International Civil Aviation Organization

Eighth Meeting of the Aerodromes Operations and Planning Sub-Group (AOP/SG/8)

Bangkok, Thailand, 15 to 19 July 2024

Agenda Item 7: Airport Innovation and Technology

IMPROVING THE QUALITY AND EFFICIENCY OF AIRPORT CONSTRUCTION WITH DIGITAL BUILDING TECHNOLOGY

(Presented by China)

SUMMARY

This paper presents the application of digital technology by China's civil aviation in the entire airport construction lifecycle, including site selection, design, and construction, which has improved the quality and efficiency of airport construction.

1. INTRODUCTION

1.1 In recent years, China's civil aviation sector has applied digital technology to the entire lifecycle of airport construction, including site selection, design, and construction, thereby enhancing the intelligence level of airport construction. Based on the practical experience of China's civil aviation, the following proposals are put forward for the application of digital construction technology in the civil aviation field.

2. DISCUSSION

2.1 Digital Site Selection

2.1.1 China's civil aviation industry has independently developed digital site selection technology, which deeply integrates multiple technologies such as "GIS + BIM + big data + drones." By comprehensively analyzing the impact weights of over 20 control factors and quantifying various indicators, this technology achieves "visualization and intelligence" in site selection, enabling rapid generation and optimization of site selection plans. The time required for site selection has been reduced from six months to one month, and the plans are more scientific and reasonable. This transformation changes site selection from a traditional, subjective judgment-based approach to an objective, scientific process. Recently, digital site selection technology has been applied to several airports, including Chongqing's new airport, Guangdong Foshan Airport, and Anhui Jinzhai Airport, marking a significant leap in site selection standards and transitioning from experience-based to digital site selection.

2.2 Digital Design

2.2.1 Building Information Modeling (BIM) technology has been introduced into the airport design field with the goal of managing the entire lifecycle of engineering design, construction, and operation through BIM applications. By focusing on standardized management, specialized design software has been developed, creating a unified and open information platform for airport design. This has enabled both horizontal and vertical integration of BIM technology.

2.2.2 First, starting with design, BIM technology has been fully integrated across planning, design, construction, cost estimation, quality control, measurement and payment, and operations and maintenance. Second, BIM design has achieved full coverage across various industries and professional fields, including building construction, municipal engineering, and civil aviation. BIM design has been applied to major projects such as Ezhou Airport, the third phase of the Guangzhou expansion project, and Chongqing Terminal, laying a foundation for subsequent construction and operations.

2.3 Digital Construction

2.3.1 BIM technology is applied to construction by using a unified model throughout the entire project lifecycle—from design to construction to operations and maintenance. Starting from the design phase and extending through to the construction phase, construction units use design drawings and models from the design stage to create detailed designs, serving as the basis for construction. This shifts the approach from traditional drawing-based construction to model-based construction, laying the foundation for precise measurement.

2.3.2 Supported by BIM and satellite positioning systems, a digital construction management platform is established, consisting of two modules: digital construction site and digital construction. The digital construction site module uses video monitoring to oversee personnel, vehicles and equipment, materials, and the environment, achieving comprehensive digital management of all elements and processes of the project. Additionally, by equipping machinery with high-precision satellite positioning systems and sensors, and utilizing IoT and automated mechanical control technologies, the BIM model is integrated into the equipment control systems. This enables precise digital construction operations, ensuring the physical construction matches the BIM model. The operational data of construction equipment is fed back to the platform in real time.

2.3.3 The digital construction management platform has several notable features: real-time data uploading, dynamic management, on-site interface visualization, and permanent, traceable data storage. Additionally, the platform connects with the project management platform of the construction unit, allowing information to be fed back into the unit's information system. This enables the construction unit to monitor project progress and quality in real time, thereby improving construction efficiency, reducing costs, and shifting quality control from post-construction to in-progress control. This enhances project safety management.

2.4 Integrated Air-Ground Simulation Technology and Digital Monitoring

2.4.1 Integrated air-ground simulation technology is used throughout the planning, design, construction, and operational stages to simulate the operations of passengers, cargo, aircraft, and baggage at airports. This technology enables comprehensive optimization of airspace, ground operations, environmental impact, and operational efficiency, laying the foundation for efficient, low-carbon, and safe airport operations and improving flight punctuality rates.

2.4.2 In terms of digital monitoring, advanced technologies such as intelligent sensing, satellite remote sensing, and BeiDou navigation are employed to implement runway condition sensing. This allows for real-time online monitoring of the health status of all runway surfaces, thereby constructing an intelligent runway system. In the future, a nationwide intelligent monitoring platform for airport engineering will be established, creating an extensive monitoring database for airport projects.

2.5 Typical Achievements

2.5.1 Ezhou Airport in China ranks fourth globally and first in Asia as a specialized international air cargo hub airport. It is the first truly digital airport of its kind. The Ezhou Airport project began with BIM design and integrated contracts, cost management, construction, quality evaluation, safety management, measurement and payment, third-party testing, and design change fund

supervision with the BIM model. Simultaneously, a digital twin visualization platform was established, laying the foundation for digital operations. By adopting information management methods and refined BIM technology management, Ezhou Airport has achieved a 10% reduction in project investment.

3. ACTION BY THE MEETING

3.1 The meeting is invited to note the information contained in this paper and:

a) promote application of digital construction technology for airport construction lifecycle gradually establishing industry standards to ensure compatibility and interoperability among different technologies and systems;

b) encourage State Governments, industries, and research institutions worldwide to prioritize investment in digital construction technology. Initiate multinational collaborative projects to drive technological innovation and foster knowledge sharing; and

c) encourage industries and research institutions from all countries to participate in international conferences and exhibitions to showcase technological innovations in airport construction and share experiences for further advancements.

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