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BIM Technology Application Strategy in the Whole Life Cycle of Green Building

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Abstract:

This paper summarizes the concept, influencing factors, principles and design methods of green building by combing the relevant research of green building at home and abroad. On this basis, this paper takes the whole life cycle practice process as the main line, and puts forward the specific application strategy of corresponding BIM Technology for the bottleneck problem of traditional technology in each stage. Then this paper demonstrates the unique advantages and feasibility of BIM Technology through practical cases. Among them, BIM Technology integrates geometric model and attribute database, and realizes the organic combination of spatial data and attribute data. The test results show that the BIM calculation and analysis function and ecological condition simulation function provide a very effective performance analysis tool and auxiliary decision-making tool for green building project participants. This paper studies the relationship between green building, life cycle and BIM, and puts forward constructive BIM application strategies, hoping to provide scientific reference for green building practice and related research, so as to achieve the goal of healthy and sustainable development of construction industry.

Keywords*: Green building, Wooden structure, BIM, Whole life cycle.*

I. INTRODUCTION

The success of the industrial revolution has brought rich wealth and a new way of life to mankind [1-2]. With the development of industrial civilization, human society has formed a development model for the purpose of pursuing economic growth. All sectors of society pay more and more attention to ecological damage, environmental pollution and climate change. Sustainable development has become an important topic in all walks of life [3]. Especially since the new century, the greenhouse effect and the consequent climate change threaten human survival. Building energy consumption accounts for more than four floors of the total social energy consumption, which is the largest application of energy consumption. The green design

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concept is dominated by high and new technology [4]. Through scientific overall design, it creates an effective living environment with low energy consumption, no pollution, comfortable use and green ecology, makes scientific use of ecological resources, and shows the high unity of architecture and people, ecological environment and science. It has become the mainstream trend of the progress of the construction industry under the background of globalization of environmental problems.

In the design stage, the simulation and analysis of ecological environment using BIM Technology can effectively solve the problems related to green building sites [5-6]. Relying on the BIM cloud computing function, the budget of green potential can solve the problem of concept comparison, lay a solid foundation for the whole life cycle practice of green buildings, and build a framework of design simulation analysis integration based on the accurate design of BIM [7]. In the construction and operation stage, BIM Technology provides guidance for construction collision inspection and formulation of construction plan through its powerful 3D coordination and 4D simulation function, solves the problem of low fault tolerance of construction activities, and formulates scientific use and maintenance plan through the management of space and equipment by BIM Technology in the operation stage, At the same time, it can be used as the information basis for building reconstruction and demolition in the future.

II. MAIN INFLUENCING FACTORS OF GREEN BUILDING

The basic concept of green building is to maintain natural resources, strive to protect the environment and reduce pollution as much as possible in the whole life cycle of the building, so as to create a comfortable, healthy and efficient building space for people to live in harmony with nature [8]. The life cycle of green building research includes planning, design, construction, operation and maintenance, which extends upward to material production and raw materials, and downward to demolition and recycling. The impact of architecture on resources and environment focuses on its time significance in the whole life cycle. From the beginning of planning and design to the following construction, operation management and demolition, architectural design is an irreversible process. Due to people's attention to the whole life cycle of the building, in the planning and design stage, the "anti planning" design means will be used to analyze the surrounding conditions, reduce the quantities of human development activities, provide an activity place to meet the needs after the building is put into use, and reduce the harm to the surrounding environment after demolition. The management organization structure in project construction is shown as Figure 1.

(1) Water and land resources. Construction consumes a lot of water resources: Although China ranks sixth in the world in terms of total water resources, with an annual volume of 2800 billion m3, the individual water volume is only 1 / 4 of the world's per capita water volume, i.e.

