# Application of Prefabricated Building Construction Technology in Construction Project Management

**Shengshang Wang**

Tongcheng City Tianzheng Holdings Group Co., Ltd.,Tongcheng, Anhui, 231400, China

**Keywords:** Prefabricated buildings; Construction project management; Component supply chain; Hoisting construction safety; Construction progress coordination

**Abstract:** This paper focuses on the core requirements of component management, safety control, quality acceptance, and progress coordination in the construction of prefabricated buildings. It studies the technological process and management application strategies of prefabricated building construction technology. The key points of the technological process are analyzed from three aspects: component prefabrication in factories, on-site hoisting, and node connections. Management strategies are discussed from four dimensions: supply chain optimization, hoisting safety, quality acceptance, and progress control. Management methods such as "full-chain collaboration" and "three-dimensional prevention and control" are proposed to solve problems such as the imbalance between component supply and demand, high hoisting risks, and difficulties in controlling node quality. The aim is to improve construction efficiency and management level, providing practical references for the construction management of prefabricated building projects.

## 1. Introduction

In the promotion of prefabricated buildings in the construction industry, it becomes more and more essential for its adaptability between construction technology and management mode. Traditional management methods cause problems such as disconnections between components supply, hoisting safety hazards, and poor quality of nodes, which affect project progress and quality. In order to utilize the characteristics of prefabricated building in terms of construction efficiency and environmental protection, it must be clear massive classification optimization concerning workways.

## 2. Technological Process of Prefabricated Building Construction Technology

### 2.1 Component Prefabrication and Quality Inspection in Factories

When technicians get the design drawings, they follow the drawing parameters to create high-precision standardized molds. For instance, the perpendicularity error between each side of wood core panel for wall panel mould should be controlled within 1 mm to guarantee mould accuracy and ensure part dies. Once the mold is fixed in position, raw materials(cement, aggregates and admixtures) are accurately weighed based upon the mix ratio. The concrete is combined into a homogeneous mixture and gradually poured into the mold using a material distributing machine. An immersion vibrator is placed at 300 mm intervals and the vibration time is adjusted to compact concrete between 20 and 30 s. Then, vibration, and after that, the part goes to be cured. In the case of steam curing, the temperature rise rate should not exceed 15 °C per hour; the constant-temperature stage should be maintained at a temperature between 50 and 55 °C for this stage: meanwhile, the cooling rate cannot exceed 10 °C per hour. The part can only be demolded after reaching at least 75% of the design strength. After demolding, the quality inspector measures the dimensions of the components with a steel ruler, and it is allowed to deviate by ±3 mm. The strength is tested with a rebound hammer, and the surface is examined for defects (honeycombs, pits, cracks). Qualified components are tagged with model number, project name and where it is going to be installed and then lifted to the holding area for shipping.

  DOI: 10.25236/icacel.2025.136

## 2.2 On-site Component Hoisting and Positioning

The floating mortar and debris on the site base layer shall be cleaned, and the positioning lines of component installation shall be marked with a chalk line (the deviation is required to be within ±2 mm) before transporting the components to the site. Once the truck crane arrives at the site, the mechanics test its performance, choose suitable lifting appliances based on component weight and shape. A double-beam lifting appliance is selected for lifting the wall panels because it provides stable lifting of large shapes. The hoisting sequence is first wall panels, then floor slabs; interior walls first and exterior walls last. The component model number and position are verified before hoisting[1]. During a wall panel to be hoisted, it is stopped at a height of 500 mm from ground level to perform lifting appliances and components status checks. If all is right, the hoisting goes on. The speed is reduced when the component is hoisted to a position of 1000 mm above the installation location Construction staff using ropes guides the component while also observing with a total station. By adjusting the shims and diagonal supports at the base of the component, elevation and perpendicularity are adjusted. The deviation of elevation is controlled within ±5 mm and the deviation of perpendicularity is controlled within 3 mm. The position deviation is measured again after temporary fixation to ensure that the no pins do not comply with specifications, which provides an important basis for subsequent connections.

## 2.3 Component Connection and Subsequent Construction

Grout sleeves are provided to connect the vertical components with the steel bars. Step 1: Remove the dirt on the sleeves and steel bars. The machine is filled with fully-blended high-power grout and injected from a bottom grouting partition of the sleeve until the upper outlet orifice overflows full of grout. The outlet hole is first closed and kept under constant pressure for 30 seconds creating a tight interface. For horizontal components connection based on welding of pre-embedded parts, the position deviation is firstly adjusted to less than 5 mm. Welding rods of the E50 type are used, and welding is performed according to the specified height and length of the weld. Check the welding quality after welding, there shall be no pores or slag inclusions. Once the connections have been concluded, waterproofing treatment is performed at the joints [2]. The horizontal joints of wall panels are filled with sealant, the depth of which shall not be less than 10 mm to ensure a tight fit. The water and electricity pipelines shall be pre-embedded, of which the position deviation of the pre-embedded pipes shall not exceed 5 mm in size. The dry-hanging process will be divided into interior wall panels and exterior wall panels through decoration, and the outer wall panel is also artificially defined in order to facilitate flatness and tighter joints. It involves internal walls placed in plasters using putty and coats painting with brushes in emulsion paint, Requirements finishing touches of floors laid your walls on tiles or wooden flooring building product so the whole make a complete building work finish.

