

# Development Status and Countermeasures of Prefabricated Building

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## Abstract

Since 2016, prefabricated building has been paid attention to and encouraged by the nationality. Although the development of prefabricated building has broad prospects, there are still some problems in the process of its development. This paper studies the current development status of prefabricated building in China, and puts forward suggestions combined with the industrialization of new building.

## Keywords

**Prefabricated Building; Development Proposals; Current Status of Development.**

## 1. Introduction to Prefabricated Building

### 1.1. Prefabricated Building Definition

In the Guiding Opinions of the General Office of the State Council on Vigorously Developing Prefabricated Building, prefabricated building is defined as building that is assembled with prefabricated parts on site. Popular speaking, prefabricated building is in the factory, prefabricated external walls, internal walls, beams and other building components, and then in the field of prefabricated installation mode, the prefabricated components are transported to the site for assembly. In terms of structure, prefabricated building can be divided into three types: prefabricated concrete building, prefabricated steel building and prefabricated timber building. The prefabricated building realizes the construction, decoration and integration, integrates the development, design, procurement, construction, maintenance and other business areas, and meets the development requirements of green building. It is a completely sustainable development of new building production mode.

### 1.2. Advantages of Prefabricated Building

Compared with traditional construction methods, prefabricated building has many advantages, including energy saving, environmental protection, shorter construction period, etc. Prefabricated building conforms to national green building requirements and design standards. It adopts information management and integrated design and construction of building and decoration. The components are prefabricated in the factory and then installed on the site, which can significantly shorten the construction period and reduce the number of workers. Compared with on-site pouring, the construction waste generated on the construction site can be greatly reduced and the utilization rate of resources can be improved. At present, prefabricated architecture has been applied in many buildings, such as Vulcan Mountain and Thor Mountain Hospital in Wuhan, which were built with prefabricated architecture in ten days, creating a Chinese miracle and making Chinese people proud. The development of prefabricated building has been strongly supported by the state. Since 2016, the State Council and the Ministry of Housing and Urban-Rural Development have issued many policies to promote the development of prefabricated building. We will focus on the three urban agglomerations of Beijing, Tianjin and Hebei, the Yangtze River Delta, and the Pearl River Delta.

We will vigorously develop prefabricated building such as steel structures, and promote the adjustment and upgrading of industrial structure. Now China's prefabricated building has entered a period of rapid development, and its future is bright.

## **2. An Overview of Provincial Policies on Prefabricated Buildings**

In order to respond to national policies and develop prefabricated building according to local conditions, various provinces have issued many policies to encourage the development of prefabricated buildings, and the assembly rate has been stipulated in the implementation opinions. For example, the development plan of prefabricated building in Hainan Province includes that the proportion of assembled buildings in new construction area in the province will reach 50% in 2020 and 100% in 2022. At the same time, various provinces and cities have also formulated various relevant guidance and encouragement policies. The contents of each province are different, such as the implementation of construction area incentive, the establishment of special funds, the granting of tax concessions, the priority protection of land, the plot ratio incentive and so on. Among them, Shenyang, as the central city of the old industrial base in Northeast China, has a broad construction market and started to practice the modernization of the construction industry earlier. Shenyang has adopted the method of steady push to develop prefabricated buildings, which has achieved some results. Now Shenyang will continue to study and introduce the new system of prefabricated building, encourage the development of prefabricated building, and strive to continue to play a leading role in the future nationwide demonstration. All provinces and cities have actively implemented the relevant national work deployment. At the same time, the Ministry of Housing and Urban-Rural Development announced the first batch of prefabricated building demonstration cities and industrial bases in 2017 and evaluated their implementation in 2018. Those who fail to pass the assessment will be withdrawn. In 2020, the second batch of prefabricated building demonstration cities and industrial bases were announced, which shows that the state from the central to the regional has paid high attention to the prefabricated building and has given strong support to its development.

## **3. Disadvantages of Prefabricated Building**

### **3.1. High Cost**

Although our country supports the development of prefabricated building, there is still a gap between our country and Europe and the United States, and there are some problems in the development. Although prefabricated buildings are prefabricated by factories, the production cost and installation cost of PC prefabricated components are too high. The prefabricated components are transported for a long distance. During the transportation, there may be damage caused by knocking and falling of components. The production, transportation, construction and other links of parts need a high degree of cooperation between the parties, so these problems greatly increase the cost of prefabricated building.

### **3.2. The Industry Chain is not Perfect**

The industrial chain of prefabricated building includes research and development, design, production, construction, operation and maintenance, etc. At present, the industrial chain of prefabricated building in China is not complete enough, and relevant enterprises cannot timely realize information sharing and exchange. Therefore, the industrial chain of prefabricated buildings should be improved, and the integration of prefabricated buildings and BIM and other technologies can improve efficiency.

### 3.3. The Lack of Talent

Assembly construction requires professional skills training for construction staff. At present, the technical standards of workers are low, so there is a shortage of construction personnel. At the beginning of 2021, the Ministry of Housing and Urban-Rural Development and other 12 government departments issued guidelines, which pointed out that construction workers in the new era should be trained faster, and local governments should fully recognize the importance and urgency of building construction workers. Finally, due to the lack of assembly management talents, colleges and universities should introduce the theory and practice of assembly building into the classroom, and students should pay equal attention to both theory and practice, so as to provide talents for the country.

