Evaluation System of Green Building and Its Application in Engineering Practice

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Abstract: Green building is the main trend of the future development of the construction industry, and all countries in the world attach great importance to the development of green building. Among them, the continuous improvement of green building evaluation system plays an extremely important role in promoting the rapid development of green buildings. Although China has made some achievements in the development and evaluation system of green buildings, the development of green buildings in China is still in its infancy, and the evaluation system of green buildings still needs to be improved. Based on this, on the basis of explaining the significance of establishing green building evaluation system, this paper summarizes six principles of using green building evaluation system to guide design, and takes Shenzhen Vanke Center as a case to analyze the application of green building evaluation system in engineering practice. In order to provide a reference for optimizing China's green building evaluation system and promoting the application of green building evaluation system in engineering practice.

1. Research background

1.1 Literature review

Chen Liuqin pointed out that China has basically established the framework of green building evaluation system, but there is still room for improvement in the level, integrity of evaluation criteria and the establishment of relevant systems. Therefore, the following aspects should be improved: the evaluation method should be changed from qualitative to quantitative, the process of implementing third-party certification system should be accelerated, etc. (Chen, 2011). Wang Xinyu and Wang Shaodong elaborated the concept of green building, studied the specific application of green building concept in practical engineering projects, and took Shenzhen excellent green building as an example, analyzed the technical measures and architectural benefits of green building (Wang and Wang, 2019). Huang Liyan used the methods of comparative analysis and weight analysis to compare and analyze the differences of evaluation contents, evaluation methods and number of evaluation indicators between public buildings and residential buildings in green buildings. She believed that there were still some problems in the application process of domestic green building evaluation system, such as neglecting the evaluation of operation stage, lagging evaluation of building greening and large regional differences in application. Measures to promote the green transformation of existing buildings and the establishment of third-party evaluation system are put forward to promote the application of green building evaluation system in China (Huang, 2017). Wei Guoan and Xue Jianyang pointed out that the combination of China's Green Building Evaluation Criteria and trial production mechanism was not close enough after comparing and analyzing the policy environment of China's and America's green building evaluation system. They also proposed that the policy should focus on the market and the policy should be practical floor lamp countermeasures (Wei and Xue, 2018). Zhang Zhenglei and other scholars introduced the development history of green building evaluation systems in China, the United Kingdom, the United States and Singapore, and made horizontal comparisons between the four countries' evaluation criteria in terms of weight comparison, evaluation indicators and evaluation levels (Zhang et al, 2018). Lu Mei and Wu Yuxiang, based on the “Technical Standards for Green

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Building Evaluation” in 2015, surveyed consumers'attitudes towards green building evaluation indicators by setting up questionnaires. The dynamic evolutionary game model is constructed from the supply and demand levels respectively. Based on the analysis results, some countermeasures are put forward to promote the healthy development of green building market (Lu and Wu, 2017).

1.2 Purpose of research

At present, due to excessive human development and construction, the environment has been seriously polluted and destroyed. People are gradually aware of the importance of environmental protection, and countries around the world are paying more and more attention to green environmental protection and other aspects of construction. Since the concept of green building was introduced into China in the 1990s, after nearly 30 years of development, green building in China is at the initial stage of rapid development. However, there are still many shortcomings in China's green building evaluation system. In view of this, this paper attempts to analyze the significance of establishing a green building evaluation system and the design principles of the green building evaluation system, and analyze the application of the green building evaluation system in engineering practice with the actual case. In order to provide reference and suggestions for promoting the development of green buildings in China and improving the green building evaluation system.

2. Significance of establishing green building evaluation system

2.1 Social significance

On the one hand, green building evaluation system is conducive to advocating a healthy lifestyle. The principle of green building evaluation system is to promote sustainable development by creating healthy building space on the basis of abiding by ecological laws and effective utilization of resources. The proposition of green building evaluation system has positive significance for correcting people's misconceptions of consumptive lifestyle. This concept points out that we should not blindly pursue material enjoyment, but moderately pursue life enjoyment on the basis of ensuring the sustainable use of the environment. When people's lifestyles and cultural awareness are not sustainable, the value of green buildings will be reduced, and green buildings will only work best if they match the lifestyles that meet sustainable development requirements. On the other hand, the green building evaluation system is conducive to enhancing public participation awareness. Green building evaluation system is not only a tool monopolized by professional designers, but also an evaluation tool shared by developers, engineers, designers and planners. The development of green building evaluation system will help break the monopoly situation of professional designers in the past and encourage the participation of public groups such as citizens. Through the participation of public personnel and the introduction of dialogue mechanism between architects and construction participants and other building users, the original architect-led design process is more open. Public participation is conducive to the creation of a more dynamic community that reflects social justice.

2.2 Economic significance

With the rapid development of China's industrialization and urbanization, China's demand for resources and energy is becoming more and more urgent. However, China's water resources, land resources and energy resources are seriously short, and the utilization rate of resources is not high. The shortage of resources has become a major factor constraining China's economic development. The construction industry is a major energy consumer, and doing a good job of resource conservation in the construction industry will ease the burden of China's economic development. In order to achieve sustainable development, it is necessary for urban buildings to change from the traditional high-energy-consuming development mode to the efficient ecological development mode. The only way to realize the transformation is to establish a green building evaluation system. Although the development of green buildings will increase the initial investment cost, in the long

run, green buildings consume less energy and have less impact on the environment, so their economic benefits are much better than ordinary buildings.

