Research on the Application of BIM Technology in Computer Aided Architectural Design

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Abstract. With the rapid development of China's economy, the construction industry has entered a period of rapid development. The large-scale urbanization process has brought unprecedented demand for new buildings. BIM technology is an emerging engineering digital design method in the architectural design industry in recent years. By building an architectural information model, the comprehensive and comprehensive civil engineering design, related inspection and pipe network control can be realized. From the overview of BIM technology and the analysis of the characteristics of BIM technology, this paper analyzes the application of BIM technology in energy conservation.

Keywords: Architectural Design, Computer Technology, BIM Technology, Application

1. Introduction

In the construction industry, promoting energy conservation and emission reduction in buildings and developing green, low-carbon and energy-saving buildings are important measures to implement China's energy and resource development strategy. The concept of green building design includes saving resources, returning to nature and creating a comfortable and healthy living environment. Green building requires designers to design the whole process in an interdisciplinary and comprehensive way, and BIM technology complies with this requirement. Through the building information model of this project, the orientation, temperature and humidity, sunshine, sunshade and solar radiation of the building in the real environment are simulated, as well as the annual energy consumption and the influence of building environmental noise and wind field. It is guaranteed that the concepts of environmental protection, green, low carbon and energy conservation will be applied throughout the whole design process from the plan stage.

2. Overview of BIM technology
At the 7th International Conference on Green Building and Building Energy Efficiency, Qiu Baoxing, Vice Minister of Housing and Urban-Rural Development, gave a keynote speech entitled “Draft Green China Action Plan”, which stated that the development of green buildings in China will be in the next five years. From the enlightenment stage to the rapid development stage, this revolution in the construction industry may not only help China to move towards a green and low-carbon development, but also bring enormous challenges and opportunities to the urban planning and construction industry. Solid work and solid actions in regulations, technologies, standards, and design have pushed China's green buildings to a new level. At the same time, China’s “Twelfth Five-Year Plan” also clearly proposed to accelerate the development of green buildings.

There are many studies on green buildings today, specifically; it involves many issues such as building design and management, raw material and building performance, energy and resource consumption. Therefore, the green building with the goal of improving resource utilization efficiency first emphasizes the integrated integration of technology. If the whole life cycle is regarded as a vertical integration consideration, the technical integration system is proposed. The concept of integrated design is an embodiment of horizontal technology organization. To truly realize the automation, digitization and integration design of green building design, a digital model containing all the information of the building and a building performance analysis tool that can identify this information are needed[1].

3. Features of BIM technology

3.1. Visualization

At present, the mainstream building CAD software adopting BIM technology in the world includes Archibald of Graphisoft, Revit of Autodesk, Micro station Triforma of Bentley, Vector works of Nemetschek North America, Soft plan of Soft plan Systems, and so on. as shown in figure 1 below[2]:

![Figure 1. Building environment assessment diagram based on BIM technology](image-url)

As shown in figure 1, due to the huge advantages of green buildings in energy conservation, many countries have begun to promote them and achieve outstanding achievements in economic development and continuous decline in energy consumption. In western developed countries, green
buildings have had a history of successful development for decades. The UK's research and engineering practices for green buildings have always been at the forefront of the world and have made great progress in the field of sustainable construction. The development of green ecological buildings in Germany is also very rapid\cite{3}. The new energy-saving materials and technologies developed by them have recently appeared frequently in foreign professional media and fairs, causing widespread concern. The green buildings in the United States started early and developed rapidly. The Green Building Industry Standard issued by the American Green Building Council has become the benchmark for green building assessment in the world. Canada's “Green Building Challenge” initiative uses new technologies, new materials, and new processes to implement comprehensive optimization design, so that the buildings consume the least resources and energy on the basis of meeting the needs of use. Green buildings have also made great progress in France, Sweden and Japan.

3.2. Coordination

BIM technology transforms traditional 2D drawing design into an intuitive visual 3D model, which helps designers to transform design thinking and achieve breakthrough innovation and expression. At the same time, the designer changes any design, the BIM model can achieve the overall automatic change of its associated parts, significantly speeding up the overall process of design. BIM software can be used in conjunction with relevant green energy-saving analysis software (such as Octet software) to analyze the design of the solution at any time during the design phase, and timely feedback the results of the simulation evaluation. In addition, traditional sustainable analysis tools require analysts to have strong professional qualities in building physics and data analysis. BIM's sustainable analysis software is easy to operate and easy to master. It does not require lengthy data analysis. Quickly evaluate different design strategies to provide technical support for architects in the early design phase\cite{4}.

In the BIM model, the architectural drawings are no longer the drawing lines but the expression of the multi-faceted architectural information in the model. BIM technology unifies the participants of different systems in the construction activities into a collaborative model, and establishes a multi-disciplinary design decision-making information support platform for architecture, structure, electromechanical, etc., avoiding the lack of timely communication or information transmission. Design delays and errors can greatly improve the efficiency and quality of overall design decisions. As shown in figure 2 below, the expected control of energy-saving standards in the design process can be realized:
Figure 2. Indoor illumination on a cloudy day divided by outdoor illumination without shade

The BIM model is used for the outdoor solar radiation analysis in figure 2, and the BIM coordination service can help deal with this problem. In other words, the BIM building information model can coordinate the collision problems of various specialties in the early stage of building construction, generate the coordination data and provide it. Of course, the coordination role of BIM is not a function to solve the collision between different majors. It can also solve such problems as the coordination of elevator shaft layout and other design layout and clearance requirements, the coordination of fire partition and other design layout, and the coordination of underground drainage layout and other design layout[5].

3.3. Simulative

The performance indicators such as landscape visibility, sunshine, wind environment, thermal environment and acoustic environment of the construction project have been basically determined in the early stage of development, but due to the lack of suitable technical means, it is difficult for the general project to have time and Costs Multi-scenario analysis and simulation of the above various performance indicators, BIM technology provides the possibility of popular application of building performance analysis. The next step of Greentown Residential Science and Technology Department will be to promote the performance analysis of buildings, improve the comfort of pedestrian areas around residential buildings, and improve the layout of the residential area, reduce the eddy currents and stagnation by adjusting the layout of the planning scheme and the layout of landscapes[6].

4. Application of BIM technology in energy conservation

BIM assisted residential energy-saving design, or capability performance simulation and FENIX, is the integration of comprehensive data information. The plan is for feasibility prediction. The application of green building technology and products will greatly enhance the comfort and environmental performance of the house products, and provide owners with a higher quality green life. In the practice of building technology, through the continuous improvement and adjustment of BIM
technology application, the “extraordinary method” for design and engineering management requirements is also that Greentown “creates more refined products for the society and creates more for the city. The beauty of the concept is embodied. Among them, the problems between residential design and residential energy consumption analysis include:

◆ The residential energy consumption calculation is huge, the method is responsible, the designer needs to apply auxiliary tools, otherwise it is not easy to grasp.

◆ Residential designers in the design period of the scheme are not conducive to the rapid and intuitive analysis of energy consumption, so that the difficulty of optimizing the design has increased.

◆ In the scheme design stage, the analysis results of energy consumption cannot be directly applied to guide the design and help the designers to modify the design scheme.

5. Conclusion

Based on the above applications, in general, BIM can be used for design analysis before building construction, so as to control material cost, save water and electricity, control building energy consumption and reduce carbon emission, and achieve the most reasonable work from rainwater collection calculation, solar energy collection to aging and renewal of building materials. In today's green era, architectural design needs to shift to practical, cleaner and more efficient technologies that minimize the consumption of energy and other natural resources, and establish processes and technical systems that produce minimal waste and pollutants.

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