



MCC Capital Engineering & Research Delivers Green, Smart Manufacturing Facility

Bentley's Digital Twin Applications Create First Green, Intelligent Iron and Steel Manufacturing Factory in China

TRANSFORMING TO A GREEN AGE

A USD 6 billion plant will be built in China's Leting Economic Development Zone in Tangshan, with an aim to be an advanced, green, and intelligent modern factory. Upon completion, its annual output will reach more than 7 million tons of iron and steel. The project will also propose the concept of intelligent manufacturing and the application of green technologies, promoting energy conservation and emission reduction to ensure clear water and blue skies for the 2022 Beijing Winter Olympic Games.

MCC Capital Engineering & Research Incorporation undertook design, procurement, and construction of all equipment and processing facilities, covering 534 hectares, including 42 plants and a 26-kilometer roadway. A large-scale construction manufacturing facility with extremely complicated processing systems, the project involved multiple disciplines in various locations, presenting coordination, technical, and engineering challenges, compounded by site constraints and strict timelines that conventional design methods could not accommodate.

ESTABLISHING INTEGRATED DIGITAL PROCESSES

The sheer enormity of the project scale and complicated process system made it challenging to determine the general plant layout and avoid collisions and errors among the different specialties during the design stage. "The project involves many disciplines—such as equipment, infrastructure, and industrial pipelines—that are intricate and complicated. Therefore, how to minimize errors, omissions, and collisions in the design stage and complete the design work with high quality posed a huge problem for the project team," explained He Zhang, BIM manager at MCC.

With more than a dozen disciplines distributed among various areas and project sites, MCC faced communication and data sharing difficulties, and needed collaborative BIM technology in a connected data environment to generate a digital twin deliverable for lifecycle asset management.

They wanted to build a digital factory that included digital models of the entire plant infrastructure, establish an engineering database with all components to create the digital assets, and incorporate artificial intelligence and the Internet of Things to maximize data potential for smart, energy-efficient operations. However, they found it challenging to synchronize design, construction, delivery, and operation of the digital factory with the physical factory. For example, the complex manufacturing processes made it difficult to create a digital model consistent with actual production flow of the physical factory and required real-time automated technology to synchronize the two.

They realized that they needed comprehensive, integrated modeling and analysis applications to establish a unified platform to meet their digital deliverables and achieve a smart facility.

FACILITATING SMART SOLUTIONS

"Considering the comprehensive applicability of Bentley's software, many professional modules for relevant design works, and the load-bearing capacity of MicroStation for large-scale models, [MCC] decided to adopt BIM technology and Bentley's solutions from the planning stage," stated Zhang. They selected ProjectWise to coordinate the multidiscipline, geographically dispersed team, establishing a connected data environment to conduct collaborative design that streamlined workflows and improved communication efficiency among the four design units and 13 construction units.

PROJECT SUMMARY

ORGANIZATION

MCC Capital Engineering Research Incorporation Ltd.

SOLUTION

Manufacturing

LOCATION

Tangshan, Hebei, China

PROJECT OBJECTIVES

- ◆ To streamline design and construction processes in a connected data environment.
- ◆ To achieve intelligent manufacturing production via a digital twin.

PROJECT PLAYBOOK

AssetWise, AutoPIPE[®], Bentley Raceway and Cable Management, ContextCapture, LumenRT, MicroStation[®], OpenBuildings[®] Designer, OpenPlant[®], OpenRoads[™], OpenUtilities[®] Substation, ProjectWise[®], ProSteel, ProStructures, SYNCHRO[™] 4D

FAST FACTS

- ◆ The large-scale, multidiscipline project covers 534 hectares with 42 plants and a 26-kilometer roadway.
- ◆ MCC initiated collaborative BIM methodologies to generate a digital twin for intelligent plant operations and management.

ROI

- ◆ ProjectWise provided the collaborative platform to streamline multidiscipline design and shorten the design cycle by 35 days.
- ◆ Using SYNCHRO 4D optimized plant layout and significantly reduced the construction cycle, reducing by 75%.
- ◆ The digital twin improved plant operation efficiency by 50% and optimized equipment maintenance, reducing spare parts quantities by 40%.

