

# Brief Analysis of the Influence of Prefabricated Building on Interior Design

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**Abstract.** In accordance with the requirements of the Central committee and The State Council, the prefabricated building tide has begun to rise until 2026. Prefabricated buildings account for 30 percent of new construction in China. The construction process of prefabricated buildings is the process of manufacturing the whole building as a product. Engineers will supervise and control the manufacturing process, thus forming the integration, standardization, industrialization and highly organized of the whole construction. At the same time, with the rapid development of prefabricated building, the interior design of prefabricated building also gets rapid development again, but also provides new opportunities and challenges for the interior design of prefabricated building.

**Keywords:** Prefabricated Building; Interior Design; Impact Analysis.

## 1. The Concept of Prefabricated Buildings

Prefabricated building, as the name implies, refers to the work that should be carried out on site in the traditional construction method, which is adjusted to the professional prefabricated construction site after standard integrated design and intelligent production of factory information in advance. These building components adjusted to the factory for pre-production mainly include the main structure of the building (internal wall, external wall), steel structure and wood structure, etc. The construction completed in this way not only ensures high quality, durable and long life, but also takes into account the cost and duration of the project and has greater green benefits, energy conservation and emission reduction. Therefore, the prefabricated building has become the world's mainstream construction mode by virtue of its innate advantages.

The main difference between precast structural buildings and ordinary non-precast component buildings is that the processing and manufacturing methods of parts are different: general buildings are carried out in the construction site with concrete and steel as the main construction materials, while the main zero (structure) components of the reinforced precast house are carried out in the workshop. Because the main parts are manufactured in the factory, so the design must strictly follow the factory production design logic. The main components of ordinary precast concrete houses are composed of thousands of precast structures, while the number of architectural structures in a group of buildings can reach tens of thousands. Due to the process requirements and cost constraints of industrial production, there cannot be too many types of components. Too many kinds will greatly increase the difficulty of production and construction cost, which is uneconomical. Therefore, in the design of prefabricated buildings, the way of "less specification, more combination" is advocated to balance the contradiction between the production of parts (components) and the individuation of architectural form. [1]

## 2. Analysis of the History, Current Situation and Future Development of Prefabricated Buildings

### 2.1 History and Current Situation of Prefabricated Buildings at Home and Abroad

The two architectural systems that have far-reaching influence on the historical inheritance of human society are the western ancient masonry architecture system represented by Greece and Rome, and the Eastern wooden architecture system represented by ancient Chinese architecture. [2]

The systematic "systematization" of Our country has been recorded as early as the Spring and Autumn period and the Warring States Period in the "Zhou Li ·Kao Gong Ji", involving pre-Qin

weapons, ritual vessels, Musical Instruments, architecture, water conservancy and other technologies; In ancient times, Chinese architecture followed the old system with few changes. It is rare to see the progress of the whole ancient architecture in China by leaps and bounds, but in this way, the ancient architecture in China has formed its own architectural system, which has been spread for a long time and has far-reaching influence. "Zaofangfa" of the Song Dynasty, "Examples of Engineering Practices" of the Qing Dynasty and "ZaoFangfa Notes" of Liang Sicheng of the Republic of China all embody the standard design handed down from tradition to tradition. In ancient times, China's prefabricated buildings were embodied in the standardization system of wood construction, with a set of universal standards in modules, interfaces, shapes and forms. Ancient Chinese buildings with dougong, tenon and tenon joints, courtyards, roofs and foundations constitute the East Asian wooden building system in the history of human architecture. In terms of architectural technology and artistic attainments, it is worth us to combine modern technology and innovative thinking to strive for the great revival of Chinese architecture. Until now, the Ministry of Housing and Urban-Rural Development released the "Modernization of the Construction Industry" and the "Development Outline" plan in 2015, proposing to 2026. China's prefabricated buildings to account for 30 percent of the proportion of new construction requirements. Our country's prefabricated buildings and the interior design of prefabricated buildings have been significantly enhanced, in the construction of workers, materials, time limit, environmental protection and a series of issues have been significantly improved.

