Research on Green Building Energy Saving and Environmental Protection Design Based on BIM Technology

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Abstract. At present, the construction industry consumes a large proportion of energy and causes serious problems to people's living environment and living space. Therefore, the energy conservation and environmental protection of green buildings have become the focus of the construction industry. In order to make green buildings continuously improvement and sustainable development. By analyzing the advantages of BIM technology and applying it to green buildings, it simulates and analyzes important evaluation parts such as indoor lighting, outdoor acoustic environment simulation, indoor acoustics, and outdoor wind environment simulation of green buildings, and optimizes them in time to achieve energy saving of green buildings, and purpose of eco-friendly design.

Keywords: Building Information Modeling, Green Building, Energy Saving and Environmental Protection.

1. Foreword
Buildings consume about 30% -40% of the world's energy in the process of use. At the same time, buildings can emit 1/3 of global greenhouse gases, which makes people's living environment and living space also face severe ecological problems. In addition, the level of informatization in China's construction industry is not high. These factors hinder the sustainable development of the construction industry in China. Therefore, the green development of the construction industry and the informatization of the construction industry can make the construction industry sustainable development. The energy saving and environmental protection design of buildings requires the efficient use of energy and the pollution and damage to the surrounding ecological environment caused by the projects under construction to a minimum. BIM technology can promote the sustainable green development of the construction industry. Through the characteristics of synergy, simulation, and visualization of BIM technology, it can meet the energy efficient use for building design. BIM technology can simulate the energy consumption of buildings. The comparison of schemes in the decision-making or design phase provides simulated energy consumption data, which provides a more reasonable basis for the project's design scheme. In order to promote the development of green buildings, the state has released relevant documents such as the “Green Building Evaluation Standards”, “Building Energy Efficiency and Green Building Development Thirteenth Five-Year Plan”, “Building Lighting Design Standards” and other related documents. And by following the green building design principles, building and human and nature can achieve harmonious coexistence, which, not only can create a good living environment for
people and reduce damage to the ecological environment, but also promote the sustainable development of the construction industry. Therefore, the application of BIM technology in green buildings can save energy and protect environment, save costs and optimize functions.

2. Advantages of BIM technology

Building Information Modeling Technology is not only used to build building information models, but also an information integration platform for the entire life cycle of the building, which completes the collection, classification, storage, analysis, output, and sharing of building information.

2.1. BIM technology has the advantage of visualization

Visualization is the form of “what you see is what you see”, as shown in Figure 1. After building the information model of the building, the size information, material information, light source information, and indoor and outdoor environment information of the building can be more intuitive, and the design effect of the building can be expressed intuitively, it can also avoid frequent changes in design drawings, difficult coordination, and avoid designs efficiency. It is convenient for the participants to have a platform for mutual communication, and at the same time, it helps the site construction personnel and management personnel to better understand the intent of the drawing design.

![Civil model of the basement of Building 1 of the Fujian Provincial CDC Relocation Project](image)

2.2. BIM technology has the advantage of simulation

BIM technology saves costs by modeling and solving problems in advance by importing Navisworks after modeling the building. At the same time, BIM technology can also be used for building energy saving simulation, sunlight simulation, and simulation of the current construction site environment, which is convenient for optimal design and management.

2.3. BIM technology has the advantage of synergy

The building information model established using BIM technology, using the building information model as a carrier, can coordinate collision problems of various specialties in the early stage of building construction, generate coordination data, and store it in an independent database, which facilitates coordination and discussion among more participants with communication, the management of internal and external information can be integrated.

2.4. BIM technology has the advantage of dynamic optimization

In the ongoing process of the project, in order to meet the dynamic changes of the project, through the integrated management of building information through BIM technology, it can proactively control the dynamic changes of the project and optimize in time, thereby improving the design quality and management level of the building.
3. The value of BIM technology in green buildings

Green building is to save energy, land and materials to the maximum extent in the whole life cycle of the project, reduce the damage to the environment, provide comfortable environment and efficient use of space for people's living, and realize the harmonious coexistence between man and nature.

