

Research on the Development and Countermeasures of Prefabricated Buildings in Anhui Province under the Dual Carbon Target

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Abstract: Under the dual carbon goal, green and low-carbon development has become a new pursuit in building development. Prefabricated buildings replace traditional on-site concrete pouring operations, reducing energy and material consumption. With the characteristics of economic, low-carbon, green and efficient, it has become an important technological approach to promote the high-quality development of the construction industry. This article compares the development status of prefabricated buildings at home and abroad, analyzes the current situation and existing problems of prefabricated development in Anhui Province under the dual carbon goal, and proposes relevant countermeasures: increasing policy support subsidies, deepening the intelligent construction of BIM modern technology throughout the entire process, and developing the EPC general contracting management model.

Keywords: Anhui Province; Dual carbon targets; Prefabricated buildings; Strategy research.

1. Introduction

In September 2020, China clearly proposed the dual carbon goals of "striving to achieve carbon peak before 2030 and carbon neutrality before 2060", actively fulfilling the responsibility and mission of a major country. In the report of the 20th National Congress of the Communist Party of China, it was clearly pointed out that we should actively and prudently promote carbon peaking, carbon neutrality, and implement carbon peaking actions in a planned and step-by-step manner. The transformation and upgrading of the construction industry structure is an important way to achieve the dual carbon goals, among which the development of prefabricated buildings has significant advantages in achieving the dual carbon goals of "carbon peak" and "carbon neutrality". In recent years, China has issued various documents and policies to encourage and support the development of the prefabricated construction industry, play a leading and demonstrative role in prefabricated construction, and drive the transformation and upgrading of the construction industry. Each province and city actively responds to the pilot and demonstration base construction of the prefabricated construction industry, improves the standard system of prefabricated construction, and strives to make prefabricated construction lead the green development of the construction industry, steadily promoting the development of the dual carbon goal. Anhui Province actively implements the Party's policies and guidelines, helps achieve the dual carbon goals, provides policy support for the development of prefabricated buildings in the field of green development of buildings, fully utilizes the advantages of industrial resources in the province, and supports the development and construction of industrial bases. As of the end of 2022, the cumulative area of prefabricated buildings in the province has reached 175 million square meters, driving the construction industry output value to about 450 billion yuan. However, the

overall development speed is relatively slow, which is constrained by various factors such as incomplete management systems, high construction costs, and technological bottlenecks. Analyze the current situation of Anhui Province using the SWOT method and propose countermeasures from three aspects: policy, cost, and market.

2. Prospects and research status of prefabricated buildings

Compared with traditional cast-in-place construction methods, prefabricated buildings are more time-saving and efficient, standardized processes result in higher building quality, improved resource utilization, cost savings, and have broad prospects and advantages. Xu Jing pointed out that construction enterprises should actively layout the industrial chain, supply chain, innovation chain, and value chain of prefabricated buildings, and achieve green and low-carbon transformation of prefabricated buildings through the implementation of carbon emission measurement and low-carbon management throughout the entire process. Tang Yujiao believes that prefabricated construction is an innovation in building technology, with the characteristics of convenient construction and lightweight. Liu Yan believes that prefabricated buildings have policy orientation, energy conservation, are in line with the trend of the times, can improve the quality of buildings, and are in line with the advantages of green environmental protection in the era. Divan believes that the use of prefabricated concrete assembly construction technology improves construction quality and shortens production and construction time, making it a good choice for building multi story buildings. Bari believes that prefabricated production and construction methods can shorten construction time, save labor, provide safer and higher quality building products compared to traditional construction methods, and have good economic and environmental benefits.