The western architectural civilization "owes its greatness to Rome". Ancient Roman architecture is characterized by natural stone and brick structures, such as arches, coils and domes. Stone on the outside and brick on the inside. The bricks are fired in a brick kiln, the stone is processed by quarries and masons according to the rules of the column and the architects' requirements, and the building is connected by concrete made from volcanic ash. So ancient Roman architecture, you can think of it as a building made of brick and stone. After the Second World War, post-war economic reconstruction became the focus of development in various countries. In the 1970s, modern prefabricated buildings began to appear in European and American countries, and Japan, an East Asian country, also began to develop prefabricated buildings under the influence. The Tour Total tower, completed in 2012, represents the direction of prefabricated concrete construction in Germany. [3]

## 2.2 Analysis of the Future Development of Prefabricated Buildings at Home and Abroad

Compared with the traditional cast-in-place method, the prefabricated building is more outstanding and it is the inevitable development direction of the construction industry in the future. Compared with the traditional building, the prefabricated building is more environmentally friendly. Prefabricated construction in recent years, China has entered the stage of development, the addition of prefabricated area of China's urban new area proportion has increased from two point percent in 2015 to 2018, more than nine percent, but still with the most developed countries around the world in more than seventy percent of the assembly rate there is a very big difference, the United States, Japan has the highest proportion of existing prefabricated construction area, reaching 90%, followed by France, Denmark, Sweden and Singapore, which account for 85%, 80%, 80% and 70%, respectively. In 2018, about 190 million square meters of prefabricated area was added nationwide, accounting for about 9 percent of the new urban area.

The early prefabricated housing in the United States prevailed in the 1970s. In 1976, the FEDERAL Congress of the United States passed the National Industrial Housing Construction and Safety Act, the same year issued a series of strict industry standards, has been used today. In addition to focusing on quality, prefabricated homes now focus more on beauty, comfort and individuality. In 2001, there were 10 million prefabricated homes, or 7 percent of all U.S. homes, according to the Industrial Housing Association. In the United States and Canada, concrete and steel prefabricated houses dominate in large cities, while light steel and wood structure houses dominate in small towns. [4]

Japan introduced the concept of prefabricated housing as early as 1968. Every five years to develop a five-year plan of economic development, housing construction project in every five-year plan has clear policies to promote housing industry booming, state government intervention and powerful policy guarantee measures for the vigorous development of housing industry has had an impact: government departments rely on the legislative power to ensure the construction quality of concrete components ready; Persisting in reform and innovation, the government has put forward a number of directions, policies and measures for the industrialization of housing construction, and formed a unified production modulus standard, which has overcome the conflicts between building standardization, mass production and the rapid development of diversified housing construction.

The eu is also the birthplace of prefabricated building, central parties in advance of precast concrete prefabricated construction engineering, has accumulated a lot of split early to prepare the construction plan, the successful experiences in construction organization design, has solved the construction and installation technology of the new breakthrough, has formed a relatively complete system mature standard prefabricated. Germany in the end of the 20th century proposed zero energy passive building, and the use of prefabricated housing to implement. Since the U.S. government began to implement component-based construction and mechanized manufacturing during the energy crisis in 1970, the U.S. Department of National and Urban Development also developed a set of technical standards and standards, which are still used today.

China's building assembly rate is far lower than the mature markets of major countries in the world. In 2016, the Government Office of The State Council issued the Directives and Opinions on Accelerating the Development of Assembly Construction Projects, which clearly stated that it would strive to use about 10 years to increase the proportion of prefabricated assembly construction projects to 30 percent of the newly increased area of the country. According to China's ministry of the social modernization construction industry rapid development platform, plan to 2020, the prefabricated construction accounted for the proportion of new construction projects will be more than twenty percent, and cities under separate state planning and vice provincial capital cities by more than thirty percent, engineering of a low-income housing construction of the construction of the packaged proportion was over forty percent. More than 30 percent of the construction area of newly started fully decorated finished houses. In prefecture-level cities, cities separately listed in the state plan and large and medium-sized cities of provincial capitals, the proportion of all the finished houses that have been renovated shall reach more than 50%.



Figure 1. Market size of prefabricated construction in China (100 million Yuan) (Author's own)

