

WISDRI Delivers Smart, Green, Low-carbon Iron and Steel Production Facilities in China's Yunnan Province

Bentley's Digital Twin Technology Saved CNY 28.6 Million in Design Costs and Reduced Annual Carbon Emissions by 346,500 Tons

DEVELOPING MODERN, ECO-FRIENDLY METALLURGICAL FACILITIES

A key initiative for both Yunnan province and the city of Yuxi, this CNY 7 million iron and steel project replaces older, inefficient production equipment with more advanced, modern, and environmentally friendly facilities. Covering eight square kilometers, the project includes the installation of new blast furnaces, multiple converters, and ancillary apparatuses. It aims to achieve a steelmaking capacity of 5.15 million tons per year while reducing emissions and environmental impact. Upon completion, the facilities will produce an annual output value of CNY 36 billion.

WISDRI is the general contractor delivering the Yuxi metallurgical production plant, located within a 70-kilometer radius of three national nature reserves. With a forest coverage rate of 83.4%, the area is considered one of the most intact regions in terms of biodiversity and plant communities. It is the habitat for more than 1,000 rare, endangered, and endemic species, including nationally protected plants and animals. "To protect this vast natural museum and biological species gene bank, we need to control nitrogen oxides, sulfur oxides, and carbon emissions, improve land use efficiency, and reduce damage to vegetation," said Chu Xuezheng, project BIM manager and senior engineer at WISDRI.

ADDRESSING ENVIRONMENTAL, TECHNICAL, AND COORDINATION CHALLENGES

From the outset, the major underlying challenge for WISDRI was protecting the surrounding natural and residential environments. Compounding this was the massive project scale and complex terrain, presenting design and construction difficulties. The project simultaneously constructs four iron

and steel production lines in a mountainous region with complicated geological conditions and high seismic intensity. "The iron and steel refining processes, equipment, pipelines, and structures are large, interesting, [and] irregular, requiring holistic consideration for production scheduling under full load and unexpected malfunctions, posing high design difficulty," explained Xuezheng. With tall structures reaching 100 meters in height, the construction works required high-altitude lifting.

In addition to the strict environmental requirements and technical challenges, WISDRI also faced coordination issues managing the large-scale works among a multidiscipline team. "[The project] encompasses 50 participating units, 250,000 tons of steel structures, 800,000 cubic meters of concrete, 6,300 kilometers of cables, [and] 80,000 A1 construction drawings, requiring timely, accurate, and reliable data exchange and cross-functional collaboration, posing significant management challenges," emphasized Xuezheng. WISDRI realized that neither traditional 2D design nor single-discipline 3D design were capable of meeting the project's time, technical, environmental, and multi-party coordination and communication requirements. To efficiently and cost-effectively deliver the modernized, eco-friendly production facilities, they needed an integrated design, construction, and project management technology solution.

LEVERAGING BENTLEY'S OPEN MODELING AND DIGITAL TWIN TECHNOLOGY

Leveraging ProjectWise, Bentley's Open applications, and SYNCHRO, WISDRI established a connected data environment and collaborative design models, performed construction simulation, and created a digital twin, realizing integrated design, refined construction, and green operations. "We decided

PROJECT SUMMARY ORGANIZATION

WISDRI Engineering and Research Incorporation Limited

SOLUTION

Process and Power Generation

LOCATION

Wuhan, Hebei, China

PROJECT OBJECTIVES

- ◆ To deliver an iron and steel production facility close to three national nature reserves.
- ◆ To generate a digital twin to realize intelligent, green plant operations.

PROJECT PLAYBOOK

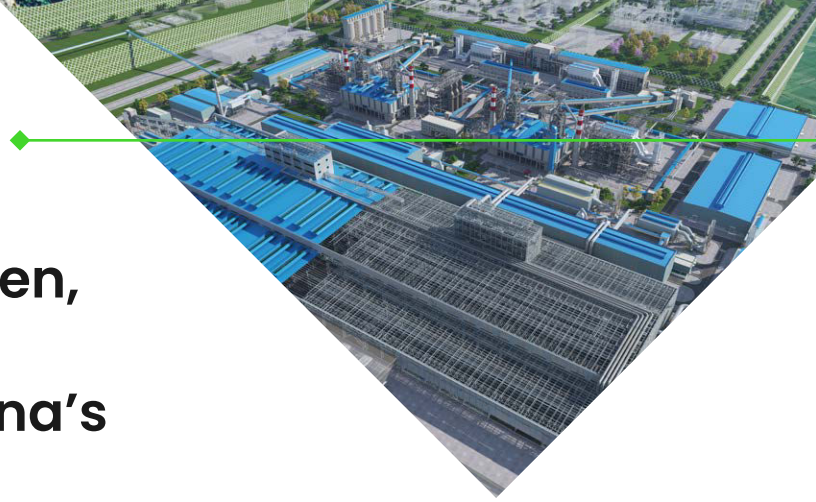
AutoPIPE[®], Bentley Descartes[™], Bentley LumenRT[™], Bentley Raceway and Cable Management[™], iTwin[®] Capture, OpenBuildings[®], OpenPlant[®], OpenRoads[™], OpenUtilities[®], ProjectWise[®], ProStructures[™], STAAD[®], SYNCHRO[™]

