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Advancing Infrastructure

CASE STUDY

Guangdong Airport Authority Delivers the Largest Reconstruction and Expansion Project in China's Civil Aviation Airport Construction

Using iTwin® and SYNCHRO™ Saved CNY 78 Million and Shortened Construction by 33 Days

ESTABLISHING A WORLD-CLASS AVIATION HUB

As part of China's strategic plans to develop a world-class airport aviation hub in the Greater Bay Area, Guangdong Airport Authority is delivering the Guangzhou Baiyun International Airport Phase III Expansion project. With an over CNY 53.77 billion budget, it is the largest reconstruction and expansion project in the history of Chinese civil aviation airport construction. The project includes constructing a new terminal building that adopts a unique flower-shaped architectural form—symbolizing Guangzhou's floral crown—two new runways, and a comprehensive transportation center with subway, intercity, and high-speed railway access. "After the project is completed, Guangzhou Baiyun International Airport [will have] a passenger throughput capacity and cargo and mail throughput capacity of 120 million passengers and 3.8 million tons, respectively, a 50% increase compared with the current passenger volume, and a 52% increase in cargo and mail volume," said Jianlong Zhang, senior engineer and head of BIM department at Guangdong Airport Authority.

This pioneer project promotes intelligent airport construction and digital workflows throughout all stages. It adopts advanced technologies—ranging from digital construction and Internet of Things to AI, cloud computing, and simulation—to innovate and develop platforms for unmanned driving, smart security, and hub collaborative decision-making. Boasting numerous "firsts" in domestic and national civil aviation, Guangdong Airport Authority developed a complete intelligent construction system, conducted model measurements based on the national standard list of project quantities, implemented BIM standards, and expanded application of the project component coding system to the entire civil aviation industry. "It is the first project in China to plan intelligent construction and integrate smart operation and maintenance in advance, during the construction stage," noted Zhang.

MEGAPROJECT SCALE, UNINTERRUPTED SERVICE, TIGHT SCHEDULE

The large project scale consisted of delivering the flight area, terminal, and transportation facility amid complex geology and necessitated coordination across 20 disciplines. "There are many participants. It involves three industries: civil aviation, municipal administration, and construction; [and] there are 35 participating units and more than 300 on-site personnel, making coordination quite difficult," said Zhang. Compounding these challenges were the tight schedule and constraints to keep the existing airport operational without any interruption in air service. "The construction of the Phase III Project of Guangzhou Baiyun International Airport without suspending air service involves the most engineering projects in the history of the Chinese civil aviation, and requires the most complex technologies, most difficult construction, longest duration, and has [the] greatest impact on operation," added Zhang.

Throughout construction, the various engineering teams had to go through and underneath runways, requiring precise planning and coordination to avoid disrupting air travel. Guangdong Airport Authority wanted to implement BIM and a digital construction methodology; however, with more than 3 million airport model components, the largest in the domestic BIM field, they faced challenges finding a suitable platform. They realized that they needed an open, integrated BIM and digital twin technology solution to accommodate the massive data, view the BIM attributes, facilitate real-time, multidiscipline collaboration, and ensure the model runs smoothly.

PROJECT SUMMARY

ORGANIZATION
Guangdong Airport Authority

SOLUTION
Facilities, Campuses, and Cities

LOCATION
Guangzhou, China

PROJECT OBJECTIVES
- To deliver China's largest airport reconstruction project, creating a world-class civil aviation hub.
- To utilize advanced technologies throughout the airport lifecycle, promoting smart civil aviation in China.

PROJECT PLAYBOOK
Bentley LumenRT™, iTwin, iTwin Capture, MicroStation®, OpenBridge®, OpenBuildings®, OpenRoads™, ProjectWise®, ProStructures™, SYNCHRO

FAST FACTS
- As China's largest civil aviation airport project, the Guangzhou Baiyun International Airport expansion will increase capacity to 120 million passengers per year.
- The megaproject required Guangdong Airport Authority to coordinate large-scale construction works across 20 disciplines and multiple parties without impacting existing airport operations.
- Using Bentley's BIM and iTwin technologies, Guangdong Airport Authority established collaborative digital workflows and an intelligent construction methodology.