### **3. The Influence of Prefabricated Buildings on Interior Design**

#### **3.1 The Significance of Modular Coordination**

At present, the main materials used in most buildings are still steel, wood, cement, sand, brick, block, glass, paint and so on. In theory, any form desired by the architect could be built on site using the above materials. Many buildings throughout history were built this way. Before the Industrial Revolution, many large public buildings were built by large numbers of people, which took decades, some even centuries, to complete. This construction method mainly relies on human labor. While there are many examples of artistic architecture, buildings built this way are essentially unreplaceable and extremely expensive to maintain or rebuild. The construction method of "Qin brick and Han Tian brick" is of low technical level and low production efficiency, and the construction quality completely depends on the technical level of the artisans. It is also very expensive from a cost point of view. At present, most of the construction of non-prefabricated buildings is still a kind of semi-manual, semi-mechanical custom production, the degree of standardization is very low, cannot be regarded as real industrialization, of course, information also does not know how to start. In 1974, the United Nations published guidelines on Government Policies and Measures for The Gradual Realization of Building Industrialization, which defined "building industrialization" as follows: the construction industry is transformed in accordance with large-scale industrial production mode and gradually transformed from handicraft production to socialized large-scale production. [5] The basic approaches are construction standardization, factorization of parts production, construction mechanization and scientific organization and management, and the gradual adoption of new achievements of modern science and technology to improve labor productivity, speed up construction, reduce project cost and improve project quality ". Prefabricated buildings reflect the highly integrated industrialization of architecture, the first consideration should be the standardization of design. The purpose of standardization is to improve the production efficiency of parts and achieve large quantities and high quality supply of parts at a lower cost.

In order to make the building in the premise of meeting the design requirements, as far as possible to reduce the type of components, so that it can achieve standardization, serialization, universalization. Give full play to the investment benefit, carry on modular coordination to the dimension relation in the mass building. [6] Standard kitchen and toilet modules need to be unified, unified module coordination. It is suggested to take 300mm as a module unit and change the size of the toilet and kitchen according to the 300mm level difference, and strive to increase and improve the function while changing the size.

#### **3.2 Application of Assembly Building in Toilet**

The use of integrated bathroom in China is also quite common in some hotels, and integrated bathroom is a general term for some new industrialized bathroom products. Goods usually have a single frame and related functions, and the single form of goods is some separate functional monomer, can be installed in the same indoor environment according to the requirements of use.[7] Products are uniformly completed in the factory and assembled on the construction site. The main component of assembly type toilet is roof, wall board, floor board, these 3 kinds of foundation part form the main frame of assembly type toilet, add hardware, clean to provide, illumine, water and electricity in frame, can complete the basic function of assembly type toilet. As a special form of decoration, the concrete precast will be used, and the site construction of the toilet will not be carried out after the completion of the installation.

In the interior space of modern kitchen standardization module, the author classified three kinds of interior space according to three basic functions: washroom space, bath space, urinal space. According to Asian people's body shape, activity habits and equipment requirements, the minimum requirement for washroom space is 900mm\*680mm, the minimum requirement for urinal space is 1200mm\*560mm, and the minimum requirement for bathing space is 900mm\*900mm. How do you meet basic requirements in such a small space? Borrowing becomes important. Through a certain

design combination, washroom space and urinal space are partially overlapped, and each other's space is borrowed to meet their own needs, so as to achieve the optimization of space utilization. For example, again, when wash bath space is insufficient, adopt the means that bath shade is installed in each space.

Advantages: First, reduce pollution, save resources and energy, and greatly improve the utilization rate of materials. Traditional toilet construction mode adopts on-site pouring and on-site wet operation, and there is a lot of construction waste in the production process. Assembly customization is standardized, and almost no construction waste is generated after on-site assembly, which is of great significance to save the environment. [8]

### 3.3 Application of Prefabricated Building in Kitchen

The application of prefabricated building in kitchen is also toward integration and modular development. The design idea of prefabricated building in the kitchen is to divide the kitchen space according to the functional requirements of a block, and then consider the behavior of the users in the use of the kitchen, and study the behavior and the facilities in the kitchen and the space occupied. Consider whether different blocks can be converted to each other.

In the interior space design of module of contemporary kitchen standardization, those who consider above all is to design a function to satisfy the 4 basic functional requirements of the kitchen, namely: "store, catharsis, cut cent, cook". To this a few big basic functions because of setting store content ark, cime, work station, hearth, platoon lampblack system. In addition, household appliances will also have expanded functions in the kitchen, such as "refrigerator, oven, microwave oven, dishwasher, sterilizer" and so on. Kitchen design satisfies the requirement that serialization changes even below the requirement that satisfies standardization, modularization, function from satisfy the basicest "storage, catharsis, cut cent, cook" arrive "complete function sex" kitchen, dimensional combination strain changes into kind is various, change much terminal.