“The project involves many disciplines—such as equipment, infrastructure, and industrial pipelines—that are intricate and complicated. Therefore, how to minimize errors, omissions, and collisions in the design stage and complete a high-quality design posed a huge problem for the project team.”

-He Zhang, BIM Manager, MCC Capital Engineering Research Incorporation Ltd.

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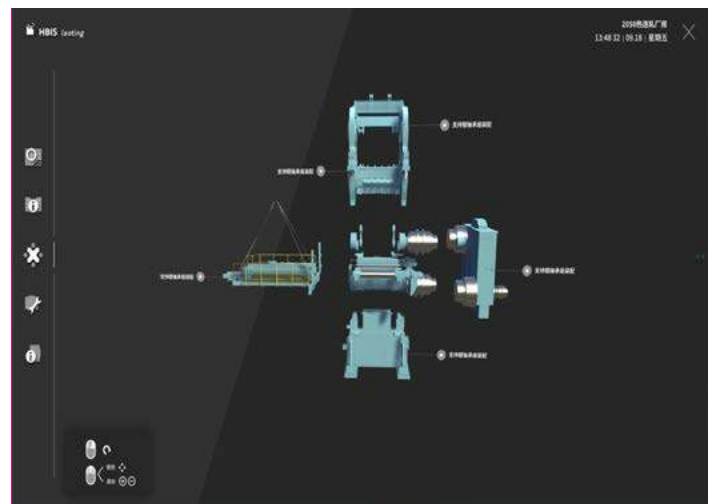
Using SYNCHRO 4D optimized plant layout and significantly reduced the construction cycle, reducing by 75%.

Using ContextCapture, they processed oblique photography to generate an accurate reality mesh of the entire site. With SYNCHRO 4D, they conducted construction simulation to visualize and achieve the precise plant layout and equipment installation within the limited space. Lastly, by integrating AssetWise® ALIM, MCC developed an engineering database to incorporate all asset information, design, procurement, manufacturing, construction, and installation data, laying the foundation for a digital factory deliverable.

Leveraging Bentley applications in a connected data environment, MCC optimized construction of the physical plant and established a digital twin to perform real-time monitoring and simulation analysis, achieving an intelligent manufacturing production facility. The recorded data of the production system is imported into the virtual digital factory to reproduce the production process. The data is the foundation for and the connection between the digital twin of the plant and the intelligent physical plant. Through the Bentley platform, MCC can visualize and monitor equipment and operational data in real-time and see that the production status is consistent with the actual situation, enabling optimization of some processes to maximize energy efficiency.

DIGITAL TWIN SETS INDUSTRY BENCHMARK

Using Bentley's integrated applications, MCC implemented collaborative 3D BIM methodologies that streamlined multidiscipline workflows, reducing design errors and collisions to shorten the design cycle by 35 days. Working in a connected data environment reduced rework, optimizing construction efficiency, improving quality, and saving costs. The ability to generate accurate drawings and material lists directly from the models avoided material waste to save USD 6 million, while the interoperability of OpenPlant with MCC's self-developed piping master feature enhanced the design efficiency of external pipelines by more than four times. By establishing a digital twin—combining design, construction, production, and operational information—they achieved multidimensional visual data integration and transparent management of assets, improving operational efficiency by 50% and optimizing equipment maintenance.



The digital twin improved plant operation efficiency by 50% and reduced spare parts quantities by 40%.

Based on the digital twin, the automation, control, and process models are all integrated to connect operations and management data, achieving a digital world that is parallel to reality, where scenarios can be customized according to operational requirements for optimal production. In addition, the digital factory has enabled logistics scheduling management, virtual training, video monitoring, and emergency simulation drills within the plant. The application of the digital twin and implementation of intelligent digital processes provided an industry benchmark for future digital deliveries of metallurgical processing plants.

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