## 4. Development Proposal

In July 2020, the Ministry of Housing and Urban-Rural Development and other departments issued guidelines on promoting the coordinated development of intelligent construction and construction industrialization. The first of the key tasks mentioned vigorously developing prefabricated building and speeding up the upgrading of construction industrialization. Since then, the Ministry of Housing and Urban-Rural Development has focused on building a "1 + 3" standardized design and production system to promote the sustainable development of the industrialization of new buildings, namely, launching a design and selection standard for prefabricated residential buildings and three main components and parts size guidelines. The three guidelines include: Dimensional Guidelines for Main Components of Steel Structure Residential Buildings, Dimensional Guidelines for Main Components of Prefabricated Concrete Structure Residential Buildings, Dimensional Guidelines for Main Components of Assembly and Decoration Residential Buildings. It can be seen that for the development of prefabricated building, the state holds a positive encouragement policy. Since the issuance of the Guiding Opinions on the Vigor Development of Prefabricated Building, the industrialization of new building represented by prefabricated building has been rapidly promoted, and the construction level and building quality have been significantly improved. Therefore, in order to promote the prefabricated building to respond to the policy requirements, this paper puts forward some suggestions on the development of prefabricated building based on intelligent construction and industrial upgrading of building.

### 4.1. Effectively Exchange and Share Building Information with the Help of Three-dimensional Model Information of BIM Technology

BIM is a Three-dimensional building information model, which can realize 5D modeling by integrating time information and cost dimension. It has the characteristics of strong visualization, drawing ability, simulation and optimization, etc. In the management decision-making stage, the advantages of visualization of BIM model can be used to find the deficiencies in the design. Parameters in the model can be adjusted according to the actual situation, and the cost can be estimated, so as to maximize the utility of resources, determine feasible schemes and improve the benefits of cost management. It can also carry out multi-dimensional positioning to realize information sharing between different units, so that the communication between the participating units can be conducted, and the collision problem of each link design can be solved. The collision point can be found so that the design units can coordinate and modify, and the possible difficulties in the construction process can be found in time to improve the construction efficiency. Therefore, BIM is reasonably combined with prefabricated building. It will be an important development trend of prefabricated building in the future.

#### **4.2. Formulate Prefabricated Building Standards and Systems in Line with China's National Conditions**

Compared with developed countries in Europe and the United States, prefabricated building in China started late and developed slowly, so it is necessary to develop suitable assembly technology system and standards. Prefabricated building is a new kind of building, which needs to develop constantly with time. Abroad, Sweden built *Swedish industry standard SIS* prefabricated construction technology system, the Japanese built *urban regeneration mechanism frame + populated residential building system (KSI)* prefabricated building system, Singapore, France and Britain and other developed countries and their respective formed the unique technical system and standard, widely used in industrial and civil buildings. China has also issued a series of technical standards such as *Design Code for Assemble Integral Concrete Public Buildings* to guide the sustainable development of prefabricated building. In addition, a product standard system should be further developed to improve the quality of prefabricated building product standards, improve the classification system of special standards, and promote its development.

#### **4.3. Reduce the Cost of Components and Reduce the Cost of Assembled Construction**

In order to reduce the cost, the whole process of the project should be fully supervised, and the relevant staff should do a feasibility study of the cost control scheme. Once the scheme is determined and approved, it must be strictly implemented in the later period. Relevant staff must go deep into the project site for investigation when formulating the cost control plan. In addition, the project management and construction parties and other participating units should be integrated into the project cost management and follow up the project, so that there can be no misunderstanding or inconsistent understanding of the project. At the same time, the enterprise should keep pace with The Times, follow the pace of development with The Times, innovate the management mode, and attach great importance to the design, construction and completion stages. In the later stage, if major changes are needed to be made to the project, they should be confirmed by engineers to ensure that the changes are feasible and pay attention to coordinating the three objectives of quality, cost and schedule before changes can be made. Strengthen the control of each link of the project, optimize the project cost management.

#### **4.4. Improve the Quality of Construction Personnel and Management Personnel**

At the end of 2020, the Ministry of Housing and Urban-Rural Development and other 12 ministries and commissions issued a document to accelerate the cultivation of workers in the construction industry in the new era. The on-site construction personnel of assembly type buildings need to be trained to be skilled in their skills, so it is necessary to carry out vocational skills training for construction workers and improve the assessment and evaluation system and effectively protect the rights and interests of construction workers. Change the previous extensive building mode, the arrival of intelligence makes managers need to master more skills and knowledge, there are higher requirements for prefabricated building management talents. Enterprises should improve the standards for talent selection, strengthen training for existing talents, and build a scientific and reasonable training system, which is also an aspect that construction enterprises need to pay more and more attention to in the process of development. At the same time, colleges and universities need to pay equal attention to the training of students majoring in architecture with both theory and practice, develop high-quality training programs, cultivate versatile talents, bring new blood to the country, and create engineers who understand management in the new era.

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