The Application of New Green Buildings in Beijing

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Abstract: With the increasingly serious global environmental problems, green building has become an important development direction of the construction industry. The purpose of this paper is to design a green building that satisfies the factors of energy saving, environmental protection and sustainability in the process of building design, construction and operation, which can reduce the negative impact on the environment and improve the overall efficiency of the building. This paper takes Tsinghua University in Beijing as the research area, analyzes the data of the new green building model, and obtains the specific model data and the practical significance effect of energy saving, so as to prove the practical application feasibility of the building. Suggestions are made on environmental protection, energy-saving design of doors and Windows structure, strengthening recycling of building construction materials, reducing dust pollution and principles that should be observed in green Construction, in order to achieve practical progress in green building application.

1 INTRODUCTION

Since the oil crisis in the mid-1970s, mankind has faced challenges such as environmental degradation, resource depletion and energy crisis. Therefore, in the late 1970s and early 1980s, architects began to study energy-saving building materials and green building methods, such as fully using ventilation, increasing the use of natural light, and using natural materials.

Green buildings refer to high-quality buildings that save resources, protect the environment, reduce pollution, provide healthy, applicable and efficient space for people, and realize harmonious coexistence between people and nature during the whole life of buildings (Jingshan, 2022). Compared with traditional high-cost building materials, such as biomass building materials, low-energy building materials and new green building materials such as walls, waterproof seals, heat preservation and heat insulation, the cost of building is lower, which can effectively reduce the cost of building. Not only that, but with the gradual development of green buildings, the concept of green buildings has also received more attention from the construction industry. Green buildings can reduce the load of the building on the environment, make people friendly to nature, pay more attention to the comfort and health of the indoor environment, and, through reasonable design and layout, let people get close to nature and close to nature. At the same time, let everyone's environmental awareness has been further cultivated, establish environmental awareness, and promote the harmonious coexistence of man and nature.

When humanity enters the 21st century, the rapid development of urbanization and industrialization is accompanied by increasingly severe problems such as resource consumption, environmental pollution and global warming. Therefore, green building, an emerging model of low-carbon environmental protection and sustainable development, has come into everyone's vision and gradually received global attention. With the rapid development of social economy and the continuous improvement of science and technology, people's living standards have also been greatly improved, and people's requirements for living environment and quality of life are getting higher and higher (Li, 2018). At present, China has comprehensively promoted the reform of the market economy system. Still, the development of the entire market economy is not fully mature, efficient market system and mechanism have not yet formed, and there are still some defects in the process of market

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operation (Kai, 2022).

The green building designed in this paper is a three-story heterosexual villa located in Beijing. According to the concept of green building, we choose green building materials that reduce building costs and energy consumption, and improve the utilization of natural energy as much as possible, such as wind and sunlight, among which we pay most attention to the use of light. We use glass building materials as much as possible, maximize the increase of light, increase ventilation, reduce energy consumption, expand the vision, increase the proximity between people and nature, and create a more comfortable, comfortable and environmentally friendly living environment.

2 EXPERIMENTAL DESIGN

Beijing is located in the north of China, the north of the North China Plain, the east adjacent to Tianjin, the rest are adjacent to Hebei Province, the center is located in 116°20 'east longitude, 39°56' north latitude, In the northwest Beijing is high, and in the southeast it is low. Three sides of the region are mountainous: the west, north, and northeast; the southeast is a plain that gradually declines into the Bohai Sea. The Mongolian high has an influence on Beijing's climate, which is a continental monsoon climate and has an annual precipitation of 604 mm in its warm temperate semi-humid area. The climate in Beijing varies from dry winters to winds during spring, rainy summers, sunshine during fall and mild winters, while an average temperature throughout the year is 10-12 degrees Celsius. In winter, the cold air blowing from the northwest is blocked by the mountains and warmed when sinking, so Beijing is warmer in winter than other regions of the same latitude, and the frost-free period is about 180-200 days. The opposite-sex building is located on the Tsinghua campus in Beijing.

The building is environmentally friendly, green and sustainable development as the core concept of architectural design. Beijing is cold in winter and hot in summer, and the area has a large sunlight exposure range, which is worth making use of. Therefore, this paper builds this green building under this condition. Similar buildings used light before, but they are not widely used. Therefore, this paper designs architecture in this background design output.

