



Project summary

Organization:
PowerChina ZhongNan Engineering Corporation, Ltd.

Solution:
Roads and highways

Location:
Chongzuo, Guangxi Autonomous Region, China

Project playbook:
Bentley LumenRT™, iTwin® Capture, MicroStation®, OpenRoads™, ProjectWise®, ProStructures™

Project objectives

This modernized ecological highway serves the Detian Transnational Waterfall, promoting tourism and supporting cross-border connectivity and cultural exchange between China and Vietnam.

PowerChina ZhongNan leveraged Bentley's open, integrated digital applications to optimize design and construction and ensure sustainable outcomes.

Upon completion, the route is estimated to boost annual tourism revenue by 12%.

ROI

Standardizing and automating 3D design workflows improved collaboration by 60%.

Bentley LumenRT reduced communication costs by 30% and minimized construction risks.

Working in a connected digital environment streamlined workflows, reducing labor costs by CNY 1.2 million.

Bentley applications reduced demolition, geological risks, and earthworks to save a total of CNY 1.7 million in costs and 37.2 tons in carbon emissions.

Ecological tourist highway improves China-Vietnam cross-border access to Asia's iconic transnational waterfall

Bentley applications accelerate project delivery by 25 days while reducing carbon emissions by 37.2 tons

Balancing economic growth with environmental preservation

Located in China's Guangxi province along its border with Vietnam, this highway improvement project is one of several initiatives aimed at enhancing tourism, improving mobility, and facilitating cross-border exchanges within the China-Vietnam cross-border tourism cooperation zone. PowerChina ZhongNan is delivering the roadway, being designed and constructed as an ecological tourist highway that stretches 13.5 kilometers between the Detian Transnational Waterfall Scenic Spot and the Shulong International Port. The project upgrades an existing border route and features one 335-meter tunnel, 49 culverts, and eight at-grade crossings. Together, these improvements will provide easier access for tourists from both countries to experience the iconic waterfalls and shared cultural heritage—fostering economic growth while promoting cultural integration.

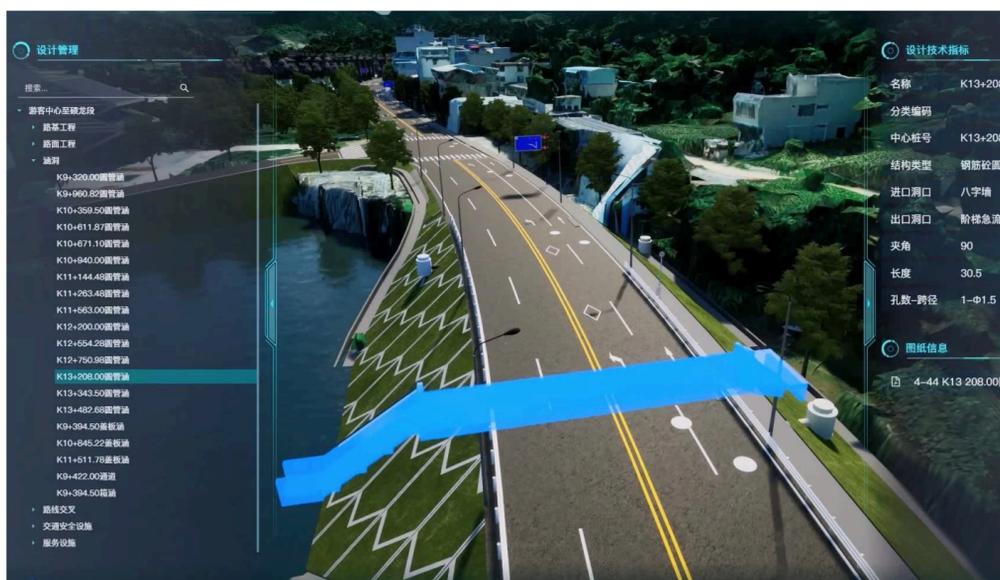
"The project's construction has urgent practical significance and long-term strategic significance for strengthening regional external exchanges, improving resident travel conditions along it and promoting the development of tourism resources," said Fanyun Zeng, director of digital engineering at the Urban Construction and Transportation Engineering Institute, PowerChina ZhongNan. As a sustainable cross-border project, the eco-friendly corridor exemplifies how modern transportation development can balance economic opportunity with environmental preservation in a sensitive border region. To minimize impact on the

scenic karst landscape along the route, PowerChina ZhongNan is utilizing advanced digital modeling to ensure environmentally sensitive design and construction processes. Upon completion of the project, visitor traffic efficiency is estimated to increase by 30%, driving an approximate 12% boost in annual tourism revenue along the route.

