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Application of High Rise Civil Building Design in Green Wood Building Design

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Abstract:

The use of traditional wood building materials has a long history in China. The wooden building has its own system. Based on the characteristics of BIM Technology and related standards, this paper expounds the principles, objectives and Strategies of green building design. Combined with the advantages and characteristics of BIM, such as visual design, collaborative design, information interoperability and performance simulation, this paper puts forward the application method of BIM Technology in green building and solves the problems existing in the traditional design of green building. In this paper, the green building design is divided into four design stages in chronological order: preliminary design, scheme design, preliminary design and construction drawing design. In each design stage, combined with the design points of green building, this paper analyzes the application points of BIM. Then this paper puts forward the specific application strategy of BIM Technology. Finally, combined with the practical case, this paper verifies the feasibility of BIM Technology in green building design.

Keywords*: Wood Building Design, BIM Technology, Data Integration, Service Platform.*

I. INTRODUCTION

With the beginning of the industrial revolution, the non renewable energy supporting human development is gradually decreasing, and the natural environment has been seriously damaged with the rapid development of industrialization [1]. The shortage of resources and global environmental problems have attracted people's attention. It is found that the global construction industry produces harmful substances is the main cause of climate warming. In order to reduce energy consumption and meet the requirements of natural light and natural ventilation, the shape of the building is likely to be different from that of the traditional founder [2-3]. In order to reduce the wind load, most of the buildings are cylindrical. In order to use more natural light, most of the floors of the buildings may be uneven. The special appearance of the buildings increases the difficulties in structural design and construction drawing. In the face

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of more and more huge building volume and more and more diverse participating units in collaborative design, The existing technology has been unable to meet the needs of the market. In addition, green buildings pay attention to the whole life cycle of buildings, and information transmission fault will appear with traditional technology [4]. The emergence of BIM brings the dawn to solve the above problems. BIM is the second information revolution in the construction industry after the comprehensive promotion and application of CAD technology in the 1990s. BIM, as one of the most emerging technologies in the current construction industry, promotes the evolution of the construction industry from two-dimensional CAD to three-dimensional BIM [5-6]. As a highly integrated set of three-dimensional information data, BIM can effectively solve the problems of information transmission fault, a large number of duplication of modeling work, and the problem of information transmission fault in the process of traditional green building design practice There are some technical problems such as the poor cooperation among different specialties. To a large extent, it meets the needs of green building project design, and our country also attaches great importance to the use of BIM Technology in green building.

II. APPLICATION OF BIM TECHNOLOGY IN GREEN BUILDING DESIGN

The green building design at this stage is not sufficient due to the design time of the project. The lack of communication with the green building consulting team does not make the green consulting team really participate in every stage of the design. In particular, many green buildings at present still adopt traditional design methods in the early stage of the design, and do not have a clear understanding of the site climate, site terrain, ground conditions, site wind environment, etc The sound environment and other natural factors that affect the green building design are analyzed scientifically and favorably, but the preliminary design is carried out according to the designer's own experience [7]. As a result, the concept of "energy saving" in the design of green building has not entered into the project from the beginning, and the conflict between technology and building has not been fundamentally solved, And performance simulation is also in progress after the completion of the design, which does not form a guiding role for the design. When a green building is selected as a star, it can meet the scoring requirements based on reasonable natural lighting and ventilation, or it can meet the scoring requirements through high-performance mechanical and electrical equipment. The latter is often used in many projects, which costs a lot of money to use expensive equipment. The main reason for this phenomenon is that designers lack the understanding of green building suitability technology. Lack of analysis of project environment and close communication with green building consulting team [8-10]. The process of illumination analysis under BIM application is shown in Figure 1.

The specific design process is as follows:

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(1) Collaborative design

Green building is an interdisciplinary and multi-stage comprehensive design process. In the design process of green building project, it needs the participation and timely communication of owners, architects, green building consultants, structural engineers, HVAC engineers, water supply engineers, interior designers, landscape engineers and other professionals. In order to unify and integrate a green energy-saving design concept in the project, pay attention to the internal and external system relationship of the building, track the modification of the scheme at any time through the shared BIM model, let each specialty participate in the whole project, and pay attention to the internal connection of the system of each specialty, such as the installation of new energy-saving windows, higher insulation performance than conventional windows, shading and ventilation functions in summer, At this time, we need to contact the equipment professional, so that the equipment engineer can reduce the installation of air conditioning and other equipment. In order to reduce energy consumption, the advantages of BIM Technology Collaborative Design solve the problem of communication between the green building consulting team and the participants, improve the understanding of green building, and make the project participants follow up and understand the project at any time, so as to achieve a better generation of green building projects.

