

Application of BIM Technology in Concrete Structure Design

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Abstract: Nowadays, China's social economy has been developing rapidly, the growth rate of population is also faster and faster, the industrialization of construction industry is becoming more and more important. The application of prefabricated structure in construction engineering is more and more, and the market also puts forward higher requirements for its precision and complexity. Therefore, researchers can use the corresponding technology to study the three-dimensional structure of the building, and build the information-based building model on the real building structure, so that the traditional two-dimensional structure building is again attractive in essence, and enhance the three-dimensional sense of the building itself in the construction field. BIM Technology Based on information technology can simulate the whole life cycle of buildings, so as to optimize the design of construction projects and improve the design level of projects. Therefore, the effective combination of prefabricated concrete structure and BIM Technology improves the design level of prefabricated concrete structure and promotes the vigorous development of construction industry.

1. Introduction

In recent years, the rapid development of China's urbanization process, the gradual expansion of the scale of high-rise building concrete structure project, put forward higher and higher demand for the overall quality of building engineering, also increased the difficulty of building structure design work [1]. If we apply modern science and technology to the field of architectural engineering design, we can monitor the progress of the project anytime and anywhere, and at the same time, we can improve the overall quality of construction engineering [2]. The BIM Technology in this paper is very suitable for the field of construction engineering; it plays an important role in the design of prefabricated concrete structure. The advantage of BIM Technology is that it can make designers understand the building structure model more clearly, and then analyze the problems in the high-rise concrete building structure more carefully, and finally solve it reasonably.

So why use BIM? It is because of the lack of design and component docking in construction engineering, resulting in unreasonable resources and even wastes [5]. In view of the lack of awareness of many construction enterprises on the industrialized construction of prefabricated concrete structure engineering, BIM Technology can be used to simulate the construction work, and three-dimensional demonstration is used for technical disclosure, so as to lay a good foundation for the efficient development of future construction work [6]. Using BIM Technology, combining information technology with construction industrialization, it is very beneficial to carry out information integration and project management for the whole process of prefabricated concrete structure, and establish a general platform for different disciplines such as architecture, civil engineering, electromechanical engineering, etc., so as to facilitate design change and information exchange [7].

The application of BIM Technology can make the construction enterprises better improve themselves, remedy some problems in the construction, make the allocation of building resources more reasonable, and make the construction scheme more perfect [8]. Therefore, BIM Technology can play a major role in the development of prefabricated concrete structure [9]. This is mainly because BIM Technology takes component family as the core. Reasonable design of buildings can give play to the advantages of parameterization and visualization, simulate buildings, and then accelerate the development of the construction industry [10].

2. BIM Technology Related Content and Application Advantage Analysis

2.1 Overview of BIM Technology

BIM Technology, also known as building information model, is the derivative of digital and information technology in the current construction industry. BIM Technology presents a new building mode by establishing three-dimensional model and combining with the form of database. The database contains all the relevant information and data of construction engineering. The virtual simulation technology of digital information presents the characteristics of simulation and drawing, which can realize the unity of building, design and construction units, property units and users. The reason why BIM Technology can be used reasonably in the whole prefabricated concrete structure is that BIM Technology can play a certain role in the protection of ancient buildings and complex buildings. Moreover, BIM Technology also has a great role in camp layout and hub layout modeling. Gradually, BIM Technology plays a very important role in China's construction industry, and information technology occupies an increasingly large proportion in the development process of China's construction industry.

2.2 Overview of Fabricated Concrete Structure

Prefabricated concrete structure, referred to as PC in the construction industry. Prefabricated concrete structure building is a building method and building materials developed in recent years, which is mainly used in residential buildings. This is mainly because China's economy is more and more developed, people's living standards and income levels have been improved, and residents require higher living conditions and living conditions, which promotes the industrialization of residential buildings in China, thus stimulating the construction industry in China. The main purpose of using prefabricated construction method is to improve production efficiency and maximize economic benefits. Prefabricated concrete structure refers to the production of relevant accessories for the building in advance in the factory, through the construction project builder to provide the relevant technical parameters of the building, complete the processing of building components, transport the building components to the construction site by means of transportation, and complete the assembly of the whole building by large machinery. The prefabricated construction method not only realizes the construction efficiency and quality of construction engineering, but also has the effect of environmental protection and energy saving, which provides a new technical guarantee for the sustainable development of China's construction industry. Moreover, through the factory production of standardized building components, not only makes the quality and efficiency of China's construction industry reach the level of advanced countries, but also enables residents to experience the comfort and comfort brought by science and technology in the process of living.

