Research on Existing Problems and Improvement Measures of Fabricated Shear Wall

Tongliang Xiao¹², Hubing Li², Ziyang Yu² and Yan Li²

¹ Nanjing Chixia Construction Co., Ltd., Nanjing, Jiangsu, 210046, China
² School of Architecture and Engineering, Nanjing Institute of Technology, Nanjing, Jiangsu, 211167, China
*Corresponding author’s e-mail: xtl@njit.edu.cn

Abstract. When assembling the shear wall during hoisting and positioning, due to the many and dense reinforcements around the shear wall members, there are also many connection joints with other members, which makes the construction more difficult during assembly; it needs to be connected with the floor slab, too many connection joints are easy to bend the steel bar. This study proposes a shear wall positioning installation method. According to the parameters of the shear wall components, installing matching positioning braces before the components are hoisted can reduce unnecessary joint damage during the installation process and improve the efficiency of construction.

1. Introduction
Prefabricated concrete structure has the advantages of high component production quality, fast on-site assembly and construction, saving materials, reducing construction waste, and reducing construction noise [1]. It has good economic, environmental, and social benefits, and is in line with China's green, low-carbon, and sustainable development concept. Shear wall structure is currently the main structural form of high-rise residential buildings. Although the installation of reinforced formwork for assembled concrete shear wall structures is heavy and the cost of prefabricated components is relatively high, due to its application in high-rise housing and full construction demand, in recent years, it has become a research and development focus of integrated enterprises integrating real estate, engineering design, prefabricated component production and construction [2-3].

2. Assembled Shear Wall Problem Statement
Prefabricated concrete buildings, that is, PC buildings, are transported to the site for assembly after the components are prefabricated in the factory. During the hoisting construction process, the prefabricated concrete components have multiple and dense steel bars, many connection joints, difficult installation and low efficiency [4-5]. When accidentally reaching into the upper member, it is prone to bending and other phenomena, which affects the performance of longitudinal tendons, thereby leaving hidden dangers [6-7].

In addition, prefabricated concrete buildings, that is, PC buildings, are transported to the site for assembly after the components are prefabricated in the factory. PC components of fully assembled concrete structures are integrated by dry connection (such as bolting, welding, etc.), because there are many connection joints Problems make installation difficult and inefficient [8-10].
3. Positioning installation method of assembled shear wall

Before hoisting the prefabricated shear wall, install the positioning support plate before and after the installation position according to the cable release. Fix it on the ground through 4 screw holes on the bottom plate, and rotate the sloping plate to the maximum angle perpendicular to the bottom plate through the rotating shaft. The brace is inserted into the fixing hole, and the threaded column and the threaded pipe can be rotated to support the length of the brace so that the sloping plate cannot be moved. The positioning brace should be symmetrically arranged, and the number should be determined according to the form of the shear wall and the size of the brace. The shear wall is hoisted to the upper position. If the plane position is slightly deviated, it falls on the arc surface of the sloping plate, and the sloping plate remains unchanged under the reaction between the strut and the bottom plate, so that the deviating shear wall slowly slides into the inside of the positioning brace. The positioning brace can shorten the lifting time of the shear wall and can continue to work as a diagonal brace, saving labor.

Because the bottom plate is fixed to the ground, the sloping plate is perpendicular to the ground, and the shear wall is sandwiched in it, so there is no need to adjust the verticality of the component. When the component reaches the support-free condition, remove the bolt, rotate the threaded column and threaded tube to reduce it. Connect the length, remove the brace, and then put the sloping plate into the storage slot. It can be transferred to other components by the handle.

In Figure: 1-slope plate; 2-strut; 3-fixation hole; 4-bottom plate; 5-thread hole; 6-handle; 7-threaded column; 8-threaded pipe; 9-rotation shaft; 11-Curved surface; 12-storage slot

Figure 1. Connection diagram of prefabricated shear wall (many connection joints)

Figure 2. Axonometric view of the positioning stay
4. Fully assembled shear wall structure method

According to the design, the required upper and lower longitudinal ribs are prefabricated, and the ends of the upper longitudinal ribs are opposite in height. The thread segments at both ends are removed, and the upper longitudinal ribs are outsourced with Fiber Reinforced Plastics. The indwelling section, the lower part of the indwelling section and the middle section are provided with equal-height, equidistant, and same-direction thread sections, and FRP processing is outsourced to the middle of the thread sections at both ends.