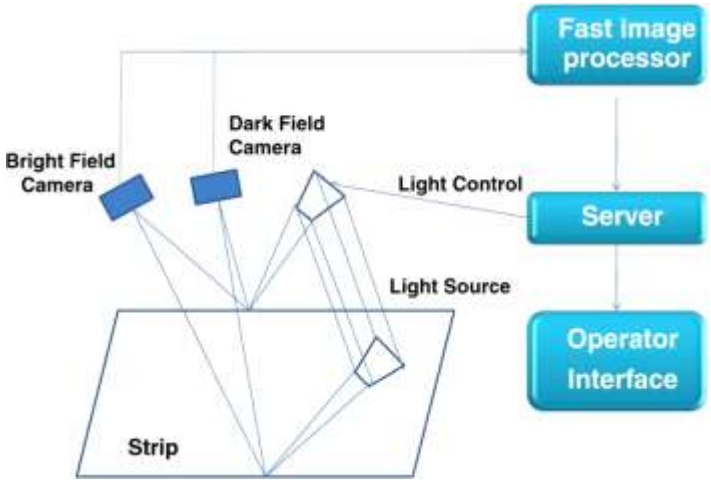

Fig. 1: The process of illumination analysis under BIM application

(2) Comparison of performance analysis schemes

The conventional performance analysis and Simulation of green building must be operated by professional technicians, using these softwares and manually inputting relevant data. When using different performance analysis softwares, it is necessary to re model for analysis. When the design scheme needs to be modified, it will cause time-consuming data input, re proofreading and model re modeling. This wastes a lot of human and material resources. This is also the reason why the performance simulation of green building is usually a symbolic work in the construction drawing design stage. Using BIM Technology can solve this problem well,

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because in the design process, the BIM model has stored a lot of design information, including geometric information, component properties, material properties and so on. Therefore, there is no need to re model in performance simulation. We only need to convert the BIM model to the commonly used GXML format for performance simulation analysis, and then we can get the corresponding analysis results, which greatly reduces the time of performance simulation analysis. The process is shown in Figure 2. Secondly, through the analysis and Simulation of the site environment and climate, let the architect design the site rationally and scientifically, and put forward the green project of harmonious coexistence with the surrounding environment. During the scheme comparison, BIM is used to establish the volume model, and the wind environment and sound environment of the building site are simulated and analyzed in the early stage of the design. The energy consumption of different building volumes is simulated, and the optimal scheme is finally selected. In the preliminary design, the performance simulation is carried out again to deepen the optimal scheme, so as to realize the design purpose of green building.

