

Application value of BIM technology in prefabricated building

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Abstract

prefabricated construction as a kind of green environmental protection building form, is composed of a large number of prefabricated assembly construction, and can make use of the Internet, the BIM (building information model) technology, Internet of things, such as R&D industrialization BIM platform, realizing design standardization, production factory, assembly, the management informationization construction, etc., so as to improve the performance and efficiency of prefabricated construction, promote the development and application of prefabricated construction in our country, accelerate the process of building industrialization in our country. Will be prefabricated construction combining its own characteristics, this paper discuss the BIM technology in prefabricated construction design, component production, hoisting construction and operation and maintenance phase of the application, the product of the combination are respectively BIM collaborative design platform, prefabricated production management system, the virtual construction and operational management systems, prefabricated building for the future of the research and development to provide the reference value.

Keywords

BIM, prefabricated building, architectural design, component production, construction hoisting, operation and maintenance.

1. Introduction

Prefabricated construction as a kind of green environmental protection building form, is composed of a large number of prefabricated assembly building, its construction process is similar to the form of "building blocks", this way of building is beneficial to reduce the loss, shorten the construction period, quality assurance, and accord with the environmental protection "" four standard, meet the applicable, economy, the requirement of safe, green and beautiful, but there are also some problems^[1]For example, the construction is difficult, the standard is not perfect, the cost is high, the information management request is high.BIM (Building Information Modeling) technology refers to a new type of technology using computer technology to assist architectural design, which can build a Building model with highly concentrated Information^[2]. And has the visualization, the coordination, the virtuality, the optimization characteristic^[3].The industrial platform of prefabricated buildings based on BIM technology research and development can realize design standardization, factorization of production, construction and assembly, and management informatization, so as to improve the performance and efficiency of prefabricated buildings, reduce production costs, promote the development and application of prefabricated buildings in China, and accelerate the process of construction industrialization in China^[4].Will be prefabricated construction combining its own characteristics, this paper discuss the BIM technology and prefabricated construction design, component production, operation and maintenance and construction hoisting phase combination, combined with the product of BIM are collaborative design platform, prefabricated production management system, the virtual construction and operational management systems, prefabricated building for the future of the research and development to provide the reference value.

2. BIM collaborative design platform

With the advent of the information age, especially under the background of great efforts in the development of prefabricated buildings, building structures become more and more complex and functional requirements become higher and higher. Traditional two-dimensional CAD (Computer Aided Design) Design can no longer meet the requirements of today's building Design. In order to realize collision detection, coordination optimization and information collection and collation, a BIM collaborative design platform can be established based on BIM technology to realize information exchange and sharing among various majors and facilitate collaborative design among designers of various majors. In the design process of prefabricated buildings, the designer first carries out architectural design, and then carries out structural design on the basis of architectural model, and then the equipment engineer builds the equipment model for equipment layout. Similarly, designers specializing in water, electricity, heating and ventilation respectively carry out pipeline layout and design^[5], and then to the deepening of prefabricated model design, and on BIM collaborative design platform for various professional internal optimization design, and between professional, collision detection and coordination optimization and deepen the design, after many times between specialty and internal coordination optimization, can determine the optimal 3 d model, finally using BIM technology in 3 d model introduced in resources and time dimension, the three-dimensional model into five dimensional model^[6], and then carry out construction simulation to determine the best construction plan and construction drawing, as shown in figure 1.

