Research on Design Method and Construction Key Points of Prefabricated Building Structure Combined with Machinery

Yangyang Guo1,*
1Shi Jia Zhubang University of Applied Technology College of Architecture and Civil Engineering, Shijiazhuang, China
*Corresponding author e-mail: Gyy777@sjzpt.edu.cn

Abstract. The design method of prefabricated building structure combined with machinery and the technology in the research of construction key points effectively solve the problem of cost control in the process of building construction through application sensitivity. The successful development of the design method and construction key research of the combination of prefabricated building structure and machinery will enable many branches to converge, thus benefiting the world.

Keywords: House Construction, Prefabricated Concrete Structure, Construction Technology

1. Introduction
Under the strong promotion of the national sustainable development strategy, many environmentally friendly and energy-saving building materials and building structures have emerged, which have been widely used in building structures[1-2], and prefabricated buildings are one of them.

The resource utilization rate of prefabricated buildings is relatively high. In terms of energy saving, it uses new materials to manufacture sound insulation, heat preservation and light-weight prefabricated interior wall panels to reduce the utilization rate of heating equipment and indoor air conditioning, thereby achieving the purpose of reducing energy consumption[3-4]. In terms of land saving, the prefabricated overall structure adopts the existing technology, which can be used in high-rise buildings, thereby increasing the utilization rate of the unit land and intensive land, thereby saving the land area of the building. In addition, the prefabricated construction occupies a smaller construction site than the cast-in-place construction site, achieving the purpose of saving land. In terms of water saving, the prefabricated building conforms to the standardized production of the prefabricated component factory, and the method adopted is on-site assembly, which greatly reduces the wet work on site. In terms of saving materials, the effect of intensive, large-scale and industrialization of prefabricated components is good, and the utilization rate of materials is greatly improved[5-6].

This paper conducts in-depth research on building prefabricated concrete structure construction technology combined with machinery, and combined with machinery, tries to analyze the superiority of prefabricated concrete structure construction technology.
2. Analysis of the importance of construction technology of prefabricated concrete structures

2.1. Conducive to keeping the construction period within a reasonable range
In the process of building concrete prefabrication construction, the components of prefabricated concrete mainly benefit from the prefabrication of the factory, eliminating the need for re-splicing. In the construction site, the staff need to conduct an in-depth analysis of the design drawings to ensure the accuracy of the component installation position and smoothly connect the plates. Based on this, it is of great help to improve the construction efficiency and minimize the construction time. In addition, in the process of installing the external wall, the staff should strengthen the application of wooden bricks to close the periphery and ensure the formation of the external construction environment.

In addition, the prefabricated building construction technology can jointly complete different processes, such as exterior wall decoration and paste insulation materials, etc., to control the indoor masonry time and increase the construction speed.

2.2. Conducive to highlighting the characteristics of green and environmental protection
Prefabricated building construction technology, with the attributes of green craftsmanship, can be in line with the development trend of green buildings, and continuously improve the quality of housing construction, adding vitality to the development of green buildings. Mixing single materials and performing unified processing will help to form prefabricated concrete construction, improve the quality of building materials, and promote the formation of prefabricated components, prevent unnecessary raw materials from wasting, and minimize the amount of materials. For example, compared with traditional concrete structures, with the help of prefabricated exterior wall panels, during the installation of exterior walls, unnecessary wood can be prevented from wasting and the amount of materials can be kept within a controllable range. At the same time, it can also effectively avoid problems such as noise pollution and air pollution, so as not to affect the normal life of surrounding residents, so that the construction industry and the natural environment can achieve coordinated development and harmonious coexistence.

2.3. Conducive to fully demonstrate the structural performance
For the construction technology of prefabricated house construction, it has a high degree of integrity and connectivity, so it has significant seismic resistance, which helps to build a safe atmosphere for the building and maintain people's personal safety. At the same time, in the construction operation process, more insulation materials need to be used, and each prefabricated component is closely connected, which greatly improves the airtightness of the building and helps to improve the insulation strength and comfort of the building. In addition, prefabricated building construction requires the design of prefabricated components, and reinforced concrete is the main construction component. Among them, the rigid-flexible combined construction method has been widely used, which helps to improve the construction efficiency and provides structural load-bearing. The guarantee of certain ability, and thus the seismic strength of the prefabricated building can be guaranteed. The specific structure is shown in Figure 1.
3. Analysis of construction technology of prefabricated concrete structure