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2250m3. The water consumption of buildings accounts for about 50% of the total water resources, and the water consumption is huge, especially in the process of construction, transformation and use. In terms of water supply and drainage, the green concept is considered from the perspective of comprehensive utilization of water resources. It should not only consider the water supply and drainage system inside the building, but also the source and utilization mode of water. Due to the lack of water resources, water resources have become the bottleneck in the construction of green building system. At present, "building a resource-saving society" has become the guiding ideology of China's economic and social development. Land as the carrier of architecture, the rationality of its architectural design directly affects the efficient development and use of land. In terms of land use, in previous years, urban and rural construction land continued to expand, and extensive land can be seen everywhere, which has attracted the attention of the industry. Green design is a land-saving strategy through various means to create rich, diverse and hierarchical architectural space and improve land use value. It can be achieved by creating underground space and increasing roof activity space.

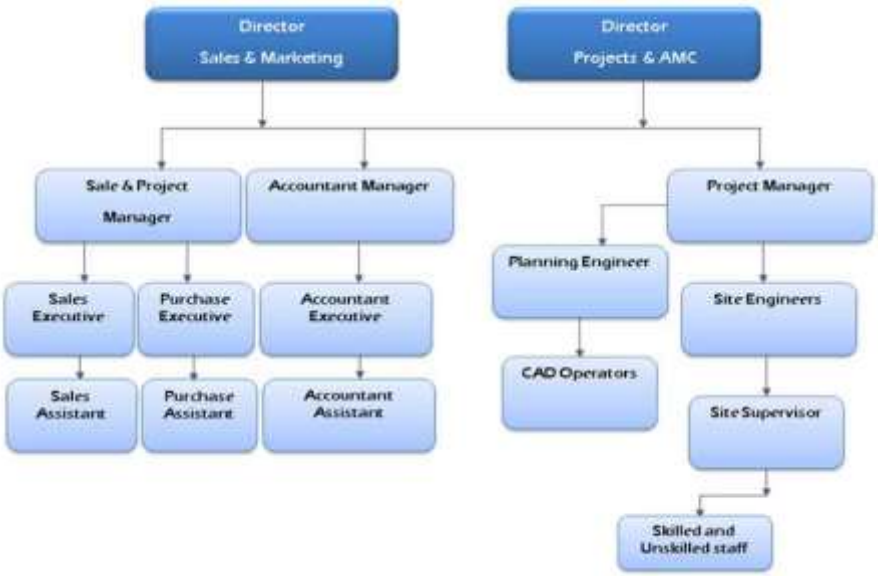

Fig 1: Management organization chart

(2) Energy factor. Nowadays, energy has become an important and dependent aspect in modern architectural design. For buildings that use a lot of lighting and air conditioning, energy is equivalent to blood power. The main reason for the world's energy shortage is attributed to those high consumption and low efficiency buildings, and the atmosphere is seriously polluted. According to data, the construction and use of buildings can consume about 50% of the global energy. In order to reduce building energy consumption, green building renovates the current design ideas and methods, and enables the building to achieve energy self-sufficiency through energy-saving technology and the development of new energy, so as to reduce the loss of non

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renewable resources. Efficient energy utilization, such as the use of clean renewable energy such as wind energy and solar energy, can reduce the dependence of buildings on fuel, and reduce the loss of non renewable resources such as coal and oil, so as to reduce the generation of greenhouse gases.

(3) Material factors. The building materials required for construction projects account for 2 / 3 of the cost, and in terms of quantity, there are about 76 categories, more than 1800 varieties and more than 2500 specifications. Therefore, the application of materials greatly affects the "green" degree of buildings. Green building materials and ecological environment complement each other, and they possess three characteristics: advanced nature, environmental harmony and comfort. At the same time, green materials should meet their basic needs in terms of process and technical performance, environmental performance and human health. System design framework is shown in Figure 2.