3. Experimental Ideas and Design

3.1 Experimental Ideas

In the design process, the staff should first clarify the overall idea, they should start from the perspective of the model construction parameters of the prefabricated concrete structure, and then refine the design, and collect all the data of the prefabricated concrete structure, which can help to build the three-dimensional model. In detail: (1) the staff should build the model database, and then sort out the data information of all components. (2) Staff needs to understand the implementation of the project, and preliminary construction of prefabricated concrete structure. (3) Staff should really implement the construction of prefabricated concrete structure model, so that the effect of structural design can be better.

3.2 Experimental Design

In the design, taking a public rental housing project as an example, the prefabricated components of this project include composite floor and inner wall panel. The purpose of using BIM Technology is to solve the problem of unreasonable resource allocation and even waste due to the lack of docking between design and construction. We can deepen the design of construction model by

establishing parametric component family of BIM Technology. During the construction, various methods are used to reflect the advantages of BIM Technology, such as short construction period and scientific use of labor force. In accordance with the relevant specifications, the BIM implementation principles and objectives of the project, the application scope of Bim and the selection of software are specified, which directly standardize the standards of prefabricated concrete structure engineering, and form a complete set of implementation process from design to construction. Prefabricated concrete structure engineering uses BIM model to realize the information interconnection of component processing drawing and building model, including component model, component quantity, etc. the statistical table of component parameters is shown in Table 1

Table 1. Statistical table of project standardized component parameters

Component model	floor	concrete consumption (single)	polystyrene volume (single)	concrete strength	design drawing code	weight (single)
YNB-3	three layer	1.81	0.58	C30	S6 interior wall panel	4.75
YNB-4	three layer	1.36	0.13	C30	S6 interior wall panel	3.18
YNB-5	three layer	2.06	0.46	C30	S6 interior wall panel	5.07

4. Discussion

4.1 Application Analysis of BIM Technology in Concrete Structure Design

Prefabricated building structure has higher requirements for construction technology. Different from traditional reinforced concrete building; prefabricated building structure mainly relies on information technology, especially BIM Technology. However, in the production and construction stage, if there is no correct information technology design, it is difficult to carry out construction. In order to illustrate the important role of BIM Technology in prefabricated concrete structure, this paper takes a prefabricated engineering project in Nanjing as an example for analysis. The net land area of the project is 45586.00 square meters, the plot ratio requirement is 1.5-1.7, and the building height is 20-58m. In order to better implement the prefabricated building in this case, considering the cost factors and production factors of production and construction, the standard unit is formulated, and the standardized design of unit type combination is carried out. The statistics of house type are shown in Figure 1.

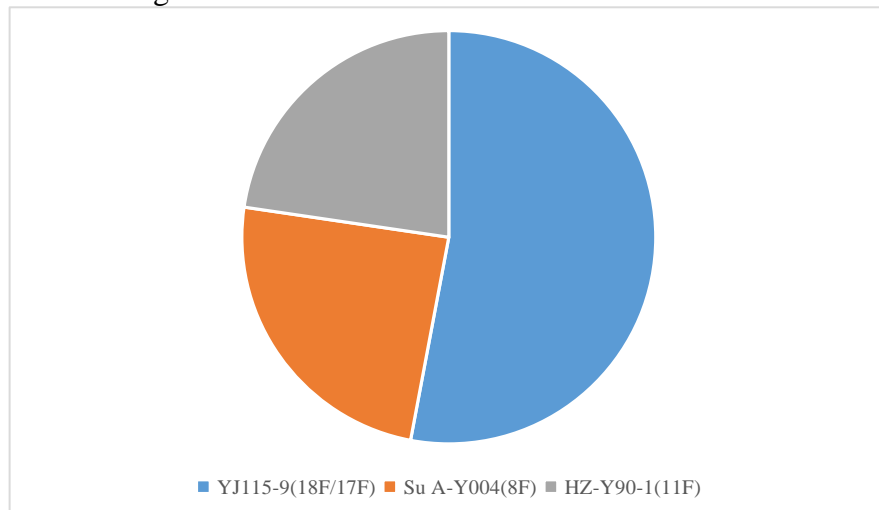


Figure 1. Statistical chart of standardized design house type

If BIM Technology and Internet of things technology are combined effectively, we can see the important data of the model anytime and anywhere through the computer information management system, which can drive the scientific installation of components. Component library can support multiple centralized management on the same platform, and support loading private family library files, which ensures the efficient updating of family library. We manage and classify the internal components of enterprises in a unified way, which can not only improve the efficiency of BIM modeling, but also help the development of BIM Technology. The BIM Technology can also build a parameter query model, upload the data information to the database, and then the construction quality records can be queried, as shown in Figure 2.