3.1. PC construction technology
For PC technology, it has a wide range of application value in the development of the construction industry. Among its applications, air conditioning panels and wall panels are more common. In the PC installation process, if the PC board matches the designated position, the temporary support should be strengthened, and the stability and safety of the bracket should be improved. After the PC board enters the construction site, the PC board installation design process should be combined, Organize its plates uniformly, ensure the neatness and rationality of stacking, and bring convenience to the implementation of subsequent hoisting work. During the installation of the PC board, prevent any gaps between the PC board and the prefabricated wall board. When using PC technology, it is necessary to ensure the high degree of compactness and cohesiveness of the material, prevent the appearance of gaps, and give full play to the thermal insulation performance of concrete [4]. In addition, it can greatly enhance the dryness of the construction site environment, prevent the appearance of water leakage in the window frame, and control the construction cycle as a whole to minimize the workload.

3.2. Composite slab concrete shear wall technology
The latest introduction of this technology is Germany, which developed relatively late in China. For analysis of its components, stacked wall panels and stacked floor slabs play an important role. Generally speaking, structural steel bars and floor prefabricated slabs are important components of laminated floor slabs, while double-layer prefabricated slabs and structural steel bars are the composition of laminated wall panels. In the construction site, after the concrete pouring related work is implemented, the concrete pouring can be started in the double-layer precast slab. At the same time, the structural steel bars also play an important role in the precast slabs. The node is shown in Figure 2.
However, due to the relatively late introduction time, there is a serious lack of operating experience, so the scope of application is relatively limited, which is only fully reflected in the structural design of the underground garage. Moreover, in actual application, technicians sometimes did not conduct in-depth analysis of the specific design of the prefabricated panels at both ends.

3.3. NPC technology system

For NPC technology, it mainly refers to strengthening the application of full prefabrication technology and lamination technology to handle vertical and horizontal walls respectively. Under the influence of the full prefabrication method, the vertical wall is processed, such as the component filling wall, etc., with the help of the superposition method, the horizontal component slabs and beams are effectively processed, and the vertical lower component is constructed through the steel connection. The metal anchor pipe is connected to the upper end member to provide a smooth connection of the reinforced grout anchor. The specific construction is shown in Figure 3. Strengthen the setting of the cast-in-place connecting belt, and provide certain help for the connection through the method of cast-in-place concrete. In the process of connecting horizontal and vertical members, the methods used mainly include steel anchor joints, superimposed cast-in-place, and so on.

Figure 2. Technical structure node diagram of laminated slab concrete shear wall.

Figure 3. Schematic diagram of laminated floor concrete structure.

The NPC technology system has a high degree of completeness. In the process of horizontal and vertical components, the full prefabrication and stacking methods have been widely used, which helps to reduce the cast-in-place beam and ensure the steady increase of the assembly rate. In the construction site, the phenomenon of grouting holes is difficult to avoid, and the quality of grouting at each hole position can be controlled. Therefore, in the application of house prefabricated concrete structure technology, in order to maximize the safety of house building structure, the vertical
connection of the shear wall in the NPC technology system must be improved.

3.4. Assembling monolithic precast concrete shear wall technology
Among the fabricated shear wall structures, the high-rise and multi-layer fabricated shear wall structures cannot be ignored. The analysis of these two types of shear wall structures mainly refers to the design principle of "equal to cast-in-place". In addition, the two types of shear walls are compared, and the multi-layer fabricated shear wall structure simplifies the setting of edge components and connection of horizontal nodes. In actual operation and use, many construction companies still use steel bars at the connection reserved holes for grouting. In the process of continuous exploration and development, the technology of assembling monolithic precast concrete shear walls has emerged. The main steps of using this type of technology include construction preparation, measurement and orientation, temporary fixation, tying steel bars, and retaining embedded parts.

