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Application of BIM Technology in Quality Supervision System of Assembly Wooden Building Engineering

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Abstract:

Due to the progress of new material processing technology, design means and construction technology, wooden buildings can better meet the requirements of modern architectural space function. BIM Technology is widely used in construction management. BIM Technology has powerful information integration and processing capabilities, and can share the information in the system in real time. Based on the analysis of the existing construction quality control theory and BIM Technology, this paper introduces BIM Technology into the construction quality control process. This method expands the new idea of construction quality control. This paper systematically discusses the means and methods of BIM Technology in construction quality control. In this paper, BIM and its related technology are combined with some advanced quality detection and control technology to control the quality of the construction process.

Keywords: *Wooden structure, BIM Technology, construction management, prefabricated building.*

I. INTRODUCTION

In the construction process of construction project, information transmission is not smooth is one of the main reasons for the low efficiency of project management, which is due to the continuous loss of information in the process of transmission [1-2]. The emergence and continuous development of building information modeling (BIM) technology has brought profound changes to the whole construction industry and provided the possibility for the information development of the construction industry [3]. With the development and application of BIM Technology, the construction technology is upgraded and the construction process is optimized, which brings great value and benefits to the construction process of engineering projects.

BIM as a new thing in the construction industry, a new technology led by information technology, its application has completely broken through the technical category, and will also become a strong driving force for the transformation of the leading construction industry [4].

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BIM model contains all kinds of information such as type attribute, geometric attribute and physical attribute of engineering project. The information of materials, equipment, light source and visual angle can be obtained directly from BIM model [5]. The application and research of BIM Technology by domestic and foreign scholars has proved that the significance and value of applying BIM Technology in construction is huge. Introducing BIM Technology into construction quality control can expand the idea of construction quality management, improve the information transmission and sharing mode of construction quality control and management, improve the efficiency of construction management and construction quality control process, and promote the application and promotion of BIM Technology.

II. BIM TECHNOLOGY FEATURES

BIM Technology is the most advanced technology to solve the problem of construction project management at present. Starting from the concept of Bim and BIM Technology, we can understand the characteristics of BIM Technology, including the following:

(1) Visualization

Visualization is the most obvious feature of BIM Technology, that is, what you see is what you get. All operations under BIM Technology are completed in a visual environment. In the past construction projects, the construction personnel in the construction process, need to compare the relevant drawings, combined with their own three-dimensional imagination and construction experience to conceive the shape of the building, which is conducive to the project construction and management. With the building modeling more and more complex, it is difficult to imagine the concrete form of the building and its components with their own imagination. By using the visualization characteristics of BIM Technology, the building and its components can be displayed in a three-dimensional mode in front of the relevant personnel. The spatial relationship between components is straightforward and clear, which is conducive to the understanding of the project and the control of the construction process. BIM model can not only be used to show the project process rendering and generate the required reports, but also can be used for visual communication between different professionals to complete the project communication and decision-making.

(2) Coordination

Coordination is the key content of construction process management, and the construction process is a process of continuous coordination and collaboration. Based on BIM Technology, the collaborative work among project participants has the characteristics of high efficiency and accuracy. In the construction process, the use of BIM Technology to provide a clear and efficient communication and coordination platform with various system specialties can better meet the needs of the project and improve the efficiency and quality of construction.

(3) Simulacrity

Building information model (BIM) can not only simulate building objects, but also simulate

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some necessary experiments to verify the design results; In the construction stage, the virtual construction can be carried out for the project, and the 3D information model and time parameters can be used to carry out more detailed virtual construction-4d simulation for the project, which is also used to simulate the actual construction process according to the construction organization design. By using the simulation of BIM Technology, the construction process can be defined, the project quantities can be determined, the construction interface and construction sequence can be made clear, the coordination among various disciplines in the construction process can be facilitated, and the resources of materials, labor, machinery and so on can be reasonably arranged; It can also carry out 5D simulation (3D model + time dimension + cost dimension) to realize dynamic control of cost and resources; In the later stage of operation and maintenance, daily emergency can be simulated. In addition to the above simulation applications, BIM Technology can also be used for load simulation, system simulation, equipment simulation, etc.

