Exploring the Design of Green Buildings Based on Building Intelligence

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Abstract. With the continuous development of the world and the continuous progress of science and technology, people's material living standards have made a great leap forward, and gradually realized the importance of the natural environment for human survival. In the context of the world gradually advocating carbon neutrality, architecture, as the most important activity place in human life, has become a crucial part. Traditional buildings with high pollution, high energy consumption, and high cost have been unable to meet people's needs for high-quality life. At the same time, people's demand for the aesthetics and comfort of buildings is also increasing. As an important means to protect the natural environment and maintain the ecology, the design and use of green buildings have become increasingly indispensable. Through a literature review, this paper compares the current status of traditional buildings with the development trend of green buildings in the future, summarizes the advantages and application scope of green buildings, and studies the materials of green buildings. To provide a reference for green building-related practitioners.

Keywords: Green architecture; building intellectualization; building materials; architectural design technology.

1. Introduction

With the improvement of people's awareness of protecting the natural environment and the development of building construction technology, people gradually realize that traditional buildings with high energy consumption, high consumption, and high pollution can no longer meet the current social needs [1]. As a developing country with poor resources and a large population, China is also in the stage of rapid development, compared with the Western developed countries faced with a more prominent contradiction of population, resources, and environment [1]. With the acceleration of the urbanization process, the building stock in the country has continued to grow rapidly, and the level of building energy consumption has also continued to grow accordingly. There is no doubt that adhering to the sustainable development concept and taking the road of "green" development is a major strategic national policy and an inevitable choice for the country to cope with the pressure of population, resources, and environment [2]. This study mainly expounds on the status quo of traditional architecture and the development direction of green architecture in the future, including green building design principles, green building characteristics, sustainable development, and people-oriented principles. The purpose is to provide a reference for green building-related practitioners.

2. Concept of Green Building Design

The concept of green building design is an architectural design concept that does not adversely affect the surrounding ecology and natural environment. Its main characteristics are low carbon, environmental protection, energy saving, nature, and ecology. From the perspective of the requirements of the green building design concept in the construction process, the environment should be protected to the maximum extent, and the consumption and waste of natural resources should be reduced [3]. And make full use of limited resources, reduce the damage to the ecological environment, and promote the realization of sustainable development.

3. Literature Review

Gao Jie believes that green buildings provide an innovative way for the sustainable development of high-rise civil buildings [4]. Li Cong believes that the use of BIM technology can help designers make comprehensive considerations from various dimensions such as thermal environment, wind environment, and light environment [5]. Zhang Pengzhong believes that new energy-saving materials can effectively reduce the pollution of the natural environment in the construction process [6]. Zhao Hai also believes that natural resources can be reused and environmental pollution can be reduced through the use of energy-saving building materials [7]. Xu Longrui believes that modern building energy conservation can improve the energy-saving and environmental protection effects of different types of buildings by combining past design experience and modern information technology, making full use of natural resources, and creating a better environment for users' lives through manual intervention [8].

4. Green Building Design Principles

The principle of green energy conservation is: to maximize energy utilization and promote the most efficient transformation and utilization of energy in the building; Minimize carbon emissions in the entire life cycle of the building; The highest use of comfort, while striving to save energy, to provide the highest comfort; Minimization of maintenance costs, minimizing building maintenance costs while achieving the above objectives.

4.1. Green Building Features

The main characteristics of green buildings include regional characteristics, externality characteristics, economic characteristics, and other life-cycle perspectives, and five aspects of indexing effect orientation [9].

Regional characteristics. Regional characteristics refer to the different conditions of the building combined with the region and then have different needs for the function and form of the building. Architects are required to formulate technical strategies for low-carbon green buildings according to local climate conditions, natural resources, economic level, customs, and other perspectives. For example, compared with the buildings in the north, the buildings in the southern region should focus on the control of cooling and refrigeration technology [10].

External characteristics. External characteristics require the overall consideration of the building and the external environment [11]. For example, enterprises need to consider the environmental benefits brought by green and low-carbon buildings in the development and construction of buildings. Under the guidance and promotion of national policies, continuous technological upgrading is carried out. However, considering the status quo that developers have certain inertia in developing green and low-carbon buildings, the government needs to formulate relevant active policies and guidelines, requiring the realization of low-carbon development, and reduce the development cost of developers through regulation and control, to increase the enthusiasm of developers to develop green and low-carbon buildings. The green economic benefits of the construction industry require the control and reduction of carbon emissions, which requires the cost to be considered in the technologies and measures adopted in the construction of construction projects, rather than the pursuit of a green and high-cost technology stack [12]. For the building body, the green low-carbon building is guided by the overall optimization design, and with the support of modern innovative technology and materials, the optimized design of land saving, energy saving, material saving, and water saving is carried out to reduce the environmental load such as carbon emissions, and finally achieve the balance and savings of costs.

