design, and put more than 30,000 kilometers of new rail lines into operation. However, they had yet to incorporate BIM methodology on all aspects of a rail project. FSDI wanted to make the Xi'an-Shiyan project their first fully digital project, but they needed to find a way to accommodate and unify the work of 19 disciplines.

DETERMINING HOW TO DESIGN IN COMPLICATED TERRAIN

FSDI quickly determined that their choice of digital platform would have to accommodate the unique challenges presented by this project. In addition to being a particularly lengthy stretch of railway, Xi'an-Shiyan runs through the Qinling Mountains, presenting complicated terrain and unfavorable geological conditions. As a result, the railway alignment would frequently vary and require special structures, including five tunnels stretching approximately 10 kilometers each and nine bridges with four of them incorporated into the design of railway stations. All work would need to conform

to 13 separate BIM standards issued by the China Railway BIM Alliance.

Additionally, their technology solution would need to accommodate the use of 66 different design and modeling applications. Though these applications would allow the 19 disciplines to design all required elements, transferring data between applications created by different vendors would become cumbersome and had the potential to introduce errors. FSDI needed an open solution that could eliminate bottlenecks and unify contributions from all specialist teams.

COORDINATING WORK WITH OPEN APPLICATIONS

After examining potential options, FSDI determined that they could coordinate work from the various disciplines and meet all project challenges by using Bentley's open and integrated applications. They first used ProjectWise to establish a single source of truth, ensuring that all data was easily accessible to every stakeholder. Next, they used MicroStation[®] to develop designs for track, overhead line systems, earthworks, bridges, tunnels, communications, and other disciplines, as well as the complicated design models for elements like structural reinforcement. Next, they optimized the design of discipline-specific elements with specialized Bentley applications. Specifically, they used OpenRail Designer to create models of the subgrade, track, and drainage design, OpenUtilities Substation to design electrical systems, OpenPlant to model fire protection and water supply systems, and OpenRoads Designer to relocate roads affected by the railway's construction.

As teams created models, FSDI used applications including PLAXIS, LumenRT[™], and SYNCHRO 4D to optimize both the design of the railway and construction sequencing. Lastly, the teams used

PROJECT SUMMARY ORGANIZATION

China Railway First Survey and Design Institute Group Co., Ltd.

SOLUTION

Rail and Transit

LOCATION

Xi'an, Lantian, Shangluo, Shanyang, and Shiyan, Shaanxi and Hubei, China

PROJECT OBJECTIVES

- ◆ To construct the 255.75-kilometer Xi'an-Shiyan High-speed Railway project.
- ◆ To implement a 100% digital workflow on the entire railway design.

PROJECT PLAYBOOK

iTwin[®], iTwin Capture Modeler, OpenBridge[®], OpenBuildings[®], OpenPlant[®], OpenRail[™] Designer, OpenRoads[™] Designer, OpenUtilities[®] Substation, PLAXIS[®], ProjectWise[®], ProStructures[™], SYNCHRO[™] 4D

FAST FACTS

- ◆ FSDI is designing the 255.75-kilometer Xi'an-Shiyan High-speed Railway project.
- ◆ Despite the complexities of the railway project, FSDI wanted to establish 100% digital workflows, a first for the company.
- ◆ To succeed, their project would need to accommodate the use of 66 different software applications.

ROI

- ◆ Bentley applications streamlined contributions from all disciplines, improving collaboration efficiency by 50%.
- ◆ Resolving issues before finalizing the design helped them significantly improve design quality.
- ◆ The 100% digital design environment enabled China Railway to complete the design in four months, compared to an original design estimate of over eight months.

“The Bentley platform provides powerful functions. The design experience was good. It has laid a solid foundation for comprehensive BIM design of the Sichuan-Tibet Railway.”

– Xu Xingwang, Chief Engineer, BIM Laboratory of China Railway Construction Corporation, Ltd.



the iTwin Platform to verify the integrity of the federated, multidiscipline model, and to provide high-quality visualizations and data integration as the foundation for full lifecycle management. “[The design] can be continuously improved to form a digital twin, with the different components being used as the carrier and basis of information management,” said Xu Xingwang, chief engineer with FSDI.

RESOLVING DESIGN PROBLEMS BEFORE CONSTRUCTION

With the help of Bentley applications, FSDI successfully achieved 100% digital planning of all aspects of the Xi'an-Shiyan railway design. Despite the size and complexity of the project, the teams integrated 66 different software modules while eliminating bottlenecks and meeting all standards and requirements. Using Bentley applications as the main design platform for the project improved

communication among stakeholders and ensured cohesion among all design elements. The streamlined workflow improved collaboration efficiency by 50%. BIM processes helped the team detect and resolve 286 problems with the initial design, including clashes, incorrect positioning, and missing elements. Resolving issues before finalizing the design helped them significantly improve design quality and avoided costly errors that would have been discovered during construction. Bentley applications enabled design teams to undertake engineering for sound barriers, earthworks, signals, the electrical system, and other elements during design, reducing the need for on-site surveys by 10%. By moving completely to digital design for the first time, FSDI completed the design in four months, compared to an original estimate of over eight months, and significantly reduced the amount of resource hours needed. “By fully adopting the research and development results of the Bentley platform for design, this project overcame these difficulties and basically solved the problem of multidiscipline collaborative design,” said Xingwang.



Bentley applications streamlined contributions from all disciplines, improving collaboration efficiency by 50%.



Resolving issues before finalizing the design helped them improve design quality by 50%.



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