# 3. Application Strategies of Prefabricated Building Construction Technology in Construction Project Management

## 3.1 Optimize Component Supply Chain Management

Develop a dynamic supply plan. According to the principle of "monthly refinement and weekly adjustment", the project management team shall decompose the component requirements according to the overall construction progress plan. Like, "March for main structure construction" can become more detailed like, "20 wall panels and 15 composite slabs in week 1 of March", plus the component model numbers with their local installation sites and arrival time limits. At this point, a "Component Supply Requirement Table" will established and synced into the component factory since the production rhythm of the factory must be harmonized with site construction progress. Establish an information-sharing mechanism. Use supply chain management platform to synchronously get construction nodes information in real time. The site must give factory a 3 days' notice that "the wall panel will be installed on the Third Floor next week", and the factory feedbacks on how many components are produced. The information on component requirement needs to be updated within 24 hours in case of design changes, so that the factory does not produce a mismatched product. Standardize component transportation control. For transport, special transport brackets are needed to be customized (depending on the type of items — wall panels, stairs. Wall panels are installed on vertical brackets with a spacing not greater than 1.5 m; composite slabs resting on horizontal layered brackets with foam boards of 50 mm thick between the layers [3]. Transport vehicles should have GPS positioning systems and the project team can view real-time transportation information. It is necessary to confirm the arrival time of the components 12 hours in advance, and reserve on-site unloading area and hoisting equipment. Must strictly implement a strict on-site acceptance process. Once it has been confirmed that the components are at the site, the management should verify how many and what component model number to qualify and check if there is a quality certification for each component arriving; then inspecting components should be examined on the surface integrity for damage and cracks as well as verifying dimensional deviations of surfaces in terms of compliance with specifications. The limit of the length deviation of wall panels is ±3 mm. Qualified components must be registered and stored; unqualified components shall be returned to the factory immediately, so as not to bring construction work into the construction process, resulting in construction schedule delay. A full-chain control can achieve the three goals of "no overstocking, no shortages and proactive loss on components".

### 3.2 Strengthen Hoisting Construction Safety Control

Conduct equipment checks before hoisting. Settle management around 24 hours ahead of hoisting, then execute instrument checks. Specific to the cranes should check the driving license and annual inspection report, with particular attention to urge relevant departments on hoisting mechanism (the wear of steel wire rope shall not exceed 10% of diameter), luffing mechanism (hydraulic system no leakage). When lifting appliances are selected, they should be used in conjunction with the component weight (a 5-ton wall panel needs a dedicated lifting appliance rated load not less than 8 tons). Loose bolts and pins in the connecting parts of lifting appliances, and worn-out lifting appliances must be replaced immediately. Do not put equipment with "over performance or service life" into operation. Define the safe operation area. Use hard isolation fences outside the hoisting radius (the maximum slewing radius of crane), the height should not less than 1.8 m, hang warning signs such as "Hoisting operation, No entry" on the outside of fences [4]. Spread protective steel plates of no less than 10 mm thickness on the underground pipelines and temporary works within the hoisting radius to prevent damage from falling components during hoisting. Clarify personnel responsibilities. Form a four-person operations team including: 1 "hoisting chief commander", 1 signalman, 1 rigger, and 1 safety officer. The chief commander, who should have crane operation command certificate, deals with general coordination. The signalman is to stand somewhere with a clear view and keep a visual distance of 30 m away from the crane operator. Make use of standardized hand signals such that instruction are transmitted as "stretching both arms = pick up and swing one arm down = drop". The supervision must be until the end of process, where every violations are checked in real-time. Implement a standardized hoisting process. Test hoist prior to hoisting. The component should remain 300 mm above the level of ground for 30s to test the applied stress on lifting appliances, as well as balance of component. If all is normal, the hoisting may continue. The ascent speed of the component during hoisting should be less than 0.5 m/s, and the downward speed must not exceed 0.3 m/s; no components may be suspended over other personnel. While the component is positioned, this position should be moved slowly to avoid collisions with already installed components [5]. Prepare for emergency response. The hoisting site should have a first kit with tournique and phyro fixation splint, as well as fire extinguishers (at least two 4kg dry powder fire extinguishers). Establish a hoisting accident emergency plan and carry out one hoisting accident emergency drill every month, set up typical scenario exercises such as "component tilting", "lifting appliance breakage" to ensure that operation personnel master the emergency response process, and control the whole process by implementing safeguards to avoid hoisting safety accidents.