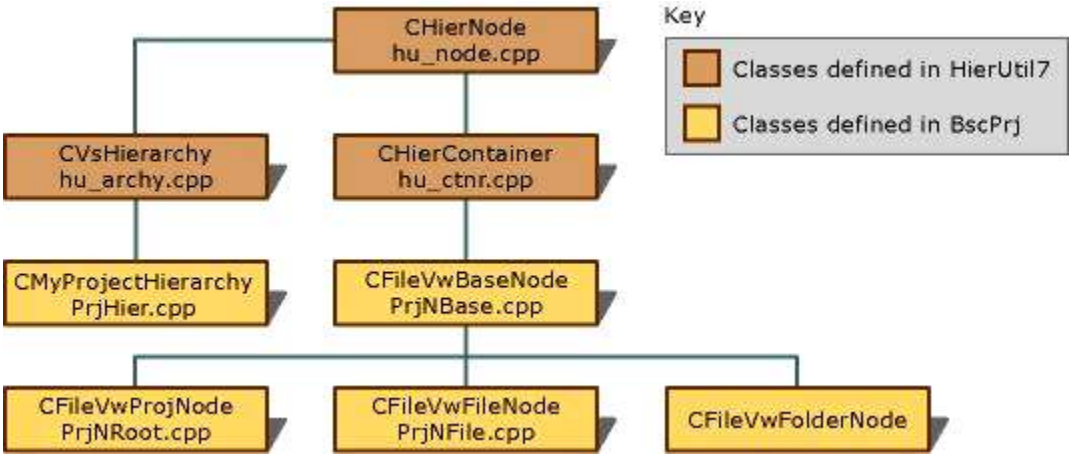

Fig. 2: GXML format for performance simulation analysis

(3) Complete information transmission of whole life building model

Both green building and BIM pay attention to the concept of building life cycle. BIM Technology Information Completeness makes BIM model include all the information in the whole life cycle, and ensure the accuracy of information. BIM Technology can effectively solve the problems of traditional green building information redundancy and low information transmission rate. BIM model carries the data of green building design, construction requirements of materials, equipment system and building material properties, equipment system manufacturers and other information. Complete information is transmitted to the operation stage, so that the owners can have a more comprehensive understanding of the project, so as to carry out scientific and energy-saving operation management. The conversion process is shown in Figure 3.

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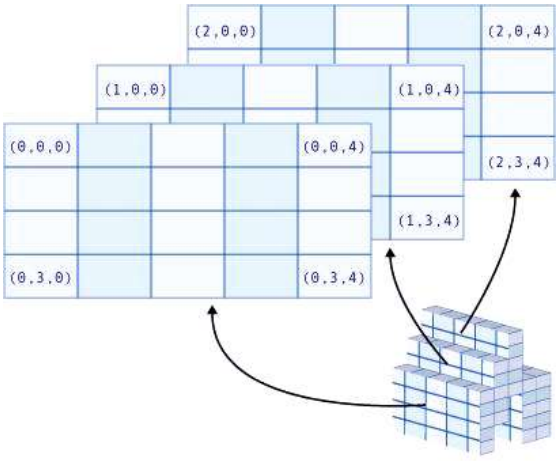

Fig. 3: The conversion process

III. APPLICATION OF COMPONENT PRODUCTION STAGE

In the process of component production, BIM Technology can be combined with RFID technology. RFID is a kind of non-contact automatic identification technology, which can automatically identify the target object and obtain relevant data through radio frequency signal without manual intervention. As a wireless version of bar code, RFID technology has the advantages of waterproof, antimagnetic, high temperature resistance, long service life, large reading distance, encrypted data on the label, larger storage capacity, and easy change of stored information, which is one of the most widely used technologies in the Internet of things. RFID technology is applied to the whole life cycle management of prefabricated buildings, that is, RFID tags are implanted into various prefabricated components, and an independent tag is set for each component, which can provide high traceability for component production and management, and strengthen the management of component storage, transportation and hoisting process. The building information data processing center is shown in Figure 5.

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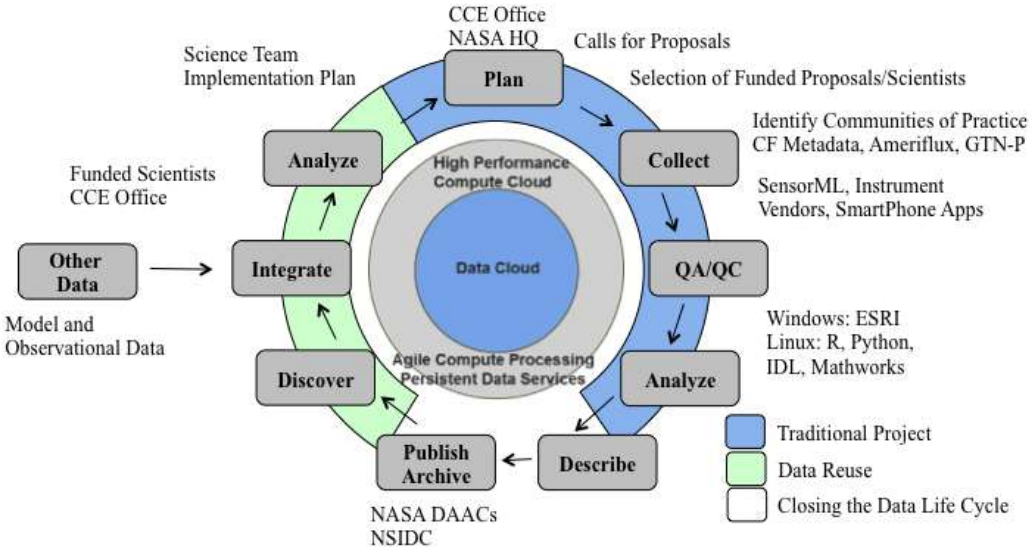