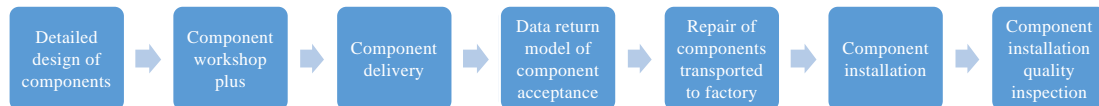


Figure 2. Component construction flow chart

4.2 Research and Analysis of BIM Technology in Prefabricated Concrete Structure Design

1) BIM Technology can reduce the conflict probability of professional design

In order to improve the design efficiency, most of the buildings are designed at the same time by different disciplines or regions. This parallel design mode can greatly improve the design efficiency and is a common method of current architectural design. However, this kind of design method often has conflicts or deficiencies in the convergence of various disciplines and the overlapping of design areas, which affects the design quality and efficiency. With the help of BIM Technology, the collaborative design of various disciplines can be realized. The work of each designer is summarized in the background, and the design model is overlapped. Once the conflict is found, the workload of repeated design is reduced, and the probability of design conflict between specialties is reduced. The simulation function of BIM Technology can realize the construction preview of the design, find the defects and unreasonable points in the design in time, provide the designer with the opportunity to modify and perfect the design, and realize the optimization and adjustment of the design.

2) Improve efficiency and strengthen construction period control

In order to realize the structural management of prefabricated concrete structure engineering, it is necessary to improve the management standards. The established standards need to be based on national interests to ensure more scientific application of BIM Technology. The established standards will also affect the implementation of BIM Technology, and ultimately affect BIM model standards. In addition to these, in order to do a good job in the management of prefabricated concrete structure engineering, it is also necessary to establish parametric component family to clearly grasp the differences in the structure. Reasonable use of the parameters in the component family can realize the sharing of design drawing information and effectively guarantee the quantity of prefabricated concrete. In this process, BIM Technology can be used to query and store the information in the design drawings. BIM Technology can optimize the internal model library of concrete structure engineering, develop more modular platforms, and ultimately improve the construction quality and control the construction progress.

3) BIM Technology can optimize the quality of building structure

The quality of high-rise concrete building structure has a great impact on the quality of the whole construction project. It will also have a great impact on the public's life safety, comfort and quality of production and life. This is why the quality optimization of high-rise concrete structure must be realized through scientific and reasonable detection. If the structural design is displayed in the form of two-dimensional plane, side view and top view, this method will have a lack of three-dimensional sense, which makes it difficult for designers to understand the collision between

individual and overall structure in high-rise concrete construction, thus forgetting to consider the collision problem of the model, which is easy to lead to inconsistency between the construction structure design and the current construction, and affect the subsequent construction speed. If the problem is found out, the whole plan must be revised, which will lead to construction delay and may affect the construction quality of the project. In addition, the probability of collision can be reduced by browsing the high-rise concrete model and reducing the probability of collision. BIM Technology can also be used to detect the abnormal problems in the structural design of high-rise concrete buildings, so that the staff can better find the problems, then analyze the problems, and finally solve the problems reasonably, which can improve the scientific nature of the building structure design.

5. Conclusions

In general, it is very important to strengthen the study and use of BIM Technology in prefabricated concrete structure engineering to achieve good results. When we use BIM Technology, we should pay more attention to its key links and elements, and pay more attention to the scientific implementation of specific measures and methods. The application of BIM Technology in prefabricated concrete structure can not only solve a series of problems caused by components, but also improve the work efficiency of construction projects to a greater extent by ensuring the construction progress and controlling the project price. The establishment of building component library not only plans the design and production of different structural components in the assembly engineering, but also reasonably controls the operation process, strengthens the supply of assembly engineering, standardizes the installation operation, improves the construction quality, improves the overall economic benefits, and promotes the sustainable development of the construction industry.

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