Implementation Issues and Strategies of Green Design in Residential Buildings

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Abstract: This article focuses on the implementation of green design in residential buildings, and explores its current situation, existing problems, and strategies in depth. By analyzing the current implementation status of green design in residential buildings, this study reveals key issues such as deviation in design concepts, inadequate application of technology, and inadequate collaborative mechanisms. Targeted strategies are proposed to enhance green design concepts, optimize technology application systems, and improve collaborative mechanisms, with the aim of providing theoretical references and practical guidance for promoting effective implementation of green design in residential buildings.

Keywords: residential buildings; Green design; Implementation issues; Solution strategy

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Introduction

With the increasing emphasis on environmental protection and sustainable development worldwide, the concept of green buildings is gradually taking root in people's hearts. Residential buildings are an important part of the construction industry, and the implementation of green design is of great significance in improving the living environment, saving resources and energy, and reducing environmental pollution. However, in the specific implementation process, the green design of residential buildings faces many problems and challenges, which limit its further development. Therefore, conducting in-depth research on the implementation of green design in residential buildings and proposing effective strategies is of great practical significance.

1 Implementation Status of Green Design in Residential Buildings

1.1 The design concept is gradually being promoted

The concept of green design is gradually being promoted and widely recognized in the field of residential buildings, and has become one of the driving forces for sustainable development in the construction industry that cannot be ignored. Many designers are increasingly emphasizing the harmonious coexistence between architecture and the natural environment, and deeply integrating elements such as energy conservation, environmental protection, and comfort into the design process. In the selection of building sites, designers carefully consider factors such as natural ventilation and lighting conditions, and through scientific and reasonable layout, fully utilize natural wind and sunlight, reducing excessive dependence on artificial energy and achieving the goal of energy conservation. In terms of architectural design, they actively draw on ecological wisdom from traditional architecture, explore the design techniques of harmonious coexistence between traditional architecture and nature, and cleverly apply them to modern residential building design, pursuing the perfect combination of architecture and surrounding environment, and achieving harmonious unity. The profound transformation of this design concept not only provides a more ecological and suitable living environment for residential buildings, but also lays a solid ideological foundation for the comprehensive implementation of green design in the field of residential buildings, leading residential buildings towards a greener and more sustainable direction.

1.2 Technological applications have made progress

In the implementation of green design in residential buildings, significant progress has been made in the application

of technology, which has effectively promoted the development of green design. From the perspective of energy utilization, solar hot water systems and ground source heat pump technology have been applied in some residential buildings. The solar hot water system utilizes solar energy as a clean energy source to provide hot water for buildings, reducing reliance on traditional energy sources; Ground source heat pump technology utilizes shallow underground geothermal resources for heating and cooling, which is efficient and environmentally friendly, and both effectively improve energy utilization efficiency. In terms of enclosure structure, the use of new insulation materials is a major highlight. It can effectively block heat transfer, enhance the insulation performance of buildings, and reduce energy consumption caused by indoor and outdoor heat exchange. In terms of water resource utilization, rainwater collection and utilization systems and reclaimed water reuse technologies are gradually becoming popular. The former collects rainwater for greening irrigation, road flushing, etc., while the latter treats domestic wastewater and reuse it in non drinking water scenarios, achieving the recycling of water resources. The comprehensive application of these technologies provides strong support for green design of residential buildings from multiple levels.

1.3 Market awareness is gradually increasing

Against the backdrop of increasing promotion of green buildings, consumers' awareness of green design in residential buildings is becoming deeper and their demand is growing day by day. Nowadays, the green concept has gradually been integrated into consumers' purchasing decisions. More and more homebuyers no longer only focus on traditional factors such as housing price, location, and layout when choosing housing, but also turn their attention to building green performance indicators. The energy-saving rate directly affects the energy consumption and cost expenditure of the house during subsequent use; Indoor environmental quality, such as air quality, lighting and ventilation, is closely related to the health and comfort of residents. The shift in market demand is like an invisible yet powerful hand that prompts developers to make changes in project development. To meet consumer demands and enhance project market competitiveness, developers must pay more attention to green design, including architectural planning, design, and construction, actively integrating green concepts and processes to create green residential buildings that meet market demand, in order to occupy a place in the fiercely competitive market.