Fig. 5: The Building Information Data Processing Center

The combination of RFID and BIM Technology can timely extract the parameters (model information in the design stage) required by the production activities, so that the production personnel can carry out the component production according to the specific parameters in the system, and can better ensure the quality of components. Because RFID tags are embedded in each component, the information of production, quality and storage of all components can be transmitted to BIM database to ensure that the components can be used accurately. In a word, the combination of RFID technology and BIM Technology can improve the accuracy of component production, improve the efficiency of component management, and achieve the goal of zero inventory and zero defect management as far as possible. At the same time, in the component production stage, it can also transmit the actual progress of the prefabricated building and related information technology to the subsystem, improve the scientificity and automaticity of the production work, avoid the production problems such as waiting for work and materials, ensure that the production work can meet the construction needs of the construction project, and ensure that the project is completed on time as required.

IV. APPLICATION OF PROJECT CONSTRUCTION STAGE

(1) Schedule management

The traditional schedule management work is usually controlled according to the experience of the management personnel, so the problem of blind rush or schedule lag often occurs. Applying BIM Technology to construction schedule management, managers can identify tags in components by using RFID scanner, collect relevant information of components, fully grasp the on-site assembly progress, and carry out schedule management on this basis. At the same time, with the help of MSProject, P3 and other schedule preparation software, the site construction

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schedule can be accurately prepared, and the site construction schedule can be effectively controlled.

(2) Cost management

Specifically, cost management is divided into four different sections.

(a) Statistics of quantities. The statistics of construction quantities is the basis of cost management, but the traditional statistics method is more complex, and there are some errors. Using BIM Technology to count the engineering quantity can accurately count the information and data related to the construction engineering, provide accurate engineering quantity data for the staff, and improve the work efficiency.

(b) Payment audit module. Through the 4D model of BIM management system, we can directly use the visualization function to summarize the project progress, and complete the audit in the first time to avoid payment loopholes.

(c) Analyze consumption. Through BIM Technology, managers can systematically analyze the consumption of mechanical equipment, construction materials and labor in prefabricated buildings according to the characteristics of the construction unit, the level of construction personnel and the construction scheme.

(d) Funding plan. Firstly, the time dimension is combined with BIM model to arrange the start time and end time of the project according to the specific situation, and then the user-defined cost is obtained to ensure the effectiveness of cost management.

(3) Quality management

In the whole life cycle management of prefabricated building, quality management is the most important work in all work, including:

(a) According to BIM Technology, manage all construction machines and tools on the construction site, and strengthen the management of mechanical equipment;

(b) BIM Technology is applied to establish a quality management platform. Through the platform, the differences between the construction situation and the design requirements are analyzed, and then targeted measures are taken to standardize the behavior of construction personnel and improve the project quality;

(c) In the application of BIM management system, the mobile terminal can be used to transmit the site security risks to the system, so as to ensure that the management personnel can grasp the site situation in time and improve the construction mode;

(d) All personnel related to construction engineering can strengthen mutual communication through visualization technology, coordinate the relationship between all parties, and ensure the smooth progress of the project.

V. CONCLUSION

The state and local governments have continuously issued a series of policies to encourage

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and promote the development of prefabricated buildings, so as to promote the upgrading of the industrial structure of the construction industry and achieve high-quality and green development. Steel structure has many advantages, such as high recycling rate, good seismic performance, convenient construction and so on. In a long time in the future, the number of steel structure buildings (including prefabricated steel structure residential buildings and steel structure public buildings) will be more and more. As the high-quality development of prefabricated building is inseparable from BIM Technology, with the development of prefabricated building, BIM Technology, especially the joint use of multiple BIM software, will be more and more widely used in prefabricated building.

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