

BIM-based full life cycle management of construction projects

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Abstract: In recent years, despite the rapid development of China's construction industry, the management efficiency is relatively low and the overall management level is relatively backward. By analyzing the reasons, if we want to improve the management level of China's construction industry, we must carry out the whole life cycle management, and BIM technology is the key to realize the whole life cycle management of buildings. As a new type of intelligent information technology, BIM is leading a historic technological innovation in the construction industry. At present, BIM technology is widely used in various fields of the construction industry. This paper systematically expounds the application of BIM technology in the whole life cycle of construction projects, including planning and design, construction, operation and maintenance, etc. With the application and deepening of information technology in the construction industry, scholars and safety managers are trying to seek building safety management methods based on information technology, which is represented by building information model (BIM). At present, how to apply BIM technology throughout the entire construction process is one of the main problems faced by the current BIM application. The research of creating, managing and sharing the whole life cycle information of new construction projects has become an important research direction and development trend in the field of construction engineering.

1. Introduction

In recent years, the construction industry has developed by leaps and bounds, playing an important role in promoting my country's industrialization and urbanization, and has become an important pillar of the national economy. Under the premise of the rapid development of information technology, it is feasible to provide assistance for safety management through information technology. At present, the information age is hitting the world in an all-round way, and information resources have become the key to global economic development. In many industries, since people began to master information technology, it has become an important factor in improving the level of production and competition. The construction industry is a pillar industry of my country's economic development, and bears the heavy responsibility of promoting social and economic development, stimulating domestic demand, alleviating employment pressure, and driving rural economic growth. At present, China's spending on the construction industry is constantly increasing. In 2010, China invested more than US\$ 1 trillion in construction projects, surpassing the United States for the first time to become the largest construction country in the world. According to the forecast of the global economic report, by 2020, the proportion of China's investment in the construction industry will be expanded to one fifth of the world. Compared with some European and American countries, BIM started late in China at present, and it also faces many obstacles in the process of practice promotion and application.

The construction industry is an important pillar industry for the development of my country's national economy and an important material basis for ensuring the quality of people's lives. In the case of a substantial increase in the total national economy, the proportion of the added value of the construction industry in the GDP remains above 6% [2]. The construction industry has provided

stable jobs and transferred more than 40 million rural surplus labor. At the same time, due to the lack of unified information integration and exchange mechanism in the construction industry for a long time, the management level of the construction industry has not been significantly improved, and the management efficiency of construction projects is generally low. In view of the development situation of the existing construction industry, in order to improve the overall management level of the construction industry, we must run the management work through the whole life cycle of the construction, and vigorously promote and apply BIM Technology. Only in this way can the construction industry develop healthily and stably. China's resource consumption rate in the construction industry is several times that of developed countries, causing more serious energy depletion and environmental damage [3].

2. Research on Application System of BIM Technology in Building Lifecycle Management

2.1. BIM concept

The concept of BIM was first proposed by Dr. Chuck Eastman of the United States. It refers to the use of 3D technology and digital information to build buildings, digitize building entities and functional characteristics, integrate all information of construction projects in the whole life cycle, maximize data resource sharing, strengthen collaborative management, and improve decision-making optimization and project production efficiency [4]. The research of BIM Technology began in the 1970s, but the name BIM officially appeared in 2002, which is fully known as building information model. The emergence of BIM technology has provided a reliable technical support means for the management of the whole life cycle of buildings. By applying BIM technology in the management of the whole life cycle, the management efficiency of each stage can be fully exerted, thereby improving the management efficiency at the same time. , but also reduce environmental pollution. BIM is an information model that can fully and fully express the building information, and then can support the whole life cycle of the building, which can be managed and interpreted by computer technology [5].

2.2. Application advantages of BIM technology in building life cycle management

In the operation of the comprehensive building construction project, based on the application of BIM technology, the content of each data item is entered into the BIM model, and it is integrated with the digital technology to complete the 3D construction design structure of this technology [6]. Compared with traditional technology, BIM technology has obvious application advantages. These application advantages are mainly reflected in four aspects: First, BIM technology can carry out 3D visual design of project engineering, and it can visualize the construction project. Second, BIM technology can simulate the construction process in the construction project, it can also perform 3D collision checking on the model, and the engineering It can effectively avoid the occurrence of design changes and construction conflicts, and fundamentally ensure the construction progress of the construction project; thirdly, the application of BIM technology is of great help to the later management and maintenance of construction projects; its Fourth, BIM technology can not only save project costs, but also significantly improve project quality. The comprehensive application skills and all-round analysis of the current main BIM work and analysis work have greatly improved their ability and laid a foundation for all aspects of the project in the future.

2.3. Application of BIM in Construction Engineering

In the design stage of the project, BIM models of architecture, mechatronics, structure and other disciplines are mainly built, and BIM software is used to split the components. After the split design, collision detection is required to avoid various problems in the assembly process of components, pipelines and equipment. In the construction of building engineering, BIM series software is used to establish its three-dimensional model of civil engineering, reinforcement and installation, and to review the drawings and optimize the construction scheme. Combined with the actual situation on site, by using BIM technology to conduct collision inspection and comprehensive optimization of

pipelines, the problems of pipeline collision and precise positioning of reserved openings can be solved conveniently and quickly, the quantities can be extracted quickly and accurately, and multi-calculation comparison can control the cost, save resources, shorten the construction period and improve the construction quality, with considerable actual benefits [7]. The completion of project construction does not mean the termination of BIM Technology Application. The three-dimensional integrated database constructed by BIM will play an important role in the management of construction trial operation stage after completion. For maintenance and operation, when problems occur, the traditional practice is to check the risk factors and formulate the maintenance plan according to the component layout on the two-dimensional drawing. The application of BIM Technology makes everything simple and easy to operate. By reading the relevant data of operation and maintenance in design and construction modeling, it can be optimized and integrated into the information platform database. Through browsing, it can quickly master the data of the whole building, master the performance of building structure and corresponding equipment, and complete the operation management of building spatial structure, It can be extended to the inspection and maintenance of additional facilities. The application process of BIM Technology in the engineering project design stage is shown in Figure 1.