2 Problems in the Implementation of Green Design for Residential Buildings

2.1 Design concept

2.1.1 One sidedness in understanding the concept of green design

Some designers' understanding of green design is still superficial, only equating it with the use of certain green materials or the application of several green technologies, ignoring the consideration of green throughout the entire life cycle of buildings. For example, when designing, only focusing on the energy-saving effect after the completion of the building, but neglecting the energy consumption of building materials in production, transportation, and environmental pollution, this greatly reduces the overall efficiency of green design.

2.1.2 The shackles of traditional design thinking

The constraints of traditional design thinking have become the main obstacle to promoting green design in residential buildings. The long-standing design thinking patterns have led some designers to follow traditional design methods and processes step by step, lacking enthusiasm for exploring and practicing innovative methods of green design. They focus their main attention on shaping the form and satisfying the functions of buildings, pursuing too much the unique appearance and practical interior space of buildings, while neglecting the organic integration of buildings with the natural environment and ecological environment protection. This mindset makes it difficult for green design concepts to be fully reflected in design schemes. Even if designers are willing to promote green design, due to limited thinking, they often cannot find a feasible design path, ultimately making it difficult for green design to be truly implemented and unable to realize its ecological benefits and sustainable value.

2.1.3 Conflict of interests and demands among all parties

The green design of residential buildings involves the participation of multiple stakeholders such as developers,

designers, and owners, and there are certain contradictions between the parties in terms of their interests and demands. Developers tend to pursue the economic benefits and development cycle of projects, and are more sensitive to the additional costs of green design; Designers aspire to fully stimulate creativity during the design phase to achieve the concept of green design, but this is subject to some limitations imposed by developers; While homeowners focus on the green performance of their living environment, their understanding and acceptance of green buildings are also mixed. The contradiction in this interest demand makes it difficult to form consensus in all aspects during the implementation of green design, thereby affecting the smooth progress of green design work.

2.2 At the level of technical application

2.2.1 Lack of maturity in green technology

Although there are many green building technologies to choose from now, some technologies still lack maturity. The unstable efficiency and high cost of certain new renewable energy utilization technologies in practice constrain their widespread promotion; Although some green building materials have good environmental performance, they cannot meet the actual requirements of building use in terms of durability and applicability, which makes designers hesitant about their technical selection.

2.2.2 Difficulty in technology integration application

The green design of residential buildings requires the collaborative application of various green technologies to achieve the best green effect. However, in practical implementation, the integration and application of various technologies pose certain difficulties. On the one hand, due to the lack of unified technical standards and specifications, the compatibility and collaboration of various technologies are poor, making it difficult to achieve optimized system operation; On the other hand, there is a lack of effective communication and cooperation among various professional and technical personnel, resulting in insufficient smooth integration of technology and serious duplication of design, which increases the difficulty and cost of implementing green design.

2.2.3 Outdated technical maintenance and management

Professional maintenance and management are required for the operation of green building technology to ensure its long-term stable operation and green performance. However, at present, the implementation of green design in residential buildings in China has not given sufficient attention to the maintenance and management of green technology, and there is a lack of relevant technical maintenance personnel and management systems. After some green equipment and facilities are put into operation, their performance may decrease or even be damaged due to delayed maintenance, poor management, and other reasons, resulting in the inability to achieve the expected green effect and wasting resources.

2.3 Dimensions of Collaborative Cooperation

2.3.1 Lack of collaboration between different stages of design

The green design of residential buildings covers many professional fields such as planning, architecture, structure, equipment, etc., which requires close collaboration and cooperation among various professions in the design process. However, in actual design, there is often a lack of collaboration between professions. For example, during the conceptual design phase, the architectural profession did not fully consider the green design requirements of structural and equipment specialties, resulting in professional conflicts, repeated modifications, and other issues in later design, which affected design efficiency and quality; The mechanism for drawing co signing and review is not sound enough, and there are design loopholes and errors in the drawings between specialties during the construction drawing design stage, which makes construction difficult.

