Research on Construction Management Strategies for Building Engineering Based on Low-Carbon Economy

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Abstract: The effectiveness of construction management directly impacts the overall quality and benefits of building engineering projects. Especially in the current context of the low-carbon economy, when undertaking building engineering projects, to ensure economic management outcomes, the principle of low carbon should be prioritized, thereby promoting the sustainable development of China's building engineering enterprises and the industry as a whole. It is evident that traditional construction management models for building engineering can no longer meet the development needs of the modern building engineering field. Therefore, it is essential to actively introduce low-carbon and green construction management concepts, enrich and improve engineering construction management plans, and address numerous practical issues faced in traditional building engineering project construction. Based on this, this paper conducts targeted research on construction management strategies for building engineering based on the low-carbon economy, hoping to provide some experience for the stable development of building engineering enterprises in the future.

1. Introduction

Building engineering projects are one of the most crucial components in China's engineering construction field. However, during the formal construction of building engineering projects, due to their long duration, large scale, and the use of various materials and energy sources, excessive consumption of materials and energy can easily lead to environmental pollution issues. This not only severely damages the surrounding natural ecology but also restricts the pace of modernization and sustainable development of China's building engineering industry. With increasing investment in ecological environment governance in China, the concept of the low-carbon economy has been introduced into building engineering project construction, serving as the basis for engineering construction management. The aim is to balance the socio-economy and the ecological environment, promoting the development of the building industry towards low carbon and environmental protection by reducing energy consumption and environmental pollution during engineering construction. However, from the current introduction of the low-carbon economy into modern building engineering construction management, there are still some practical issues, such as low resource utilization rates and numerous construction processes prone to environmental pollution. Due to the objective existence of these issues, the effectiveness of implementing the low-carbon economy concept is not optimal. Therefore, it is necessary to explore specific application strategies for the low-carbon economy in building engineering construction management based on the development needs of China's modern building engineering field.

2. Brief Analysis of the Low-Carbon Economy Concept

The concept of the "low-carbon economy" is relatively complex and generally refers to achieving coordinated development of sustainable economic growth and carbon emission reduction through technological innovation, institutional reforms, and other means, gradually forming a new economic model. Under this economic model, the steady and healthy development of related industries is promoted, ensuring the rationality of the socio-economic structure and scale. Analyzing the low-carbon economy reveals that its main characteristics are as follows: Firstly, green

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production. The low-carbon economy emphasizes the importance of developing a circular economy and promoting resource conservation, enabling related industries to achieve green and clean production during daily operations. This significantly reduces the degree of pollution to the surrounding ecological environment during production processes. Secondly, energy transformation [1]. Under the low-carbon economy concept, the promotion of clean energy sources such as wind, solar, and tidal energy can improve energy utilization efficiency and effectively control the degree of environmental pollution during energy production and utilization, thereby promoting energy transformation and effectively reducing carbon emissions.

3. Analysis of Existing Problems in Building Engineering Construction Management Based on the Low-Carbon Economy

3.1 Resource Utilization Efficiency Needs Improvement

Under the low-carbon economy concept, when conducting construction management for building engineering projects, improving resource utilization efficiency should be the primary task to ensure management effectiveness and promote the sustainable and healthy development of the industry and enterprises. However, currently, although the low-carbon economy concept has been widely applied in China's building engineering construction field, reducing energy consumption and improving the economic benefits of building engineering project construction, there is still a phenomenon of low resource utilization efficiency [2]. This situation is related to the fact that the building engineering construction field is inherently a high-energy-consuming industry. Especially with the continuous improvement of China's social modernization and economic level, the scale of building engineering project construction continues to expand. Therefore, the total consumption of materials and energy during building engineering project construction is also increasing, making it more likely for material and energy waste to occur in some construction processes and details. It is difficult to conduct fine-grained control over material and energy waste in each construction process, which is the main factor contributing to the still-needed improvement in engineering resource utilization efficiency [3].

3.2 Numerous Construction Processes Prone to Environmental Pollution

Due to the numerous construction processes involved in on-site operations of building engineering projects, although the low-carbon economy concept is widely applied in China's building engineering field, according to data from the 2022 "Research Report on Building Energy Consumption and Carbon Emissions in China," the total carbon emissions throughout the entire building process nationwide are approximately 5.08 billion tons, accounting for more than 50% of the country's total carbon emissions. From the summary and analysis of the above data, it can be seen that although the implementation of the low-carbon economy concept has transformed the specific thinking of traditional building engineering project construction management, making the key points and approach during management more explicit and clear, it has not changed the objective fact that the "building engineering industry is the industry with the highest carbon emissions in China" [4]. Additionally, with the continuous expansion of the scale of modern building engineering projects and the increasing integration of modern technologies during construction, the functions of building engineering have become more diverse. However, at the same time, construction processes have become more complex, resulting in multiple carbon emission processes. It is precisely because of the increased total carbon emissions during the construction of modern building engineering projects that the impact on the surrounding ecological environment is becoming increasingly severe.

For example, the noise pollution level during building engineering construction is relatively high, mainly due to the use of various large-scale mechanical equipment such as cranes, mixers, dynamic compaction equipment, loaders, and crushers during construction. These mechanical equipment not only consume a large amount of energy during operation but also generate significant noise pollution. When the noise levels of numerous large-scale mechanical equipment

are superimposed, the degree of noise pollution significantly increases. When the noise decibel level rises, it seriously affects the daily lives, learning, and work of surrounding residents [5].

Another example is dust pollution, which is one of the most common pollution issues at current building engineering project construction sites. During engineering construction, various materials such as cement, earth, and sand are used. Under the action of mechanical equipment and natural wind, these materials easily generate fine particles, forming dust. When it floats in the air, it significantly reduces the surrounding air quality, exacerbates the greenhouse effect, and also has a negative impact on the physical health of surrounding residents and passersby.