The total construction area of the green is 91.00 square meters, the net construction area is 45.56 square meters, the unconditional construction area is 45.44 square meters, and the height of the building is about 13 meters. The building has three floors and is located north to south. Taking into account ventilation, sunshine, beauty and other factors, the south and west of each floor of the building are a large area of 180° panoramic Windows, including 32.8 square meters in the south and 24 square meters in the west, which can maximize the use of sunlight, reduce energy use, and achieve green environmental protection. In the east of the building, the building also adopts a glass roof, the staircase is not only full of light but also effectively avoids some dead corners, so that the interior space looks more transparent, and can improve the temperature of the house, and set up a glass terrace on the third floor, so that the room is more ventilated, comfortable, and more light. Glass is used in a large area of the building because it can convert the sun's rays into infrared rays. This kind of long wavelength light can be absorbed by the glass and block some direct ultraviolet rays, thus reducing the cooling load of the building and saving energy (Le, 2020).

There are 5 Spaces from the first floor to the third floor, including two on the first floor, two on the second floor and one on the third floor. The internal space zoning is clear and clear, and the functions are rich, which can meet the needs of families of about 6 people. The front section of each floor adopts a step design, which is an architectural form of jumping down layer by layer, constituting a unique architectural facade effect. Its feature is that each floor can have an outdoor platform, and can get a good view, making the overall building more hierarchical, from the visual can also give people a sense of freshness, while improving the utilization of sunlight, make each floor space brighter, but also make the overall building more transparent. There is also a balcony on the east side of the second floor, which can increase the sunshine and enrich the activity space. The roof adopts a dark slanted roof design, which can absorb outdoor heat in summer, effectively prevent low temperatures in winter, maintain indoor temperature, make indoor all seasons like spring, reduce cold and hot energy consumption, meet the drainage function, and heat preservation and insulation, help to keep indoor temperature stable, summer can gather heat on the top, reduce indoor heat loss; In winter, excessive indoor cold can be prevented to create a comfortable, healthy, energy saving and emission reduction living space (Haoyuan, 2010).

3 EXPERIMENTAL RESULTS

3.1 Result Analysis

This paper uses AUTODESK Revit software to test the building data. The building uses 65.46 gigajoules for cooling, 41.28 gigajoules for heating, 5.80 gigajoules for indoor lighting and 5.80 gigajoules for indoor equipment. Depending on energy use, district heating is the main heat source. The power intensity of illumination is 127.29 megajoules per square meter, the district cocooling intensity of HVAC is 1436.71 megajoules per square meter, the district heating intensity is 906.00 megajoules per square meter, and the other power intensity is 127.29 megajoules per square meter. Energy per gross floor area for heating end-use components is 1639.06 megajoules per square meter for source district heating, 759.37 megajoules per square meter for cooling, 201.84 megajoules per square meter for interior lighting power, 201.84 megajoules per square meter for interior equipment, The total energy end-use components are 403.69 megajoules per square meter for power supply, 759.37 megajoules per square meter for source district cooling and 1639.06 megajoules per square meter for source district heating. The total energy of the total energy consumption of the site is 118.33 gigajoules, the energy per unit building area is 1300.41 gigajoules, the energy per condition building area is 2597.29 gigajoules, the total energy is 254.98 gigajoules, the energy per unit building area is 2802.13 gigajoules. The energy per condition building area is 5596.63 gigajoules. The actual use of the building is significantly less energy than other buildings in the area, and heating uses less energy than cooling.

3.2 Suggestions

3.2.1 Environmental Protection

Nowadays, the prosperity of China's construction industry, any scale, any type of project, people attach importance to environmental protection, which directly determines that in the construction management and green project management must follow the principle of environmental protection, in the project construction more common application of energy-saving technology and environmental protection materials, fundamentally reduce all aspects of pollution, These include water sources, noise and dust. In addition, when formulating the construction plan, we should consider not only the economy and technology but also the environmental protection to ensure that the construction management is consistent with the specific requirements of environmental protection (Yingfei and Jialin, 2022). In the process of architectural design and Construction, natural resources such as wind energy and light energy can be fully utilized to minimize the energy consumption and environmental pollution of buildings. Qualified green buildings have very strict requirements in interior design, need to use the most environmentally friendly building materials, maximize the use of sunlight and wind energy, and create an environment close to nature. To achieve the goal of harmonious development of humans, architecture and the natural environment, it is necessary to create a healthy living environment on the basis of environmental protection, minimize the damage to the natural ecological environment as much as possible, and achieve the goal of harmonious coexistence between human and nature (Baolong, 2022).

