

# Application analysis of BIM technology in intelligent buildings

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**Abstract.** With the increasingly prominent environmental damage caused by architectural development, people's desire for green buildings is also growing stronger. At this stage, the society and the public's awareness of environmental protection is getting stronger and stronger. At the same time, relevant departments have also proposed the goal of green construction. Under this situation, the way of architectural design has also undergone a relatively large change. It has also become a content that the industry pays great attention to. Under the background of the continuous updating of modern information technology and the rapid development of computer technology, a new type of BIM technology has emerged. Through it, it can assist the feasibility of completing green and intelligent buildings, avoid the interference of external elements, and complete the design through network cloud computing according to local conditions. . Based on this concept, this paper will take BIM technology as the support point to analyze the functions of green building design, explore the mysteries, expound the application status of BIM technology in intelligent buildings, and analyze BIM technology from three aspects: design, construction and operation and maintenance. The application in intelligent buildings provides a new design direction for future architectural design and realizes the popularization of green and intelligent design concepts.

**Keywords:** BIM technology; green intelligent building; application analysis.

With the advancement of domestic science and technology in recent years, buildings are increasingly being updated in the direction of intelligence. The emergence of intelligent buildings has prompted the use of modern buildings to become more and more powerful. In addition to providing users with comfortable, safe, healthy and safe In addition to the living environment, it can also demonstrate the ecological benefits of green buildings. At present, my country is transforming the construction industry in order to build a beautiful countryside, and actively builds green intelligent buildings. With the application of advanced computer technology, intelligent buildings fully optimize the structure, systems and services of buildings according to user needs. configuration to create an intelligent environment for users. Green intelligent buildings need to implement sustainable development goals, solve the problem of waste of resources, and promote the standardization and standardization of construction projects.

## 1. Green and intelligent building

### 1.1 Concept

Intelligent building refers to the design of the best combination method in terms of the structure, facilities and management of the building, based on the actual needs of the majority of owners, and then to create a building environment with high comfort and convenience. Green building refers to saving the cost of various resources as much as possible within the useful life of the building, so as to achieve the goal of "green environmental protection, energy saving and consumption reduction", and create a healthy and safe living environment for users.

### 1.2 Features

#### 1) Energy saving

In the practice of green intelligent building design, relevant technical personnel should make full use of renewable natural resources such as wind energy and solar energy. In addition, when designing

a building, install an envelope structure with energy-saving effect, or design a reasonable air-cooling system on the basis of natural ventilation conditions outside the building, so as to improve the heating efficiency of the building and the efficiency of air conditioning and cooling. At the same time, it can also reduce the user's dependence on air-conditioning equipment, which will reduce the consumption of various resources and energy, and achieve the goal of energy saving and consumption reduction.

#### 2) Festival source

In terms of overall design, actual construction and selection of building materials, green intelligent buildings will comprehensively consider the recyclability and renewability of resources, and then improve the effective utilization rate of building resources. For the waste generated during the construction phase of the project entering the site, the corresponding recycling and reuse work will also be purposefully completed, so as to realize the resource utilization of solid and liquid waste, save a large amount of resources for the construction enterprise, and increase the enterprise's efficiency. benefits in all aspects.

## 2. BIM technology

### 2.1 Concept

BIM technology is a digital tool used in the design of engineering drawings, engineering construction, and engineering management. It is the main construction information management mode based on computer information technology. Project users can accurately grasp construction data through cloud computing, thereby reducing unnecessary construction and operation costs. And through the 6D correlation database, including sound, light, air, water flow, heat, etc., to provide management data to support engineering projects, and to provide building services according to local conditions to meet the needs of users.



Figure 1. BIM technology

### 2.2 Features

As the latest building information technology, BIM technology has achieved the design goal of transforming from two-dimensional plane design to three-dimensional three-dimensional design through this technology. Many of its contents are consistent with the needs of green building design. Applying this technology to green intelligent buildings can ensure the improvement of architectural design quality.

#### 1) Visualization

For BIM modeling technology, visualization is the most prominent feature of this technology. Compared with the previous design methods used by technicians in architectural design, this technology is very different. BIM modeling technology is mainly to input all the building information into the computer, and then use the special functions of the computer to splicing various data information, and automatically build a three-dimensional building model on this basis. In this case , the relevant designers can refer to the model to simulate the implementation process of the construction project, so as to detect the construction problems and optimize the engineering design scheme.

#### 2) Interoperability and sharing of information resources

BIM modeling technology has the intercommunication and sharing of information resources, which can ensure that data information resources can be consistent after sending andreceiving. In detail, the various data information entered in the BIM building model can enable the relevant

technical personnel to clearly grasp the operation of each construction link of the construction project with the help of the computer, so that the various construction projects that may exist in the project can be used. Problems are predicted, and then targeted measures are adopted to optimize the corresponding problems, so as to reduce the input of various resource costs and prevent the occurrence of delaying the construction period.