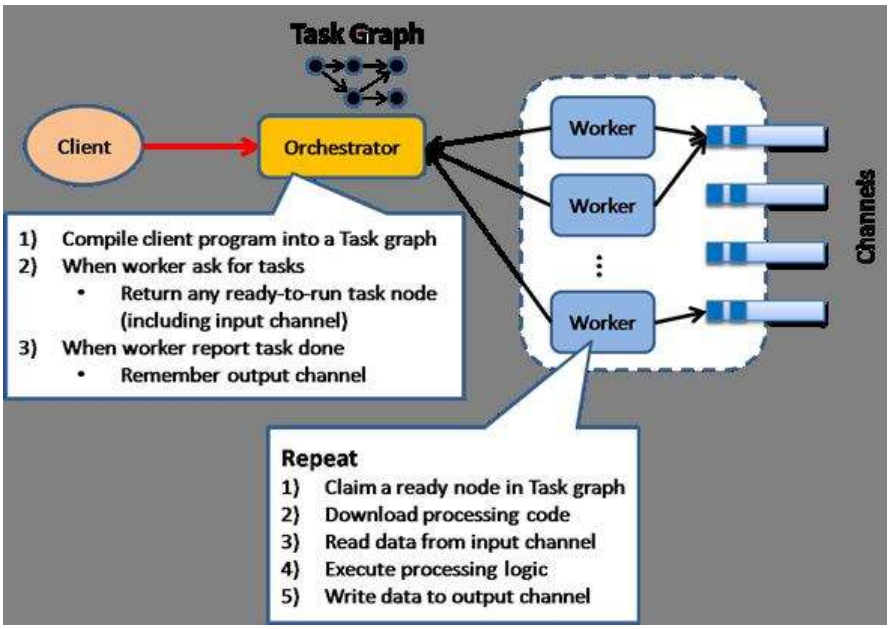

Fig 2: System design framework

III. DESIGN MODE OF CYCLIC FEEDBACK

From the perspective of design process, the essential feature of the current two-dimensional design method is the linearization of design process. Each part of the system has the characteristics of specialization and specialization, that is, each component of the linear system only performs specific functions. This mode has a strong time node function, and the phased results are difficult to form the circular system of the project cycle. The design points of some links are modified many times, and affected by many parties. If there are serious problems in

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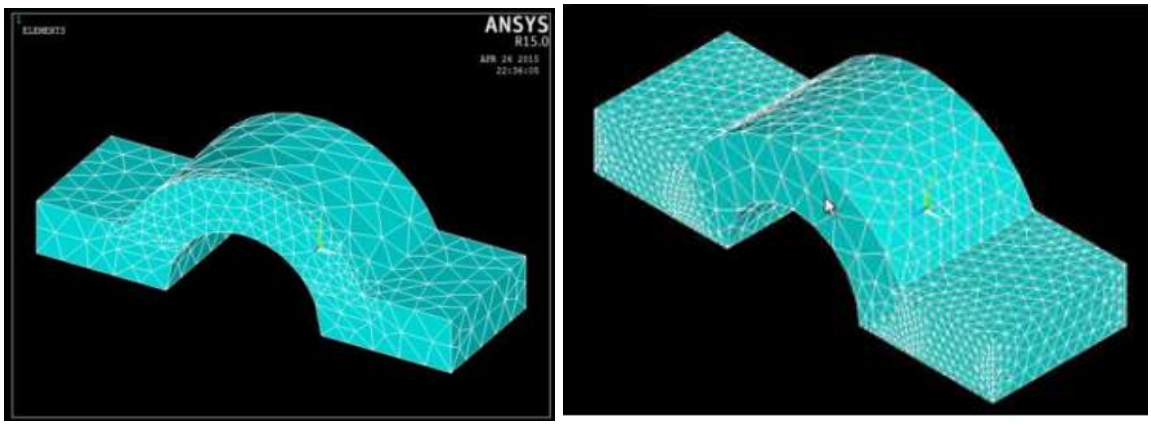
any link of the process, the linearized process will face the life of restarting. The current design mode is to divide each sub link according to the nature of work in different disciplines, with architecture as the leader and relevant disciplines as cooperation and assistance. This kind of strong stage, according to the conventional design process of time series, meets the development of construction industry in a certain period in process organization and task allocation. However, many years of practice has also encountered problems that are difficult to solve. In the preliminary and construction drawing design stages, various disciplines need a large number of repeated modifications and corrections due to the handover and integration of drawings, which has become a time-consuming and essential link in the design stage. In today's integration requirements, various new architectural design constraints add more complexity to this link and are difficult to overcome.