Full life cycle perspective. All stages of the building life cycle should be planned and constructed with the goal of low carbon and green [13]. At the beginning of the design, it is necessary to establish a holistic view of the whole life cycle, and effectively implement the green concept of the design stage in the construction management of the subsequent stage, so as to truly realize the green and

low-carbon building. Indexed effect orientation. In the face of the current situation that the energy-saving effect of the application of green technology in buildings is not ideal, China emphasizes the reduction of the actual energy consumption value of the final operation, which can avoid the "surface article" made by blindly using the stack of relevant technical measures, and implement the low-carbon results.

4.2. Sustainable Development

The first design principle of green building design is sustainable development [14]. In the process of green building design, it is necessary to combine ecological environment design with urban building design and pay attention to the coordination of the two. The concept of energy-saving buildings refers to that compared with non-energy-saving buildings, energy-saving buildings can reduce energy consumption while ensuring the comfort of building users, so that the building can release the energy efficiency of energy consumption as far as possible. Green building design, different from traditional architectural design ideas, requires designers to focus on the principles of respecting the natural environment, saving natural resources, and ensuring user comfort.

4.3. People-Oriented

People, as the designers of the building, are also the users, and then become the most important goal of the construction project, "people-oriented" is the most basic design principle. In the selection of environmentally friendly and green building materials, it is necessary to consider whether it will harm the physical and mental health of the human body. At the same time, the secondary principle of the design is to ensure that the user's living environment is clean and comfortable, the use of better technology and technology, the maximum use of natural light and natural wind to ensure that the indoor temperature and humidity are more suitable for crowd activities.

5. Suggestion

5.1. Overview of Traditional Building Materials

Compared with the use of energy-saving building materials, traditional building materials have many defects. For example, there is high energy consumption, high pollution, and even there is a certain toxicity, endangering the life safety of users. Taking concrete, the most commonly used material in traditional construction, as an example, most materials such as coal and stone used in the process of production and processing are non-renewable natural resources, which have a great impact on the environment. At the same time, raw material cement will produce a lot of energy consumption in the production process, and the waste of resources is more serious. After the completion of production, there will be a large amount of waste residue wastewater, and other production wastes, polluting the ecological environment. In the traditional building structure, more steel bars and heavy metals are used, which cannot be naturally degraded. Nowadays, the vast majority of construction waste treatment methods are still mainly stacked and cannot be effectively recycled. At the same time, traditional wall insulation materials often contain formaldehyde, benzene, and other substances harmful to human health, and when the air enters the room through the insulation materials, it will also have a harmful impact on indoor air quality.

5.2. Application Value of Green Building Materials

New green building materials refer to building materials with high efficiency, environmental protection, and novelty compared with traditional building materials. According to the nature and use of the material itself, there are many different classifications of new building materials. First of all, from the source and nature of materials, new building materials can be simply divided into natural materials and synthetic materials two categories. Natural materials include wood, stone, soil, and bricks. Such materials are generally easier to obtain in nature, and the vast majority of them have

natural advantages such as renewable, environmental protection, heat preservation, and so on. Artificial materials are materials synthesized by artificial processing of natural materials, such as concrete, glass fiber, polymer, and other materials. Compared with natural materials, these materials have the characteristics of high strength, corrosion resistance, and easy processing. Secondly, according to the function and application range of new materials, materials can be divided into structural materials, thermal insulation materials, decorative materials, and other different types. Structural materials are mainly used in the load-bearing and support of buildings, such as steel, concrete, thermal insulation materials are mainly used to improve the thermal insulation performance of buildings, such as thermal insulation board, thermal insulation mortar, aerogel, etc., mainly used for building thermal insulation to prevent indoor heat loss. The decorative materials are mainly used for the aesthetics of the interior and exterior of the building. Such as paint, ceramics, wallpaper, and so on. In addition, according to the special functions of new building materials and their application fields, these materials can also be divided into fireproof materials, sound insulation materials, energy-saving materials, and other different categories. Through such classification, it provides a clearer direction and guidance for the research and application of new building materials.

First of all, the use of green building materials can greatly reduce the energy consumption of the building, building facade, and wall insulation are important means to reduce building energy consumption to ensure that as far as possible to reduce building energy consumption, in the design of the building facade, one can use less decorative means to ensure that the facade is simple and clean, to reduce the heat consumption of wall materials. The enclosure structure such as doors and Windows also needs to be coordinated with the overall style of the building, and the materials with good tightness and air tightness can effectively reduce the temperature difference between indoor and outdoor. At the same time, the size of the doors and Windows, materials, and thickness also need to be reasonable choices, in ensuring lighting and ventilation, as much as possible to use heat, the indoor heat loss reduction, such as in the selection of Windows can choose coated glass, vacuum glass, to reduce the indoor and outdoor heat exchange level, reduce the frequency of use of air conditioning. For building walls, such as aerogel can be used to replace traditional insulation materials to effectively reduce the heat loss of buildings and reduce the utilization rate of mechanical ventilation and heating in buildings, to achieve the effect of energy saving. At the same time, the use of new thermal insulation materials with excellent thermal insulation performance can effectively isolate the outside noise and improve indoor comfort. In addition, the new building materials can effectively filter the humidity of the outside air through the humidification function, to regulate the indoor air quality, and reduce the growth of mold and bacteria, which is conducive to the physical and mental health of the building's occupants.