The kitchen module combination is divided into storage space, washing space, cutting space and cooking space according to the basic function. According to the basic requirements of ergonomics and kitchen operation, the minimum scale of the washing space operating table is 600mm\*600mm, and the operating radius is 900mm; The minimum scale of the operating table in the cutting space is 900mm\*600mm, and the operating radius is 900mm. The minimum scale of the operating table in the hearth space is 900mm\*900mm, and the operating radius is 400mm;

## 4. Advantages of Prefabricated Buildings

Prefabricated construction, can according to the requirements of the current architecture I lift construction to advance the need to use to the construction of good processing, the basement wall could be carried out in the plant and construction parts such as beam-column processing, to also be able to install inside wire, set up the Windows, etc., a lot of wall decoration materials can also directly in the factory for processing and manufacturing. These parts can be in the factory for production and processing, at the same time, also can use mould for work, can greatly improve the standardization of production, and the unity of the technical standards would be more convenient, after completion of the production and processing can be directly applied to engineering field, and this process is like mechanical equipment assembly process, can fully meet production standardization, At the same time, it can reduce the consumption of materials.

In the past, as the construction industry is a labor-intensive industry, this has become an important constraint to the development of the construction industry in the new era, but now the labor cost continues to increase. Applied in the factory building, can reduce the artificial pressure LiLi construction site, so that workers could have a large number of labor saving, work effect was very obvious in the liberation of production resources, and also can improve the efficiency of the I, thus saving the construction period, also reduced the construction cycle control problem.

Now the concept of sustainable development in China has been developed to a great extent, and it has also been applied in the construction industry. Now people are paying more and more attention to the conservation of energy and resources, and at the same time, they have begun to explore effective ways to reduce pollution. [9] Use of prefabricated construction technology, its main production link is carried out in the factory, the quantity of the construction site is greatly reduced, shovel didn't burn a lot of dust and noise, at the same time, to reasonably reduce the pollutant emissions, when factory construction, many building materials can be used for recycling, it reflects the energy conservation and environmental advantages. And the main body of the whole construction control system of main is, ceramsite concrete, mortar and other lightweight construction materials, the structure of the component not only has the extremely high strength and light weight, ryukyu and different material filling material can achieve building insulation and heat preservation heat insulation system of the basic requirements of the construction of big board buildings can also act as a building waterproof, such as moist insulation effect. This building system also has low carbon emissions and low energy consumption, making it a real green building product.

## 5. Prefabricated Buildings Hinder Interior Design

Precast concrete components and steel structure construction, ready in precast concrete components factory specifications, parts and holes require very accurate, always unable to reduce the deviation during manufacture, use, the greater the overall error, the more obvious, is bound to affect some slotted holes, site construction difficulty will be greater than the traditional process, some even affect the structure.

At the same time, due to the production process of prefabricated components or host panel will have a certain deviation, the size of the gap in the field installation cannot be determined, so whether the ground or ceiling installation process will have a certain degree of impact on the overall appearance of the room will also have a certain negative impact.

When the factory's lead time is shortened, the feng shui electrical system is prefabricated in the first design, so it is difficult to modify and adjust. Especially when the overall design method of interior decoration of steel structure or prefabricated building is changed and adjusted in the later period, the flexibility and diversity of interior decoration will be severely limited by the electromechanical system such as ceiling and toilet in this area.

In the factory distribution and handling site, also can be affected by the change of weather. Damage to plants near the construction site is relatively low and can increase significantly over long distances, especially during rain and snow, which can damage and affect parts and simple interior decoration materials delivered from the plant. Modular production and quantification are better, but interior design also has great limitations. Interior design and decoration are free and varied, with few unified shapes, such as ceiling shapes. The flexible and varied shapes of walls and walls make modular production impossible. In interior decoration design, opposite sex design, big space and tall space cannot realize modular production and design, the restriction of floor height is also very outstanding. Limitations of materials: In the factory production of prefabricated building interior decoration design, materials that are relatively simple, easy to install, hard to wear, and easy to transport and distribute can only be selected. In contrast to complex interior decoration design, craft materials can only be used in the construction site for secondary decoration construction.

Initial investment is large. In the early production process, the corresponding suppliers, manufacturers, production sites, transportation equipment, production equipment and other factors need a large amount of start-up capital. At the same time, the corresponding manufacturers of materials for the preliminary design of interior decoration should also make corresponding investment at the same time. In addition, the decorative materials and styles of the late on-site interior design have great limitations and changes are not so arbitrary.

## 6. Summary

At present, the construction industry has become the pillar industry of China's economic development. The modern prefabricated building is one of the typical representatives. In the future, housing engineering will also begin to reflect the characteristics of industrialization, which also proves the development and progress of a society. At present, China's construction has become an important pillar of China's economic and social development. At the same time, the development model of China's modern construction industry is also facing a transformation. This paper first describes the basic characteristics of prefabricated buildings, and then summarizes the impact of prefabricated buildings on interior design work, hoping to provide some reference for the development of related work, and design more new buildings with suitable environment.

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