At present, the design process of green building relies on the linear organizational process of traditional design. The green analysis results of each link are fed back to the architect. The architect will feed back the design scheme when dealing with a single problem. The process is repeated many times, resulting in the backwardness of scientificity and timeliness. On the other hand, in the concept and scheme of green building, the green building staff can not determine all the information of building related skills due to the attribute of practical activities, and only consider the passive design points such as spatial layout, while the conception and planning of active technology will coordinate and adjust the design of green building in the follow-up work, To avoid the conflict between the formulation of building technology and the design scheme, while the traditional working mode is only efficient at the beginning of green design. Under the correction of many design and technical points, it will hinder the practical work of green building. This design process in time linear order can not fully support each separate design stage to obtain the best green design results. Green building design needs self-evaluation and inspection of multiple links, which forms this forward way of circular feedback, which is the biggest difference from the traditional design process. The application idea of the system is shown as Figure 3:



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A. Axial diagram of type II surrounding rock support system

B. Bending moment diagram of class II surrounding rock support system

Fig 3: System application ideas

In order to improve work efficiency, the key points of these cycles and feedback in the design process are often started successively after the end of the scheme in one stage, so as to ensure the synchronization with the design process. Secondly, the division of design cycle is not based on the depth of the scheme or work progress, but more importantly, the control points that promote the control points of the standard. The design process is a point-to-point influence relationship, and architects need to cooperate to complete the transmission and handover of results. And the stage results are closely related to the subsequent design cycle nodes.

When designing in the BIM platform, basic graphic units are called elements. For example, walls, doors, windows, text, dimensions, etc. established in the project can be called elements. All these multi-dimensional information elements are stored by "family". It can be said that "family" is not only the design basis of BIM, but also the basis of collaborative design. Architects can extract some or all of the information required for green design from the edited family files for green quantitative analysis. At the same time, the reserved project family library can be used as a resource for the long-term practice of green building. For example, the evaluated walls or materials can be extended to multiple projects, Editing its dimensions or finishes does not affect the diversity of buildings and improves the efficiency of green buildings.

For green buildings, the construction of "family" library is like the process of real simulation of building status, which includes all the information of green building design stage. The methods and steps of building green building project family library: first, input the ecological receipt into the site model to provide the basic data of visualization and informatization for architects; Secondly, the information of building entities is gradually determined according to the process from overall to local and from abstract to concrete. The modeling methods include mass modeling and parametric modeling; Third, edit the BIM model. With the deepening of the project, the family also includes building materials, structural levels, thermal performance, cost information, etc.

IV. METHOD STATEMENT 4D SIMULATION WITH BIM

Applying virtual construction technology to green building construction, this paper selects the core modeling software Revit and naviswork of BIM Technology as examples to illustrate the virtual building method. First, after completing the three-dimensional construction model corresponding to the model collision, then carry out the construction organization design of the model to build a reasonable construction scheme, including the overall construction site planning of the project, It also includes the construction sequence of detailed links. For example, relying on the Revit integrated platform, effectively integrate the overall to local observation of

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green building projects, strengthen the sharing of quantities, project progress, management objectives and other information between green building professionals and non professionals, and reduce the waste of resources caused by the inconsistency of coordination documents and data information to a great extent. BIM model itself can provide full information building entities, and promote the animation demonstration to be associated with the real building component generation process, so as to realize the virtual construction technology in BIM. The virtual building not only avoids major errors in the project, but also avoids the pollution of construction activities to a certain extent.

BIM Technology is used to establish the building construction process model to realize the real-time, interactive and realistic simulation of the construction scheme. Several schemes of green construction can be compared as the content of 4D simulation. The main process is to demonstrate the three-dimensional visualization function as planned, evaluate the feasibility and existing risks of the green construction scheme, and solve the potential hidden dangers affecting the green construction in advance. This construction technology is the core content of BIM virtual reality and the implementation basis for different green building professionals and non professionals to jointly formulate green construction plans at this stage, involving the construction sequence and virtual reality of building components. It is NavisWorks software based on BIM core modeling software and integrated into the green construction plans of architects and constructors, The significance is that before the construction of green buildings, combined with the key points of construction evaluation, the construction method is modified, which will help to solve the problem of no fault tolerance when the construction practice activities have occurred.