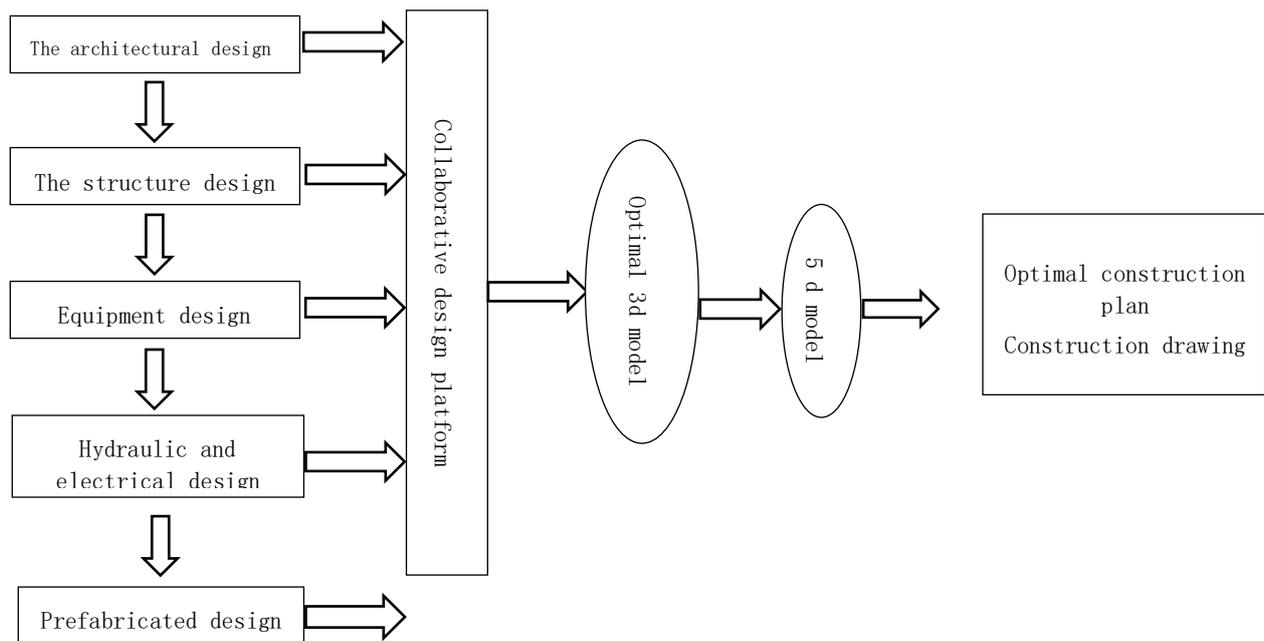


FIG. 1 BIM collaborative design platform

3. Production management system for prefabricated components

In component production stage, the use of BIM technology to establish a prefabricated production information model, can give full play to the visualization of BIM technology, collaborative and the advantages of the information completeness, participants more effectively solve the component production stage, the amount of information and complicated problems such as information, realize the visual expression of production information as well as information sharing and collaborative work of each participant^[7]. BIM technology can not only establish component production information model and realize the visual expression of production information, but also establish prefabricated component production management system and realize the collaborative management of component production ^[8]. In a prefabricated production management system, ERP system with the BIM model docking, forming the fundamental component production database, the use of RFID and the 3 d

scanning technology to track and collect information, such as to build a integrated digital prefabricated building information interaction platform, the prefabricated prefabricated parts production process information integration management and tracking management, improve the management efficiency and benefits[9]cars only The production management system of prefabricated components mainly includes the management modules of workshop information, order, production schedule, production quality, inventory, workshop report and process production[10]Therefore, the detailed management of component production plan, cost, schedule, quality and storage can be realized.

4. Virtual construction

Virtual construction is the construction before the use of BIM technology and virtual simulation technology to realize the whole process of construction scheme optimization, such as virtual construction contains the virtual simulation technology, parametric modeling technology, the construction optimization technology and computer aided technology, such as its core idea is "building" after simulation, first, namely to simulate the construction, to find the best construction scheme, construction again[11]cars only Virtual construction of prefabricated buildings mainly USES BIM technology to carry out virtual layout planning, construction technology and visual display of nodes, as well as dynamic control of construction progress and cost.Construction site of a virtual layout planning mainly includes: planning material transport routes, simulated the layout, simulation, mechanical construction, optimizing the construction process, etc., in advance of prefabricated transport routes, the layout design planning is beneficial to reduce the secondary handling, reduce transportation cost, simulation of the construction machinery hoisting process, can reduce the conflicts of construction, speed up the construction of assembly process. In addition, BIM technology can also be used to simulate the occurrence of safety accidents and improve the emergency plan for safety accidents, so as to ensure the safety of construction personnel. Virtual building model based on BIM can not only visually display the whole building, but also demonstrate the construction process and complex nodes, so that people can more easily understand the construction process and facilitate the construction connection of workers and collaborative work of various departments. Virtual construction of prefabricated buildings is to add cost plan and schedule plan into BIM model, determine the 5D construction model, and then determine the optimal construction plan through virtual construction. Through virtual construction, we can intuitively understand whether the stacking, construction progress, resources and cost input of prefabricated components are reasonable, so as to timely optimize the construction plan and process, reasonably arrange the supply of resources and realize the dynamic control of progress and cost.

5. Operation and maintenance management system

In the whole life cycle of prefabricated buildings, the operation and maintenance stage occupies an important position, and the consumption of time and capital accounts for more than 70% of the whole cycle. Therefore, the improvement of operation and maintenance level is of great significance. In order to improve the management information level of the operation and maintenance of prefabricated buildings, the information platform built based on BIM technology and Internet of things can establish the operation and maintenance management system, and realize the comprehensive automatic management of the property, safety and energy consumption of the buildings. Based on BIM and RFID technology in the intelligent property management system, its working principle is in all kinds of prefabricated electronic label on the equipment and facilities, record the details of the components and equipment and the operation of the staff records, and store the information to BIM property management system, so that it can be for all the components and the operation of equipment to realize real-time monitoring, timely detection equipment and material damage, and according to the monitoring information in a timely manner to repair.In the emergency rescue process when a fire breaks out, BIM information management system can provide fire fighters with information of prefabricated components and equipment and facilities, provide rescue workers with accurate fire

location and 3D visual guidance, and facilitate timely rescue and disaster treatment. Management mainly through monitoring equipment energy consumption of building energy consumption monitoring and feedback of information, such as installation of RFID chip in the prefabricated, implementing BIM energy consumption monitoring and analysis of building energy consumption management system, and according to the energy consumption simulation of energy consumption data collected, can predict building energy consumption, find and solve the position of the high energy consumption, so as to achieve the best energy saving scheme.

6. Conclusion

From the perspective of the future development of the construction industry, the application of BIM technology in prefabricated buildings will certainly change the production mode of the traditional construction industry, improve the management level of the traditional construction industry, and promote the innovative development of prefabricated buildings. This paper introduces the application of BIM technology in prefabricated building design, component production, construction hoisting and operation and maintenance respectively. The application of BIM technology in prefabricated building design stage realizes the leap development of architectural design from CAD drawing to BIM collaborative design. In addition, the application of BIM technology in the production stage of prefabricated components is introduced, which produces the production management system of prefabricated components and improves the management efficiency and benefit of component production stage. In the construction stage of prefabricated buildings, the advanced technologies such as BIM and virtual simulation can be fully utilized to realize the virtual construction of prefabricated buildings and improve the collaborative efficiency and construction efficiency. Finally, the operation and maintenance management system established by BIM technology realizes the management of property, safety and energy consumption during the construction operation and maintenance. BIM can closely link the design, component production, construction and operation and maintenance stages of prefabricated buildings, solve the problems of information creation, management and transmission, realize the collaborative management of the whole life cycle of prefabricated buildings, and promote the innovative development of prefabricated buildings.

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