Complex terrain, landscape protection, multiple stakeholders

As an old roadway and ecological reconstruction project located in a mountainous area with a developed water system and close to the Guichin River, there were many design restrictions and considerations regarding the integration with existing infrastructure and the surrounding environment. The tourist route also passes through nine scenic spots, including the Huashan Scenic Area, Old Kapok, and Green Island Xingyun. "The landscape design requirements are high and there are many environmental sensitive factors along the route," explained Zeng.

Further complicating the mountainous topography and landscape protection requirements were the complex geological considerations given the karst development, and the dense urban residential areas along the route. "This project is adjacent to 11 residential areas, so we have to try our best to reduce the land use and excavation, refine the land acquisition and demolition, and speed up resettlement to minimize interference to residents' lives," explained Zeng. To make maximum use of the existing roads and minimize damage and disruption



Working in a connected digital environment streamlined workflows, reducing labor costs by CNY 1.2 million.



PowerChina ZhongNan leveraged Bentley's open, integrated digital applications to optimize design and construction and ensure sustainable outcomes.

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For complex projects, Bentley's powerful engine and tools are indispensable; and more importantly they rely on this open platform and [allow for] enterprise level customization.

— Fanyun Zeng, Director of Digital Engineering, Urban Construction and Transportation Engineering Institute, PowerChina ZhongNan Engineering Corporation, Ltd.

to the environment and community residents, PowerChina ZhongNan realized that these site constraints required practical and flexible digital engineering schemes.

Finally, the involvement of diverse engineering disciplines and multiple stakeholders demanded collaborative workflows and refined management to avoid collisions and optimize construction. “There are many participants in this project, and there is a high requirement for refined management of BIM, GIS, and work breakdown structures during the construction process,” emphasized Zeng. To streamline and coordinate design and construction management and keep the project on track, the team needed an integrated digital modeling solution.

Establishing integrated and automated digital workflows

To manage the complicated design and construction, PowerChina ZhongNan replaced traditional 2D models with Bentley's integrated and open 3D modeling and project management applications.

“We used Bentley as the basic platform followed with a full workflow from establishing the enterprise standards, developing the BIM design system, capturing the environment, designing and delivering the project, light-weighting the models, and managing the construction coordination,” explained Zeng. Using ProjectWise, they established a common data environment to improve collaboration and streamline design, proactively resolving design conflicts prior to construction, while iTwin Capture allowed them to accurately capture and model the existing environment.

At the same time, throughout design and delivery, the team relied on Bentley's Open applications, especially OpenRoads Designer, to better support local design and management through the development of their innovative BIM Design System for Highways and Municipal Roads. The Bentley-based system includes 12 professional modules of road design and embeds traffic engineering BIM standards to automate the assignment and management of model attribute information, facilitating intelligent design and targeted decision making. “We built the BIM Design System for Highways and Municipal Roads by relying on Bentley's platform and corporate design standards, greatly improving the efficiency and quality of forward design and delivery of BIM for highway specialties,” said Zeng. Integrating Bentley LumenRT into their digital workflow, the team visually communicated design intent to all stakeholders and simulated the construction process to achieve a fully integrated lifecycle digital design and construction management solution.

Digitalization drives savings and sustainable development

“Through the application of Bentley's series solution, we have achieved a win-win situation for all parties,” stated Zeng. For the design team, working in an open

modeling and connected digital data environment improved design efficiency by 40%, increased multidiscipline collaboration by 60%, and enabled PowerChina ZhongNan to identify and resolve 37 design conflicts, equivalent to saving CNY 1 million. By using Bentley LumenRT to communicate design intent and simulate construction, the team completed construction 25 days ahead of schedule to save 5% in total costs. Leveraging Bentley's integrated applications streamlined workflows, reduced design changes, and optimized coordination and management to save an estimated CNY 6 million in overall costs.

Beyond time and cost savings, PowerChina ZhongNan's digital innovations delivered significant sustainability outcomes. Replacing traditional design and construction processes with advanced digital methods facilitated strategic planning that reduced unnecessary demolition, minimized land acquisition, and protected natural habitats near the Guichin River. “We used Bentley software to integrate the design model with onsite tilt photography [and] optimized the demolition scheme,” said Zeng. “We intuitively avoid scenic areas and water source protection areas, protecting the landscapes and ecological environment.” Together, these achievements contributed to a 50% reduction in impact on the water resources and retention of 97% of natural habitats.

Accurate calculations reaped further benefits, optimizing earthworks allocation by 60,000 cubic meters per kilometer to cut carbon emissions by 37.2 tons. “Thanks to Bentley's series of solutions, this project has made innovative achievements in many aspects, such as design scheme optimization, scientific and technological innovation, cost reduction and efficiency improvement, ecological protection and sustainable development, which not only enhances the influence of this project, but also provides a reproducible digital solution for similar projects around the world,” concluded Zeng.

Find out more at Bentley.com
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