Design method of assembly architecture based on BIM Technology

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Abstract: With the deepening of economic development and the gradual development of sustainable development, the construction mode of assembly building with the characteristics of energy saving and environmental protection has also been strongly supported and concerned by the state. To promote the better development of the assembly construction, it is particularly important for the research of BIM technology. In this paper, the design method of BIM and assembly architecture is expounded, and the concept of assembly architecture design based on BIM technology is considered.

1. INTRODUCTION

With the development of information technology in all walks of life, information technology has also been paid attention to in the field of construction industry. The related research and technical application of BIM (Building Information Modeling) have also made breakthrough progress. As a new structural form of building industrialization, fabricated building promotes the rapid development of modern architecture industrialization, and is the only way for the development of building industrialization [1]. The construction industry gradually advancing to the green low-carbon, low energy consumption, low pollution and sustainable development, as a new form of prefabricated construction as the construction industry, informationization, serialization and standardization is the inherent technical requirements of the construction industry, BIM technology is a technology to meet the needs of the assembly the development of architecture.

2. BASIC PRINCIPLES OF BIM BASED DESIGN METHOD

Module is the basis of modular design. Modules can be defined as "units that are designed and assembled by standard modules and non-standard modules with specific functions and structures. They can form more combinations, modules or systems with other components (or modules) by standardizing standard interfaces." Modules can be made up of a series of standardized models through building blocks. They can also be configured with non-standard models which are quite different in performance and structure, and can meet different users' diverse requirements [2].

In the construction project, the module mainly includes the component and the component model. Modular design is based on system function analysis, and decomposes the total function of the whole system into several low level, interchangeable and independent basic unit modules. According to the specific design requirements of users, by selecting and integrating modules, we can quickly design various new systems with different series, different performance and different uses. Modular design emphasizes the type division of all kinds of functional spaces, organizing the space with the same function in one unit, and realizing the transformation from unit to whole through modular combination. In many large buildings, such as residential apartments, hotels, hospitals, teaching building contains a lot of similar units, using prefabricated modular design and is a good choice, this method can not only satisfy the requirement and choice of individual consumers, but can save time to a certain extent, the developers, the construction and the designer's identity [3].

Architectural design is a process from abstract concepts to specific design, is to find out the physical structure and the corresponding one according to the functional requirements of the professional design, by solving the problem, making the construction of each sub function can be dependent on the physical structure of the. The professional module hierarchy based on the consideration of architectural concept design considering the function, specialty, production, construction and other factors, multi-level design both from the top down, and can achieve the bottom-up structure combination, is building components model library, an effective method for building standard design [4]. The modular design method is introduced into the overall design and design decomposition process of architectural design combination, which can effectively achieve the rapid and effective polymerization, configuration, modification and reconstruction of buildings, thus forming modularized design based on function and structure.

3. SPECIFIC METHODS FOR MODULAR DESIGN OF MODULAR STRUCTURE

According to the functional requirements of selecting the corresponding structure corresponding to the apartment layout, choose from the apartment layout

structure base according to the arrangement of the apartment layout, equipment selection module according to the function and structure of the apartment layout, equipment at the same time with the building structure apartment layout coordination, avoid the collision between components [5].

The design of the inner unit is the basis of the modular design of the structure system, and it is the most important part of the workload in the modular design process. Standardization and serialization can improve the efficiency of collaborative design and lay the foundation for the precise implementation of modular design.

The interior design of the unit is the division of the internal function of the complete unit, and the accuracy of the coordinated design between the building, the structure and the equipment of the unit is ensured. Inter-unit design refers to the building unit which can be selected by the designer through the structure interface that can transmit the function of the unit. Building system is an orderly whole components through the organic integration and form, which has relatively independent function of each apartment layout, have certain relation, between the shared apartment layout component called the "interface", its role is not only a part of the building of the system, and is the apartment layout. For series parallel design of the media, become a combination of architectural models. The design of the apartment is mainly to solve the problems of the interface, and the interface can be divided into two types, which are reclosing interface and connection interface according to the shared parts of the component. The overlapped interface is the component that the shared part is superimposed. The connection interface means that the components shared by the collaboration do not coincide, and need external components to connect them. The solution of the interface between the Huxing is usually in the stage design of the Huxing, which will duplicate the overlapped components in the interface to delete one of them, so as to ensure the integrity of the whole building [6].

