

# A REVIEW OF RESEARCH ON STEEL STRUCTURE HOUSING

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**Abstract:** In the process of human development, people have been exploring and trying again and again in the field of architecture, from masonry buildings to reinforced concrete buildings and steel structure buildings, constantly updating and improving people's living environment and conditions. With the advancement of technology, the rapid rise of steel structure residences not only relies on advanced science and technology, but also the advantages of the steel structure itself cannot be underestimated. In recent years, steel structure residences have become the dominant building structure in developed countries. Although the development of steel structures in our country is not as good as that in developed countries, our country's steel production has repeatedly ranked first in the world. Coupled with people's unremitting efforts, the gap between our country and developed countries is gradually shrinking. This article focuses on the problems encountered in the development of steel structure housing in our country and puts forward corresponding suggestions to promote the development of steel structure housing in our country.

**Keywords:** Steel structure housing; Development status at home and abroad; Advantages of steel structure; Existing problems; Solutions

## 1. INTRODUCTION

From 1993 to 1994, the concept of "China's residential industrialization" was proposed in the field of residential research and design, indicating that the country began to attach importance to steel structure residences. Although there is still a certain gap between my country's steel structure buildings and foreign countries, advanced foreign experience can be absorbed. , avoid detours, speed up the construction of steel structure residences, continue to promote steel structure residences in our country, and lead our country into a new era of efficient, energy-saving, green and pollution-free buildings.

## 2. DEVELOPMENT OF STEEL STRUCTURE HOUSING ABROAD

As early as the end of the 19th century, metal structure buildings appeared in the UK. The design reason for using steel structures was to prevent warehouses containing cotton from catching fire. Since then, steel structures have ushered in a wave of development, and a series of steel structure buildings have appeared one after another, such as the famous Eiffel Tower. Steel structure houses appeared during that period, and some steel structure houses are still well preserved to this day. The glory of steel structures in European and American countries also extended to Asia, Australia and other regions. In the mid-to-late 20th century, Japan and Australia also began the production of prefabricated steel structures, and the degree of residential industrialization has reached a very high level. Up to now, the foreign steel structure residential system has entered a mature stage and entered the industrial production process. More than half of the residential buildings built are steel structure buildings.

## 3. THE DEVELOPMENT OF STEEL STRUCTURE HOUSING IN CHINA

The development of steel structure housing in my country started late, and the development time is not as long as that in the West. However, in recent years, after realizing the many advantages of steel structures in building structures, our country has also begun to pay attention to the development of steel structures. my country's steel output ranks first in the world. In terms of technology, the state is gradually increasing support and providing funds for scientific research. Economically, our country encourages and actively guides and promotes the construction of steel structure residences. At the end of the 20th century, the government's successive introduction of relevant urban housing policies and my country's continuous investment in the housing field have greatly improved residents' living conditions, promoted economic development, expanded employment, and improved people's livelihood. Due to a series of advantages of steel structure residences, people have begun to increase research efforts on steel structure residences, and steel structure residences have also achieved great development in our country. Especially in big cities, where land resources are scarce and population density is high, it is imperative to promote steel structure housing. At present, the main structural systems of steel structures commonly used in my country can be divided into: steel frame-shear wall structure system, staggered truss structure system, steel frame-core tube structure system, light steel structure residential system, steel frame-support structure system, Steel frame structural system. From the perspective of residential construction and sustainable development, steel structure residences will replace reinforced concrete structures in the near future and become a new generation of high-efficiency, environmentally friendly, and energy-saving green buildings.

## 4. ADVANTAGES OF APPLYING STEEL STRUCTURE

Good and rich architectural artistic expression makes steel structures generally favored by architects. In many years of construction practice of traditional metallurgical industrial plants, high-rises, super-high-rises and large-span structures, the outstanding advantages and functions of steel structures are almost irreplaceable. Compared with structures made of other materials, steel structures have the following advantages.

High strength, high rigidity, light weight and good sealing. The steel structure has good plasticity and toughness, is suitable for working under dynamic loads, and has good seismic resistance; the material is uniform, and its stress conditions are relatively consistent with the assumptions of mechanical calculations. With the advancement of science and technology, the defects of steel structures that are easy to corrode and are not fire-resistant will also be solved, such as using weather-resistant steel and fire-resistant high-strength steel, or applying high-efficiency anti-corrosion and fire-retardant coatings on the surface.

It can be made into a large span and large bay structure. The building plane can be arranged and divided at will. Compared with concrete structures, it can increase the utilization of space. The usable area is 6% to 8% higher than that of reinforced concrete structures. The appearance can also be changed according to the design, making the shape more complex and diverse.

Most of the steel structure parts and their supporting technical corresponding components can be manufactured in a factory. The construction is mechanized and program-controlled, with high accuracy and precision. After the steel structure components are prefabricated in the factory, they can be transported to the construction site for on-site assembly. A small amount of steel structures and light steel structures can still be fabricated on site, with simple connections and easy installation, speeding up construction progress, saving construction period, and improving efficiency.

