

PAPER • OPEN ACCESS

Overview of the application of digital construction in airport construction

To cite this article: Zhiguo Jia and Jihong Lv 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **643** 012181

View the [article online](#) for updates and enhancements.

You may also like

- [Impact of Weather Conditions on Airport Arrival Delay and Throughput](#)
Álvaro Rodríguez-Sanz, Javier Cano and Beatriz Rubio Fernández
- [Reduce aviation's greenhouse gas emissions through immediately feasible and affordable gate electrification](#)
Fiona Greer, Jasenka Rakas and Arpad Horvath
- [Global, regional and local health impacts of civil aviation emissions](#)
Steve H L Yim, Gideon L Lee, In Hwan Lee et al.



ECS
The
Electrochemical
Society
Advancing solid state &
electrochemical science & technology

DISCOVER
how sustainability
intersects with
electrochemistry & solid
state science research

Overview of the application of digital construction in airport construction

Zhiguo Jia¹, Jihong Lv^{2,3*}

¹ Beijing Capital International Airport Group Beijing Daxing International Airport, Beijing, 102604, China

² China Airport Construction Group Co.,Ltd., Beijing, 100102, China

³ Beijing Super-Creative Airport Technical Ltd., Beijing, 100621, China

*Corresponding author's e-mail: zhongqizc_official@126.com

Abstract. Aiming at the current application status of digital construction in various industries in China, this paper analyzes the GIS and BIM technology used in the existing digital construction, and summarizes the application of GIS and BIM technology in the digital construction in the airport construction industry, which also analyzes the application value and development prospect of digital construction in the area of airport construction.

1. Introduction

Since the start of the construction of "Smart China" in 2009, various industries especially industrial construction, have carried out various digital technology applications and constructions in full swing. With the development of the 13th Five-Year Plan for civil aviation, as one of the important components of the "Four-type Airport", "Smart Airport", has become one important benchmark for measuring the informatization degree of airport construction process. The digital construction of airport construction that integrates GIS and BIM technologies has gradually realized full-scale application from point to surface in the construction of multiple airports, gradually providing strong support for "Smart Airport".

2. Development status of digital construction

Digital construction is the process of digitizing, networking, intelligentizing and visualizing the construction process. Its core idea is to use digital means to solve engineering construction problems and maximize the usage of information resources. Digital construction can realize the visualization and real-time control of construction progress and quality management for each main participating party of the airport construction projects, and can timely discover possible risks in construction, make timely decisions, and improve work efficiency and management. Among the various technical means of digital construction, GIS technology and BIM technology, as technical means suitable for the whole life cycle of the project and precise positioning and projection, have become an important part of digital construction.

BIM technology is called Building Information Modeling . It is a tool used in the whole cycle of engineering construction. It is a building or construction engineering information model directly explained by computer applications [1]. It is foreseeable that, as a new technology that is beneficial to the industry, BIM has gradually been recognized by various construction industries at home and abroad.



GIS technology helps people strengthen their cognition of geographic space by describing spatial distribution patterns, geographic conceptual models, and spatial relationships, and achieves a high degree of unification of the semantic definition, feature abstraction and behavior expression [2]. GIS technology provides a reliable way for project management and control of digital construction through graphic processing, unification of spatial-attribute data, three-dimensional spatial analysis and the application of WEB-GIS.

With the expansion of the application of information technology in the field of engineering management, informatization and standardization of engineering construction sites have gradually become the mainstream trend. The technical application of digital construction mainly includes quality control, process monitoring, and engineering management. At present, in multiple engineering construction industries such as urban rail transit [3], railway construction [4] and urban construction projects [5], digital construction combining BIM and GIS technology has been applied and is booming.

3. Application analysis of digital construction in airport construction

In traditional airport construction projects, there are many characteristics such as complex engineering, numerous facilities and equipment, large scale, wide area, large influence, long construction period, low precision, poor information sharing, complex specialties, and unsmooth information transmission. While the traditional construction monitoring is mainly monitored by the supervisors, which has defects such as humanity and discontinuity. It has become an important requirement for airport construction to keep track of on-site construction conditions anytime and anywhere, comprehensively monitor on-site construction dynamics, and investigate hidden safety and quality hazards during construction at any time, which also need to prevent them and eliminate them in time. In the construction of civil aviation infrastructure projects, more effective supervision and management measures, smarter information transmission mechanisms, and more efficient emergency response capabilities are required.

In the context of this demand, integrated airport digital construction applications that integrate multiple technologies such as GIS and BIM have emerged. A complete digital construction system consists of base station equipment (GPS antenna and receiver), rover system, machine control system and control system software [7]. Through such a digital construction system, combined with the back-end digital construction management system software that integrates the GIS+BIM system, in actual engineering applications, various digital construction platforms have sprung up. Among them, the civil airport flight area digital construction and quality safety monitoring system developed by Chinese enterprises integrates digital construction and BIM technology to achieve comprehensive and real-time monitoring and management of the entire airport construction cycle, using BIM technology to model and 3D sand table realizes the three-dimensional engineering model, thus assisting the management personnel to control the engineering quality.

3.1. The practical application of digital construction in domestic airport engineering

At present, a number of digital construction systems and platforms have been put into use at home and abroad, including the completed Beijing Daxing International Airport, Chengdu Tianfu International Airport, Guangzhou Baiyun Airport expansion project, and Kunming Changshui Airport expansion project, etc.