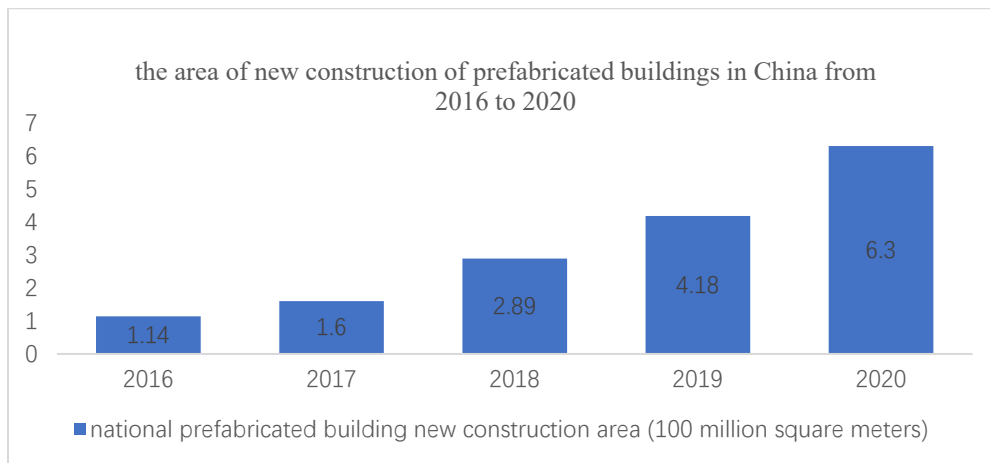


Figure 1. Newly started construction area of prefabricated buildings in China from 2016 to 2020

3. Analysis of the current development status and problems of prefabricated buildings in Anhui Province

In recent years, the development of prefabricated buildings in Anhui Province has shown a rapid growth trend, which is a characteristic of the construction industry in Anhui Province. At present, Anhui Province vigorously promotes the application of prefabricated buildings, actively carries out industry training, technical guidance, and standard planning, strengthens cooperation with prefabricated building manufacturers, and promotes the research and industrialization of prefabricated buildings through the establishment of industry university research cooperation.

3.1. Development Status of Prefabricated Buildings in Anhui Province

Anhui Province has implemented a batch of prefabricated building demonstration projects, involving residential, commercial, tourism and other fields, some of which have been put into use. In addition, Anhui Province encourages enterprises to introduce advanced technology and equipment, strengthen exchanges and cooperation with domestic and foreign prefabricated construction enterprises, and improve the quality and technical level of prefabricated construction in Anhui Province. As of now, the cumulative area of prefabricated construction in Anhui Province has reached 191

million square meters. In 2022, the newly started prefabricated construction area was 59.2415 million square meters, accounting for 36.59% of the total newly started construction area that year, ranking among the advanced in the country. Overall, the development prospects of prefabricated buildings in Anhui Province are broad, and they are expected to become the main development direction of the construction industry in Anhui Province in the future. Anhui Province has always attached great importance to the development of prefabricated buildings as an important way to promote green and low-carbon development and transformation. In 2022, the Anhui Provincial Action Plan for Building Energy Conservation and Carbon Reduction was issued and implemented. The province implemented actions to improve the energy efficiency of new buildings, reduce carbon emissions from existing building operations, and optimize the energy consumption structure of buildings. It vigorously developed green buildings and prefabricated buildings, optimized the energy consumption structure of buildings, and proposed a stage goal to increase the energy efficiency of buildings in the province by 30% compared to 2020 by 2025. Many prefecture level cities such as Hefei, Bengbu, and Wuhu actively responded and cooperated, issued relevant policies, organized meetings, proposed goals and requirements, laid out industrial planning, and strived to create an efficient and interconnected policy environment, providing sufficient guarantees for industrial development.

Table 1. Anhui Province Prefabricated Building Policy

region	file	content
Anhui Provincial Department of Housing and Urban Rural Development	<i>Guiding opinions on Accelerating the Development of Steel Structure Buildings</i>	We will vigorously promote the application of steel structures in public and industrial buildings. During the 13th Five Year Plan period, we will strive to use steel structure buildings in new public buildings, with a proportion of more than 20%, and continuously increase the proportion of steel structures used in urban and rural residential construction.
Anhui Provincial People's Government	<i>Notice on Vigorously Developing Prefabricated Buildings</i>	Accelerate the promotion of green buildings, steadily improve building energy efficiency, actively promote technological innovation, and provide strong guarantees for promoting green development of urban and rural construction in the province.
Anhui Provincial People's Government	<i>Opinions on Promoting the Development of Prefabricated Construction Industry</i>	About 10 provincial-level prefabricated building industry bases have been cultivated in the province, with a production capacity of 10 million square meters. Prefabricated buildings account for 15% of the newly built construction area.
Anhui Provincial People's Government	<i>Development Plan for Prefabricated Buildings during the 14th Five Year Plan period</i>	By 2025, prefabricated buildings will account for 30% of the newly constructed building area. Cultivate more than 50 provincial-level prefabricated building industry bases and 3-5 national level prefabricated building industry parks.

3.2. Problems in the Development of Prefabricated Buildings in Anhui Province

High cost and cost; The cost of prefabricated buildings is generally higher than that of cast-in-place concrete construction, which poses a huge challenge to the promotion of prefabricated buildings. In terms of design and production, the accuracy of the types and quantities of components required for the entire project, as well as the control of the error in the connection methods between nodes, play a decisive role in project cost. However, there may be some discrepancies between the initial design and production and the actual project, resulting in a certain degree of waste and increased costs. In terms of logistics transportation, there is no industrial logistics supply chain formed, which is affected by transportation distance, traffic restrictions, vehicle selection, etc., resulting in higher costs.