2.3.2 Problems in the connection between design and construction

In the construction of residential buildings, design and construction are two core links, and ensuring a smooth connection between them is crucial for the successful implementation of green design. However, in actual engineering, there is a lack of smooth connection between design and construction. Designers often lack sufficient understanding of construction techniques and the actual situation on site during design, making it difficult to effectively implement the design plan into construction; The construction party may arbitrarily change the design scheme due to limited technical

level or lack of understanding of green design concepts, which damages the overall and systematic nature of green design.

2.3.3 Design and operation disconnect

The implementation of green performance in residential buildings runs through the entire process of design, construction, and operation, but there is currently a serious disconnect between design and operation. Designers often only focus on meeting the requirements of building functionality and appearance when designing, and rarely consider the management needs and actual operational conditions during the building operation stage, resulting in design schemes that cannot fit well with operational reality and are difficult to achieve ideal green effects during operation. After taking over the building, the operator was unable to operate and manage it scientifically and reasonably based on the green characteristics of the building due to a lack of understanding of green design concepts and insufficient technical support. For example, effective measures have not been taken in equipment operation regulation and energy management, resulting in incomplete utilization of building green performance. Over time, green performance will gradually decrease, leading to resource waste and deviation from green design goals.

3 Implementation Strategy for Green Design of Residential Buildings

3.1 Enhance the concept of green design

3.1.1 Strengthen training on green design concepts

Strengthening the cultivation of green design concepts is an important aspect of improving the green design of residential buildings. Provide professional green design concept training activities for designers, and invite authoritative experts in the industry to give lectures, which can systematically and profoundly explain the connotation, principles, methods, and techniques of green design, and help designers establish a comprehensive knowledge system. With the help of professional training, designers can deeply understand that green design is not simply a technical pile up, but a design thinking and values that need to be integrated throughout the entire lifecycle of a building. This will guide designers to actively consider issues such as harmonious coexistence between architecture and natural environment, and ecological environment protection in their design practices, fundamentally ensuring the implementation of green design concepts.

3.1.2 Promoting Innovation in Design Thinking

Promoting innovative design thinking is a key link in the implementation of green design in residential buildings. Traditional design thinking often has many limitations and is difficult to adapt to the needs of green design development. To this end, designers should be actively encouraged to break free from thinking constraints and boldly explore and apply innovative methods of green design. Organize green design competitions and seminars, build a platform for designers to communicate and learn, and enable designers to gain innovative inspiration through the collision of thinking. At the same time, introducing the concept of interdisciplinary design and integrating knowledge of ecology and environmental science into architectural design broadens the horizons of designers, allowing them to consider problems from a more macro and diverse perspective. It brings new vitality to green design and promotes innovation and development in green design.

3.1.3 Establish a mechanism for balancing interests

To coordinate the interests and demands of all parties, it is necessary to establish a complete set of scientific and reasonable mechanisms. The government can adopt corresponding policies to provide partial financial subsidies and tax incentives for green design developers to alleviate their cost pressures; On the premise of strengthening consumer promotion and guidance, increasing consumers' awareness and acceptance of green buildings, cultivating market demand for green buildings, and enabling developers to obtain reasonable economic benefits in green building projects. We should also strengthen communication and consultation between designers, developers, and homeowners, fully listen to the voices of all parties, find a balance of interests in the green design process, and ensure the smooth progress of green design.

3.2 Optimize the technology application system

3.2.1 Strengthen research and development of green technologies

The government and enterprises should increase investment in the research and development of green building

technology, and encourage research institutions, universities, and enterprises to engage in industry university research cooperation to jointly overcome the problems in green technology. Given that the current maturity of green technology is not high enough, we should focus on researching and developing renewable energy utilization technology and green building material preparation technology. These technologies have the characteristics of high efficiency, good stability, and low cost, which improve the performance and reliability of green technology and provide strong technical support for green design.

