



## Project Summary

### Organization

SEI Engenharia Ltda.

### Solution

Mining and Metals

### Location

Canaã dos Carajás, Pará, Brazil

## Project Objectives

- Design and engineer a new copper mine projected to cost US \$2.6 billion
- Create, accurate 3D designs to advance the study of various concepts and enable the objective review of alternative designs from cost, environment, and safety perspectives
- Meet an aggressive project timeline

## Products Used

MicroStation V8i, Bentley Architecture, Structural Modeler, InRoads, i-model Composer, Bentley Navigator, Bentley View

## Fast Facts

- Engineering and design were completed on time and under budget
- i-models were used to exchange precision 2D and 3D engineering information and give Vale direct access to underlying engineering data
- The strategic use of Bentley software and i-models streamlined the collaboration and review process with the client.

## ROI

- Gained new efficiencies, saving SEI 5,100 man-hours
- Reduced front-end loading costs for the customer by US \$400,000
- The project was completed with 80 percent fewer large-scale drawings produced

# SEI Engineering Uses 3D Models to Accelerate Design, Review, and Approval

Bentley's 3D Modeling Products, i-Models, and Collaboration Technologies Save Time, Reduce Costs, and Help Ensure Delivery of an Optimal Plant Design

## A Large-scale Mining Project

When Vale, the world's second largest mining company, planned a \$2.6 billion copper plant in northern Brazil, it contracted SEI Engineering, a design and construction firm based in Belo Horizonte, Brazil, to perform front-end loading (FEL) and deliver detailed 3D models. The new mine, which is expected to have a life of 24 years, will produce 16 million tons per annum of run-of-mine with an average annual production of 340,000 tons of copper concentrate. Once in production, it will help address the deficit of copper production in the Brazilian domestic market. To build the 3D models and meet an aggressive design schedule, SEI leveraged MicroStation®, Bentley Navigator®, Bentley Architecture®, and other Bentley software products.

The software helped SEI quickly create 3D models and streamline workflows.

One of the challenges of this project was to prepare the basic engineering (i.e., the FEL 3) as 3D models. Vale wanted to use the 3D models to advance the study of key concepts prior to their integration into the detailed design plan, as well as give plant operations staff the opportunity to provide early input during the detailed design phase. At the same time, the models would accelerate project execution by shortening design review sessions and approval processes. "From the beginning of the project we also needed to work with plant operations information to improve planning, including the use of schedule simulation in Bentley Navigator, to plan and save resources," explained Rafael de Santiago Silva, CAD manager, SEI Engenharia Ltda.

## Building Accurate 3D Models

As a long-term user of Bentley software, SEI engaged Bentley Institute to train a multidisciplinary design team of engineers to use MicroStation, Bentley Architecture, Structural Modeler,

InRoads, and Bentley Navigator to model infrastructure, concrete structures, steel structures, substations, and industrial installations in 3D.

Using these tools, SEI's design team developed several simulated 3D plant layouts, including options showing different internal and external access roads; these layouts helped Vale identify the optimal plant layout design that

required the least enterprise investment; for example, they could quickly compare the environment, cost, and construction times associated with various plans. The result was the production of an initial mine layout followed by a master plan – mapped out in 3D – complete with a timetable for execution.



*These flotation columns were designed using Bentley's 3D modeling tools.*

## Streamlining Collaboration and Review Cycles

Using Bentley Architecture, Structural Modeler, and MicroStation, SEI developed 3D models quickly and efficiently and published them via i-models. These i-models, which are containers for exchanging precision 2D and 3D engineering information, gave Vale direct access to the underlying design data down to individual component details with complete accuracy. Vale had two ways to view i-models: 1) using Bentley Navigator, or 2) downloading them through FTP into Bentley View for deeper analysis. "Replacing the usual design drawings with i-models as the project 'deliverables' was a breakthrough in the relationship with the client," explained Santiago Silva. "For example, everyone could analyze designs to any level of detail and send and receive comments electronically."

i-models also accelerated client review cycles. "The design review sessions grew shorter since everyone had made comments directly in the i-model. This accelerated the approval of the project," said Santiago Silva. Because safety and operational engineers could review the 3D models during

*“Using i-models as the project ‘deliverables’ was a breakthrough in our client relationship. Any level of detail could be analyzed and comments could be electronically exchanged. When clients could interact with the 3D model, they had more confidence in our design and our progress on the project.”*

*—Rafael de Santiago Silva, CAD manager, SEI Engenharia Ltda.*

audit review meetings, the final design was also safer; for example, using Bentley Navigator, they could review these models in detail, redline them, and check for inconsistencies throughout the design process.



*A visualization of the concentrate thickener.*



*A visualization of the mineral dressing area.*

enabled by the software also saved SEI approximately 5,100 man-hours and reduced front-end loading costs for the customer by US \$400,000. And by using i-models as their main deliverable type, they completed the project with 80 percent fewer large-scale drawings created using plotters – a real cost saver.

In addition to significantly shortening the time spent on design engineering, using Bentley software and i-models increased the quality and accuracy of designs. And because the team had a single, integrated model providing 3D visualization of the entire project, SEI was able to reduce construction time, save on labor and rework costs, and minimize the need to create costly printed documentation. Most importantly, the increased accuracy and improved review cycle meant time and cost savings were achieved while increasing construction and plant operational safety.

### **About i-Models**

Developed by Bentley, i-models (containers for open infrastructure information exchange), enable the precision sharing of engineering data without loss of accuracy. Bentley i-models are information rich, including 2D and 3D geometry, from lines and arcs to surfaces, solids, and meshes. i-models also contain business properties and data, provenance (knowledge of its origin and evolution – essentially its i-model change history), the state of the information when the i-model was published, and the purpose for which it was created.

### **Bottom-line Benefits**

Bentley software enabled SEI to develop detailed 3D models and facilitate a streamlined collaboration process, ensuring that Vale ended up with an optimal, detailed, and safer plant design – on time and within budget. The integrated workflow

Lastly, Bentley i-models store information reliably, using digital rights management to secure access and reuse permissions, and digital signatures to validate and verify an i-model's status.

**Find out about Bentley at: [www.bentley.com](http://www.bentley.com)**

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