(4) Optimization

Optimization means that BIM Technology can optimize the project construction process and construction scheme, and also optimize and control the complex nodes, complex components and other parts prone to quality problems.

(5) Relevance

Relevance refers to both independence and relevance, or "interrelated or interactive" relationship. BIM model has this kind of association. All components in the model are built with parametric information. When a component in the model changes, the whole model will be updated automatically.

(6) Graphizability

After applying BIM Technology to design or deepen the design of the building, according to the needs of construction, the plan, elevation and section of the project can be directly derived from the three-dimensional building information model to guide the construction. At present, the application of BIM Technology in engineering design and in-depth design only plays the role of auxiliary design or construction management. With the popularization of BIM Technology in the design stage, after the standardization of BIM drawing, the application of BIM Technology in drawing will become the main form of Design Institute drawing, and the accuracy of drawing is higher.

III. Integration of BIM Technology and Prefabricated Building Technology

A. Development Status of Prefabricated Building Technology

(1) Development status of prefabricated building abroad

In the process of developing prefabricated building, Japan has established a perfect system. After continuously exploring the prefabricated technology system, the KsI building system

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(urban regeneration framework + filled residential building system) is formed, as shown in Figure 1. Prefabricated buildings have accounted for more than 50% of the market. In the process of developing prefabricated buildings in the United States, low rise wood structure and light steel structure residential buildings are the main ones, and the market mechanism is the main one [6]. As early as 1976, the design, construction, energy saving and durability of prefabricated buildings were standardized [7-9]. At present, assembly parts can be selected on demand through the standard catalog. In addition, Singapore, Britain, Sweden and other countries have formed a perfect system in the development process of prefabricated buildings, and precast concrete members have been widely used in civil and industrial buildings.

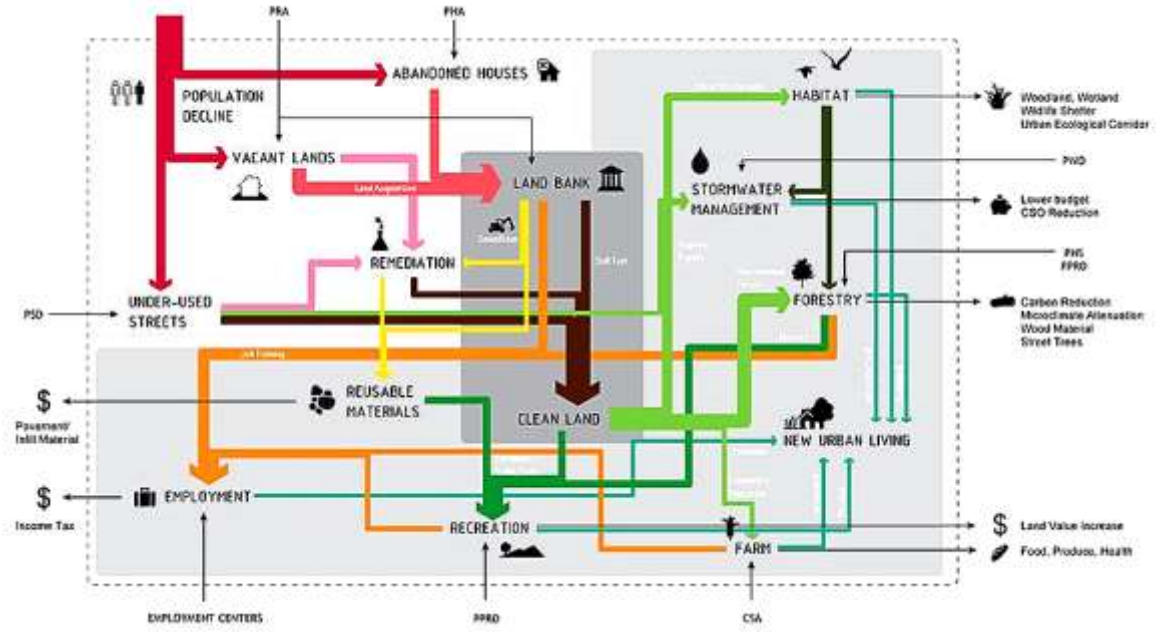

Fig 1: KsI building system

(2) Development status of prefabricated building in China

Since the 1990s, China has proposed the development of prefabricated architecture [10]. In recent years, with the continuous introduction of policies to promote prefabricated buildings, cities such as Beijing, Shanghai, Shenzhen and Chengdu successively require the use of prefabricated components in housing construction. With policy support and market orientation, developers and construction enterprises have begun to participate in the research and implementation of prefabricated construction technology.