3.2.2 Strengthening Technology Integration Research and Application

Research on the integration of green building technology, establishment of unified technical standards and specifications, clarification of interfaces and collaborative requirements between different technologies, enhancement of green technology compatibility and collaboration. At the same time, we will strengthen communication and cooperation among various professional and technical personnel, establish a cross disciplinary green design team, and fully consider the characteristics and needs of various professional technologies in design, achieving organic integration and optimized application of green technology to enhance the green performance of residential buildings.

3.2.3 Establish sound technical maintenance and management mechanisms

Improving the technical maintenance and management mechanism of green buildings is of great significance for ensuring the effectiveness of green design in residential buildings. It is necessary to strengthen the operation monitoring and maintenance of green equipment and facilities, detect problems in a timely manner through real-time monitoring, and solve them. Pay attention to the cultivation of professional maintenance talents in green technology, improve their technical literacy and business capabilities, and provide manpower support for the development of maintenance work. At the same time, detailed maintenance management systems and operating procedures have been formulated, defining maintenance responsibilities and processes in all aspects, ensuring the orderly progress of maintenance work. The establishment of green technology maintenance archives provides detailed records of the operation status and maintenance process of equipment and facilities, providing reliable basis for subsequent maintenance management and technical optimization work, ensuring the long-term stable operation of green equipment and facilities.

3.3 Establish a sound collaborative mechanism

3.3.1 Strengthen collaboration in various stages of design

Establish an efficient collaborative work mechanism to enhance communication and cooperation among various disciplines in the design process. During the scheme design phase, organize joint design between disciplines to discuss green design ideas and schemes to ensure consistency in design requirements between disciplines; During the construction drawing design phase, it is necessary to establish a sound system for drawing co signing and review, strengthen inter disciplinary drawing review and coordination, and identify and resolve professional conflicts. At the same time, utilizing information technology to build a collaborative design platform to achieve real-time sharing and interaction of design information between professions, thereby improving design efficiency and quality.

3.3.2 Promote effective integration between design and construction

Strengthen communication and collaboration between design and construction, and establish an integrated management model for design and construction. Inviting the construction party to participate in the discussion and optimization of the design scheme during the design phase, in order to make the design scheme more in line with the construction technology and actual site conditions; During the construction phase, designers should frequently go deep into the construction site to provide technical guidance and services, and promptly solve design problems that exist during construction to ensure the accurate implementation of the design plan. At the same time, the construction party should strengthen the research and understanding of green design concepts, strictly implement the design plan, and not arbitrarily change the design content.

3.3.3 Integrate design and operation closely

The design process fully considers the management needs and actual operational conditions during the building operation phase, incorporating operational management ideas into the design plan. For example, in the design phase,

reasonable planning of the layout and management space of building equipment and facilities is carried out to facilitate subsequent operation and management; At the same time, detailed design materials and operation manuals were provided to the operator, which helped them understand the green performance and operational requirements of the building. After taking over the building, the operator should strengthen communication and cooperation with the designer, provide timely feedback on the problems that exist in the operation of the building, and jointly discuss solutions, continuously optimize the operation and management of the building, and ensure that the green performance of the green building is maximized.

4 Conclusion

Implementing green design in residential buildings is an essential measure to promote sustainable development in the construction industry. Although the concept of green design is gradually becoming popular, technological applications have made certain progress, and market awareness is gradually improving, there are still many problems in the implementation process, such as one-sided understanding of design concepts, lack of maturity in technological applications, and insufficient collaborative mechanisms. By strengthening the concept of green design, optimizing the application system of technology, and improving the implementation of collaborative mechanisms, the above problems can be effectively solved, promoting the efficient development of green design in residential buildings, achieving harmonious coexistence between buildings and the natural environment, and creating a healthier, more comfortable, and more environmentally friendly living environment for people.

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