2.3 Technical significance

In the early days of green building research, the research on individual technologies was the main one. The technical means were relatively isolated and did not form an organic whole. However, with the deepening of the research on green building, people began to explore more operational environmental concepts. The combination of environment and capital has become a new direction for the development of environmental protection, and green building has entered a new stage from advocating ecological ethics to studying ecological practice. The research of green architecture shows a trend of integration of natural science, humanities, social science and computer science, which makes the research of green architecture design enter a multi-dimensional development stage. With the further deepening of the application of computer technology in the field of design, management and construction, the technical connotation of green building design is more abundant. Mechanical automatic control and material science are applied to green building. Green building presents the characteristics of high technology. Establishing a green building evaluation system is the inevitable result of the continuous improvement and systematization of green building technology. The establishment of green building evaluation system provides a platform for organic integration of green building technology, so that green building technology, computer technology and information technology can play their respective roles on the unified platform.

3. The principle of using green building evaluation system to guide design

Green building evaluation system contains many evaluation projects, some of which need to be designed to a certain extent in order to grasp. In the initial stage of design, it is difficult to fully consider all evaluation projects. Although the evaluation items of the green building evaluation system are different, the overall principled problems are consistent. Therefore, from the green building evaluation system, we can extract several principles, so that we can grasp the correct direction in the initial stage of design and the planning stage, and provide comprehensive guidance for the further in-depth design. The overall design plays an extremely important role in green building. We can summarize the following design principles of green building evaluation system.

First, rational site selection and site planning. The design scheme should pay attention to the protection of the building site and the surrounding regional ecosystem, so as to reduce the impact on the surrounding regional ecological environment. We should adhere to the principle of economizing the use of land and improve the greening rate of the site. We should also take into account the factors such as sunshine and ventilation, and do a good job in site traffic planning. Second, efficient recycling of resources and energy. New energy such as wind energy, bioenergy, geothermal energy and solar energy should be used as building energy schemes as far as possible. Save on the use of non-renewable energy sources such as oil and coal, reduce the consumption of resources such as building materials, land and water, and use the remaining waste from the building as a building material. Third, make rational use of water resources. The design scheme should adopt various measures to save water and reduce water consumption, such as the use of water-saving devices, combined with the layout of landscape greening water and fire water. Rainwater can also be recovered and sewage treated to realize the recycling of water resources. Fourth, control of construction waste discharge and pollution. The design scheme should reduce the discharge of waste gas, waste water and solid waste, and utilize ecological technology to realize the recycling and harmless treatment of waste, so as to achieve the purpose of recycling. Fifth, improve the indoor environment. Natural ventilation system and natural light should be used as building ventilation system and lighting source to minimize the use of air conditioning and artificial lighting. Indoor humidity and temperature should be adjustable with little change. And indoor sound insulation measures are adopted to make the room free from interference. Sixth, improve the building function. The building functions of green buildings should be adaptable, flexible and easy

to maintain.

The above principles are the overall grasp of green building design from the macro level. Under the guidance of the above principles, green building design can grasp the correct direction in the initial link, thus taking less detours. After the green building design is deepened, more detailed evaluation indexes can be used to guide the detailed design, so as to enhance the green performance of the building.

4. Application of green building evaluation system in engineering practice

Located in Yantian District, Shenzhen, Vanke Center is a project related to energy-saving and green building, which has a typical demonstration role. Taking Shenzhen Vanke Center as an example, this paper focuses on the specific application of green building evaluation system in practical engineering practice.

4.1 Land saving and outdoor environment

In the construction process of Vanke Center project, the noise pressure level in the site should meet the national standard requirements, pass specific tests to ensure that the national standard can be met, and also ensure that the sunshine can be achieved. When choosing glass curtain wall, we should pay attention to the selection of materials and adhere to the principle of energy saving in order to reduce light pollution. In the process of project construction, the first floor of the project is overhead design, which strictly controls the geothermal quality and geothermal environment of the site. Attention should be paid to ensuring the coverage rate of roof greening and increasing greening area through roof greening so as to achieve the goal of green building. In addition, when dealing with underground space, the project should also make rational use and layout.

4.2 Energy conservation and energy utilization

During the construction of Vanke Center, attention should be paid to the use of building exterior walls, strict selection of building materials, and more attention should be paid to the rational use of energy. In order to achieve the purpose of energy saving, adjustable aluminum alloy sunshade system was used in the construction process. And only by scientifically and reasonably selecting and arranging the opening angle of the sunshade can we minimize energy waste. Considering the climatic characteristics of Shenzhen, the choice of air conditioning does not need to choose both hot and cold air conditioning, just choose refrigeration air conditioning for use in summer. Wind system is used for secondary utilization by collecting wind energy. Vanke Center adopts a new type of recovery system and mode.

4.3 Water saving and water resources utilization

In the process of project construction, more attention is paid to the rational planning of water system, so that water resources can be rationally utilized to achieve the purpose of comprehensive utilization. When choosing outdoor road materials, Vanke Center has chosen permeable surface to make rainwater naturally permeate underground, thus realizing water resources circulation and avoiding excessive use of groundwater. Because of the lack of water in Vanke Center, more attention has been paid to the collection and recycling of water resources in roof design. In addition, water-saving equipment is used in the selection of water utilities in this project, which can save and utilize water resources and reduce waste of water resources.

4.4 Utilization of materials and materials resources

During the construction of Vanke Center Project, commercial mortar and premixed concrete are mainly used as raw materials. Before the formal construction, it is necessary to classify the required materials according to the requirements, reuse the surplus materials and the remaining items, and centralize the disposal of the unusable wastes. In interior design, a large number of green building materials such as bamboo are used, which not only reduces the use of trees, but also has artistic beauty. In the whole process of project construction, indoor construction and outdoor construction

are carried out simultaneously, and materials are used together, which greatly reduces the waste of materials and achieves the goal of material saving.

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