



SAMI Delivers Industry's First Plant-wide Digital Twin at Chalco's Zhongrun Aluminum Factory

Bentley's Digital Twin Applications Digitized Factory Operations to Save CNY 6 Million in Annual Management Costs and Support Sustainable Practices

PIONEERING A PLANT-WIDE DIGITAL TWIN

To cope with shifting operational paradigms and support China's sustainability initiatives, enterprises in the aluminum industry are seeking to digitize factory and plant processes. Committed to the national call for green development, reducing energy consumption, and their corporate strategy to accelerate digitalization, Chalco initiated a digital demonstration project at their Zhongrun aluminum factory. To meet their corporate digitization goals, as well as improve production and operational efficiency at the plant, they retained Shenyang Aluminum & Magnesium Engineering & Research Institute (SAMI) to apply digital twin technology throughout design, construction, operations, and maintenance of the facility. "[We] undertook the digital modeling, digital delivery, and digital operation and maintenance implementation of the project," said Fangbo Liu, director of project operation of the digital engineering center at SAMI.

With a total investment of CNY 3.94 billion, the project included constructing an electrolytic aluminum production system and supporting facilities at the existing Zhongrun factory, covering 750,000 square meters. SAMI sought to apply digital twin technology to the whole lifecycle of the project with a goal to create the industry's first plant-wide digital twin, providing a new development and enterprise management strategy for Chalco and the aluminum industry in China. "[We] aim to create a digital model for the entire plant project, link all static information, such as design and construction, into the model to produce complete digital project deliverables, apply digital twin technology to enterprise operation and management, and improve enterprise operation and management efficiency through the application of digital twin technology throughout the lifecycle of the project," said Liu.

ADDRESSING DATA INTEGRATION AND COORDINATION ISSUES

The project involved multiple disciplines and many subprojects, generating voluminous data that needed to be managed and coordinated on a short timeline. "One of the challenges of this project is that the project lasted 18 months from design to completion," said Liu. With 52 subprojects involving 100 engineers from 13 different disciplines, 300 gigabytes of data, and more than 100,000 documents, SAMI faced data integration and synergy challenges when developing a rapid and accurate 3D digital model of the entire plant. From modeling and delivery to the establishment of a digital operation and maintenance platform, the project included design institutes, constructors, owners, and suppliers. Therefore, SAMI needed to ensure seamless transmission of varying types of data between numerous departments and platforms.

At the same time, SAMI also needed to provide digital deliverables to help owners improve efficiencies and reduce costs managing and maintaining the plant. "[The question became] how do we integrate the data and models and create a digital outcome for the owner, so that the property owner can check this for operations and maintenance later," said Liu. To accurately link hundreds of gigabytes of design and construction data with a 3D model to manage the facility, SAMI had to move to a centralized and standardized digital system. They needed open modeling technology and a connected data environment to organize, structure, and integrate data with the 3D digital model, then generate a digital twin, facilitating accurate insight into operation processes to help owners optimize plant maintenance and management.

PROJECT SUMMARY ORGANIZATION

Shenyang Aluminum & Magnesium Engineering & Research Institute Co., Ltd.

SOLUTION

Process and Power Generation

LOCATION

Lvliang, Shanxi, China

PROJECT OBJECTIVES

- ◆ To generate a digital twin for Chalco's Zhongrun aluminum factory.
- ◆ To promote green development and reduce energy consumption in China's aluminum industry.

PROJECT PLAYBOOK

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

FAST FACTS

- ◆ SAMI created the first plant-wide digital twin for China's aluminum industry at Chalco's Zhongrun factory.
- ◆ Leveraging Bentley's digital twin technology, SAMI integrated 300 gigabytes of data across 52 subprojects involving 13 disciplines.
- ◆ The successful demonstration project promotes sustainable, eco-friendly industry practices.

ROI

- ◆ Using Bentley applications shortened modeling time by more than 15%.
- ◆ The Bentley-based enterprise digital factory management platform and digital twin reduced management costs by 10%.
- ◆ By using smart operations and maintenance methods, SAMI will reduce environmental emissions by 5%.

“Bentley software provides SAMI with a comprehensive solution from design to project management to digital delivery.”

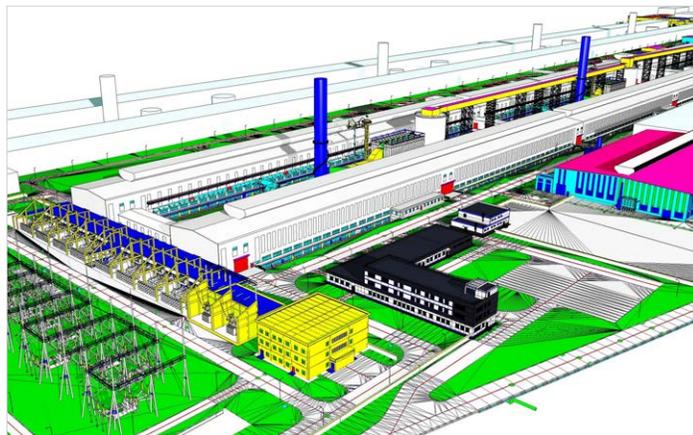
– Fangbo Liu, Director of Project Operation of the Digital Engineering Center, Shenyang Aluminum & Magnesium Engineering & Research Institute Co., Ltd.

