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# Research on the construction of external wallboard of prefabricated building structure for housing construction project

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## Abstract

**This paper studies the construction of external wallboard of prefabricated building structure in housing construction engineering, and aims to discuss its application in modern architecture and the problems encountered in the construction process. The advantages and challenges of prefabricated building structures were analyzed, and then the construction steps of external wall panels were introduced, including material selection, processing and production, installation and adjustment. Through the field construction case, the feasibility and effect of the technology are verified, and the technical support and reference experience are provided for the engineering practice in related fields.**

## Keywords

**Prefabricated building, external wall panel, structural design, modern architecture.**

## 1. Introduction

With the development of the construction industry and the progress of technology, prefabricated building structure, as a new type of construction mode, has received more and more attention and application. Among them, as an important part of prefabricated buildings, the construction technology of external wall panels plays a vital role in the overall building quality and efficiency. This paper will deeply discuss the construction technology of external wallboards, analyze its advantages and challenges, and show its application effect in practical engineering through examples, aiming to provide useful reference and reference for the technological progress and development of the construction industry.

## 2. Analysis of the design principle and advantages of the external wall panel of the prefabricated building structure

Prefabricated building structure external wall panel is an important component in modern architecture, and its design principle and advantage analysis are directly related to the quality, safety and efficiency of the building. In terms of design principle, the core of the external wall panel lies in its modular design and high customization, through the pre-made modules, it can be quickly assembled and installed on the engineering site, thus greatly shortening the construction period. This modular design also allows the external wall panels to adapt to different building structures and needs, such as customizing the design according to the building's height, load requirements and climatic conditions, improving the overall stability and safety of the building.

### 2.1. Design Principles

In the design and calculation of the main structure of the external wallboard, it is necessary to comprehensively consider the factors such as load transmission, wind resistance, earthquake protection, connection mode, vibration and noise control, and safety detection and maintenance, so as to ensure the structural stability and safety of the external wallboard in use,

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and at the same time, through reasonable structural design, the indoor environment of the building can be effectively improved, and the comfort and energy saving of the building can be improved. When calculating the main structure, the impact of the external wall panel should be included in the following provisions:

(1) The self-weight of the external wall panel supported by the main structure should be included;

(2) When the external wallboard is eccentric relative to its supporting members, the adverse effects caused by the gravity load eccentricity of the external wallboard should be taken into account;

(3) When the external wallboard connected to the main structure is connected with the point support, and the connecting node has the ability to adapt to the deformation of the main structure, its stiffness influence can not be included;

(4) The external wallboard connected to the main structure with line support shall be included in its stiffness influence according to the principle of stiffness equalization, but the beneficial influence of the external wallboard shall not be considered.

### 2.2. Advantage analysis

In terms of advantage analysis, one of the biggest advantages of external wall panels is the high construction efficiency. Due to the modular design and prefabrication process, the external wall panels can be mass-produced and quality controlled in the factory, reducing the time and labor cost of on-site construction, while reducing the safety risk during the construction process. This rapid construction makes the overall construction period of the construction project greatly shortened, which is of great significance for projects that need to be delivered quickly or have strict requirements for the construction period. In addition, the external wall panels are highly environmentally friendly and sustainable. The use of lightweight materials and modular design not only reduces the building's consumption of natural resources, but also reduces the building's energy consumption and carbon emissions. At the same time, the detachability and reusability of external wall panels also increase the sustainability of the building, which is in line with the green and low-carbon development concept pursued by modern buildings. The design principle and advantage analysis of the external wall panel of the prefabricated building structure reflects the advanced and practical nature of modern building technology, and through reasonable design and construction, it can bring more efficient, safer and more environmentally friendly solutions to the construction industry, and promote the development of the construction industry in the direction of intelligence and green.

## 3. The key technology and construction cases of the construction of external wall panels

The key technologies of the construction of external wallboard include material selection, processing and production, installation and adjustment, etc.

### 3.1. Material selection

The material of the external wall panel needs to have the characteristics of light weight, high strength, weather resistance and heat and sound insulation, and the common materials include lightweight concrete, glass fiber reinforced plastic, carbon fiber, etc. These materials need to undergo rigorous quality testing and evaluation to ensure that they meet architectural design requirements and standards, as well as the strength and stability requirements of the building structure.

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## 3.2. Processing and production

External wallboard needs to be modularized and prefabricated, which requires that in terms of installation and adjustment, the installation of external wallboard needs to be carried out in strict accordance with the design requirements and construction plan, including fixed connection, adjustment deviation, sealing and waterproofing, etc., especially in large-scale construction projects, the installation process of external wallboard is more complex, and it is necessary to consider factors such as the bearing performance of the building structure and the influence of temperature change on the wallboard, and ensure that the connection between the wallboard and the main body of the building is stable and well sealed through the precise installation and adjustment process.

## 3.3. Installation adjustments

The external wall panel and the main structure can be connected by point support, or by line support.

### 3.3.1. When the external wallboard is connected with the main structure by point support, the node structure shall comply with the following provisions:

(1) The number and location of connection points should be determined according to the shape and size of the external wall panel, and the connection points should not be less than 4, and the load-bearing connection points should not be more than 2;

(2) Under the action of external force, the external wallboard should be able to slide or rotate horizontally in the plane of the wallboard relative to the main structure;

(3) The size of the sliding hole of the connector should be determined according to the diameter of the perforated bolt, the deformation capacity requirement and the construction allowable deviation.