Consumers and businesses have lower expectations; Early prefabricated buildings were mainly applied to public rental housing and shantytown renovation households, leaving consumers with a low-end and cheap consumption psychology, with stereotypes, and overall low sentiment towards prefabricated buildings. Compared with traditional reinforced concrete poured buildings, their trustworthiness is relatively low, and consumers are concerned about the quality and safety, waterproofing, insulation, and other issues of prefabricated buildings, resulting in a weak willingness to purchase. Due to the fact that prefabricated buildings are built using the same standard, it is difficult to meet the diverse needs of consumers, which makes consumers who pursue personalization hesitant. For enterprises, considering the pessimistic evaluation of the consumer purchasing market, high construction costs, and weak overall project interest rates, they are unwilling to invest heavily in prefabricated buildings. Therefore, it adds challenges to promoting prefabricated buildings.

4. Exploration of the Development Path of Prefabricated Buildings in Anhui Province

4.1. Policy guidance and improvement of standard system

Encourage relevant institutions such as the construction administrative department, construction enterprises, and prefabricated construction industry associations in Anhui Province to strive to improve relevant supporting work methods, technical guidelines, standard atlases, etc., actively prepare local standards, enterprise standards, and industry standards, timely promote adaptable, mature and stable standards and norms, and apply for upgrading to higher-level standards, gradually establishing an effective set of standard specifications. Set corresponding support levels for various enterprise projects, presenting an inverted triangular ladder like support gradient, and creating a positive and favorable industrial environment; When the management and supporting construction process system in the field of prefabricated construction are mature, it is appropriate to consider reducing funding subsidies or stopping subsidies for some projects, forming a favorable development environment of survival of the fittest.

4.2. Innovation driven, developing new models

With the increasingly diverse needs of people, the development of the prefabricated construction industry also requires continuous innovation in development models to adapt to the changes of the times. Hefei pioneered a new development model of "Five Plus One", which includes "prefabricated buildings"+"engineering general contracting+building information models+new templates+ specialized teams+green buildings". This model provides us with positive experience and inspiration. In terms of organizational management mode, prefabricated buildings can adopt engineering general contracting (EPC) mode, full process architectural consulting, architect responsibility system and other methods to solve the problem of fragmented management, which is conducive to controlling costs from the design stage and enhancing the risk resistance ability of the general contractor; In terms of technical means, prefabricated buildings can promote the integrated application of BIM technology throughout the entire life cycle of buildings; To form a systematic project for the development of prefabricated buildings, comprehensively integrate and enhance the comprehensive strength of the industry, and help deepen the supply side reform of the construction industry.

4.3. Technical support, leading intelligent specialization

Nowadays, with the popularity of modern information technologies such as 5G, the intelligent construction of the construction industry has also emerged. REVIT modeling, BIM construction, and RFID application transform the two-dimensional perspective into three-dimensional visualization, which makes the details of node connections between structural components more concrete. At the same time, an assembly type component database platform can be built, where professionals can find the required component models and obtain corresponding component size information. Based on this, optimization design and transformation can be carried out to build new models, This greatly reduces the construction period of the design phase, effectively achieves full process information management, and enhances fault tolerance. Using BIM technology as the main line of integrated development for prefabricated buildings, connecting the entire process of design, production, construction, decoration, and post management.

5. Conclusion

With the further guidance of the "dual carbon" goal in China's construction industry, prefabricated buildings, as a green construction method, will inevitably become the mainstream of the times. At present, the development of prefabricated buildings in Anhui Province has initially formed a policy standard system, accumulated an industrial foundation, encountered technical bottlenecks, incomplete industrial chains, and sluggish consumer markets. In the context of the dual carbon era, the overall trend in the future construction industry will inevitably be green, environmentally friendly, highly efficient, and in line with the characteristics of the times. Prefabricated buildings, with their characteristics of integration and informatization, are different from traditional reinforced concrete buildings and will undoubtedly become the main construction method in the

future. Anhui Province fully utilizes its policy advantages and industrial foundation to vigorously develop prefabricated buildings, making it possible to build houses with building blocks. The goal is to gradually form a unique prefabricated industrial base with Anhui characteristics in the future, become a leader in the industry, and help promote the economic development of the construction industry in the province.

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