Project summary

Organization:
CSCEC AECOM Consultants Co., Ltd.

Solution:
Water and wastewater

Location:
Jinchang, Gansu, China

Project playbook:
Bentley LumenRT™, MicroStation®, OpenFlows™, OpenRoads™

CSCEC AECOM uses digital modeling to create an integrated, accurate flood control system

Bentley applications improved collaboration and sped development, helping to protect 300,000 people while lowering environmental impact

Project overview

CSCEC AECOM had to redesign a large-scale drainage system in the Jinchuan district of Jinchang to safeguard 300,000 people.

Incomplete pipe data and a chaotic underground utility system made traditional methods of work impossible.

The team used Bentley applications to unify all teams in a single platform and create 3D models of all elements.

ROI

By streamlining the design process, the team achieved a 40% reduction in design time.

Advanced 3D visualization and collaboration tools minimized design errors by 90% and cut rework by 15%.

Precise construction reduced earthwork excavation by 30%.

Repairing and rethinking a drainage system

CSCEC AECOM Consultants is a comprehensive municipal engineering design firm covering all aspects of urban infrastructure development and maintenance. In recent years, the firm has embraced digital design, establishing the Information Modeling Institute to explore the use of new digital technologies, accumulate real-world applications of these advancements, and apply lessons learned to new projects.

Local officials entrusted CSCEC AECOM with creating a design to enhance flood resilience in the Jinchuan district of Jinchang, Gansu, China. “The project scope includes constructing and renovating rainwater pipelines, repairing damaged roads and facilities, and addressing key problems such as systemic drainage deficiency, connection of rainwater and sewage pipes, and pipeline blockages,” explained Di Ma, director of digital research center at CSCEC AECOM.

Complexity too great for 2D design

However, the goals of the Jinchuan project went well beyond previous attempts at flood control. Objectives included precisely diagnosing urban drainage system issues through digital analysis, developing visual models, and optimizing designs to ensure flood resilience under extreme rainfall. “The project is expected to deliver high-precision drainage network models and 3D reality models, identify overflow risk points, and verify scheme feasibility through flood models,” elaborated. “To the local community, the project is significant as it can reduce flood threats to residents' lives and property, enhancing urban resilience.”

This ambitious goal was just the start of the challenges CSCEC AECOM faced. Not only did they lack data for aging pipelines, but they also had to work around complex and sometimes disorderly underground utilities. Additionally, they had to combine the work of various specialized teams, including experts in roads, bridges, water and wastewater, and hydraulic engineering. Early attempts to overcome the site issues using manual surveying and 2D CAD design failed, as they could not produce accurate 3D designs. The team needed integrated applications that could unite all contributors and accurately render the project.

Unifying teams with digital design

CSCEC AECOM determined that Bentley applications could accurately model the entire project in a single environment, eliminating any concerns about incompatibility. They began by collecting site data through drones, pipeline robots, and ground-penetrating radar. By using MicroStation as the basis for development, they used that data to seamlessly integrate large-scale reality models with an accurate digital twin of the complex pipeline system. OpenRoads helped coordinate modeling of roads, pipeline, and terrain, ensuring the design fits the terrain and elevation.

Then, they used OpenFlows Sewer to undertake hydraulic analysis of the proposed drainage system. “[It] can precisely simulate pipe overloads and overflow risks and is directly connected to BIM models for pipe diameter and slope adjustments,” Ma said. The team created a three-in-one analysis system combining reality models, pipelines, and hydrodynamic models. The process can extract elevation targets and triangulate terrain, then simulate waterlogging depth and overflow through a 2D solver to verify the pipe diameter adjustment plan. “The solution, achieved through multisoftware collaboration and data intercommunication, has achieved full-process digital closed loop, overcoming the inherent limitations of traditional tools and providing efficient and reliable technical support for complex urban flood control projects,” Ma explained.

Improving accuracy with less time needed

Creating digital models of the project significantly enhanced delivery. For example, by integrating reality models with a 3D map of the pipeline system in MicroStation, the modeling process for the 15-square-kilometer area was reduced from the months required by traditional surveying to seven days. With OpenFlows Sewer, they lowered analysis time for a 30-year storm scenario from weeks to hours, all while accurately identifying overload risks on a key pipeline. With full knowledge of potential water flow, the team adjusted the pipe diameter to DN800 (800 millimeters outer diameter), avoiding rework and lowering costs. The project reduced pipe material waste by 15% through optimized design, while the digital collaboration platform streamlined the ‘design-review-approval’ workflow, boosting process efficiency by 30% and cutting communication costs by 20%,” Ma said.