Among them, Beijing Daxing International Airport has applied BIM technology to assist the construction process in six aspects: project management, program simulation, business management, dynamic management, prefabrication and deepening design. The BIM model is closely integrated with the construction site management to realize the BIM-based schedule, cost management and deepening design of various specialties [8].

Chengdu Tianfu International Airport has developed and adopted the “digital construction and quality and safety monitoring system for the flight area”. All construction machines entering the construction site are equipped with digital monitoring equipment. In the digital application of airport construction, multiple units or even the entire construction site realizes real-time management and precise control of the construction mode, which enables visual and real-time monitoring of project

construction conditions during the entire life cycle of project construction, which relieves management pressure and improves management efficiency [9].

In the Guangzhou Baiyun Airport expansion project, through the establishment of a BIM-based information model, data sharing and integrated management of design, construction, installation and operation and maintenance are assisted in BIM modeling, construction simulation, etc., In different aspects, such as engineering quantity list statistics, BIM construction management application, have implemented BIM technical means [10].

From the analysis of the actual application of digital construction in various airports, the existing digital construction methods mostly focus on the management of the construction process of the airport project and the integration of information. Information integration includes multiple management systems such as engineering quality information management platform, underground pipe network information system, airport clearance management system and digital construction quality monitoring platform. Construction process management can be divided into two parts: digital construction of earth and stone works and digital construction of road surface engineering. Digital construction of earth and stone works can be subdivided into digital construction of foundation treatment and digital construction of earth and stone filling. Including the quality monitoring system of vibrating and rolling, construction quality monitoring system of dynamic compaction, gravel pile/CFG pile quality monitoring system, plastic drainage board quality monitoring system and other various pile machine quality monitoring systems.



Figure 1. Digital construction system for construction machine in airport (left: CFG pile system; right: Vibration Roller system).

3.2. Prospects of digital construction in airport construction

According to the "Thirteenth Five-Year Plan" of civil aviation, the number of transportation airports in the country will reach about 260, and an airport network with reasonable layout, complete functions, and safety and efficiency will be basically completed [11]. A large number of newly built, rebuilt and expanded airports have provided a solid foundation for the broad application of digital construction. However, in the actual application process, the multi-technology integration process of BIM and GIS technology still needs continuous improvement by researchers in order to be better applied to the digital construction process. In addition, the application of digital construction in airport projects still has the phenomenon of "technological islands". It needs to be promoted and implemented in multiple airport construction stages such as design, construction, and maintenance, so that the technical means of digital construction can be used in airport projects. Many benefits. At the same time, the arrival of new technologies will inevitably have an impact on the original working methods of front-line staff. It is necessary for relevant practitioners to increase their sensitivity to new technologies and new methods in order to better serve the airport project itself. On the basis of various digital construction applications

that have been built, the research prospects for network transmission growth and information security are also very broad.

4. Summary

Digital construction technology proposes easy-to-land solutions to various problems in the traditional construction process. This article briefly describes the current development of digital construction in airport projects, and analyzes the existing application platforms and applications, and finally looks forward to the prospects. In the construction of various airports at home and abroad, the application of digital construction has begun to take shape. With the development of GIS, BIM technology and other technologies, digital construction integrating multiple technologies will more effectively help the development of airport engineering construction. The application breadth and application depth have been further improved.

Acknowledgments

This research was funded by the China Civil Aviation Safety Capacity Building Fund Project: Realization and Construction Demonstration of Digital Quality Monitoring System for the Construction of Gravel Pile in Airport Projects.

References

- [1] Goldman, M. (2009) BIM for Construction, BPMs and Owners.
<https://www.slideshare.net/hellomarc/bim-for-construction>.
- [2] Hu, Z., Tang, G., Lu, G. (2012) The Concept and Characteristics of GIS Language. *Acta Geographica Sinica*, 67: 867-877.
- [3] Dai, H. (2017) Study of Rail Transit Digitization Construction Integrated Management Based on BIM. *Urban Roads Bridges & Flood Control*, 4: 168-171.
- [4] Liu, C., Dong, F., Xie, X., Liu, H. (2019) Digital subgrade filling construction process control based on BIM technology. *Railway Computer Application*, 28: 59-63.
- [5] Mao, Z. (2017) Promoting the Construction of Intelligent Sites to Advance Sustainable and Healthy Development of Construction Industry. *Journal of Engineering Management*, 31: 80-84.
- [6] Han, Q. (2020) Practical Research on Application of Digital Management in Civil Aviation Infrastructure Engineering Construction. *Technology Innovation and Application*, 6: 193-194.
- [7] Huo, C. (2016) Digital construction, leading the dawn of future intelligent construction technology. *Construction Machinery Today*, 3: 46.
- [8] Glodon. (2018) Glodon helps Beijing new airport BIM application to land.
<http://news.ccd.com.cn/Htmls/2018/3/1/20183194023196829-1.html>.
- [9] Wang, Y., Chen, Z. (2019) Application and Thought about Digital Construction Technology of Ground Treatment & Earthwork Engineering in Chengdu Tianfu International Airport. *Civil Aviation Management*, 6: 42-47.
- [10] Yang, Y., Xu, Z., Rao, J., Xian, C., Xu, J. (2017) BIM Application Technical Focus in Guangzhou Baiyun Airport T2 Terminal and Supporting Facilities Project. *Journal of Information Technology in Civil Engineering and Architecture*, 9: 1-7.
- [11] Civil Aviation Administration of China. (2016) Interpretation: Civil Aviation "13th Five-Year Plan".
http://www.caac.gov.cn/XXGK/XXGK/ZCJD/201701/t20170110_41651.html.