

# Application and Quality Control of Concrete Prefabricated Component Construction Technology

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## Abstract

With the development of science and technology, prefabricated components have gradually become the core of the main structural engineering. Prefabricated prefabricated building are innovated by integrating conventional construction technology and applied in many projects. Building industrialization replaces the scattered, low-level, and inefficient handicraft production methods in traditional architecture. Prefabricated components are assembled and hoisted on site, and the components are positioned, connected with holes and reserved joint bars, and grouting and pouring operations are carried out properly. Prefabricated concrete buildings are the main way of building industrialization, which have many advantages such as providing quality, shortening construction period, saving energy, reducing energy consumption, and clean production.

## Keywords

Concrete Prefabricated Components; Prefabricated Building; Prefabricated Component Construction Process; Quality Control.

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## 1. Introduction

Prefabricated prefabricated building is an important construction project. It can reduce the construction process, provide labor cost rate, save energy and environmental protection, shorten the construction period, reasonably plan the construction process, and mass production to comprehensively improve economic benefits.

## 2. Types of Precast Concrete Components

Prefabricated concrete components mainly include prefabricated composite panels, prefabricated infill walls, prefabricated shear walls, prefabricated staircase slabs, prefabricated columns, etc.

### 3. Process Technology of Concrete Prefabricated Components

#### 3.1 Construction Process

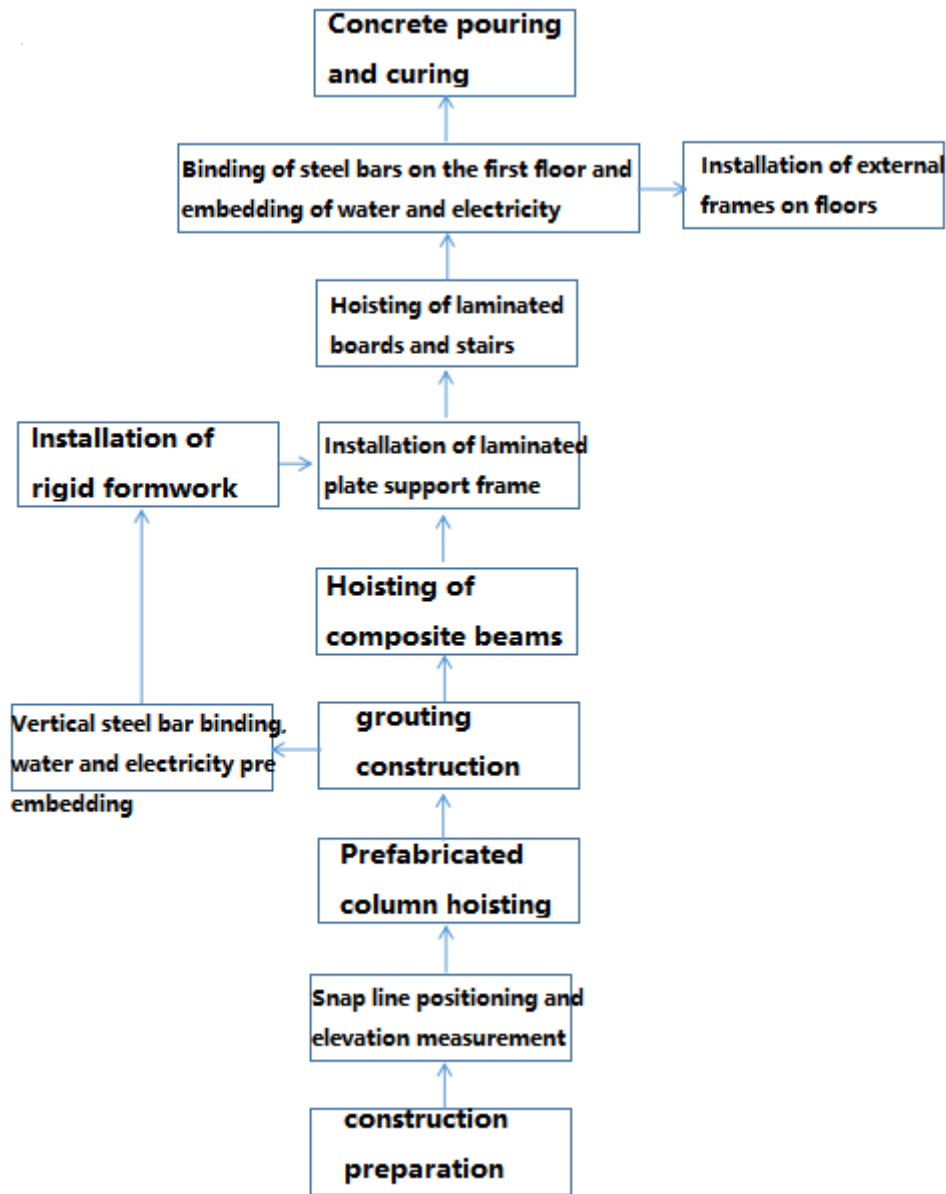


Fig. 1 Construction process diagram

#### 3.2 Prefabricated Component Installation Process

##### 3.2.1 Prefabricated Wall Installation Process

Clean and install the foundation surface → Set adjustment elevation shims at the bottom of the components → Lift and place → Install diagonal supports → Adjust and align the components → Tie the connection points with steel bars, lay pipelines → Seal the joints around → Grout → Install the cast-in-place connection point template → Pour the cast-in-place connection point concrete → Remove the assembly support.

##### 3.2.2 Prefabricated Laminated Plate Installation Process

Erect the bottom support frame of the plate → Place the prefabricated composite plate → Check and seal the joints of the prefabricated components → Install pipelines and other embedded parts

→ Lay reinforcement and additional reinforcement at the joints → Lay the upper distribution reinforcement → Wet the surface → Pour concrete → Remove the assembly support.

