

SAMI Provides Digital Foundation for Smart Factories in China's Aluminum Industry

Bentley's Open Technology Will Save CNY 117 Million to Deliver a Large-scale Production Facility in Guinea

AN OVERSEAS ALUMINUM PRODUCTION INITIATIVE

Guinea is home to the world's largest reserves of bauxite, the main source of aluminum production, and is a top exporter to China, which is where the bulk of global aluminum is produced. As an African country participating in China's Belt and Road Initiative—promoting bilateral partnerships to increase global trade and stimulate economic growth—the Guinean government contracted with the Aluminum Corporation of China Hong Kong to develop a bauxite mine in Guinea's Boko region. The first phase of the project requires them to construct a CNY 7.19 billion aluminum production facility with an annual output of 1 million tons. The manufacturing investment aims to ensure long-term and steady imports of high-quality bauxite reserves, helping guarantee raw materials for China's aluminum business.

Shenyang Aluminum & Magnesium Engineering & Research Institute (SAMI) was tasked with conducting a feasibility study and preparing a report for the large-scale overseas facility covering 62 hectares. SAMI needed to remotely coordinate over 70 engineering subcontracts, as well as find a way to maintain the stringent scheduling and cost requirements that conventional

design and construction methods could not accommodate. "The traditional delivery method was unable to fundamentally solve the complex, massive data management needs, and could not leverage and integrate the data generated during the entire project lifecycle," said Fangbo Liu, project operation director of the BIM center at SAMI and BIM manager for this project.

DIGITALIZING WORKFLOWS AND DELIVERABLES

SAMI committed to providing the owners with digital deliverables based on digital asset management to improve factory operations and facilitate intelligent maintenance management. They also wanted to use digital technology in an effort to save approximately 5% of the construction costs. To attain these goals, they sought to establish digital twins and a connected data environment for the entire project. However, they faced difficulties remotely collaborating and managing resources with designers using different software applications, as well as determining how to effectively utilize the digital twins for visual construction planning and asset management. "We faced many challenges, including how to use digital twin technology to provide the owners with digital asset management and integrate design, engineering, operation, and maintenance information," explained Liu.



Using SYNCHRO 4D for construction simulation will save 72 construction days and CNY 57 million.

PROJECT SUMMARY

ORGANIZATION

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

SOLUTION

Manufacturing

LOCATION

Boffa, Boké, Guinea

PROJECT OBJECTIVES

- ◆ To create a standard engineering database as a single source of design information.
- ◆ To provide deliverables based on digital asset management and construction simulation.

PROJECT PLAYBOOK

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

FAST FACTS

- ◆ To manage over 5,000 documents and models and over 70 engineering subcontracts, SAMI established a connected data environment.
- ◆ The engineering database had over 8 million pieces of data, facilitating intelligent design.
- ◆ Bentley applications delivered the first asset-based digital twin in China's aluminum industry.

ROI

- ◆ ProjectWise helped streamline remote workflows, saving 30% in travel costs.
- ◆ Using SYNCHRO 4D will save 72 construction days and CNY 57 million.
- ◆ SAMI established the foundation for future visual smart aluminum factories.

SAMI used Bentley's digital twin technology and delivered digital deliverables based on AssetWise, which has integrated design, construction, operation, and maintenance information.

-Fangbo Liu, Project Operation Director of Digital Engineering BIM Center, SAMI Co., Ltd.

Although SAMI was familiar with using Bentley technology as the basis for generating reports and drawings for 3D modeling, they had not used Bentley's digital project delivery applications, instead providing the deliverables as physical files to the end customer. Furthermore, the sheer enormity, design depth, construction monitoring, and asset-oriented performance management for this project was beyond their prior experience. They proposed collaborative visual workflows and aimed to establish a standard engineering database as a single source of design information to create the digital twins. Then, they would establish these models as data information carriers that they would deliver to their customer. They realized that to achieve this innovative 3D digital delivery for China's aluminum industry, they needed an integrated technology platform and an open digital twin solution to resolve interoperability issues and digitalize lifecycle workflow processes.

LEVERAGING BENTLEY APPLICATIONS PROVIDES COMPREHENSIVE SOLUTION

SAMI selected ProjectWise to establish the connected data environment, facilitating collaborative digital design workflows and managing nearly 5,000 documents and digital models, 15 engineering disciplines, and over 100 project participants. Working in a unified platform improved quality and efficiencies through coordinated design, and regulated professional 3D digital modeling. They used MicroStation and OpenPlant to develop a standardized engineering database with more than 8 million pieces of data that conforms to industry design standards. The database integrates material and equipment codes to support intelligent design and construction processes. Leveraging several Bentley software applications—including AssetWise, AutoPIPE, OpenBuildings Designer, and iTwin® Services—SAMI generated a digital twin factory model centered around digital asset management. They connected asset-related documents and information with the digital twin via the AssetWise platform, establishing a scientifically organized data management structure.

Recognizing that the digital twin still required verification procedures and standards for control, they used Bentley software to develop visual and intelligent model verification and calibration processes, focusing on the rationality of equipment and pipeline layout, data integrity, safety, and operability. Implementing these processes enabled them to verify and resolve over 2,800 issues. "The Bentley software platform makes the quality of model verification specifications controllable and compliant with the standard requirements for subsequent deliveries," said Liu. Using SYNCHRO 4D, they linked the digital twin with the construction plan to perform 4D construction simulation and scheduling. Bentley's open integrated technology provided SAMI with the collaborative platform to establish standard workflows for creating digital twins and achieving digital deliverables for improved asset performance in China's aluminum industry.



Integrating AssetWise with the digital twin, SAMI established the foundation for future visual smart factories in China's aluminum industry.

DIGITAL TWIN SETS INDUSTRY BENCHMARK

Working in an open connected data environment using ProjectWise as the digital management platform helped coordinate data exchange among the remote and multidiscipline engineering teams. This technology improved workflow efficiencies that saved 30% in travel costs and 15% in labor costs, when compared to traditional data exchange methods. With Bentley's collaborative modeling and visualization applications, SAMI created a standard engineering database, intelligently generating more than 1,500 documents and reports, and saving 20% in time compared to previous traditionally designed projects. They also established a fully professional digital twin that exceeded project requirements. Through visual verification processes, SAMI optimized facility layout and reduced the occupied space by 10% and average height of the factory workshop by 5%, estimated to save CNY 60 million. At the same time, using SYNCHRO 4D for visual construction scheduling reduced the construction period by 6%, and is expected to save 72 construction days and more than CNY 57 million.

The industry's first asset-based digital delivery model is estimated to save CNY 117 million in costs, which will reduce project costs by 1.6% and demonstrate the benefits of Bentley's digital twin technology. SAMI used AssetWise and iModels to combine simulated asset and operational data at various stages with the digital twin to establish a visual digital factory model focusing on digital asset operations and maintenance management. Creating a digital twin linked to the AssetWise environment systematically inputs various data throughout project implementation and scientifically manages the data, providing clients with continuous asset management services and changing the methods for traditional factory asset management. "SAMI has cooperated with Bentley and innovatively completed the first AssetWise-based digital delivery model for the aluminum industry," stated Liu. The digital twin enables real-time, visual monitoring of equipment operating status and provides a digital model foundation that sets a benchmark for future visual smart factories in China's aluminum industry.