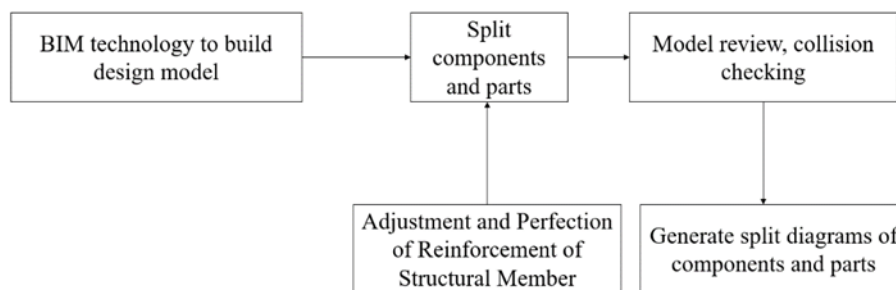


Figure 1 The application process of BIM technology in the design stage

3. Problems and countermeasures of BIM technology in China's construction industry

Due to the lack of BIM standards applicable to my country's construction industry, at this stage, my country's BIM development in the design stage is still dominated by model translation and design-assisted BIM, mainly using BIM design tools to complete the work that needs to be completed in traditional design. At present, according to relevant statistics, the design stage is still the mainstream stage of the application of BIM technology, the later operation and maintenance stage accounts for a small proportion, less than 10%, and the construction stage accounts for the middle. Therefore, it is necessary to vigorously promote the use of BIM technology in the latter two application. Compared with foreign countries in Europe and the United States, my country's construction industry has an imperfect system, lacks unified application standards, and unclear responsibility boundaries for problems arising in BIM technology, hindering the development of its market. In practice, the information management system is mainly aimed at a single stage or a goal, and has different expression forms and languages, which makes it difficult to share and exchange information during the whole life cycle, and can not give full play to the use value of information. It is inconvenient for the correlation and mutual use of relevant information between stages, and is prone to errors and changes, It will restrict the development of project construction. Without a clear modeling standard, the data information of the built BIM model will be difficult to flow in the whole life cycle of the project, limiting the further development of BIM Technology [8].

Compared with traditional architectural engineering design management, BIM has greatly improved the collaborative ability of design tools and the collaborative awareness of designers, but it has also caused some new problems brought about by the increase of collaborative work. When one stage is completed and move on to the next stage. There are always new staff involved in the construction of the project. The flow and transmission of project construction information in the

stages and between stages of the entire life cycle, and the transfer among participants, will inevitably lead to a large amount of information loss at the connection and reduce the efficiency of the project. Judging from the coordination of construction projects in the design stage, although all parties generally agree to strengthen the participation of construction parties, equipment suppliers and operators, so as to solve potential problems in the construction and operation process as much as possible in the design stage. However, through practice, it is found that the design workload is greatly increased due to the involvement of more project participants, and the design progress will also be disrupted [9]. If the design coordination problem is the most serious problem in the design management of building engineering, the design process will interact with it. Even though some design drawings and other information can be transmitted and used by electronic files, due to the requirement of compatibility, some data can not be operated on the same application software, which can not guarantee the high efficiency of information transmission and avoid the loss of information.

In the design stage, covering industries such as building structure, water point, heating, gas, etc., there is a lack of efficient communication means, the designers' plans do not match, errors and conflicts occur with each other, which is not conducive to the joint review of drawings in the post-design stage, thereby prolonging the project. schedule. In the absence of standard constraints, although a large amount of data information is created in the BIM design process, the data information lacks effective induction, and the data lacks organization and connection. From the design level, it is difficult for such applications to achieve the efficiency improvement brought by BIM collaboration to the design work. From the project level, it is also difficult to extract more valuable information for other project participants from the designed model [10]]. Since there is no unified information platform to establish information exchange and sharing, the information management software in the construction stage is effectively used based on professional knowledge and practical experience at different times and different soul nights. In addition, for the collaborative concept of BIM Technology in the whole life cycle, there is a lack of effective integrated management in each stage. This phenomenon is attributed to many aspects. More intuitively, the immature technology, the shortage of BIM talents, the lack of relevant attention of enterprises, and the inadequate training and learning of construction management personnel cause the disconnection between Bim and the actual situation in the use process, It is difficult to reflect its advantages.

4. Conclusions

All in all, by applying BIM technology in the whole life cycle management of buildings, it can significantly improve the management level of construction projects at all stages, ensure the quality of construction projects, reduce costs, and shorten the construction period. As an important way of informatization in the construction industry, BIM technology runs through all stages of the whole life cycle, and will certainly greatly promote the transformation of the construction field in a certain sense. This paper analyzes the whole life cycle of the project and the characteristics and adaptability of BIM technology, and expounds the application details of BIM technology in the whole life cycle of construction projects. During the whole life cycle of information-based construction projects, it is necessary to efficiently solve the urgent problems in construction projects. As the application of BIM in China is still in its infancy, there are still many problems that need to be solved urgently, including deeply mining BIM data and designing a data organization model based on the whole life cycle of buildings suitable for Chinese standards and engineering specifications; Research new standards and specifications of engineering design based on BIM technology. Therefore, only by combining BIM technology with the whole life cycle of construction projects and integrating it into production can the application value of BIM technology be truly reflected and the whole life cycle management goal of construction projects be truly realized.

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