4. Improvement measures for building prefabricated concrete structure construction technology

4.1. Preliminary preparations for the project
In the feasibility study stage, it is necessary to deeply analyze the climate environment and surrounding conditions of the project location to ensure the feasibility of the construction technology of prefabricated concrete components. For the design unit, it is necessary to pay more attention to the survey and design, appropriately extend the design cycle, ensure that the design plan is optimized and perfected to the greatest extent, and increase the verification efforts before submitting the project. Before the start of construction, the construction unit must carefully study and analyze the construction drawings. During the construction of prefabricated concrete components, strengthen communication and communication with the design unit, especially in terms of technical difficulties, to ensure the smooth progress of the construction process. In the construction organization design, the accident methods of special processes and components should be clarified, and materials should be stored reasonably. The surveying and laying-out personnel shall combine the construction plan to ensure the rationality of the positioning of each function. Before the prefabricated concrete components enter the site, the quality inspection report is also indispensable. On-site technicians and supervisors must conduct random inspections in time. Only after passing the inspection can they enter the site smoothly.

4.2. Key points of construction technology of prefabricated concrete components

4.2.1. Template installation
During the installation process of the formwork, it is necessary to implement work such as chiseling and planting reinforcement on the joint surface of the new and old concrete. It is more appropriate to install the inclined formwork on the top of the formwork, and then prevent the inclined formwork from flowing to the top of the formwork for better integration. New concrete top, original structure flange plate. When self-compacting concrete overflows, it is an important symbol of full concrete. In the pouring process, it is necessary to strengthen the application of mechanical equipment, apply appropriate pouring methods, and proceed from the actual construction conditions to ensure the rationality of the choice of concrete types and the number of mechanical equipment. It should be noted that in the early stage of pouring, the required tools should be carefully checked to prevent the emergence of construction hazards. In the process of pouring concrete, it is necessary to fill the buried objects and the contents of the formwork to prevent bubbling during the pouring process.

In addition, in the process of concrete vibrating, the working time should be controlled within 15 seconds, and the vibrating method should conduct in-depth analysis of engineering standards. For example, the point vibration method can reflect the integrity of the concrete after the insertion operation is completed, and eliminate internal air bubbles in place. Complete the concrete pouring of
the components at one time to ensure that the concrete is fully reflected in the PVC pipe. After 5 minutes of static pressure, close the gate.

4.2.2. PC board installation
During the installation process, the temporary support frame should be fixed. After the PC board enters the site, the stacking frame is an important place for placement. During the lifting process, the reserved hoisting ring above is bound to enable the lifting task to be successfully completed. Among them, there is a problem that cannot be ignored, that is, the occurrence of cracks between the PC board and the prefabricated board should be prevented, and the jointing should be based on the principle of integrity. After the splicing is completed, it must be corrected to promote the smooth progress of concrete pouring.

4.2.3. Component preparation
In the early stage of concrete pouring, we must strive to complete the wall concrete pouring technology. At the bottom of the pouring, the gravel-reducing cement mortar should be laid at least 3 cm to give full play to the mitigation effect of the concrete gravel and prevent the occurrence of slurry leakage. Based on the completion of the mortar pouring task, it can provide a favorable basis for concrete pouring. In wall concrete, the layered pouring method has good application value, and the requirements for pouring height are particularly strict. Keep it below 40 cm as much as possible, and the pouring time should be less than the concrete solidification time to prevent cracks.

4.3. Construction quality control technology
In the construction process, it is necessary to conduct an in-depth analysis of the component hoisting method, starting from the actual length of the component and the installation form, rationalize the application of the hoisting lashing form, prevent any damage to the component, and give a strong guarantee for the construction quality. In the process of component hoisting, the angle is an important issue. In the process of component connection, the gap should be at least 10mm, which brings convenience to the adjustment of the component. On-site measurement personnel will also put the lofting and re-test work in place. To minimize the probability of construction error. For the installed components, it is also very important to strengthen the protective support to prevent the subsequent construction from affecting and causing unnecessary quality problems.

4.4. Prefabricated concrete construction information management platform
Strengthen the application of BIM cloud platform, in the construction site, it is necessary to continuously update the construction progress and cost usage, so that all parties involved in the construction can fully understand the construction situation. At the same time, it can also bring convenience to data sharing, ensure a significant improvement in work efficiency, and reflect the continuity of construction. The owner and the designer must clarify the interests and responsibilities of all parties to make the information acquisition process more efficient.

5. Conclusion
In the current stage of construction, the number of prefabricated structures is relatively large, and the construction technology and applied materials are also very advanced, which can effectively improve the living conditions and create a comfortable and high-end living environment for the occupants, and the high-performance building quality can meet the needs of living. The production and life needs of the people. Prefabricated concrete components have a good development market and will be in continuous development and progress.

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