### 3.3.2. When the external wallboard and the main structure are connected by wire support, the node structure shall comply with the following provisions:

(1) The top of the exterior wall panel is connected with the beam, and the fixed connection section should avoid the length range of 1.5 times the beam height at both ends;

(2) The joint surface of the external wall board and the beam should be rough and the keyway should be arranged, and the connecting steel bars should be arranged at the joints. The number of connecting steel bars should be calculated and determined, and the diameter of the steel bars should not be less than 10mm, and the spacing should not be greater than 200mm; The anchorage of the connecting steel bars in the post-pouring concrete of the external wallboard and the floor beam shall comply with the relevant provisions of the current national standard "Code for Design of Concrete Structures" GB50010;

(3) The bottom end of the external wallboard shall be provided with no less than 2 connecting nodes that only have out-of-plane constraints on the wallboard;

(4) The side of the external wall panel should not be connected with the main structure.

## 3.4. Specific cases

The outer envelope of an apartment is made of 150 mm precast concrete external wall panels, which need to be installed through the top two-in-one pendant. According to the "Technical Code for Prefabricated Concrete Structures" (JCJ-2014), the external wall panels of the apartment must use supporting external wall panels and be designed according to non-structural components. When designing, it is also necessary to avoid the beam plastic hinge, which is the 600 mm area of the beam end. The two load-bearing nodes of the external wall panel are used for installation on the wall panel, and the connecting reinforcement is anchored into the laminated panel. The concrete external wall panel is set up with a three-dimensional waterproof board inside the wall, the inner side is sealed with a 22 mm ternary propylene

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adhesive strip, and the outer side is added with a 30 mm foam with weather-resistant adhesive. According to the design scheme of the prefabricated building, the apartment uses a length of 6680 mm, a thickness of 150 mm of external wall panels, the height of the hole is 1500 mm, the width is 900 mm, the area of the hole is removed, the area of the external wall panel is 20 square meters, the total weight of the wall panel is 7.512 tons, according to the influence of seismic load and wind load, the two-way double-layer steel bar of 8 mm & 200 mm in the external wall of the apartment, and the reinforcement rate is 0.34%.

In practical application, the key technology of the construction of external wall panels not only requires the technical team to have solid professional knowledge and operation experience, but also needs full communication, coordination and project management capabilities to ensure that the work in the construction process is carried out in an orderly manner and the quality is controllable. At the same time, the key to improving the construction quality and efficiency of external wallboard is to continuously accumulate practical experience and learn from advanced technology, and continuously optimize the construction process and process standards.

## 4. Prospect of the application of external wall panels of prefabricated building structures in modern buildings

The application prospect of prefabricated building structure external wall panels in modern buildings is mainly reflected in the following aspects: in terms of architectural design, with the improvement of people's requirements for the quality and comfort of the building environment, external wall panels, as a building exterior wall material with heat insulation, sound insulation, waterproof and other functions, will play an increasingly important role in modern architectural design. In the future, with the continuous progress of material science and building technology, the materials of external wall panels will be more diversified and environmentally friendly, such as the use of renewable materials, nanomaterials, etc., to meet people's needs for energy saving, environmental protection and sustainable development of buildings. In terms of the implementation of construction projects, prefabricated building structures and external wall panel technology will become the mainstream trend of construction projects.

Due to the advantages of fast construction, controllable quality, energy saving and environmental protection, external wall panels will be more used in various construction projects in the future, including residential, commercial buildings, industrial plants, etc. Especially in urban renewal and new construction projects, the application of external wall panels will be more extensive, providing technical support and solutions for urban construction and development. In addition, in terms of building performance improvement, the application of external wall panels will further promote the improvement and innovation of building performance. Through the functions of heat and sound insulation, waterproof and fire prevention of external wall panels, the indoor environmental quality of the building can be improved, and the energy efficiency and safety of the building can be improved. In the future, with the development of intelligent building technology and green building concepts, external wall panels are also expected to be integrated with intelligent systems to realize intelligent control and energy-saving management of buildings, and inject new impetus into the intelligent and green development of the construction industry. In terms of market prospects, the market demand for external wall panels will continue to grow.

With the improvement of people's living standards and attention to the quality of the building environment, external wall panels, as a high-quality and high-efficiency building material, will be widely recognized and sought after by the market and industry. In the future, the industrial chain of external wallboard will be further improved, covering multiple links such as material supply, processing and manufacturing, construction and installation, forming a complete

industrial system and bringing more development opportunities and economic benefits to the construction industry. In general, the application prospect of prefabricated building structure external wall panels in modern buildings is very broad, which can not only meet people's needs for the quality of the building environment, but also promote the development of the construction industry in the direction of intelligence and greening, and provide a better built environment and experience for urban construction and human life.

## 5. Conclusion

As an important part of modern buildings, prefabricated building structure external wall panels have the advantages of rapid construction, lightweight design, high precision, good thermal insulation and thermal insulation performance, excellent operating environment, sustainability and environmental protection, and show great application potential and development prospects in architectural design, engineering implementation, performance improvement and market prospects. With the continuous progress of science and technology and the continuous growth of market demand, external wall panels will become an important development direction of the construction industry, and make greater contributions to the improvement of the quality of the building environment and the sustainable development of the construction industry.

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