Protect the environment and facilitate resource reuse. It avoids pollution and noise caused by concrete mixing and construction. There is less on-site construction waste. It is suitable for construction when concrete transportation is inconvenient. It is easy to reinforce, rebuild and demolish, as well as recycle and reuse materials.

In the long run, the economic benefits of steel structures are much higher than those of traditional buildings. The structure is light in weight, reducing transportation and hoisting costs, reducing foundation load, reducing the cost of the foundation and part of the foundation. The construction period is short, labor costs and indirect costs can be reduced, and the comprehensive benefits are significantly improved.

## **5. PROBLEMS FACED BY THE DEVELOPMENT OF STEEL STRUCTURE RESIDENTIAL BUILDINGS IN CHINA**

### **5.1 Technical Level**

First of all, as the steel structure market continues to expand in my country, the qualifications of newly built steel structure companies in various places vary. The quality of steel products produced by various steel structure companies is also uneven. Many small factories contracted by individuals have many problems such as cutting corners and cutting corners. , large-scale enterprises with an annual output of more than 10,000 tons only account for 20% of the total field. Some small-scale steel structure manufacturing enterprises lack necessary professional and technical personnel, backward manufacturing equipment and methods, unsound management systems, and poor project quality. to guarantee. On the other hand, during the design calculation process, the steel structure is not an ideal uniform mass. After idealizing the components, the energy loss of the steel structure itself is ignored, which inevitably contains some errors and defects. In actual operation, construction and transportation Improper operation by workers and workers will also cause defects and damage to the rods, resulting in a decrease in the load-bearing capacity of the components. Under different environmental conditions, material problems are amplified to varying degrees. In structures with higher quality requirements, these problems are often the main source of structural problems.

Secondly, units with different qualifications have different technical requirements for design, construction, and supervision, and there is no set of nationally common and unified reference specifications, which increases various uncertainties in the construction steel structure market. Experience and regulations are used to ensure construction, which greatly increases the risk factor during the construction process. There is no unified inspection standard for the technical level of construction personnel, and there is a lack of regular training for technical personnel. The inability to perfectly connect the prefabricated structural components is also a flaw and shortcoming of the current technology. Each component is processed in the factory without forming a system, and the connection technology needs to be improved. All in all, my country's steel structure residential technology is in the process of moving forward, and its imperfections and incompleteness need to be constantly filled and supplemented. Compared with my country, there is a lack of supporting research on the development of steel structure industrialization and vigorous promotion of steel structure applications. According to the scope of the situation, foreign countries are constantly improving the safety factor and technical indicators of steel structure residences, and have formed a complete technical system and a complete set of steel structure residence construction and installation technology systems and unified steel structure residence quality management standards.

### **5.2 Insufficient Understanding of Steel Structure Residences**

At this stage, reinforced concrete is the first choice for residential structures in our country. Pure steel structure buildings have not yet been accepted by the public. Reinforced concrete residential buildings are not widely used. This is a lack of understanding of steel structure residential buildings. People lack understanding of the performance of steel structure residences and have doubts about the safety, durability and usability of steel structure residences. The degree of recognition of reinforced concrete structures makes it difficult for people to accept and try to use other building structures. In addition, the government does not give Developers strong support and policy support, but construction units are not active in the construction of steel structure residences. The lack of motivation and market demand has led to the slow development of steel structure residences in our country. This phenomenon not only exists among the general public, but also among relevant industry experts, government officials and related construction companies. The common "short-sighted" problem in society: From the government officials down to the common people, there is no way to form a positive acceptance and follow-up mentality towards steel structure housing from the perspective of long-term development.

### **5.3 Lack of Design and Construction Technical Personnel**

Steel structures are complex structures in the field of construction technology and are difficult to construct. my country's steel structure buildings have only begun to develop and apply rapidly in recent years. There is even less exposure to steel structure residential systems, and they are generally unfamiliar with design. The penetration rate of steel structure residential buildings is low, and there is a serious shortage of professional designers in the industry. And it cannot be solved in the short term. Regarding the popularization of professional knowledge, many textbooks do not fully reflect the cutting-edge technologies and new scientific research results of steel structures, and the training of steel structure talents is insufficient. Steel structure engineering has high professionalism and technical requirements. The design, production and installation of steel structure residential structure projects should be integrated by qualified steel structure contractors. Some design units are not familiar with the steel structure business, so the drawing review is just a formality. Some parts will be subcontracted out and the subcontracting units will design drawings for construction. Often, some construction companies have limited design qualifications and talents, resulting in the quality of engineering design not being guaranteed.

During the processing and production of specific steel structures, if construction workers are not careful and there are errors in the construction operation process, it will not only affect the accuracy of the component dimensions, but also affect the supporting integrity of the entire system and even the safety of the building structure. performance. The integration of factory production of components reflects the advantages of steel structures over reinforced concrete structures. However, if the construction technology is not mastered well, the advantages are likely to be turned into disadvantages, increasing the risk of building structures and the incidence of accidents. Therefore, only with excellent technology can the safe use of steel structures be ensured. The research and exploration of steel structure technology still needs continuous improvement and perfection.