4. Exploration of Building Engineering Construction Management Strategies Based on the Low-Carbon Economy

4.1 Actively Use Green and Low-Carbon Building Materials to Reduce the Negative Impact of Engineering Construction on the Ecology and Human Body

Currently, the concept of low-carbon environmental protection has become deeply rooted in people's minds. When conducting building engineering project construction, building engineering enterprises should also actively respond to the low-carbon environmental protection concept and embark on developing a low-carbon economy. Increasing the application of low-carbon environmental protection materials and achieving innovation can showcase the environmental protection attributes of building engineering project construction while reducing engineering costs. Currently, a series of new energy-saving and environmental protection building materials such as building energy storage materials, building energy-saving materials, and building energy-generating materials have been widely applied in engineering on-site construction. Through the application of these materials, carbon emissions at construction sites have been effectively controlled, and they have also played a role in promoting the transformation of China's building engineering project construction field towards a green and low-carbon direction [6]. Under the current low-carbon economy background, the building engineering field has formed a "dual carbon" development goal. To effectively achieve this goal, it is necessary to further increase the promotion and use of green and low-carbon building materials within the industry, thereby ensuring the energy-saving and environmental protection effectiveness of modern building engineering project construction [7]. Specifically, to achieve the full utilization of green and low-carbon building materials and reduce the negative impact of on-site engineering construction on the surrounding ecological environment and people's physical health, the following aspects should be considered:

Firstly, use prefabricated concrete. Comparing prefabricated concrete with traditional concrete, it can be found that traditional concrete requires a large amount of cement during configuration and production, resulting in significant CO2 emissions and easily causing ecological environmental pollution. For prefabricated concrete materials, they can effectively reduce carbon emissions, and their strength and durability are also superior to traditional concrete materials. From the current production situation of prefabricated concrete, energy-saving and environmental protection technologies such as solid waste utilization and green production integration technologies are being actively applied, which not only ensures the energy-saving and environmental protection attributes of concrete materials but also reduces material costs.

Secondly, use environmental protection coatings. Environmental protection coatings have also become relatively common low-carbon environmental protection materials in China's modern building engineering. They mainly include water-based wood lacquers, latex paints, and water-based coatings. Their energy-saving and environmental protection advantages are reflected in their low heavy metal content. When applied to building engineering project construction, they do not produce non-volatile harmful substances, having a low negative impact on the surrounding ecological environment and people's physical health. Therefore, in future modern building engineering project construction, the application of environmental protection coatings should be further increased to actively respond to the low-carbon economy concept [8].

Finally, use paper-faced gypsum boards. Paper-faced gypsum boards are a new type of building

material, mainly made of natural gypsum and waste paper as raw materials. During the production and manufacturing process of paper-faced gypsum boards, materials such as asbestos are not added, resulting in low production energy consumption and being non-toxic and harmless. When applied to modern building engineering project construction, they can effectively optimize the acoustic insulation, fire resistance, and other functional attributes of buildings, also showcasing green environmental protection advantages.

4.2 Develop a Fine-Grained Management Plan Based on the Specific Scale and Attributes of the Engineering Project

The development of a construction management plan is crucial as it directly affects the application effectiveness of the low-carbon economy concept in building engineering project construction. When developing a construction management plan, the degree of environmental pollution and the distribution of residents around the engineering project should be considered. By developing a fine-grained construction management plan, the damage to the surrounding ecological environment caused by on-site construction can be minimized, thereby reducing the impact on the physical and mental health of surrounding residents. From the current development situation of China's low-carbon economy, its influence range continues to expand, and the vast majority of construction units have actively responded to the low-carbon economy concept, optimizing previous construction management models based on multiple aspects such as the specific scale, functional attributes, cost, and construction techniques of the construction project, forming construction management plans with low-carbon, environmental protection, and energy-saving characteristics. However, to ensure that the above management plans achieve the expected effectiveness during specific implementation, the degree of plan refinement should be continuously improved, and fine-grained construction management should be implemented.

Specifically, construction units need to introduce an efficient management model that aligns with the specific situation of the construction site based on previous conventional construction management, achieving effective coordination of each process during on-site construction. This effectively controls the possibility of errors during construction and substandard quality in a certain construction process, which is also the key to improving the overall quality of modern building engineering construction. On-site construction managers also need to effectively manage the equipment and materials involved in the construction process, mainly including storage management, maintenance management, and requisition management, thereby avoiding situations where materials or equipment affect their original performance due to improper storage at the construction site. At the same time, this can also reduce the total amount of material and energy waste. In addition, the climate factors at the construction site should also be fully considered. For example, targeted concrete material maintenance work should be carried out flexibly based on the lighting conditions and precipitation at the construction site to ensure the optimal performance of concrete and avoid an increase in the total amount of concrete entering the site, which is also an important path for achieving low-carbon construction.

5. Conclusion

In summary, under the current low-carbon economy background, to promote the stable and healthy development of China's building engineering industry, it is essential to actively introduce low-carbon and environmental protection construction concepts to optimize traditional building engineering construction management plans. Especially considering the potential noise pollution, environmental pollution, dust pollution, and other issues that may arise during the on-site construction of building engineering projects, it is necessary to ensure that the set construction management plans have more low-carbon and environmental protection attributes and feasibility. Specifically, measures can be taken from aspects such as actively using green and low-carbon building materials and developing fine-grained management plans throughout the construction process based on the specific scale and attributes of the engineering project. Additionally, the details of the construction management plan should be continuously optimized to effectively control the

total carbon emissions during the on-site construction operations of building engineering projects, opening up new space for the subsequent development of China's building engineering field.

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