5.3. Green Building Design Aid Software

At present, green building design is in the field of architecture. Building designers use computer simulation technology and simulation technology to simulate the energy consumption of building design and use. The most widely used technology, such as Building Information Modeling (BIM), uses its three-part visualization technology to make use of various data models during architectural design and construction to provide designers with information and technical support for each construction stage, thus reducing energy consumption to the greatest extent. Control construction quality and reduce construction risks.

6. Discussion

6.1. Green Building Design Methods

From the aspects of climate characteristics and design sequence, natural ventilation should be considered first. The natural ventilation design of architectural space needs to organically integrate the overall layout, architectural space, form, and natural resources to create a natural and comfortable indoor and outdoor wind environment. From the perspective of the internal space of the building, the

order of natural ventilation design should be carried out from outside to inside. Based on protecting the original ecological environment of the site, the proposed building and the site conditions are taken as an organic whole, and the orientation, combination, and volume form of the building are considered, and the design is made in combination with landscape greening, rainwater collection, and other aspects. Create an external space wind environment that is conducive to building ventilation and outdoor activities.

When designing the location, orientation, and layout of the building, it is necessary to grasp two key issues according to the characteristics and design mechanism of the local hot and humid climate: the main facade of the building should face the dominant summer wind direction as much as possible; To effectively avoid the blocking interference of the building community on the natural wind, the width of the main facade of the building and the Angle of the dominant wind direction should be properly adjusted according to the formation law of the wind shadow, and the wind shadow area can be effectively reduced through various interleaving ways of the building community, laying the foundation for the formation of good natural ventilation conditions. For a single building, the main facade should face south or south-west as far as possible. When the building form is a slab building, the natural ventilation effect is better, but a local strong wind area will be formed on the back facade and both sides. When there are other buildings adjacent to each other, the local wind speed will be too high. This can effectively mitigate the local wind effect. The air resistance generated by the building must also be considered. When the building form is streamlined, the wind resistance is small, especially for oversized buildings. Streamlined design can avoid building wind pressure, and wind speed too large, and reduce the negative impact on the surrounding environment, so many well-known buildings in the world will use this form of treatment. Natural ventilation has the characteristics of random and changeable, and it should be fully combined with design experience, wind tunnel test, simulation analysis, and other scientific methods to improve the green performance and formal beauty of buildings. Combining with the natural environment, using ecological factors such as water bodies and vegetation, one can artificially create a good external wind environment. Afforestation can play a role in shading and cooling, and there will be a temperature difference between the building and the forest, which is conducive to building ventilation. The water feature is set to the ground wind direction, can create water and land wind, and can also achieve the effect of enhanced ventilation. When there is a contradiction between the building space and the ecological environment, the overhead design method can be adopted to avoid the destruction of the ecological environment by the project construction as much as possible. In high-density residential areas, three-dimensional greening can also be adopted to enhance the greening effect of the building facade, and truly realize the integration of the building and the natural environment.

6.2. Building External Heat Protection Design

The thermal protection design of the external space of the building and the natural ventilation design have the same goal, both are landscape greening designs combined with natural conditions and use the transpiration of vegetation and water to achieve heat absorption and cooling. According to relevant studies, the temperature of the building area is 6~8℃ higher than that of the green area, and the resulting temperature difference will promote local airflow, thereby improving the regional thermal environment. In the area of land tension, make the east and west walls of the adjacent buildings as close as possible to form the effect of shading each other.

6.3. Thermal Protection Design Inside the Building

Corresponding to the thermal protection design of the building surface, the thermal protection design of the internal space needs to further inhibit and reduce solar radiation, temperature difference conduction, and air penetration. The key lies in the processing of the transition area directly related to the building surface. Function space and buffer space are set in the main heat source to form a complete defense space system. For example, when designing balconies of general residential buildings, public buildings arrange auxiliary Spaces such as traffic and health on the east and west

sides of the building with high temperatures, etc., and ventilation and shading design can also be carried out on the transition space.

7. Conclusion

The research result of this study is that through the summary of existing literature, the design method of green building can be used to reduce building energy consumption by combining the passive design method with nature and climate adaptation. Green building design should follow the principles of integrity, performance orientation, and flexibility. Design strategies and methods based on climate analysis, including the application of green building technology. The core of green building design is building energy-saving design, the key to building energy-saving design is building space heat protection and building space natural ventilation design. Therefore, to sum up, it is of great significance to apply green design ideas to architectural design. At present, green design is still not fully popular in the field of architectural design. Therefore, it is of great significance to further explore the concept of green design, and more green design ideas will be integrated into architectural design in the future development of architecture. The in-depth development of the design concept of green buildings can better create a more comfortable and pleasant living environment for the public.

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