### 3) Integrity of information resources

Usually, the BIM building model will include all the information related to the building, such as the expression type of the building structure, construction materials, the use function of the project, the construction progress speed of the project, the construction cost, and the quality of each construction link. Building information on standards, number of workers, type and quantity of construction machinery and facilities, safety factor of engineering projects, durability of construction materials, etc.

## 3. Application analysis of BIM technology in intelligent buildings

### 3.1 Application Status

The introduction of standards such as "BIM Technology Application Standard", "Construction Engineering Information Model Application Unified Standard", "Architectural Engineering Design Information Model Delivery Standard" and other standards have formed a complete standard system at this stage. At any stage of the whole life cycle of the whole process of recruitment, construction, operation and maintenance, new construction technologies based on BIM technology should be considered, and how to use BIM technology in each stage should be written into the specification.

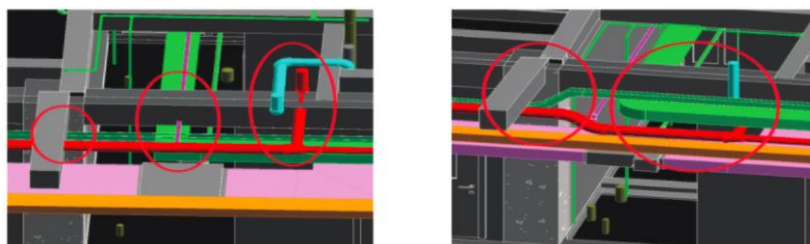
### 3.2 Application of BIM technology in the design stage

In the design process of intelligent buildings, factors such as solar energy and wind energy will be fully considered, and reasonable cooling and heating systems will be designed to reduce the consumption of various energy sources in the later use process, so as to achieve the goal of energy saving. After using BIM technology, a site model can be constructed, and the simulation of the real site can be realized through the input of parameters, so that designers can observe the site model more intuitively.

### 3.3 Application of BIM technology in construction stage

#### 1) 3D Collision Check

In intelligent buildings, there are many pipeline lines. When BIM technology is not applied, the traditional method is to check whether the pipelines collide one by one, which not only wastes manpower and time, but also may cause pipeline collisions due to omissions in inspection. , so that the construction cannot be carried out normally. At this stage, using the visibility of BIM, it is possible to realize 3D collision inspection, conduct pipeline design and operation, find problems in time and optimize them to avoid problems. Figure 2 (Comparison before and after pipeline collision detection)



**Figure 2.** Comparison before and after pipeline collision detection

#### 2) Construction process simulation

Using BIM technology, the construction plan can be combined with the BIM model to conduct a real construction simulation process, as shown in Figure 3.



**Figure 3.** BIM construction process simulation

In addition, the BIM model can also be combined with the construction schedule to truly simulate the daily engineering progress, observe the progress intuitively, and control the construction period, as shown in Figure 4.



**Figure 4.** BIM construction progress simulation

### 3.4 Application of BIM technology in operation and maintenance stage



**Figure 5.** BIM operation and maintenance management system

#### 1) Energy management system based on BIM technology

The combination of BIM technology and the Internet of Things can monitor the temperature and humidity in the smart building in real time, and perform automatic analysis of energy consumption. If the temperature is too high, turn on the air conditioner. If the temperature is moderate, turn off the air conditioner. If the temperature is too low, turn on the warm air, so that the comfort and green environmental protection of the intelligent building can be realized.

#### 2) Intelligent control system based on BIM technology

Under the premise of the combination of BIM technology and the Internet of Things, the automatic control system can also be combined with the BIM data information platform to detect equipment through the visibility of BIM. Realizing intelligent control not only increases the efficiency of operation and maintenance, but also reduces the cost of operation and maintenance.

### 3.5 Information Collection and Data Transformation

BIM technology has comprehensive data and is easy to share, and can build and visualize multi-dimensional models. In the design of building structures, BIM technology can perform three-dimensional analysis of the constructed objects, calculate the distance and width of reinforced concrete through limited software, and easily detect whether there are hidden dangers in the building structure. Designers can maximize the space utilization through BIM technology, and the understanding of the internal structure of the building is not limited to two-dimensional. This

technology can integrate data and effective information to simulate the real construction environment and achieve scientific and intelligent analysis. In the design of green intelligent buildings, calculation such as collision detection and interference inspection can effectively save construction costs, reduce environmental damage, and realize building data-based, accurate, standardized and intelligent green buildings.