The design of the standard layer is to realize the integrity of the internal functions, supplement the accessory components in the auxiliary function, and ensure the accuracy of the coordination design between the building, the structure and the equipment specialty in the story.

The design of standard layer refers to the design process of the design of the building layer by adding accessory components by the designer. The general building is divided into basement, the first floor, the standard layer, the equipment layer, the top floor, etc. the building layer is made up of building units and accessory components. It is also an important part of the building system [7].

4. THE APPLICATION OF BIM TECHNOLOGY IN THE STAGE OF ASSEMBLY DESIGN

In the process of design, the application of BIM technology can optimize the content of the design. The 3D modeling method used by BIM technology is designed to construct the 3D model of building shape, structure, water supply and other content through different design. The use of BIM technology is the first requirement of virtual building design, through the design personnel for the embedded pipeline, steel checking, impact inspection and simulated inspection work to complete the construction details of the building model. The whole design work is no longer the repeated modification of the drawings, but is directly generated on the model. The building information model can also generate views according to the needs of the builders, so as to complete the project information viewing, and even get the information, material and cost of the generated materials directly from the information model.

Figure 1 3D display of precast beam column module

Conceptual design is mainly based on the needs of construction projects, according to the design conditions of building projects, the overall scheme to meet the architectural function and performance is studied and analyzed, and the overall scheme of the building is preliminarily evaluated, optimized and determined. BIM technology is used to verify the feasibility of the project, and the further deepening of the work is deduced and the scheme is refined. The necessary analysis of the construction project by using the BIM software environment, such as slope, direction and height, vertical and horizontal cross section, excavation and filling, contour, basin, as a design basis. To further establish building model using BIM software, the input information and the corresponding field environment, the physical environment of buildings (such as climate, wind speed, surface heat radiation, lighting, ventilation, etc.) entrance, car flow, structure, energy saving and emissions reduction and other aspects of the simulation analysis, choose the optimal design scheme of engineering [8].

1) Site analysis: the main purpose of site analysis is to establish 3D site model by using site analysis software, and provide visual simulation data in the process of site planning, design and architectural design, in order to evaluate the design options. In the field analysis, the main factors of the building site

should be analyzed in detail.

2) Simulation analysis of building performance: building performance simulation analysis is the main purpose of the analysis software of the professional performance, establish the 3D building information model of buildings, visibility, lighting, ventilation, evacuation, structure, energy saving emission is analyzed, in order to improve the construction project quality, performance, safety and rationality [9].

3) Design scheme comparison: the main purpose of the design scheme comparison is to select the best design scheme and provide the corresponding design model for the preliminary design phase. The design scheme based on BIM technology is the use of BIM software, or by making partial adjustment, architectural design to form a plurality of candidate models are compared, the construction project communication, discussion, decision making in 3D scene visualization, the design and implementation of intuitive and efficient decision making project.

The preliminary design stage is a process between the design stage of the scheme and the design phase of the construction drawing, and is the stage of refinement of the scheme design. At this stage, the building model is perfected and the design is carried out with the structure model. The building model was constructed using BIM software, carry a consistency check on the plane, elevation and profile, the modified model of cutting, generating plane elevation and profile and detail, architecture, structure model and preliminary design of two-dimensional map to form the preliminary design stage. In the process of the preliminary design of the building project, communication, discussion and decision can be carried out around the visualized architectural model. The statistics of the model generated by the model can reflect the main technical and economic indexes of the construction project in time and dynamically [10].

1) Construction of professional model: The main purpose of building structure, professional model is constructed by using BIM software to establish the three-dimensional geometric model, the three-dimensional model in the design phase of the building, to further refine the structure of professional, to improve the design and structure of the target model and provide design basis for construction design.