3.2.2 Designing Doors and Windows with Energy-Saving Features

Next, When designing energy-saving windows, it is important to take into account the outer structure of the window., and the peripheral position can be reasonably increased so as to effectively improve the thermal insulation performance of the window. In addition, under the conditions of daily use by urban residents, the area of the window can be reduced in the use environment, which can achieve the purpose of reducing heat loss. Typically, during construction, windows and doors serve as primary sources for both indoor and outdoor air flow and exchange. Therefore, we aim to design a balanced ratio between doors, Windows, and walls, considering their resistance to wind and rain. Since the building is located in Beijing, which belongs to the north, we will also consider the tightness of doors and windows, and then on the premise of ensuring the smooth indoor ventilation conditions, the size of doors and Windows will be appropriately reduced according to the specific construction conditions, capable of serving as both a shield against wind and a source of warmth, while also enhancing indoor conditions (Jun 2022).

3.2.3 Enhance the Recycling of Materials Used in Building Construction

As the social economy continues to advance at a rapid pace and urbanization speeds up,, there are more demolition projects in China's construction industry at present, and a large amount of construction waste is generated in many cities after large-scale

demolition. To efficiently repurpose these valuable leftovers, construction debris can be methodically sorted using advanced technology, while certain structures can be pulverized with specialized equipment.These crushed construction materials can be applied to the road construction process, and the rest of the usable building materials can be put into concrete The processing. Through the effective recycling of these building materials, it can not only effectively reduce the cost input of the building construction unit, but also make secondary use of these waste through the processing of professional technology, and carry out the recycling of resources, so as to achieve the purpose of energy saving and consumption reduction. It should be noted that in the process of recycling waste sources, it is crucial to guarantee that the materials being recycled are not only safe for our environment but also pose no harm to our health. We must be vigilant in avoiding the recycling of any chemical waste or other harmful substances that could potentially contaminate our surroundings. Our responsibility lies in making conscious choices that prioritize the well-being of both our planet and ourselves. Not only do these chemical wastes fail to align with eco-friendly building practices, but they also significantly affect the quality of construction endeavors.

3.2.4 Reducing Dust Pollution

In the process of Construction, sand, cement and other materials that will generate dust will be used, especially in windy weather or in areas with a long period of drought, which is easy to generate dust, which will have a certain impact on the air in the surrounding area, and even affect the normal life of nearby residents. Therefore, during the construction period, relevant workers need to take corresponding measures to solve the dust problem, such as hardening the roads on the construction site, using clean fuel, or sprinkling water on the construction site, etc., which can effectively avoid the spread of dust and reduce the impact on surrounding residents (Ruifan et al., 2021).

3.2.5 Principles to Be Observed

Compared with the traditional management mode, the green construction management is more prominent in saving energy and resources and protecting the environment. On the one hand, in the construction process, particular attention should be paid to the use of clean energy and other energy conservation, and the consumption of energy and resources should be controlled from the details (Kunlin, 2022). For example, a collection and treatment system for the reuse of foundation pit precipitation is established at the construction site to realize the collection and use of water resources and save water. On the other hand, we should pay attention to the prevention and control of pollution, while using a variety of green environmental protection technologies, we should also pay attention to the management of dust, waste water, noise and other problems generated in the construction process, and write a green building blueprint.

4 CONCLUSION

These software not only help architects better understand and predict the environmental performance of buildings, but also provide data support to drive the popularity and development of green buildings worldwide. In this mini-project of Green Building Design Practice, our team used AUTODESK Revit software to design a new building in Beijing and performed the following analysis. After using Revit to design green buildings, we got an energy-efficient and environmentally friendly design solution. Revit's energy analysis shows that the building makes full use of daylight and reduces energy consumption in winter. In summer, the interior is kept comfortable through natural ventilation and shading. In addition, the choice of building materials also focuses on environmental protection and sustainability, and many renewable and recyclable materials are used. Revit's BIM features make collaboration between professional teams smoother, ensuring design accuracy and integrity. In the end, this green building design not only meets the requirements of energy saving and environmental protection, but also provides a healthy and comfortable living environment for the occupants.

AUTHORS CONTRIBUTION

All the authors contributed equally and their names were listed in alphabetical order.

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