The connection seat and the end plate are erected on both sides and fixed; the processing section of the lower longitudinal reinforcement passes from the end plate to the top of the bottom thread section of the anchoring section, and the light round section reserved at the top of the lower longitudinal reinforcement is placed in the connection seat; The rotating lower longitudinal rib is simultaneously fixed in the connecting seat and the end plate through the bottom thread sections at both ends; the appropriate side of the upper longitudinal rib is fixed in the connecting seat through the top thread (that is, when the nut is installed, the rotating nut can strengthen the lower (Thread connection, opposite direction); After connecting the bundled steel bars to the end plate, they are fixed in the mold with the distribution bars to ensure that the surface of the end plate is flush with the top surface of the concrete. The embedded pipes are designed according to the reserved holes, and the concrete is poured and cured.

The prefabricated shear wall is hoisted to the installation position by a crane, and the construction staff assists in positioning on both sides. The holes are reserved to align the bundled steel bars and slowly fall to the ground position. Slide into the slot to achieve precise positioning; when fixing the prefabricated shear wall, the top thread of the bundled steel bar of the lower shear wall protrudes from the end plate, put the gasket first and tighten it with a nut to fix it. After the exposed parts are cleaned up, Lacquering and rust prevention are performed, and the next prefabricated shear wall is hoisted.
5. Construction process

The process of shear wall positioning installation method mainly includes: formulating component demand plan, component entry acceptance, component storage yard, pay-off positioning, reinforcement correction, positioning support plate installation, component lifting and inspection acceptance[11-12]. The main construction process is shown in Figure 6. In the formulation and installation of shear wall components, basic accuracy requirements need to be met. See Table 1 for detailed accuracy requirements.
Figure 6. Construction flowchart

Table 1. Accuracy requirements of various components

| Project          | Test items                        | Regulations                  | Detection method                      |
|------------------|-----------------------------------|------------------------------|---------------------------------------|
| Master project   | Concrete strength and appearance  | Comply with GB50204-2015     | Check component inspection report     |
|                  | quality                            |                              | formally                              |
| General project  | Section size                       | Long ±5mm                    | tape measure                          |
|                  |                                   | Width ±5mm                   |                                       |
|                  |                                   | High ±5mm                    |                                       |
|                  | Flatness of bottom                 | 3mm                          | 2m ruler                              |
|                  | Diagonal                           | 2mm                          |                                       |
|                  | Rebar spacing / length at the bottom | 5mm/-3mm                  | Diagonal ruler, high-precision         |
|                  | Stirrup spacing                    | ±5mm                         | rangefinder, tape measure              |
|                  | Welded end steel bar warpage       | ≤2mm                         |                                       |
|                  | Embedded level                     | ±3mm                         |                                       |
|                  | Reserve hole centerline            | ±5mm                         |                                       |
|                  | Reserved hole elevation            | ±5mm                         |                                       |
|                  | Embedded parts positioning         | ±2mm                         |                                       |

6. Summary

- During the hoisting construction process of the existing assembled shear wall, the shear wall members are densely reinforced, and there are many connection joints, which is difficult and inefficient to install. In order to solve this problem, according to the construction shear force, the form and specifications of the wall and the installation of matching positioning braces ensure that no problems such as damage occur during the lifting process of the component and improve the engineering installation efficiency.

- The PC components of the fully assembled shear wall structure are integrated by dry connection (such as bolting, welding). Due to the problem of many connection joints, the installation is difficult and inefficient. To solve this problem, a fully assembled shear is used. The way of force wall cluster connection reduces the number of connection joints, speeds up the installation efficiency of components, and ensures the quality of nodes.

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