B. Architecture and Process of BIM Management System

In recent years, the application of BIM Technology in planning, survey, design, construction and operation and maintenance has been promoted in China. Through BIM Technology, it can realize the visualization in design stage, the cooperation in construction stage, the simulation in construction process, the optimization of scheme, the drawing ability and the high integration of data.

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Compared with the traditional construction method, prefabricated construction technology can reduce the noise in the process of concrete pumping and vibration, steel processing and welding, formwork scaffold installation and removal, save construction site and realize green construction. At the same time, because the construction process greatly reduces the impact of the traditional construction workers' non-standard level, the prefabricated building can effectively reduce the common quality problems, significantly improve the building thermal insulation performance, significantly improve the construction efficiency, and shorten the construction period. Therefore, the prefabricated building technology can better achieve green construction and energy conservation and emission reduction.

The traditional prefabricated architectural design is based on CAD two-dimensional drawings. The design of different specialties is independent of each other, the efficiency of communication and coordination is low, and it is easy to produce design problems such as professional collision, which leads to the increase of risk and cost in the later construction process. At the same time, because the drawing information is not intuitive and the amount of information is large, the probability of errors in the process of information conversion and transmission is large. In prefabricated buildings, the variety and quantity of PC prefabricated components are large, which makes the process management very complicated. As shown in Figure 1, the digital development of the construction industry is experiencing the integrated management from two-dimensional design to three-dimensional design and from single data to multi-dimensional data. In the design stage, through BIM to build three-dimensional model, the collaborative design between different professions can avoid the design conflict between various professions, improve the efficiency of design information transmission and sharing, reduce design changes, and provide guarantee for the saving of resources and costs in the construction stage. The application of BIM Technology in the collaborative design of prefabricated building design stage, preliminary design stage, construction drawing design stage and interior decoration stage is the current research hotspot. A large number of research results show that the application of BIM Technology in the whole life cycle from the architectural design stage to the operation and demolition is the focus of current design institutes, construction companies and construction units. Digital mode for BIM system is shown in Figure 2.

In the construction stage, due to the large number of personnel involved, complex process, immature technology and lack of management experience for prefabricated buildings, there are many potential risks. In the actual production process, the production and transportation efficiency of PC components, the lack of professional and technical personnel and professional workers, have a direct impact on the construction progress, component damage, wrong installation, missing installation, deviation and other situations occur from time to time. Through the application of BIM Technology and RFID technology, it can achieve efficient and accurate operation in the construction stage of prefabricated buildings. Through BIM to build a

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three-dimensional model, the three-dimensional model is associated with the schedule to become a 4D model, and further associated with the cost to become a 5D model. By comparing the actual progress with the planned progress and the actual cost with the planned cost, the results are studied and judged in real time, which can provide decision-making basis for the management, and can ensure the quality, progress and cost controllable. BIM Technology and RFID technology are combined to associate the information of PC component production and construction stage. Through component coding and storing the information in BIM model, the PC component can be accurately tracked and managed, and the component with problems can be timely decided, and the feedback and fast update can be made, which greatly improves the construction efficiency.

