Research and Application of Low-rise Assembly Modular Building System

Haihua Su

School of Architectural Engineering, Jiangsu Open University, Jiangsu, 210017, China

suhh@jsou.cn

Keywords: Low-Rise Assembly, Modularization, Architectural System, Application

Abstract: From the structure of the assembly integral building classification, it can be divided into assembly concrete, wood structure building, steel structure building, module integration, and through other components of the building. There are many kinds of construction work contents, using assembly integral construction, dividing the work content into many subsystems, maintaining the functional components and structural backbone of the components is a very key component among them, making clear the manufacturing integral unit module components to ensure that each component meets the construction requirements, the efficiency of building assembly can be greatly improved.

1. Introduction

In the stage of urban modernization development, the industry has been very large development empty in order to cure. Zhengzhou enterprises need to pay attention to the quality of construction projects according to the requirements of government departments, prefabricated buildings have. The central push to the local, and according to the local authorities on the requirements of local buildings, this is the national sustainable development strategy in the context of the building to the green direction of the important initiatives. At the same time, through policy regulation of the construction industry, the development of green building materials. In this period of practice, the State Council has issued a number of documents, such as the Green Building Action Plan was issued during this period, according to the document needs to vigorously promote the use of green building materials in prefabricated buildings, reduce the pollution of construction operations to the surrounding environment, not only improve the quality of work, but also shorten the construction time, construction costs.

2. Development Background of Prefabricated Modular Architecture

In the context of sustainable development, the government vigorously promotes prefabricated buildings, promulgates numerous green building documents, in the construction industry industrialization development stage, promotes the green building materials, uses the policy to encourage the construction industry, applies the green building materials. Compared with traditional buildings, the use of prefabricated buildings can reduce waste and prevent dust pollution to the environment, not only improve the quality of the project, but also shorten the construction period to a certain extent. According to the documents related to resolving the serious overcapacity, the construction industry needs to apply a lot of green building materials according to the content of sustainable development in the future.

For example, the shanghai government departments carry out assembly-type buildings, the contents of the document, the use of all kinds of building materials assembly rate, not only china's economically developed cities, all attach great importance to assembly-type buildings, from the central to local assembly-type construction documents have been issued. When carrying out the work, it is necessary to purchase green building materials, the equipment type building is prefabricated parts, which are made through the assembly of the site, in which the equipment maintenance, steel structure and so on are very important components in the assembly link, the assembly filter steel structure, which is 30%, the equipment system is 10%, the remaining is the

  DOI: 10.25236/iccemm.2021.029

maintenance system, according to the contents of the document, it can be seen that the construction industry will transition to the manufacturing industry, which is the inevitable trend of the industrialization of the construction industry, in accordance with the sustainable development strategy, figure 1 is the assembly modular building entity sample.

Figure 1 Assembly modular building samples

3. Principles of Assembly-Based Modular Architecture Design

Decorative modular architectural design is the main development direction of the construction industry, when using equipment, the building can avoid the pollution caused by dust to the surrounding environment, but also reduce the amount of garbage produced in the construction process, not only can greatly improve the quality of the project, but also in the construction stage, promote the construction industry to industrialization through the application of assembly building green building materials.

Practical, beautiful and economical are the characteristics of the equipment type module design. In the design process, it is not only necessary to ensure that the construction can meet the building standard, but also optimize the design scheme from the aspect of structure and function, so that the assembly type modular building can meet the living requirements of the public. When using prefabricated modular building, we should pay attention to the innovation of design according to the trend of the times, and the designers need to understand the actual needs of the public for the building and think about the construction technology. At the same time, we should learn the knowledge of other fields, combine the architectural knowledge with the knowledge of other fields perfectly, break the conventional thinking according to the needs of the public, innovate the architectural design scheme, integrate the resources flexibly, optimize the assembly integral modular building, ensure the beautiful form of the building, and have the perfect function at the same time. In the design of the modular building, it is necessary to reduce the impact of its own movement on the user's sense of residence, perfect the design scheme, improve the comfort and safety of the building, and design the space environment with personal characteristics through innovation to meet the needs of the public for the building

4. Application of Assembly Modular Building Structure System

The prefabricated modular building structure needs to have the double-layer heat-insulated ventilation epidermis to strengthen the political structure, the rapid calibration device, when the designer constructs the assembly modular building structure system, also needs to define the specific parameters according to the building standard, guarantees the scheme design, can satisfy the public to the building appearance request, but also guarantees the building to have the good use function.

4.1. Insulating and Ventilating the Skin

The double-layer insulating and ventilating skin is a kind of energy-saving exterior wall

construction technology based on the modern concept. In this work, a new type of energy-saving material is adopted, and the technical requirements of the work are high. On the basis of the original maintenance structure, the design of the outer ecological wooden column, the cross-sectional area and shape of the wooden column are very fine. The thickness of the column should be calculated according to the safety standard of the building, but the spacer and the width of the column should be kept at 1:1, so that the structure of the building can form air flow and realize the heat insulation effect at the same time. It can also ensure the ornamental appearance of the outer surface of the structure. Figure 2 shows the double insulated and ventilated epidermis.