### 3.2.3 Installation Process of Prefabricated Stairs

Clean and install the foundation surface → Set and adjust the elevation gasket on the stair beam for leveling → Prefabricate the stair for hoisting and placement → Grout the connecting holes of the stairs → Seal the joints around them.

### 3.2.4 Prefabricated Column Installation Process

Clean and install the foundation surface → Set adjustment elevation shims at the bottom of the components → Lift and place → Install diagonal supports → Adjust and align the components → Tie the connection points with steel bars, lay pipelines → Seal the joints around → Grout → Install the cast-in-place connection point template → Pour the cast-in-place connection point concrete → Remove the assembly support.

### 3.2.5 Installation Process of Prefabricated Composite Beams

Erect assembly support → Place prefabricated composite beams → Check and seal the joints of prefabricated components → Lay reinforcement and additional reinforcement at the joints → Lay upper distribution reinforcement → Wet the surface → Pour concrete → Remove assembly support.

## 4. Grouting of Prefabricated Components

### 4.1 Plugging

After the lifting is completed, the outer edge of the component joint should be sealed; According to the characteristics of the components, special sealing materials can be selected for sealing; Ensure that the sealing is tight, firm, and reliable.

### 4.2 Partial Steps

After the prefabricated wall is lifted and the verticality is adjusted, the bottom of the board needs to be sealed. Seal the inner sides of the inner wall panel with sealing material on both sides, and mix with water according to the instructions; When sealing, the filling should be approximately 1.5-2cm deep (to ensure that the sleeve hole is not blocked), and the joint between sections, the same component, or the same warehouse should be filled tightly; After filling and plastering, confirm that the dry and hard strength meets the requirements (at room temperature for 24 hours, about 30MPa) before grouting.

### 4.3 Mixing Grouting Materials

Special grouting equipment should be used for grouting, and the grouting materials should be strictly proportioned according to the design and specified mixing methods. Mix the well proportioned cement slurry evenly and pour it into the specialized grouting equipment to ensure the slump of the grouting material. The grout mixture should be used up within 0.5 hours after preparation.

Before the construction of each grouting connection, the initial fluidity of the grouting material should be inspected, and relevant parameters should be recorded. Only after the fluidity is qualified can it be used; When the ambient temperature exceeds the upper limit of the product's operating temperature (35 °C), an actual operational time inspection must be conducted to ensure that the grouting construction time is completed within the product's operational time.