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IMPLEMENTING BENTLEY'S DIGITAL TWIN TECHNOLOGY

SAMI selected Bentley technology to develop an enterprise digital factory management platform and build a plant-wide digital twin for the Zhongrun aluminum facility. Using ProjectWise and Bentley Open applications, SAMI created a structured data and engineering system to manage and store the voluminous data, customized a standardized asset coding and identification workflow, and developed a systemic digital design process to accurately model the plant. “After nearly three months of intensive modeling, SAMI created more than 1,300 model files, involving 14,000 design drawings,” said Liu. Working in an open, connected digital platform facilitated accurate linking of data generated during design and construction across all disciplines and stakeholders to create a complete 3D digital factory model.

Having built a static 3D model of the Zhongrun plant, SAMI had the foundation for integrating smart data collection and asset maintenance and management workflows, creating dynamic digital processes for the entire lifecycle of the project by applying Bentley's digital twin technology. “With Bentley's digital twin technology, SAMI built a complete 3D digital model of the Zhongrun Electrolytic Aluminum project, including static data generated during the design and construction phases, and dynamic data generated during the operation and maintenance phases,” said Liu. The digital twin enabled real-time inquiry into performance and management of equipment assets, helping owners to make more timely and informed decisions regarding asset maintenance and plant operations. Through advanced modeling and innovative digital application, SAMI established a set of delivery standards, unified data exchange, and developed integrated workflows, generating an intelligent digital twin for full lifecycle factory management.

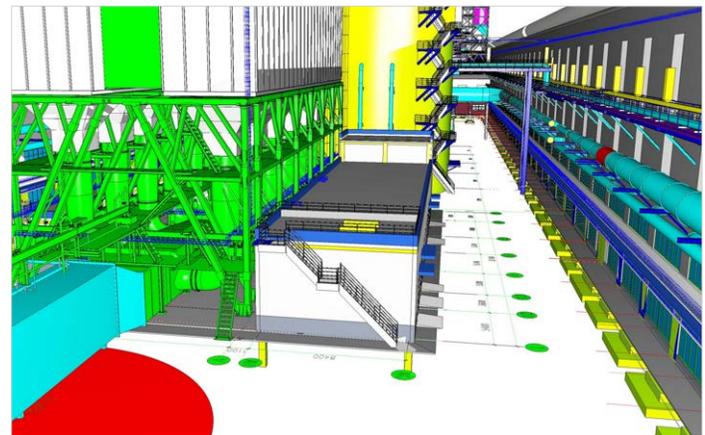


SAMI created the first plant-wide digital twin for China's aluminum industry at Chalco's Zhongrun factory.

DIGITIZATION TO REVOLUTIONIZE CHINA'S ALUMINUM INDUSTRY

Bentley's integrated applications facilitated systematic, rapid, and accurate 3D digital modeling of the Zhongrun plant, significantly reducing modeling time to save 3,000 work hours. “The entire modeling cycle of this project was shortened by more than 15%, compared to previous projects, saving about 200 working days,” said Liu. During the project delivery and implementation phase, the data openness of the digital twin improved design efficiencies by 30% and ensured seamless digital delivery for intelligent factory management. Compared to traditional manual management processes, the number of personnel in inspection and file management positions was reduced by more than 10%, which has the potential to save nearly CNY 1 million annually in enterprise employment costs. By developing a digital twin, SAMI changed asset file management from fragmented and disorderly to centralized and smart, enabling predictive and preventive asset maintenance. The digitization of factory operations reduces annual management costs by CNY 6 million, unpredictable equipment failures by 40%, and environmental emissions by 5%.

The successful project digitization promotes sustainable, eco-friendly practices, revolutionizing the production, processing, and management of aluminum factory operations. Integrating the digital twin with artificial intelligence (AI) capabilities enables manufacturing facilities to access and analyze real-time data, minimize human intervention in high-risk industrial zones, reduce production costs, and minimize the carbon footprint. The implementation of the Zhongrun project has facilitated intelligent plant management and fostered Chalco's digital transformation efforts. “[The project's] demonstration effect has influenced the related enterprises of the whole [Chalco] Group, and it has great exemplary significance for the promotion of digital transformation in China's aluminum industry,” said Liu.



Leveraging Bentley's digital twin technology, SAMI integrated 300 gigabytes of data across 52 subprojects involving 13 disciplines.

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