DASSAULT SYSTEMES

CHINA RAILWAY DESIGN CORPORATION

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Case Study

Photo courtesy of CRDC

Challenge

China Railway Design Corporation (CRDC) needed to improve its win rate of large-scale railway projects in China and abroad. They decided to leverage a brand new approach to improve design efficiency and quality.

Solution

The company uses Dassault Systèmes' **3D**EXPERIENCE platform specific industry solution to model projects based on design and engineering templates, to test more design alternatives, and to validate their possibility.

Benefits

With all project data in one place and easily accessible, collaboration between all multi-disciplinary stakeholders is improved, resulting in increased design efficiency and consistency.

"We believe that the integrated **3D**EXPERIENCE platform and its unified data source will improve efficiency and design consistency through better communication between our design, engineering and construction teams. It's a more seamless way of working."

— Changjin Wang, Deputy Chief Engineer, CRDC

A COMPANY OF MANY FIRSTS

China's rail industry is experiencing considerable growth driven by a soaring economy with rising demands for fast transportation from China's population. China Railway Design Corporation (CRDC) is competing for leadership in this growing market. It is one of China's top railway design companies, and the only integrated class-A survey and design institute affiliated with China Railway Corporation, owner of China's national railway. Class A certification means CRDC meets very specific levels of engineering capabilities and also requires providing software support.

"Our activities comprise survey, design, consulting, supervision and general contractor services of railway, road and municipal engineering, including urban rail transit," said Changjin Wang, deputy chief engineer, CRDC. "CRDC is a company of many firsts in China. We designed the first passenger line, the Qinhuangdao-Shenyang high-speed railway as well as the first high-speed line, the Beijing-Tianjin Intercity Railway. And the first heavy-haul railway also was designed by CRDC. These are just a few of our many achievements," Wang said.

As competition is fierce, CRDC decided to undergo a transformation of its business to differentiate itself from other railway design companies in China. "We are putting more emphasis on developing railway engineering general contractor services in addition to our design activities," Wang said.

The company also focuses on technology innovation. "We pioneered the use of advanced technologies in the field of railway survey and design, which include airborne laser radar technology, digital aerial photogrammetry and ground radar measurement technology. These technologies are all very state-of-the-art in the rail industry."

MODERNIZING CRAFTSMANSHIP

Since 2015, CRDC has been leveraging Dassault Systemes' **3D**EXPERIENCE® platform for its large-scale railway projects, the CATIA® application for the design of subgrade, bridges, tunnels, electrical systems and all railway-related components. "We believe that an integrated platform and a unified data source respond well to the way this industry works," Wang said. "Railway design requires the collaboration of multiple disciplines, so we need to have all the participants work on the same platform and share data in real time if we want to improve efficiency and design consistency. A single data source leads to better communication among our design, consulting and construction teams, because we collectively exchange on the same model. It's a more seamless way of working."

The rail industry trails behind other industries such as aerospace, automotive and manufacturing when it comes to using 3D. "2D design is still prevalent in our industry, but there are drawbacks: it leads to information silos," Wang said. "If information can't be seamlessly transmitted throughout the full lifecycle of a project, engineering errors will inevitably occur. 3D collaborative design based on Building Information Modelling (BIM) technology can help avoid these shortcomings."

"Originally, designs were created in 2D and delivered in a distributed manner, making it impossible to establish connections between them," said Lin Su, senior engineer and group leader of CRDC's BIM R&D group. "In large projects, this often translated into extremely large drawings that were shipped to the site. We could not perform a review of the system as a whole, because this first required integrating all of these 2D drawings. Hence, ensuring overall design integrity was too labor-intensive. Moreover, if design changes occurred, it was very difficult to update all those drawings, so people often ended up working with obsolete information."

Dastech, a Dassault Systèmes business partner, implemented the **3D**EXPERIENCE platform at CRDC and provided training and on-site support. "They also provide us with design and solution adopting assistance here in our offices to help us solve any technical issues we may have on our day-to-day projects," Su said. "We value their contribution."