#### ① Slurry hole cleaning

Before formal grouting, check the grouting holes and discharge holes of each joint one by one for any debris that may affect the flow of grout, ensuring that the hole path is unobstructed.

#### ② Dedicated grouting personnel

Grouting will be carried out by a professional grouting team. The grouting pump (gun) injects pressure into the sleeve from the grouting hole below the joint. Special attention should be paid to the completion of normal grouting slurry within 20-30 minutes from the start of self mixing with water, in order to reserve a certain amount of emergency operation time as much as possible.

③ Equipment flushing

Before grouting construction, rinse the grouting machine with clean water to ensure its normal use.

④ Pressure control

The control pressure during the grouting process is 0.2-0.4Mpa. According to the actual effect of grouting, it is sufficient for the grouting material to overflow from the grouting hole, which means that the pressure of the grouting material from the grouting machine gun head should be controlled at 0.2Mpa. Once the pressure is too high, it will "flush out" the sealing material.

⑤ Slurry blocking

When grouting multiple joints of the component through the horizontal joint connecting cavity at once, the grouting discharge holes should be sealed in sequence according to the discharge order of the slurry. During the sealing process, the grouting pump (gun) should maintain the grouting pressure until all the grouting holes are filled and sealed firmly before stopping grouting. If there is any leakage, immediately replenish the lost slurry.

⑥ Bystander record

Before grouting, the supervising unit should be informed, and personnel from the supervising unit should stand by during construction. The construction unit needs to fill out the grouting quality control record form.

## 5. Quality Control

### 5.1 Quality Pre Control

- 1) Reasonably deepen the combination of design drawings and on-site construction;
- 2) Conduct technical disclosure and strictly follow the construction plan for construction. The construction plan must have targeted measures, clear construction process, and reasonable sequence;
- 3) Establish an engineering quality inspection system, including raw material and equipment entry inspection system, and inspection during the construction process; Sampling inspection after construction completion.

### 5.2 In Process Quality Control

- 1) Before the production of components, the surface of the mold must be clean, smooth, and free from rust; The contact surface between the mold and concrete should be brushed (sprayed) with isolation agent, which should be evenly applied and should not be missed or accumulated.
- 2) During transportation, binding and fixing measures shall be taken to prevent the movement or dumping of components. The concrete at the corners or interlocking contact points of components shall be protected with padding.
- 3) The number of stacking layers should be determined based on the load-bearing capacity of the components and blocks or blocks, as well as the load-bearing capacity of the stack.
- 4) During transportation, binding and fixing measures shall be taken to prevent the movement or dumping of components. The concrete at the corners or interlocking contact points of components shall be protected with padding.
- 5) In order to ensure accurate positioning of sleeve connected steel bars, steel plate positioning is carried out for the sleeve connected steel bars used in each layer of concrete pouring to ensure the accuracy of the steel bars.

6) The horizontal angle between the diagonal support and the floor should be controlled at  $45^{\circ}$  -  $60^{\circ}$ . It is strictly prohibited to have an angle that is too large or too small during the installation of the diagonal support, resulting in uneven stress on the PC board.

7) Strictly control the slurry ratio and conduct flowability experiments.

### **5.3 Inspection (Acceptance) Control**

1) Check that prefabricated components should not have dimensional deviations that affect structural performance, installation, and usage functions.

2) Check the connection method, joint position, number of joints, and percentage of joint area of the steel bars.

3) Check the specifications, quantity, and position of grouting sleeves, lifting rings, joint bars, and reserved holes.

4) Conduct filling inspection: After the grouting material solidifies, remove the sealing rubber plug from the grouting hole, and check that the upper surface of the solidified grouting material in the hole should be more than 5mm above the lower edge of the grouting hole.

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### **References**

- [1] JGJ 1-2014 "Technical Specification for Prefabricated Concrete Structures".
- [2] DGJ08-2117-2012 "Code for Construction and Quality Acceptance of Assembled Monolithic Concrete Structures".
- [3] JGJ355-2015 "Technical Specification for Application of Steel Bar Grouting Sleeve Connection".
- [4] GB50204-2015 Code for Acceptance of Construction Quality of Concrete structural engineering.