



PROJECT SUMMARY

Project: B&W Pantex Processing Facility

Organization: CH2M Hill

Location: Amarillo, Texas

Project Objective: Develop a Building Information Model post-design to find and resolve problems in the design before construction began.

Software Used: MicroStation®, Bentley Architecture, Bentley Structural, Bentley Building Mechanical Systems (HVAC and Plumbing), Bentley Plantspace 2004, Bentley Navigator, Bentley Interference Manager (built in to BBldg Suite), Geopak Site.

FAST FACTS

- Project Duration: Four Months
- Project Completion Date: 12/6/07
- Utilized Bentley BIM suite to produce 3D PDF's for review purposes daily
- One 16-hour design review meeting found and resolved over 300 problems, saving time and money in the field, and would have otherwise resulted in significant change orders
- The DOE aggressively pursued the extension of the effort into the 4-year construction period
- Derived material quantities both as total and installed counts, to compare against the contractor's invoices
- Reviewed proposed design changes as well as field deviations to keep control of the overall and detailed design
- Staff worked in their respected offices (in a secure room on an isolated network)
- Saved time and money utilizing Reference files for collaboration

Building Information Modeling Saves B&W Pantex Nearly \$10 Million In Construction Costs

Bentley's 3D Visualization And Collaboration Tools Enable An Extended Design Team To Resolve Hundreds Of Interference Issues And Save Millions Of Dollars In Construction Costs

About 15 miles outside of Amarillo, Texas, sits the B&W Pantex Plant, a 16,000-acre facility where the U.S. Department of Energy produces, disarms, and stores nuclear weapons.

In 2004, Pantex initiated the design of a new 45,000-square-foot processing facility. The existing plant had been around since 1942, and some facilities were reaching the end of their life. The new facility was part of an overall plan to streamline operations and reduce costs.

Pantex hired CH2M HILL, a full-service engineering, consulting, construction, and operations firm based in Englewood, Colo, to create a traditional 2D design using Bentley's MicroStation. The tightly packed facility was composed of heavy concrete with miles and miles of electrical conduit and HVAC piping. The complexity of the project motivated Pantex to look for new ways to resolve as many operational and physical clashes before breaking ground.

"Once we built the walls and poured the concrete, we didn't have a lot of flexibility to move things around," said Steve Forman, project manager at Pantex. "Because this facility was so important to our mission, we wanted to do everything possible to avoid costly design mistakes and schedule overruns."

That's when Pantex received a newsletter from Bentley Systems outlining the benefits of the new 3D modeling capabilities offered in the latest version of MicroStation. MicroStation enables designers to create a Building Information Model (BIM) – a 3D representation of a building that captures geometry, spatial relationships, and material properties. What's more, MicroStation enhances collaboration by enabling users to embed 3D images and animations in Adobe PDF documents to easily share with extended design teams.

Reading about the benefits of MicroStation in the newsletter was the catalyst that sparked Pantex's foray into 3D modeling. When the 2D designs for the new facility were nearly complete, Pantex expanded its contract with CH2M HILL, asking it to create a full 3D BIM of the facility based on the 90-percent-completed 2D drawings.

INTRICATE DETAILS

CH2M HILL had plenty of experience creating Building Information Models, but this project was unique in its high level of detail. Pantex wanted a 3D model with enough dimensional accuracy to cover every object in the building down to a 3/4-inch conduit.

"Typically we don't model below 1.5 inches on anything," explained David Fouche, senior technologist at CH2M HILL. "Pantex wanted us to model every HVAC pipe and every electrical device, switch, and outlet in the facility – and they gave us only four months to do it in."

In order to complete the project within the tight time-frame, CH2M HILL quickly assembled a team of high-end designers spread across three states. The project team consisted of 18 members, including 2D architects, modelers, and Pantex engineers.

By using MicroStation in combination with other applications in Bentley's building solution, such as BIM, CH2M HILL created a complete 3D model of the entire Pantex building.

