



Project Summary

Organization:

China Nerin Engineering Co., Ltd.

Solution:

Mining and Metals

Location:

Tongling, Anhui, China

Project Objective:

- Design the \$1.1 billion Tongling Copper Smelter to produce 400,000 tons of copper and 1.45 million tons of sulfuric acid per annum.
- Facilities consisted of 109 sub-items.
- 80 designers from 15 disciplines in two locations delivered the project in 33 months.

Products used:

Bentley Architecture
MicroStation
PlantSpace Design Series
ProjectWise
Structural Modeler

Fast Facts

- Nerin adopted Bentley's 3D collaborative design platform including MicroStation, ProjectWise, and PlantSpace.
- ProjectWise allowed the main designers onsite to collaborate with designers and reviewers at headquarters.
- Upon completion, the 3D plant model was delivered to the owner, for operation, maintenance, and management.

ROI

- Collaboration through ProjectWise improved design efficiency by almost 20 percent.
- 3D design-enabled interference checks reduced collision-caused changes by about 90 percent compared to traditional 2D design.
- Optimized configuration reduced plant size and saved an estimated 10 percent in construction costs, while accurate material take-offs reduced planned material usage that enabled further savings.

China Nerin Engineering Improves Efficiency by 20 Percent with Bentley's 3D Design Technology

Delivers Tongling Copper Smelter Three Months Early Using Bentley PlantSpace Products and ProjectWise Collaboration Software

\$1.1 Billion Copper Smelting Upgrade

China Nerin Engineering Co., Ltd. (Nerin), a leader among engineering companies serving China's nonferrous metal industry, was contracted to design and deliver the \$1.1 billion Tongling Copper Smelting Project within 36 months. Owned by Tongling Nonferrous Metals Group Co. Ltd., the advanced-technology smelter is located in Tongling City, Anhui Province, China. To achieve the aggressive schedule, Nerin adopted Bentley's 3D plant design technology including Bentley PlantSpace design applications and ProjectWise project collaboration and information management software. Bentley solutions improved design efficiency by nearly 20 percent, enabling Nerin to deliver the large-scale project three months ahead of schedule, while optimized plant configuration reduced the plant size, saving an estimated 10 percent in construction costs.



China Nerin Tongling Acid Plant

Expanding Copper Production to Meet Growing Needs

Tongling Nonferrous Metals Group engaged Nerin, which has rich experience in mining, metallurgy, public works, civil works, and environmental engineering, to design the plant, with work commencing in October 2009. The smelter, which was completed in mid 2012 and went into production in December 2012, will produce 400,000 tons per annum of copper and 1.45 million tons per annum of sulfuric acid.

The scope of the project design covered production and ancillary facilities for the entire process, from the entry of copper concentrate raw materials into the plant through the production of cathode copper, sulfuric acid, anode mud products, mineral tailings, and other byproducts. A total of 109 sub-items were required in seven areas: smelting, sulfuric acid, electrolysis, slag beneficiation, general layout, transportation, and public works. With so many disciplines participating in the design, Nerin knew that effective collaboration and efficient communication would be key to completing the project on time.

Collaborative 3D Design Across Multiple Disciplines

To meet the aggressive schedule, Nerin chose to design the entire project in 3D – a first in the non-ferrous metal industry in China. They selected Bentley's ProjectWise as the project team's collaborative design management platform, with a remote virtual private network as the means to communicate with team members at headquarters in Nanchang, Jiangxi, China. ProjectWise synchronized the project data on site and at headquarters, so designers in both locations could work with the same data on the same platform. Reviewers could also see designs in progress and give advice accordingly.

During peak production, 80 designers from 15 disciplines worked together on the project. The 3D plant model made communication among designers and Tongling Nonferrous Metals Group much easier, which in turn reduced rework due to design scheme modifications.

3D Plant Model Reduces Errors

Bentley's 3D design applications were integral to interfacing the multidiscipline design work, ensuring accuracy and eliminating conflicts. Bentley PlantSpace software products provided a full range of intelligent 3D modeling applications for engineering and design from basic to detailed design. Modules included Bentley PlantSpace Equipment, Bentley PlantSpace P&ID, Bentley PlantSpace Piping, Bentley PlantSpace Raceways, and Bentley PlantSpace SupportModeler. In addition, the team applied Bentley Architecture and Bentley Structural.

“Three-dimensional collaborative design promotes the standard design level of the engineering company.

It is helpful for increasing the unit labor productivity of engineering design, and for increasing the design quality of delivered products. Design data can be inherited in production and operation phases more effectively.”

– Wu Runhua, Deputy General Manager, Project Management Department, China Nerin Engineering Co., Ltd

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Bentley Data Manager was adopted in the design of the sulfuric acid area to link smart piping and instrumentation diagrams with the 3D model. The powerful multidisciplinary content management tool greatly reduced the probability of errors. Isometric drawings produced for each pipeline made it easy for the construction subcontractor to accept the work, and ensured fast and efficient pipeline construction.



China Nerin Tongling Wastewater Plant

Optimized Design Reduces Costs

Throughout the project, Tongling Nonferrous Metals Group took part in model examination and verification to ensure that the production and operational requirements were fully reflected in the design. Bentley software allowed Nerin's designers and the owner's technicians to continuously adjust and optimize the plant configuration to achieve a more rational and compact layout. Reducing the required plant space served to reduce the overall plant size and, therefore, plant construction costs.

Nerin estimates that optimizing the plant configuration saved an estimated 10 percent in construction costs. Accurate material take-offs from the 3D model reduced wastage. In the building structure, for example, the structural model alone reduced planned material usage by about 5 percent. Giving the construction subcontractor access to the 3D plant model

provided a basis for understanding the installation, thereby shortening the construction cycle as well.

Enhanced Sustainability

As one of the most advanced copper smelters in the world, the Tongling facility demonstrates how optimal use of natural resources can be achieved through rigorous and optimized design. Nerin adopted various methods to make the smelter energy efficient and achieved a level of energy consumption that is below China's standard limit. Budgeted at about 16 percent of the total project cost, environmental protection measures included waste gas emissions reduction, industrial wastewater treatment and reuse, domestic wastewater recycling, and noise minimization. In addition, the design provided for collection of byproducts such as slag beneficiation tailings for sale to cement plants, and wastewater treatment residue for use in brick production.

Return on Owner's Investment

Nerin completed basic design, detailed design, and technical service within 16 months. Construction of the whole project lasted 33 months and was complete in July 2012, three months ahead of the target schedule. The accelerated pace was an unprecedented feat for a large-scale, advanced technology copper smelter. The 3D plant model was handed over to Tongling Nonferrous Metals Group for digital operation, maintenance, and management of the factory lifecycle. The detailed model information also facilitated training of plant personnel.

On this large-scale project, Bentley applications yielded measurable savings from design through construction. Nerin reported that the adoption of a collaborative design process within the ProjectWise management environment improved design efficiency by almost 20 percent. During 3D design, interference checks performed on every sub-item reduced the number of collision-caused changes by approximately 90 percent compared to traditional 2D design. Through design optimization, change reduction, material conservation, and shortening of the construction cycle, the direct construction cost for the project was reduced by about 3 percent.