## **6. SOLUTIONS TO STEEL STRUCTURE RESIDENTIAL PROBLEMS**

### **6.1 TECHNICAL Improvements**

Through the understanding of foreign steel structure residences and the development rules of steel structures, steel structure residences will also be popular in our country in the near future. Our country should fully learn from foreign experience, learn from each other's strengths, pay attention to the research and exploration of the technical level of steel structure housing, and increase the introduction and development of required processing technologies.

First of all, scientific research on steel structures must not be divorced from reality, and must be integrated into enterprises and practice. The government should promote research on steel structures, strengthen innovation, and gradually establish complete specifications and procedures for the design, installation and construction of steel structures, and design relevant software so that there are specifications to follow and technology to guide the construction process of steel structure residences. In addition, the development of supporting parts must also keep up. The entire steel structure housing project is a systematic project. To take the road of industrialization, problems such as immaturity and unmatched technical level in some parts of steel structure housing must be dealt with. The key technology of steel structure housing is the envelope structure, mainly wall building materials and its construction technology. In particular, we pay attention to the flexible connection node structure between the envelope structure and the steel structure, and compile a corresponding atlas. Walls are now also filled with building blocks, so that the assembled building walls can meet the corresponding functional needs and achieve the functional requirements of light weight, high strength, good thermal insulation performance, reliable installation, durability, and economical and reasonable performance. To achieve these technological breakthroughs, our country needs to continue to research, overcome difficulties, and develop more economical and efficient materials, so that steel structure housing can develop on an economical and green road. Research on the corrosion resistance and fire resistance of steel structures cannot be slacked off. In the process of industrialization of steel structure housing, it is necessary to carry out the development of steel structure housing technology step by step and on a rolling basis, promote the innovation of building materials, the technological content of construction technology and the transformation of construction methods in our country, and organically link factory production and on-site construction through computer networks to truly Realize the process of

moving from the construction site to factory production, making the construction of steel structures faster, more environmentally friendly, and safer.

## 6.2 Increase Publicity Efforts

The government should vigorously support developers in constructing steel structure buildings, increase economic policy support through macro and micro regulation, and improve the development status of residential industrialization in various regions. For example, the government can provide certain economic subsidies to developers. At the same time, various government departments must also increase publicity on the advantages of steel structure residential buildings. Only when steel structure buildings enter people's lives can people feel the benefits brought by steel structure residential buildings. Convenience, comfort and safety. The comparison between the price of steel structure residences and the price of reinforced concrete structures is the focus of consumers' attention. Only when the price of steel structure residences has an absolute advantage will it attract people's attention. In this way, in addition to publicizing and promoting the benefits of steel structure housing, the state must also effectively control the price of steel structure housing, so that steel structure housing can truly enter people's field of vision and become one of people's choices.

The development of housing must be based on the market, and steel structure housing is no exception. The research on steel structure housing should also focus on market demand. It is necessary to see both the existing market demand and the potential market demand. Through careful research on steel structure housing technology, the level of the housing supply market can be improved. It makes people realize that steel structure buildings have the advantages of light weight, high strength, saving basic cost, increasing the effective use area of the building, fast construction speed, shortening the construction period, fast investment recovery, less environmental pollution and good earthquake resistance. According to the comparison between concrete structure and steel structure, the comprehensive benefit is that steel structure has more advantages, but this is a slow recognition process and it takes time to prove.

## 6.3 Vigorously Cultivate Technical Talents

The training of technical talents also requires strong support from the government. Relevant policies should be issued to form a strong atmosphere for researching steel structure residences in major universities. Efforts should be made to promote encouraging policies for steel structure residences and increase students' enthusiasm for steel structure research, and cultivate professional and technical talents in a targeted manner, each performing their own duties and conducting research in their respective fields. In addition, construction units must also strengthen management and training. For construction workers who are already on the job, regular training and learning should be organized to enhance the accumulation of professional knowledge, combine knowledge with theory, and improve the ability to discover problems in practice, explore the unknown, and solve problems. abilities and professional business capabilities. Each research unit must also strengthen communication and exchanges, organize some in-depth lectures regularly, and conduct academic discussions. At the same time, it is necessary to integrate with foreign advanced technologies and combine advanced domestic and foreign technologies to continuously improve the soft power of my country's steel structure housing.

## 7. CONCLUSION

The steel structure has light weight, convenient construction, good seismic resistance, green and environmental protection, can be industrialized, has a short construction period, and has good social and comprehensive benefits. However, due to the late development of steel structures in our country, there are still some technical problems that have not been solved and have not been promoted nationwide. People's understanding of steel structure residences is not extensive enough. The lack of relevant design and construction technicians will also affect the project. The quality is greatly compromised. In response to these problems, this article puts forward some reasonable opinions and suggestions, such as improving technical levels, increasing publicity efforts, and cultivating outstanding scientific research and technical personnel with the strong support of the government. It is believed that in the wave of construction, steel structures have begun to occupy a place, although there are still many problems that need to be overcome, the future of steel structure housing will be better.

## COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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