"I don't know of any other software package with which you can do this type of job," said Fouche. "The concrete wasn't straightforward. It turned corners, had protrusions



Campus View of B&W Pantex New Processing Facility .

"By the end of this project, we estimate we'll have saved nearly \$10 million thanks to Bentley tools"

ABOUT BENTLEY

Bentley Systems, Incorporated is the global leader dedicated to providing comprehensive software solutions for sustaining infrastructure. Architects, engineers, constructors, and owner-operators are indispensable in improving our world and our quality of life; the company's mission is to improve the performance of their projects and of the assets they design, build, and operate. Bentley sustains the infrastructure professions by helping to leverage information technology, learning, best practices, and global collaboration – and by promoting careers devoted to this crucial work.

For more information, visit www.bentley.com

BENTLEY OFFICES

Corporate Headquarters

685 Stockton Drive
Exton, PA 19341 USA
1-800-BENTLEY (1-800-236-8539)
Outside the US +1 610-458-5000

Bentley Systems Europe B.V.

Wegalaan 2
2132 JC Hoofddorp
Netherlands
+31 23 556 0560

Bentley Asia

Unit 1402-06, Tower 1
China Central Place
No. 81 Jianguo Road
Chaoyang District
+86 108 518 5220



and penetrations, and lots of detail on how the joints came together. MicroStation enabled us to carve shapes intuitively, like working with clay. In contrast, it would have been impossible to create these complex shapes in a parametric modeler, where you have to input exact parameters."

VIRTUAL REVIEWS

In sharing the work with the team, the challenge was to get the highly skilled architects and Pantex engineers to review the model itself rather than redlining 2D drawings generated from the model.

To accomplish this, CH2M HILL issued a daily set of 50 photorealistic images taken in and around the building, produced 3D PDFs, and issued animation scripts that walked viewers along a preset camera path. They also made the 3D information model available for viewing and analysis.

Members of the review team who had little experience with computer-aided design were able to use Bentley Navigator to intuitively interact with the model. The program also enabled them to perform detailed interference analyses and simulate construction activities.

The Building Information Model immediately proved highly successful. In one 16-hour design review meeting, the team identified and resolved over 300 interference issues. In another, they found 200 interferences. CH2M HILL modelers also picked up on countless other issues in the process of creating the information model.

According to Fouche, catching all these interferences by simply looking through the original stack of 357 drawing sheets would have been impossible. "The human brain isn't capable of pulling together all those drawings to get an accurate picture of what's going on," he said.

"In contrast, the model enabled us to virtually walk through each room in the facility and discuss the types of movements involved in the construction," said Fouche. "We could, for example, visualize a crane moving to see how it might interfere with a device on the wall. And we also identified a lot of issues that contractors might run into when installing HVAC piping."

"In one case, we identified 135 penetrations in a concrete wall that needed to be lowered 12 inches," said Bill Van Winkle, senior project engineer at Pantex. "That alone saved us \$3 million."

Beyond interference checking, BIM enabled the team to estimate materials quantities, such as how many tons of concrete and how much steel and linear feet of conduit were required. It also helped the project team put together a bill of materials for use in contract bids.

"It was a big plus that our design gave us material estimates," said Van Winkle. "We had to make sure our quantities were accurate and they were dead on. That really helped us a lot."

The benefits of BIM will go beyond the design and bidding phase. After the project breaks ground in the summer of 2009, the design team plans to use the Bentley model in



Exterior View of B&W Pantex New Processing Facility.



Systems and Utilities View of B&W Pantex New Processing Facility.



Interior View of BAY 9.

the field. If a contractor needs to make a change, the design team will be able to apply 'what-if' scenarios to understand the impact of a change and assist contractors with sequencing activities. They will also use the model to track changes in material quantities and compare those against contractor invoices.

"By the end of this project, we estimate we'll have saved nearly \$10 million thanks to Bentley tools," said Forman. "The Building Information Model proved essential in identifying problems and collaborating with an extended review team. In fact, we are so pleased with the Building Information Model approach that we are using it to design our next Pantex facility."