Figure 2 Double insulated and ventilated skin

4.2. Seismic Structures

Assembly buildings need to strengthen the seismic structure, considering the disadvantages of the building assembly structure from the overall point of view, and compared with the traditional field concrete structure, its seismic performance is weaker than that of the concrete structure. If we want to make the assembly structure and improve the overall seismic resistance, we can use the shock absorption technology to strengthen the seismic performance of the structure through the joint connection, which is also a great breakthrough in the application of the assembly building.

4.3. Calibration Devices

Assembly buildings need to have a rapid calibration device, in which truss structure, need to ensure that it will not be easily deformed under the influence of external impact, need to let the truss structure have a strong bearing capacity, can resist the impact of external load, at the same time need to consider the disadvantages of the single truss structure, although the truss structure is single, easy to disassemble and assemble, but will have a certain impact on its seismic performance.In addition, it is necessary to make it have the ability of rapid calibration according to the construction requirements, give clear requirements for the installation equipment used in the engineering, in the construction opinion of the assembly room, the installation equipment and positioning mark should meet the engineering specifications within the scope of the specifications, ensure that the assembly construction can complete the requirements of rapid disassembly, assembly, transportation, and design a set of display plane frame, in the truss need of calibrated axis size, connecting rod, fixed rod and joint.

The screw is an important part of it, using the device, using the truss rod with buttons, fixing the plane structure, using the triangular fixed way, can enhance the stability of the structure, but also convenient length marking, can be quickly fixed point. When the end marking work, the device should be turned into a shrinkage state, when the operation is again, it will be expanded through the bar plane, connecting between the members, can be through the truss bar group plane structure, reach the active position, fixed through the screw, when all the work is completed, the calibration work is machined in the corresponding position.

5. Advantages of Assembly Modular Architecture

Assembly modular building compared with the traditional building, the use of green building

energy conservation and environmental protection at the same time, the quality effect is more prominent, can improve the speed of construction. Adopting the prefabricated modular construction, using the factory prefabrication, reducing the normal steel bar binding or concrete operation links, reasonably planning the construction work, while the site construction can be carried out synchronously with the factory prefabrication, so that the resources can be reasonably used to ensure the smooth development of each link, not limited by the traditional construction link, shorten the construction period, and effectively control the construction cost. In addition, it can also ensure the assembly type modular building, with the characteristics of reliability, stability and safety, using assembly integrated modular building, using prefabricated board to reduce the difficulty of construction; using assembly type module construction, can not break through the building form, at the same time, the wall beam and plate column can not be cut through and hole at will according to the needs of the user, if the relevant operation is insisted on, it may destroy the overall force structure of the building, thus causing a greater safety hidden danger, figure 3 is the assembly type modular construction site.

Figure 3 Assembly modular construction site

Assembly construction technology accords with the sustainable development strategy put forward by our country, and it has high value to apply a large number of green and energy-saving materials that can be recycled. At the same time modular architectural design, considering the production environment, to achieve automatic production. Construction work, only through on-site assembly to complete the building, prefabricated parts and on-site construction can be carried out simultaneously, so as to greatly improve work efficiency, during the construction can also provide high-quality interior decoration products, improve service quality. Comprehensive analysis assembly integral type module building, its each department quality is high, although the construction time is short, but does not affect the construction life, the existing assembly type building, the service life is above 50 years. In the process of technology development, the problem of connection point is solved, which makes the module structure connection more accurate and greatly improves the installation rate.

6. Conclusion

Assembly integral modular architecture is a new architectural structure with. The scientific structure system, at the same time, the engineering quality is excellent, the prefabricated frame can be carried out simultaneously in the field construction, which can greatly shorten the construction time, optimize the design scheme from the aspect of structure and function, and make the assembly modular building can meet the living requirements of the public.Assembly integral module has the characteristics of high building engineering, a large number of green building materials to meet the requirements of national sustainable development, buildings can meet the needs of energy conservation and environmental protection, is a friendly building, worthy of vigorous promotion.

Acknowledgements

2019 Jiangsu province construction system science and technology project “the study on Building system of Low-rise assembly residential of Rural” (2019ZD001172)

References

[1] Wang, Ercheng., Wang, Xiangyang., Yang, Baokun., Zheng, Xianxian., Zhang, Jingjun. Experimental study on shear resistance of horizontal joint of low-rise fabricated wall. Journal of Hebei University of Engineering (Natural Science Edition), vol. 36, no. 04, pp. 1-6, 2019.

[2] Liu, Kai. seismic test study and finite element analysis of low-rise fabricated reinforced concrete horizontal slurry wall. Hebei University of Engineering, 2019.

[3] Han, Yuncong. Modular low-rise prefabricated residential design research. Shandong Construction University, 2018.

[4] Lu, Ming., Peng, Chaoheng., Liu, Xiangdong. Development and application of prefabricated modular building structure system. Construction Technology, no. 01, pp. 63, 2018.