2) The main purpose of building structure plane, facade and section inspection is to check the consistency of building and structural components in plane, facade and section location by cutting the architecture and structural professional integration model, so as to eliminate the errors in design and structure.

3) The main purpose is to use the statistical area list building model, room area information extraction, accurate statistics of the common area index, technical index to assist in the construction; and

model modification process, play a role to achieve accurate and fast correlation modification, statistics.

The design of the construction drawing is an important stage of the design of the construction project, and it is the bridge of the project design and construction. This stage mainly expresses the design intention and the design result of the construction project through the drawings of the construction, and is the basis for the construction of the project site. BIM English in the design phase of the construction drawing is a complex process of building and optimizing the design of various professional models. Various professional information models include architecture, structure, water supply and drainage, HVAC, electrical and other professional. On this basis, according to the knowledge framework system of professional design and construction, the basic applications of conflict detection, 3D pipeline synthesis and vertical clearance optimization are completed, and the optimization of construction drawing design is completed. Aiming at some key parts will affect the height of the requirements of the specific analysis, optimization of electromechanical system to space arrangement and headroom.

5. PARAMETERIZED MODEL

Autodesk Revit structure is a structural design software designed for BIM, and it is also the most widely used structural modeling tool used in BIM technology design applications. It can minimize duplication of modeling and drawing, as well as errors caused by manual coordination between structural engineers and draftsman. It helps to save time for design drawings, improve the accuracy of two-dimensional graphic documents, and improve the quality of the project delivered to the customer. It can provide all the detailed lists, drawings, two-dimensional views and H dimensional views from a single basic database, and it can keep the design change automatically with the push of the project.

In Revit software, a three-dimensional BIM model is created by using interrelated databases. This parameterized model is a collection of various engineering language data. The software Revit contains three major classes of graph elements: the model element, the view element, and the annotated symbol element.

The basic element of model element Revit is the foundation of building model. It is used to establish the geometric model of building, and also is the graphic element of entity component object. The model primitives mainly consist of subject primitives and component primitives. Thematic primitives generally refer to the main components of buildings, such as walls, beams, plates, columns, staircases, ceilings, etc. The component graphics element can not exist independently. It is the element that must be attached to the main graph element in addition to the theme map element.

In the BIM parameterization model, there are inherent correlations between model elements, such as stairs between floors. If the floors are high enough to be modified, the height of the stairs will also change along with the change of story height. The model element not only contains two-dimensional graphics, but also has the actual meaning of the component model, and can update the various information.

The view primitive is the representation of the model element on the view, including the structural plane view, the floor plan, the three-dimensional view, the detail list, the section map, the elevation map, the blueprint and so on. The different observation angles of the model produce the plane, section and elevation view of the model. The list counts the attributes of various components, such as prices, materials, specifications, sizes, suppliers and other information. The drawing is a two-dimensional figure in the traditional construction of the construction project. The view primitives and model elements are all related. As long as the model is modified, the view will automatically update and change, which saves the tedious and error prone process of manually modifying related views [11].

The notation symbols are mainly divided into two categories, one is annotation primitive, including text annotation, dimensioning, symbol and mark, and the other is reference map element, which includes elevation, axis net and reference plane. In Revit, users can customize the style of the annotation metafile to meet different design application requirements.
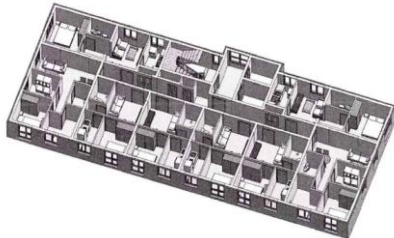

Figure 2 Unit model diagram

CONCLUSIONS

The application of BIM technology in the design of prefabricated building structure is briefly described.

To promote the better development of the assembly construction, it is particularly important for the research of BIM technology. In this paper, the design method of BIM and assembly architecture is expounded, and the concept of assembly architecture design based on BIM technology is considered.

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