

Current status and future development trend of BIM technology in China

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Abstract. By summarizing the development history, development status and technology integration of BIM technology, this paper comprehensively analyzes the research progress and application status of BIM technology in the field of construction, and predicts the research hotspot and future development trend of BIM technology in China; At the same time, it systematically introduces the specific application of BIM technology from the design stage, construction stage, operation and maintenance stage, and summarizes the application scenario and application status of BIM technology combined with specific cases. It provides reference for the subsequent research and application of BIM technology.

Keywords: BIM process, BIM application, development trend.

1. Introduction

The BIM technology we are familiar with today is actually the full name of Building Information Modeling (BIM). This technology comes from the concept of BIM proposed by Dr. Chuck Eastman (Ph.D.) in 1975. Its core is to realize the cooperative work from design, construction, operation and maintenance in the project. Simply put, all participants can use their 3DCAD models in the above process, so as to realize real-time information sharing. In this process, participants can find contradictions by combining the shared data with their own data, so as to improve the efficiency of the project. Since BIM technology was introduced into China, after more than 20 years of development, it has made great development and progress in four aspects of domestic design, construction, operation and maintenance, and integration with other technologies. This paper will focus on the application status of BIM technology from the development history of BIM technology and the application of domestic BIM technology in related practical projects. And a brief analysis of the future development trend of BIM technology, to lay the foundation for subsequent research.

2. Development and application of BIM technology

2.1. Development history of BIM technology at home and abroad

BIM technology originated in the United States. Due to its early start, it is widely used.

Today, BIM technology is widely used in most construction projects in the United States, and a variety of BIM organizations have emerged. For example, the US Federal General Services Administration's 3D-4D-BIM program, the National BIM Standard (NBIMS), and the US Army Corps of Engineers' (the U.S. Army Corps of Engineers, USACE) BIM roadmap planning.

In the Nordic countries, including Norway, Denmark, Sweden and Finland, there are many software manufacturers of information technology in the construction industry, such as Tekla and Solibri, and the application rate of ArchiCAD is also high. As a result, the Nordic countries have been among the first countries in the world to adopt a model-based design basis, and they are also encouraging and promoting interoperability and open standards (IFC) for construction information technology.

In mainland China, BIM technology started late. In 2004, through the Autodesk 2005 product promotion conference, the single field in China began to gradually understand it. By the 11th Five-Year plan, BIM has entered the national science and technology support plan key projects, and in

May 2011 issued the "2011-2015 Construction Industry information Development Outline", which clearly pointed out: Carry out the research and application of BIM technology in the construction stage, promote the application extension of BIM technology from design to construction, and reduce the attenuation of information in the transmission process; Research the application of 4D project management information system based on BIM technology in the construction process of large and complex projects, so as to achieve effective visual management of construction projects. The idea of accelerating the construction information construction and promoting the technical progress and management level of the construction industry is to achieve the goal of popularizing the concept and application of BIM technology, so that BIM technology is gradually applied to engineering projects, and the promotion of BIM technology is guaranteed through the guiding role of the Ministry of Housing and Urban-Rural Development and industry associations. In 2016, the Ministry of Housing and Urban-Rural Development issued the "2016-2020 Construction industry information Development Outline", requiring construction industry enterprises to actively explore the "Internet +", promote the transformation and upgrading of the construction industry, in-depth research on the innovative application of BIM, Internet of things and other technologies, and innovate business models. This marks the opening of the prelude to the application of BIM technology in mainland China. In July 2020, the Guiding Opinions on Promoting the Coordinated Development of Intelligent Construction and Building Industrialization jointly issued by the Ministry of Housing and Urban-Rural Development and other departments pointed out that it is necessary to increase the integration and innovative application of new technologies such as BIM, and actively apply independent and controllable BIM technology. In August 2020, the "Several Opinions on Accelerating the Development of New Building Industrialization" jointly issued by the Ministry of Housing and Urban-Rural Development and other departments pointed out that it is necessary to promote lean construction and accelerate the integrated development of information technology, and vigorously promote BIM technology, big data technology, Internet of Things technology and intelligent construction technology.

In addition to the support of relevant departments, construction units also actively try to apply BIM technology to practical projects, and the application in practical projects has also played an important role in promoting the dissemination of BIM technology in China, among which the typical representative is the application of BIM in Shanghai Tower[1]. It uses the existing two-dimensional design drawings and individual professional three-dimensional design drawings to quickly complete the creation of the overall project BIM model and applies it to collision inspection, deepening design, calculation statistics and other aspects. The successful application of BIM technology in Shanghai Tower project has triggered a BIM boom in China.

Generally speaking, the development of BIM technology in foreign countries started earlier, faster and at a higher level, and the development path and technical focus of each country are different. Although domestic BIM technology started late, it has developed rapidly in recent years under the promotion of relevant government departments and the guidance of the market, and has now reached a relatively advanced level.