ROI
- Establishing a collaborative digital environment reduced coordination time by 97 days and costs by approximately CNY 15 million.
- iTwin's large model carrying capacity and data management capability helped save CNY 78 million in costs.
- The combined BIM and digital twin solution improved construction efficiencies by 35% and shortened the construction period by 33 days.

"During the implementation of the intelligent construction project, with the support of the Bentley software platform, [we] solved the problem of accurately modeling for tens of millions of components, enabling the efficient circulation of projects throughout the lifecycle from design to operation and maintenance."

– Jianlong Zhang, Senior Engineer and Head of BIM Department, Guangdong Airport Authority

ESTABLISHING A COLLABORATIVE, INTELLIGENT CONSTRUCTION METHODOLOGY

Using Bentley's open BIM and iTwin applications, Guangdong Airport Authority established lifecycle BIM and digital construction methodologies for the complex airport project, integrating smart modeling workflows with intelligent construction. "The airport makes full use of iTwin technology and combines BIM models to apply models for all disciplines in the flight area, thus supporting the BIM data management in the airport," said Zhang. The 3D models enabled teams to adhere to national standards for project quantities, and through real-time, multidiscipline collaboration, they performed collision checks to identify and resolve thousands of potential errors.

Integrating ProjectWise, iTwin Capture, and SYNCHRO, Guangdong Airport Authority not only facilitated remote, real-time collaboration, but also simulated the construction progress, comparing actual onsite works to the digital plan and performing virtual rehearsals. "During the construction stage, the project team used Bentley's SYNCHRO 4D to conduct rehearsals for the construction of complex nodes and special-shaped sections in an attempt to optimize technical solutions and implementation paths," said Zhang. With iTwin Capture laser scanning, they compared the BIM model with the reality model to ensure the quality and accuracy of onsite construction works. By virtue of Bentley's integrated applications, Guangdong Airport Authority built an intelligent construction collaborative management platform, establishing a universal data environment and digital twin, and developed digital plug-ins for model coding, model review, and model engineering quantity extraction based on industry coding standards.

Having introduced the digital twin concept during the preliminary project stages, Guangdong Airport Authority further refined it, incorporating AI and monitoring devices to connect design, construction, and airport operations and maintenance. Through the comprehensive application across all stages, all disciplines, all businesses, and all participants, BIM design and digital twin technology is used to build a digital airport model in the design stage and a digital twin that is continuously deepened to enable digitalization of the entire construction process.

DIGITAL TWIN SETS INDUSTRY BENCHMARK FOR SMART, SUSTAINABLE AIRPORT DEVELOPMENT

Adopting full lifecycle collaborative BIM and iTwin technology, Guangdong Airport Authority resolved 3,200 problems prior to on-site construction, eliminating waste and avoiding construction delays, saving CNY 78 million in costs. "By building the ProjectWise collaborative environment, all participants involved can communicate and collaborate in a timely manner, saving the time for communication and coordination by 97 days," said Zhang. Furthermore, based on OpenRoads Designer, Guangdong Airport Authority and Bentley China developed OpenAirport Designer for China, an airport engineering component database and automatic coding software to support standardized information management and intelligent coding of massive data. The technological innovation improved coding and modeling efficiencies by 15% on this project and can be used on future airport projects across the country's civil aviation industry.

Additionally, SYNCHRO and the digital twin model were used to guide on-site construction works, improving construction efficiencies by more than 35% to reduce the construction schedule. "The use of the digital twin model successfully shortened the construction period by 33 days," said Zhang. By simulating and optimizing construction works, as well as performance of the buildings and airport infrastructure, Guangdong Airport Authority reduced resource waste and environmental impact, achieving environmental and social sustainability. "[We] have created a benchmark project in the field of intelligent construction, verifying the [ability to implement] civil aviation standards, and eventually laying a scalable route of implementation for subsequent projects," concluded Zhang.

As China's largest civil aviation airport project, the Guangzhou Baiyun International Airport expansion will increase capacity to 120 million passengers per year.

iTwin's large model carrying capacity and data management capability helped save CNY 78 million in costs.

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1.800.BENTLEY (1.800.236.8539) | Outside the US +1.610.458.5000 | **GLOBAL OFFICE LISTINGS** bentley.com/contact