CRDC leverages the **3D**EXPERIENCE platform's specific industry applications tailored for civil engineering design, steel structure, electrical systems, and water drainage, all needed by the rail industry. "BIM design for all of these disciplines can be performed on the **3D**EXPERIENCE platform," Su said. "They now work on a unified structure tree, and designers can collaboratively work together on everything. "

COMPANY STANDARDS ENSURE CONSISTENCY

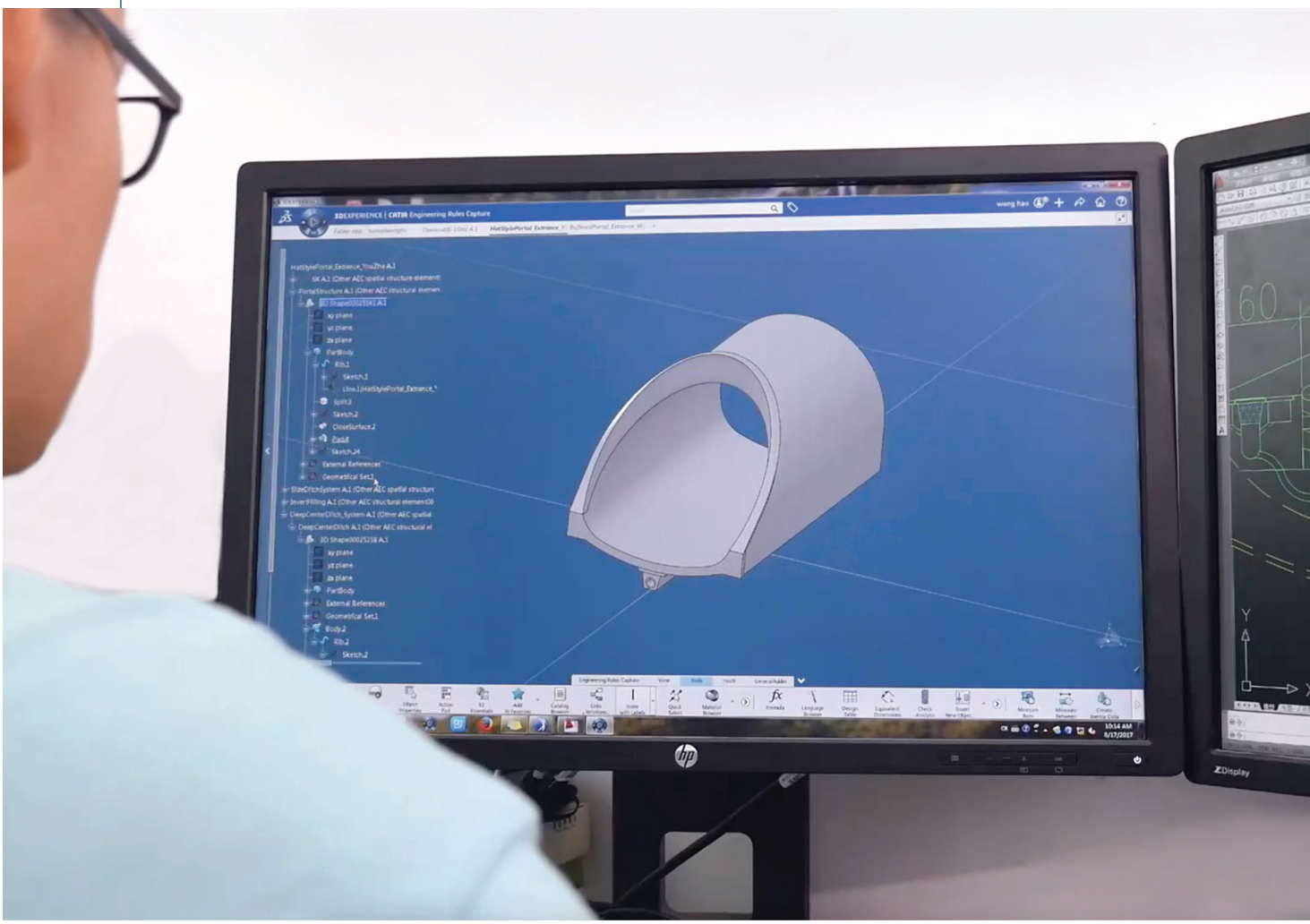
The different CRDC departments (e.g. alignment, bridge, tunnel etc.) developed a standard design framework that each department can then enhance as projects progress, ensuring that unified company rules and methods are respected by all. Numerous BIM technology standards developed by China Railway Corporation, CDRC's mother company, are fully incorporated into the **3D**EXPERIENCE platform, and consequently, all design results contain the information of these standards. "Each discipline can easily integrate key information during the design phase according to the applicable standard, and each engineer can intuitively see the design results of various departments and check the consistency of the design at any time," Su said. "We avoid transmitting wrong information this way and design quality is considerably improved."