3.1. Importance of BIM technology for green building design

First, input building information parameters in the relevant software of BIM technology, such as building materials, indoor lighting requirements, indoor sound requirements, and other parameters. Secondly, collect relevant data, use BIM technology modeling software to establish a complete building information model, form a relevant data platform, and provide a feasibility basis for green building energy saving and environmental protection design. Finally, based on this information model, the building model is simulated and analyzed to provide a basis for the building's green energy-saving design (indoor lighting analysis, outdoor acoustic environment simulation analysis, indoor acoustic analysis, and outdoor wind environment simulation analysis) to realize the green building. The whole life cycle provides a good basis for operation.

3.2. Energy-saving design of BIM technology in green buildings

First of all, when applying BIM technology to energy-saving design of green buildings, the relevant specifications of green buildings should be followed, and important information of green buildings should be corresponding to energy-saving standards. Secondly, the energy conservation of green buildings is simulated and analyzed, and the analysis result report is obtained. Finally, in reference to and changes in building energy-saving design, changes can be made to relevant data based on relevant data to optimize the building's energy-saving design in real time. Through comparative analysis and research on energy-saving design solutions for green buildings, energy-saving design of green buildings can effective use in the life cycle.

4. BIM technology applied to environmental protection and energy saving design of green buildings

4.1. BIM technology for indoor lighting analysis of green buildings

According to the surrounding environment of the building, combined with green building energy-saving design standards, enter relevant parameters in related software, such as setting the window-to-wall ratio or window-to-ground ratio, and apply BIM technology to perform indoor lighting simulation analysis. The surrounding environment is used in the design. Perform indoor lighting adjustment simulation to reduce indoor artificial lighting to achieve the effect of energy saving.

4.2. BIM technology applied to the outdoor acoustic environment simulation analysis of green buildings

The “Green Building Evaluation Standards” requires that when BIM technology is used to simulate and analyze the outdoor acoustic environment design of green buildings, as shown in Figure 2, it should be detected based on the surrounding noise and predict the environmental noise after project implementation. If the environmental noise limit is exceeded, measures should be taken to improve it to meet the requirements of the surrounding environmental noise standards in the “Quality Standard for Acoustic Environment” and meet the energy conservation and environmental protection effects of green buildings.
4.3. BIM technology for indoor acoustic analysis of green buildings
In the design process of green buildings, it is often necessary to consider the comfort of the building interior. Room acoustics is one of the influencing factors. The reverberation time is an important index for evaluating the sound quality of the room. The reverberation time is too long, which will make the sound blurry. In a small volume and large sound absorption room, the reverberation time will be short, which will cause the sound to be too dry, which will lead to poor indoor sound quality. Use BIM technology to simulate and analyze the reverberation time inside the building, and optimize the reverberation time for too long or too short, until the reverberation time reaches an acceptable range.

4.4. BIM technology applied to the outdoor wind environment simulation analysis of green buildings
According to the “Green Building Design Evaluation Criteria”, use BIM technology to simulate and analyze whether the building's planning and design is conducive to the smooth air flow in summer and the transition season, and whether it helps to block or weaken the cold winter wind; whether the outdoor wind speed is conducive to outdoor pedestrians walking or outdoor Activities; forming a good surrounding wind environment; whether the building shape and orientation are conducive to natural indoor ventilation, and lay the foundation for creating a comfortable building indoor environment. As shown in Figures 3 and 4, the outdoor wind environment simulation analysis of a project is compared with relevant national standards. After optimization, the quality of the wind environment in the building area is better, the surrounding wind field streamlines are basically obvious, and there is no obvious airflow death. Areas, eddy currents, and wind stagnation areas, the building layout is conducive to natural ventilation in the building. The effect of building ventilation is obvious, and the skylight measures have a better effect on improving indoor natural ventilation. The ventilation effect of the rooms in the office area on the south side of the building is better. The typical office space on the fourth floor has more than 5 ventilations. This design makes the design of the outdoor wind environment more reasonable, and the energy saving and environmental protection of the building design meets the standards of green buildings.

Figure 2. Simulation analysis of outdoor acoustic environment of the building

Figure 3. Wind speed distribution in pedestrian area (summer)
5. Conclusion

Nowadays, energy conservation and environmental protection are advocated by the society. Green building is an inevitable development trend of the construction industry, and then the low level of information technology hinder the sustainable development of the construction industry. Therefore, the advantages of synergy, simulation and visualization of BIM technology, applies to the design of green buildings can improve the informationization level of buildings, so that the effectiveness of energy saving and environmental protection design of green buildings can be improved.

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