FAST FACTS

- ◆ This massive iron and steel facilities' modernization project is located in Yuxi close to three pristine nature reserves.
- ◆ WISDRI is the general contractor responsible for constructing four iron and steel production lines simultaneously.
- ◆ They leveraged ProjectWise with Bentley's digital twin technology to deliver smart, eco-friendly, low-carbon facilities.

ROI

- ◆ Working in a connected data environment streamlined workflows, improving design efficiencies by 35%.
- ◆ Through digital design and construction management, WISDRI shortened the design cycle by 38 days and construction period by 76 days.
- ◆ The Bentley-based solution saved a total of CNY 48.6 million in design and construction costs.
- ◆ Establishing intelligent digital twins supports smart, green production, reducing annual carbon emissions by 346,500 tons.



“Based on Bentley’s [applications], we established an intelligent operations and maintenance digital twin platform, supporting visualized operations, efficient operations, and low-carbon production.”

– Chu Xuezheng, Project BIM Manager and Senior Engineer, WISDRI Engineering and Research Incorporation Limited

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to adopt Bentley’s ProjectWise information management platform—along with various design, simulation, calculation, and construction management software—for collaborative project management, rapid modeling design, accurate quantity calculation, multiparty collaborative construction, and digitized operation and maintenance of iron and steel production, embodying smart application innovations,” said Xuezheng.

With OpenPlant and OpenRoads, WISDRI optimized the design process, performing parametric, detailed 3D modeling to adapt to the sloping terrain while minimizing the project’s spatial footprint. Integrating STAAD for seismic calculations ensured structural safety while iTwin Capture Modeler and SYNCHRO facilitated real-time, visual construction monitoring of on-site works.



WISDRI leveraged ProjectWise with Bentley’s digital twin technology to deliver smart, eco-friendly, low-carbon facilities.

Offering interoperability, along with data and model integrity, Bentley’s applications allowed WISDRI to analyze 3 million components and 200 gigabytes of point cloud models across 22 disciplines, creating 3D models that provided the foundation for establishing intelligent scheduling and maintenance digital twin modules. Integrating learning algorithms, IoT, and 5G communication technologies enabled automated production and schedule management, along with real-time data collection and transmission, to optimize equipment utilization, operations, maintenance, and decision-making, ensuring low-carbon facility processes. “The iron and steel green maintenance digital twin module enables precise monitoring and analysis of high furnace, converter, continuous casting production processes, equipment maintenance cycles, raw material distribution, and carbon emissions,” explained Xuezheng.

DIGITIZATION DRIVES SAVINGS AND SUPPORTS INTELLIGENT OPERATIONS

By establishing a connected digital platform, WISDRI synchronized design workflows for 22 designers, enabling real-time sharing of design outcomes among more than 50 stakeholders, improving communication efficiencies by 50% and design efficiencies by 35%. Compared to conventional 3D design, the digital solution resolved 157 design errors prior to construction, shortening the design cycle by 38 days and reducing costs of subsequent onsite modifications by CNY 22 million. “The total cost savings in the design phase amounts to CNY 28.6 million,” said Xuezheng.

Using SYNCHRO for digital construction planning facilitated precise allocation of resources among multiple construction parties and offered visual insight into onsite progress to help keep the project on schedule. Working in a 4D construction simulation platform shortened the construction period by 76 days and saved CNY 40 million in construction costs. By extracting material quantities directly from the models, WISDRI controlled material loss and saved approximately CNY 31.5 million in procurement costs.

“Utilizing Bentley’s software platform’s standard data parsing and transmission, it constructs intelligent digital twins for iron and steel smart operation and maintenance,” explained Xuezheng. The digital twins provide intelligent, full-lifecycle facilities digitalization, enabling WISDRI to achieve their smart, efficient, green, and low-carbon project goals. The technology solution optimized steel and iron production processes, saving an annual 51,500 tons of standard coal and reducing annual carbon emissions by 346,500 tons. “Through these digital means, this project effectively achieves high-quality, high-standard, environmentally friendly delivery of results and smart maintenance goals, significantly improving the efficiency of personnel at all stages and reducing labor intensity,” concluded Xuezheng.



Through digital design and construction management, WISDRI shortened the design cycle by 38 days and construction period by 76 days.

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