To explain the benefits of using the **3DEXPERIENCE** platform for railway design, Su cited the Jakarta to Bandung high-speed railway project in Indonesia. "The natural ground's slope is very close to the slope of the retaining structure of the railway," he said. "Moving the entrance of the tunnel forward or backward by one or two meters will significantly impact the amount of earthwork. In the past when we only worked in 2D, it wasn't that difficult to use the location of the slope to determine the location of the tunnel entrance. The downside, however, was that we didn't have a global view of the project, what it would look like, what the impact to the surroundings would be. Working in 3D with the **3DEXPERIENCE** platform enabled us to evaluate the amount of earth to be moved. By digitally iterating among several options we chose one that reduces the amount of earthwork necessary. For example, by simply moving the location of the entrance on our screen, we can reduce construction costs because the amount of earthwork changed dramatically. Before digital optimization, we would remove nearly the entire mountain body to build the retaining structure of the railway. But after digitally moving the location of the entrance, the earthwork decreased drastically. This greatly benefitted the local environment."

"The **3DEXPERIENCE** platform's parametric modeling capabilities and engineering templates are two of the most intuitive and fundamental advantages for us," said Shufeng Song, senior engineer and team leader of CRDC's bridge discipline. "The ability to process data from our multiple departments also is a huge advantage, as railway design can involve more than 10 departments."

Song and his team recently completed the structural design for the bridge of the Beijing-Xiongan railway. "The frame pier of the railway is a very special and complex structure," Song said. "Traditionally, the first step for the design of a frame pier is to estimate its structural size and then carry out 'astronomer' computations. But estimating the structural size requires considerable time. With the **3DEXPERIENCE** platform, we can estimate the size of our structure by digitally simulating it and using parametric design to quickly implement changes. This means that we can do preliminary studies on the **3DEXPERIENCE** platform before starting finite element structural calculations. This greatly reduces design effort and improves efficiency," he said.

Bottom image: 3D simulation of tunnel entrance design for the Jakarta to Bandung high-speed railway project in Indonesia.



Focus on China Railway Design Corporation
China's leading railway design company.

Products: planning, survey and design, engineering general contracting, engineering consultant and project management of railway, urban rail transit, integrated transport terminal, highway

Employees: 4800

Headquarters: Tianjin, China

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CRDC uses CATIA to speed the design process, ENOVIA® to manage the construction process, DELMIA® to simulate this construction process before physical set-up and SIMULIA® for analysis of its CATIA models. The **3D**EXPERIENCE platform ensures digital continuity because all applications are integrated. Moreover, CRDC and Dassault Systèmes are working together to implement global railway standards based on the **3D**EXPERIENCE platform. They signed a partnership agreement, in which CRDC will provide technical requirements so that Dassault Systèmes can adapt its applications for the specific needs of the railway industry. Already, some of the BIM standards developed by the China Railway company and destined for use by the railway industry have been incorporated into the **3D**EXPERIENCE platform. In this way, all designs contain the information of these standards. "Our vision for the next few years is to become a comprehensive industrial group with advanced technology, scientific management and cultural confidence," Wang said. "By bringing our strategic partnership with Dassault Systèmes to a new level, we will further advance our digitalization and that of the railway industry as a whole."

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