## 4. Green and intelligent building design requirements

### 4.1 Define the building structure

When designing green intelligent buildings, it is necessary to clarify the interface and facade of the building. Common building structures include steel structure and glass curtain wall structure to improve building functions, bring good visual effects to people, and ensure the effective arrangement of equipment. Building intelligent control system mostly adopts field bus mode and distributed architecture. These two new forms have great advantages in changing the residential system, and can control the equipment in the other house. The green intelligent building realizes intelligent construction by collecting data and analyzing it through computer technology to ensure the efficiency and convenience of the house. For example: LAD Headquarters Green Smart Building - MVRDV has unveiled their proposal for an R&D Headquarters for Shanghai Languiqi Agricultural Technology Company (LAD), which combines innovative and traditional technologies with sustainable strategies under a sloping roof. The scheme is envisioned as an agricultural oasis in a rapidly developing area of Shanghai and one of the greenest and smartest sustainable buildings in China.

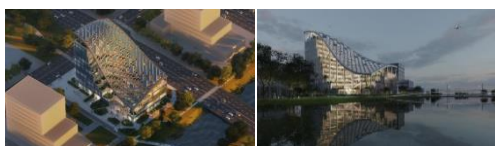


Figure 6. Rendering of LAD Headquarters Green Intelligent Building

### 4.2 Building the site model

Using BIM technology can use its own characteristics to assist designers to build a site model to show the most realistic state of the construction site in an all-round way, and it is convenient for construction personnel to view the site. Through pre-recorded data, such as elevation data and slope data, whether there are cracks in the structure It is convenient to adjust the direction according to the data, and handle every detail more scientifically.



Figure 7. Using BIM technology to build a site model

### 4.3 Key points of intelligent system design

The intelligent building takes the building as the platform, and is compatible with the application of information technology to equipment management systems such as information technology. The public safety system provides users with an efficient, convenient, energy-saving, environmentally friendly, natural and healthy building ecological environment. In the design of architectural details,

the climate and humidity around the building should be considered to give full play to and utilize various resources to serve users with the user as the center.

#### 1) Lighting and sunshine analysis

When planning the architectural design, the real sunshine situation is simulated through professional calculation of BIM technology, and the sunshine design is carried out according to the building type, and the proportion of windows and the ground is calculated accurately. related requirements.

The southern roof of the LAD headquarters is clad with solar panels, while the northern roof is hollowed out to allow sunlight and rain to reach the terrace below. On the facade of the building, solar panels and glass are folded and arranged.



**Figure 8.** Lighting Analysis

#### 2) Improve barrier-free facilities

Some intelligent architectural designs are human-centered and exist to protect ecological resources. In Victor Papanak's book "Designing for the Real World", it is proposed that architectural design should not only work for healthy people, but also work for healthy people. The concept of serving persons with disabilities should be taken into account. When designing new buildings, intelligent design of relevant facilities should be carried out according to requirements, barrier-free mode should be set up, and obvious signs should be added to facilitate the use and travel of users, so as to reflect the difference between intelligent buildings and traditional buildings.

### 5. The application value of BIM technology in green buildings

Green building refers to the traditional buildings that have a certain useful life, and save the capital cost as much as possible, so as to achieve the design goal of "green environmental protection, energy saving and consumption reduction". Aiming at the scientific detection of the building itself with BIM technology, the optimal design of green intelligent buildings is carried out by using scientific computing methods such as interference analysis method and analytic hierarchy process. For example, by designing and simulating the collision test of Revit, the bearing capacity of the main components of the building structure design is detected, and the DALI lighting analysis software system is used to conduct statistical research on the ventilation status of the building structure. Through the facade structure design, the lighting in different areas of the building can be simulated. Performance, use PHOENICS software to analyze the wind environment conditions around the building, and provide reference data for indoor natural ventilation design.

## 6. Conclusion

To sum up, in the development process of green intelligent buildings, in order to better meet the needs of users, the application of BIM technology in the design, construction and operation and maintenance of intelligent buildings can further improve the technical level of intelligent buildings at all stages and reduce costs. It has certain practical guiding significance. The new BIM technology is used to transform the building construction method from traditional to modern computer technology, providing users with green design, ecological design and intelligent design concepts. The advantages of BIM model calculation are more obvious than that of traditional buildings. During the design of green and intelligent construction projects, due to the interference of various internal and external elements, there are some difficulties, which also seriously restrict the design effect. The application of BIM technology has also become an inevitable option. It can conduct a comprehensive analysis of the surrounding environment, avoid potential hidden dangers, improve the accuracy of the building structure and the quality of building production, shorten the construction period, and effectively reuse the space, protect the ecological resources around the site and improve the function of the building. . At present, the application of BIM technology to green buildings has not been popularized in today's society. Relevant personnel must continuously improve their own technology, actively summarize experience and lessons, and continue to explore the future, so as to contribute to green and intelligent design.

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