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Advancing Infrastructure

China Water Resources Pearl River Planning Reduced Design Defect Rate by 85 Percent

Bentley's Applications Advanced Communication and Efficiency

Project Summary

Organization
China Water Resources Pearl River Planning, Surveying & Designing Co., Ltd.

Solution
Power Generation

Location
Pu'an County, Qianxinan Prefecture, Guizhou Province, China

Project Objectives

- Complete design and construction deliverables for reservoir that will supply water, irrigation, and electricity generation for homes and industrial facilities in Pu'an County.
- Use BIM methodology to create 3D terrain and geological models from which 2D drawings can be created and easily shared with the construction teams.

Products Used:
AECOsim Building Designer, Bentley Raceway and Cable Management, LumenRT, Bentley Map®, MicroStation®, Navigator, OpenPlant, OpenRoads, ProjectWise®, Bentley Substation

Fast Facts

- Bentley's 3D modeling applications supported a collaborative BIM methodology and design process.
- The team created 3D terrain and geological models before creating the 3D design model, efficiently creating 2D drawings to share with the construction team and stakeholders.

ROI

- The project team reduced the design defect rate by 85 percent and increased design efficiency by 30 percent.
- With Bentley's collaborative design platform, effective communication increased by 50 percent.

Overcoming Severe Drought

In the southwestern part of China's Guizhou province, the Pu'an County of Qianxinan Prefecture has suffered from severe drought for the last century. It affects more than 50 million people and 5 million hectares of crops. Of those people, 20 million have no adequate source of drinking water. China Water Resources manages the Wugachong Reservoir Project, a medium-sized reservoir project in the area.

To provide better water management for the area, the organization came up with a reservoir pivot project, involving the design and construction of a roller-compacted, concrete, double-curvature arch dam; a dam crest overflow surface bay; a flood discharge bottom sluice; a diversion-power system; a lift pumping station; a water supply area; irrigation area water delivery; and other buildings. This plan would supply water, irrigation, and electricity generation for the homes and industrial facilities.

China Water Resources Pearl River Planning, Surveying & Designing Co., Ltd. was engaged to complete the construction drawing design and on-site, technical services for this project. This project posed complex topographic and geological conditions, limiting project space and presenting significant site excavation and structural design challenges.

Putting Bentley's BIM Technologies Work

The project team began by developing a 3D terrain model using MicroStation. This model, combined with geology data, was then used to create a geological model in MicroStation. The model accurately reflected the complex environmental conditions of the area and provided a solid foundation for the overall 3D design and the layout scheme for the L1 crack that had been identified in the right dam shoulder.

The model information then allowed the team to begin the design for the plant and dam. Team members used OpenRoads to design the roads and bridges while using AECOsim Building Designer for the excavation. MicroStation helped with concrete reinforcement and electrical design and OpenPlant helped with the hydraulic machinery.

Bentley's BIM advancements also allowed the team to solve complex problems throughout the design process. For example, it enabled designers to address issues caused by use of zigzag-shaped rampway excavation designs. In addition, Bentley's functionality enabled the cooperative assembly of the 3D geological models and 3D design models.

Based on the 3D model, the project team resolved complex topography and geology related issues, developed the project layout scheme and site excavation, extracted the project volume and 2D plane drawing from the design drawing, and reinforced the drawing design and the display of effect drawings. Using these models, the team created the relevant, standardized technical documents required by the client.

Creating a Collaborative Environment

The project team used ProjectWise as its collaborative design platform, enabling the team to collaborate and share information with ease, centrally manage design files, and work quickly and efficiently. Throughout the design process, Bentley applications supported this type of design and product flow, which greatly aided the various specialties involved in the project. It also reduced the need for repetitive work, which greatly shortened design time, without reducing the design quality.

The project model created in MicroStation accurately reflected the complex environmental conditions of the region and provided a solid foundation for the overall 3D design.

"The various kinds of Bentley software that we used in this project provided all design specialties with a platform for collaboration, unified standards, and a standard file format. These specialties greatly improved design efficiency."

– Zhihao Fu, Director of BIM Technology Application Center, China Water Resources Pearl River Planning Surveying & Designing Co., Ltd.

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Contact Bentley
1-800-BENTLEY (1-800-236-8539)
Outside the US +1 610-458-5000

Global Office Listings
www.bentley.com/contact

The project team collaboratively developed construction drawings and had a collective 3D modeling process using Bentley's applications. Users could easily obtain information from the terrain and geology models. Additionally, the applications' interoperability mitigated the repeat entry of information when multi-discipline team members worked in concert.

Delivering Real Results

By adapting Bentley applications to meet local and project requirements, the team completed the 3D design model in just two months, easily fitting within the project's tight deadline. The 3D model was used to generate highly accurate 2D drawings for construction teams. The design team used hypermodeling to connect drawings and documentation with the 3D model. By setting and enforcing standards for the design process and effectively managing design files, the project team reduced the design defect rate by 85 percent. They also increased design efficiency by 30 percent.

The team could easily communicate their design with other team members and project stakeholders, increasing efficient communication by 50 percent. The 3D modeling capabilities of Bentley applications also helped team members visualize the design amidst a complex terrain. The construction space was narrow and included the large L1 crack. However, by creating the 3D terrain model, designers could plan around the complexities in a way that would be impossible with only 2D drawings. Without Bentley's 3D modeling applications, the project would have taken much longer to complete, if at all.

Once the reservoir is constructed and put into operation, it will greatly improve water supply, irrigation, and electricity generation for rural and urban communities and surrounding industrial sites. These improvements will also help enhance the environment and the community's quality of life, as well as promote development of the local economy. Looking ahead, China Water Resources Pearl River Planning Surveying & Designing Co., Ltd. plans to use its newly honed 3D design experience on other projects in various industries, such as with wind plants, environmental management, and water supply. They will continue their focus on green energy and use Bentley applications to make their own work more efficient.

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