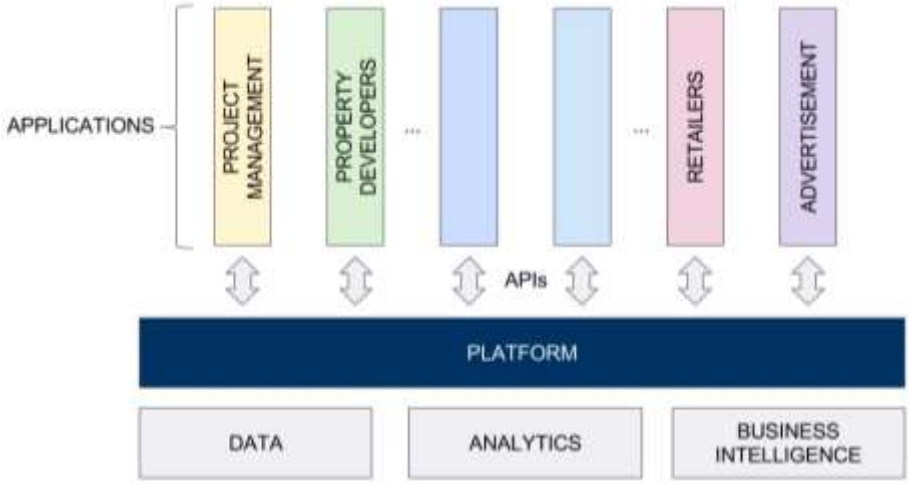

Fig 2: Digital Mode for BIM system

In the whole architectural design, construction and operation and maintenance stage, nearly 80% of the cost occurs in the use stage of the building. When the building is used for about 7 years, its cost will exceed the cost of the building construction period. With the extension of time, the operation and maintenance cost will continue to increase. Therefore, it will bring huge economic benefits to the owners if the fine management is realized in the operation and maintenance stage. At present, the maintenance of prefabricated buildings needs to collect information again. However, due to the large amount of information, it is difficult to ensure the integrity of information. These problems further affect the smooth development of operation and maintenance stage management. For example, due to the lack of information, the damage and aging of pipelines in buildings may lead to accidents and shorten the service life of buildings. Through BIM Technology, it can provide accurate and complete data information for the operation and maintenance stage management. The information management system in the operation and maintenance stage is the main means to solve the above problems. In the daily operation of the building, the equipment can be dynamically monitored to find the hazard source in advance. In the event of disaster, the BIM Technology can be used to locate the fault,

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find the fault location, and arrange professional personnel to deal with it. In the operation and maintenance stage, the combination of BIM Technology and RFID technology can play a key role in the process of equipment operation and maintenance. Some research results show that using BIM to monitor and analyze the equipment, find high energy consumption equipment and repair or adjust it in time, and find the recyclable or secondary development equipment through BIM model, which can save resources and realize green operation and maintenance.

During the disclosure of the construction scheme, the construction scheme is displayed to the workers through the three-dimensional BIM model, which is convenient for them to understand and improve the quality and safety of the construction. As shown in Figure 3, the construction scheme of cantilever scaffold is given, which is visual.

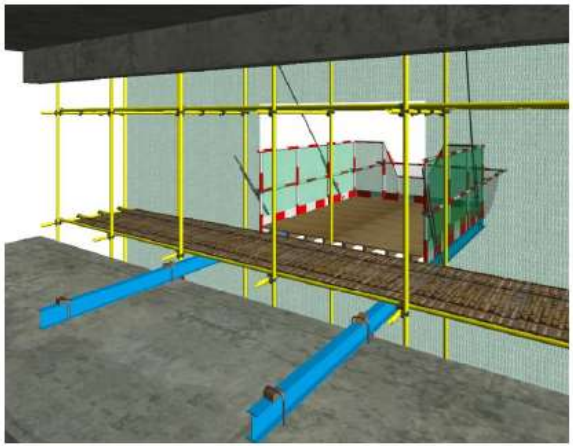

Fig 3: Construction Scheme Simulation

V. CONCLUSION

BIM Technology is a new product and technology of global construction industry in the 21st century. In some developed countries, BIM Technology has been widely used in the construction industry, which makes the information of construction project fully shared and transmitted losslessly in the whole construction process of planning and design, construction, operation and maintenance, and even demolition. In the construction and management process of the whole life cycle of the project, the project participants can carry out information operation and model operation in the BIM model on the BIM information platform. They can communicate and cooperate with each other, and make contributions to the improvement of project quality, cost saving and shortening of construction period.

This paper systematically discusses the implementation means and methods of BIM Technology in the construction quality control. In the construction process, through the application of BIM visualization, deepening design, collision inspection, virtual construction, resource dynamic management, collaborative management and other technologies, and analyzes

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the influence of these methods and means on the quality control in the construction process, It is also a summary of the application of BIM Technology in construction quality control; In addition, BIM is combined with some advanced detection technologies in the process of construction quality control, such as Bim and laser scanning technology, RFID technology, RTs (Intelligent Total Station), ultrasonic and non-metallic ultrasonic detection technology.

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