The green building construction scheme based on BIM is the basis for the realization of green construction, and the idea of not implementing the scheme in practice is still an embarrassing problem on paper. Therefore, the construction management organization based on BIM is equally important. Based on the green construction scheme, coordinate the participants of the project construction, including construction management personnel, supervisors, green building experts and other responsible personnel. Professionals communicate based on BIM visualization platform to solve problems in green construction. The problem of transmitting management information from traditional drawings is simplified, which reduces the dependence of green construction on management workers. Managers deal with green construction problems by allocating work and merging unnecessary workload, and greatly improve the efficiency of green construction through communication.

In the construction stage, BIM model will continue to be used to support construction scheme optimization, demonstration, construction simulation, quality monitoring and cooperate with the management of the construction site, so as to improve the informatization level of the construction process. Compare the construction site through BIM model, so as to quickly find the available open space, and query the geometric size of the available open space, so as to

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facilitate the use planning of the construction site; At the same time, the actual construction situation of the project can be understood directly through the real-time updated model. On the other hand, relying on the virtual construction of BIM, it almost matches the real construction process to show the working conditions of cross operation of multiple types of work, such as concrete construction, steel structure hoisting, steel platform system operation and large tower crane climbing, so as to intuitively see the conflicts between various processes. In view of these problems, the building construction party timely finds solutions to avoid unnecessary economic and time losses in practical operation, and modifies the green building.

In operation, the property and owners need to have three basic elements for applying BIM Technology: the completed BIM model, BIM database, and updating platform and interface [42]. The BIM as built model is derived from design and construction modeling. BIM database is used to store equipment related data information, including basic information, technical parameters, etc. The update platform and interface are mainly used to connect different data types in the BIM model to ensure that the BIM model is consistent with the objects under real management, even if the data is updated. These elements are interrelated and indispensable. When they are connected together, they constitute building equipment management based on BIM. The following functions can be realized in the operation of green buildings:

(1) Through the visual model, the effective management of the basic information of property management object equipment is realized. In traditional operation management, equipment information exists in different places in the form of text, pictures or documents. These information is messy. In BIM equipment management system, the information is related and easy to obtain. The visual BIM model is used for management, which avoids the direct thinking transformation between two-dimensional and three-dimensional in traditional management, and the BIM itself is three-dimensional, which matches the real architecture, omitting this thinking process.

(2) Adjust the equipment operation according to the green requirements. The traditional property management mode will carry out sunshine patrol inspection and maintenance or regular repair and maintenance for the managed equipment, but this method is loose and unscientific, and can not be avoided before the high energy consumption of the equipment. BIM Technology can directly reflect the operating parameter information of the equipment on the model through the interface with archibus, According to the operation parameter index of the equipment, adjust it to the operation scheme meeting the green standard, arrange the equipment operation schedule and automatically remind.

(3) Provide third-party vouchers for operation identification evaluation. After the BIM equipment maintenance management system has certain information data, it can carry out statistical analysis. For example, count the quantity of each equipment, the power and parameters of different equipment, and calculate it as indirect information such as air supply volume and energy consumption of air conditioning. Similarly, direct information such as

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indoor temperature and humidity can also be recorded. Finally, the relevant materials of operation management are generated, that is, the self-evaluation document is used as the third-party voucher. The revised version of the green building evaluation standard has included BIM Technology into the bonus points of innovation projects, and the BIM technical document can be used as the third-party voucher in the self-evaluation document.

IV. CONCLUSION

Compared with traditional building projects, green buildings make effective use of resources, reduce pollution and provide users with healthy, applicable and efficient use space. Affected by three factors: resources, climate and environment, they have changed greatly in design principles and methods. This paper summarizes the limitations of traditional building technology in green building practice, and takes BIM Technology as an auxiliary tool to solve the bottleneck problem of green building. In general, the paper puts forward the application strategy of BIM Technology Based on the practical problems of green building and the practical process of the whole life cycle.

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