2.2. Development status of domestic BIM technology

After more than 20 years of development, the application of BIM technology in the construction field has become increasingly mature. For example, in the "two mountains" hospitals of Huoshenshan and Leishenshan, construction [2] personnel use BIM models to export component processing details and directly carry out digital processing, which greatly shortens the production time of components. Secondly, through construction simulation, the order of assembly of each structure is optimized, and the construction period is shortened; Finally, through BIM information construction management, unified and coordinated management, nearly a thousand large machinery and equipment and thousands of workers orderly operation, carried out at the same time, each process seamless connection, greatly improve the site construction efficiency, to achieve the 10 days of extremely fast to build the myth of Huoshenshan Hospital. The construction units are not only skilled in the use of

BIM technology, but also actively combine BIM technology with UAV and other technologies, thus greatly improving the engineering efficiency, such as the project of Dapeng New District People's Hospital in Shenzhen [3]. Through the integrated application of BIM technology, UAV technology and GIS technology, the 3D real scene model is integrated with BIM model, CAD drawing GIS model and other data, and the macro and micro integrated 3D space scene of "terrain + image + model + vector" is built to realize the full perspective display of engineering overview and scene view of engineering data. In addition, it can also compare and display the project progress, and efficiently and conveniently manage the progress.

In terms of design, building design under BIM technology has three-dimensional attributes. By using the digital bearing and visual expression capabilities of BIM, the design information can be displayed in multiple dimensions, and construction drawings can be formed according to the requirements of construction, including the information and parameters required by the design and construction process in detail, so as to ensure that the docking personnel can fully understand the design information and key points. Reduce the situation of unequal information and inadequate transfer, and provide basis and guarantee for the construction phase. The application of BIM technology in the fourth Macao Taipa cross-Sea Bridge [4] well reflects the above points.

In terms of construction progress simulation, thanks to the combination of 3D visualization and time dimension of BIM technology, the construction side has the ability to integrate spatial and temporal information in a visual 4D model, so that the management can visually and accurately observe the entire construction process. In turn, the construction period can be shortened, the cost can be reduced and the quality can be improved.

In the field of operation and maintenance, BIM technology can simplify the more complex problems encountered in the operation and maintenance process to a large extent, greatly improve the efficiency of solving problems, and reduce the ability requirements of operation and maintenance personnel. Secondly, BIM technology can also make the complex drawings that only professionals can read and understand easy to understand, thus providing convenience for non-construction-related professionals to carry out operation and maintenance management, and helping to improve the efficiency of operation and maintenance management. Finally, the use of BIM technology can also generate a visual training system, so that the trainers can more intuitively understand the principle and function of the equipment. Taking Jinqiu Hospital [5] in Shenyang, Liaoning Province as an example, the operation and maintenance management system of Jinqiu Hospital adopts BIM technology to integrate information equipment, safety precautions and medical information, etc., to build a comprehensive operation and maintenance management system, which helps the hospital integrate and coordinate various resources to ensure the efficient operation of the hospital.

3. Prediction of the future development of BIM technology in China

3.1. The systematic use of BIM technology will become more and more mature

In view of the current situation that BIM technology has not been widely systemized in China, relevant government departments have been actively responding to it. In fact, the active promotion of general contracting is a typical example. General contracting, as its name implies, means that the contractor implements general contracting for engineering design, implementation of the construction organization procurement, construction or design and construction phases according to the contract signed with the construction unit. And for the quality of the project, safety, duration and cost of the project is fully responsible for the . BIM technology is a kind of efficient management tool that can be systematized in design, construction, operation and maintenance, so BIM technology makes the general contracting more perfect. Enterprises really feel the profits brought by BIM technology, and will inevitably continue to increase the application of BIM technology in practical projects, and BIM technology will therefore accelerate its own development.

3.2. Integration and development of BIM technology with the Internet of Things, big data and other technologies

With the integration and development of BIM technology with the Internet of Things, big data, artificial intelligence technology and other technologies, the emergence of smart construction sites has a realistic basis. Smart site mainly refers to a kind of engineering construction management system, which refers to the use of BIM model, Internet of things technology, VR technology, positioning technology and other means in the engineering construction process to manage the project, accurately predict the problems in the construction of the project, and timely formulate solutions to promote the construction of high-quality management system. This kind of integrated development has been applied in the actual project, especially in an information center project [6] in Chengdu City. From the beginning of the design to the completion of the project, the whole process uses BIM and Internet of Things technology, which reflects the integrated development of BIM technology and Internet of Things and other technologies. Among them, the relevant personnel based on the actual situation of site construction and the combination of Internet of Things technology, designed a unique management system. For example: remote control system, engineering project management system, staff real name system management system, engineering safety monitoring system. These systems have greatly improved the safety of construction. The joint application of the Internet of Things and BIM in safety and emergency management has greatly improved the ability of relevant personnel to comprehensively monitor the construction of construction projects. Once temporary problems occur, they can be dealt with in the first time, enhance the emergency ability, ensure the safety of construction and improve the quality of construction. Compared with the traditional building construction in the event of an emergency, the relevant enterprises and units involved in the project have to find the design drawings, and then compare the drawings to find the error point, and then deal with it after the comparison is over. Such a way often has a higher time cost. And the use of the Internet of Things and BIM joint application without looking for drawings, direct comparison can quickly obtain the results, the relevant personnel can also through the two-dimensional code and other forms, quickly achieve positioning query processing, improve the quality of construction.

4. Conclusion

Since the emergence of BIM technology, its own practicality has been widely approved. After it is introduced into our country, we BIM technology develops rapidly and has reached a more advanced level and is widely used in practical engineering. With its own development, the author believes that the following conclusions can be obtained:

(1) The research and development of BIM technology itself and the single integration of BIM technology and the Internet of Things, big data and other technologies have made great progress. Follow-up research should focus on the combination of multi-technology, BIM and artificial intelligence technology.

(2) In the three stages of design, construction and operation and maintenance, BIM technology has shown obvious advantages compared with the traditional way, and the follow-up research will focus on the application of the whole life cycle of buildings.

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