Throughout the process, Bentley’s Open applications improved collaboration, as real-time data sharing among owners, designers, and construction teams shortened the model feedback cycle from five days to two hours. “Information sharing has been achieved through the Bentley cloud platform, which supports multidevice access, clash detection, and attribute queries, ensuring cross-disciplinary data consistency and enabling full lifecycle digital management of municipal engineering project,” Ma concluded.

With the help of digital modeling, CSCEC AECOM has designed a system that will greatly lower flood risks for 1,146 hectares of flood prone areas, protecting CNY 460 million in infrastructure and safeguarding 300,000 people. The system will also work while minimizing adverse environmental impact, as it is expected to lower annual carbon emissions by 500 tons as well as preserve 200 hectares of natural habitat by avoiding unplanned expansion.

> **Bentley's integrated reality modeling, hydrodynamic simulations, and collaborative platform enabled precise drainage optimization, [helping to] build a digital flood barrier for 300,000 residents in Jinchuan district.**
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> *— Di Ma, Director of Digital Research Center, CSCEC AECOM Consultants Co., Ltd.*

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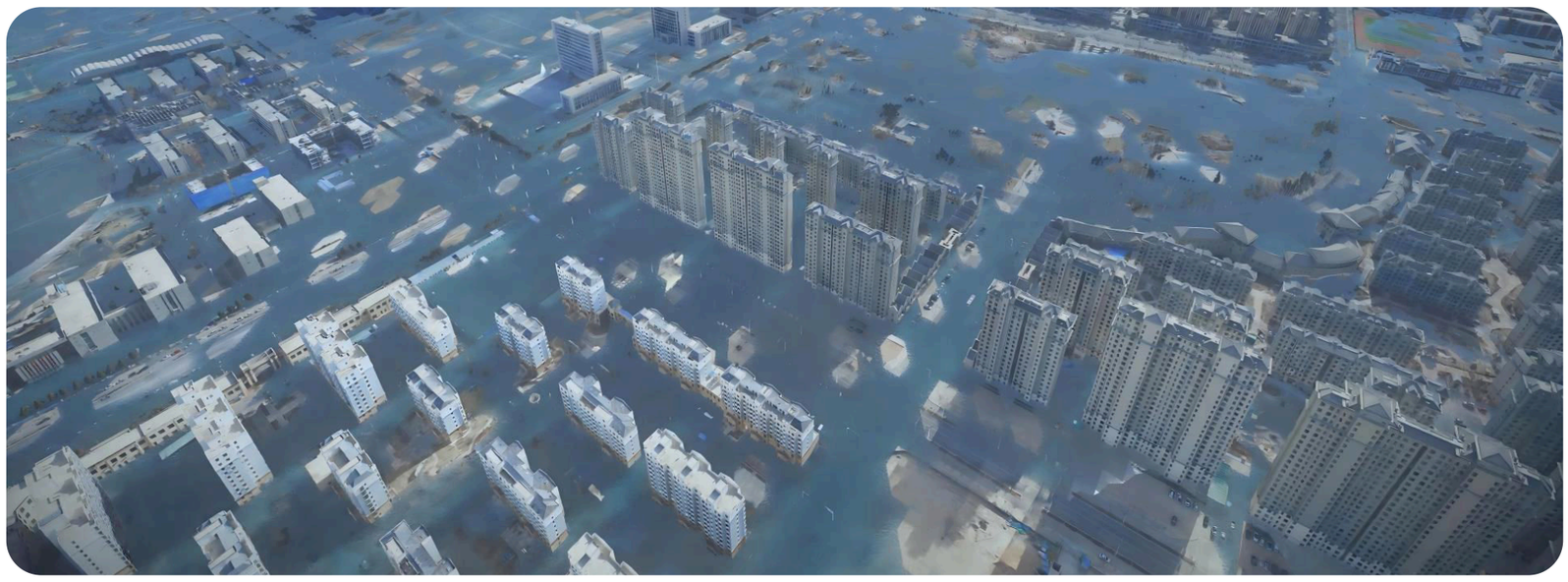

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