### 3.3 Refine Node Quality Acceptance Standards

Develop a special acceptance process. Acceptance is divided into three stages for grout sleeve connection nodes: acceptance before grouting, acceptance during grouting and acceptance after grouting. The sleeves should be free of debris and oil stains, and the embedding depth of the steel bars should not be less than 95% of the design value. Keep checking the fluidity of the grout (the initial fluidity should not be < 300mm according to the specification requirements) and fullness of grouts (it must make sure that outlet hole continues to overflow full grout during grouting). Before the surface quality inspection (the outlet hole should be sealed with special sealant, and the pavement level is qualified). For welding nodes with embedded components, acceptance can be divided into two phases "before and after the weld". Check the pre-embedded parts against position deviation (not more than 5 mm) and welding rod model (such as E50-type welding rods for Q355 steel pre-embedded parts) before the weld. Check the weld size (the height must not be less than the thickness of the embedded part, and the length should not be less than twice the width of the embedded part) and weld quality (no pores, slag inclusions or incomplete penetration defects after welding). Clarify detection methods and standards. An ultrasonic tester is used to determine the fill level of the grout at a frequency not less than 2 MHz. Sound wave propagation speed is a parameter to evaluate the density of the grout which has to be not less than 4000 m/s. There is a visual check and then also penetrant testing of the weld to check that its good. A magnifier with 20x magnification is used for visual inspection, penetrant testing should be performed in accordance with specification including wiping of the cleaning agent, spray of the penetrant and developer. Mark and Document Unqualified Welds Standardize acceptance data retention [6]. At the time of acceptance, photograph the grouting phase and weld appearance; complete a Node Quality Acceptance Record Form as well as assist in documenting detection data including ultrasonic testing sound wave speed and weld size measurements. All data must be signed by both the quality inspector and the supervising engineer, along with being archived into the folder for project quality data [7]. Create a mechanism to rectify and re-inspect Formulate special rectification plans for unqualified nodes, such as insufficient grout fullness and weld slag inclusions (drilling and re-grouting for insufficient grout fullness, removing and re-welding for weld slag inclusions) Right after the nodes are rectified, they need to be re-tested in accordance with the original standards until they pass type certificates, so as to make sure that every connection node meets different quality needs and guard against security of the entire structure.

### 3.4 Promote Construction Progress Coordination and Control

Build a progress plan system. The software that the project management team uses is Project or Primavera to disassemble prefabricated construction into five main links: component prefabrication (factory), component transportation, on-site hoisting, node connection and decoration. Every link has a logical order which is marked as per the predecessor-successor relation. That is, the identification of lower layer "does not classify" + upper layer "the type of task"; For example, predecessor and successor are those with "wall panel hoisting", precursor is "component on-site acceptance", successor is "grout sleeve connection". While determining the responsible person and completion time limit for each link of key node, to make it into a visual progress Gantt chart. Conduct real-time progress monitoring [8]. The management team tracks and compares the planned progress against actual progress every day by using on-site video monitoring along with a daily progress reporting system. In case a deviation is found, the reasons should be analyzed at once. Organize coordinated meetings. "Weekly meetings and monthly summaries" are held, participants include construction teams, component factories as well as the supervising unit. You meet every week to address the problems of short-term progress, and once a month you have summary meetings in which you analyze the trend over time regarding how far behind or ahead you are. You want meeting minutes to be taken and follow-up actions tracked. Dynamically adjust the progress plan. Under force majeure such as heavy rain, or emergency events and epidemics that result in large hindrances to progress, the management team should make an adjustment plan within 48 hours, where more hoisting teams are accumulated and two-shift operations are implemented along with process sequence optimization; carry out indoor pipeline pre-embedding + wall panel hoisting at the same time [9]. Simultaneously, the advancement schedule should be modified and shared with all members so that everyone in the group can move as a unit aligned with the new plan, alongside guaranteeing conveyance of the undertaking according to the target for total form term.

## 4. Conclusion

The above research fully reflects that the theoretical system of prefabricated building construction management needs to take strategies with the characteristics of the technological process into account: component supply chain management achieves precise component supply via dynamic plans and information sharing; hoisting safety control reduces operation risk through equipment checks and area demarcation; node quality acceptance ensures reliable structural connections through special processes and detection methods; and progress coordination and control ensure completion of the construction period target by plan building and dynamic adjustment. The technological process is deeply integrated with these strategies, which can effectively provide means for standardization and efficiency of prefabricated building construction management.

## References

[1] Yang, J. Research on the key points of prefabricated building construction technology and management measures [J]. China Architectural Decoration, 2025(7): 128-130.

[2] Jiang, G. X. Research on cost management and control of steel structure construction in prefabricated buildings under the application of BIM technology [J]. China Architectural Metal Structure, 2025, 24(9): 118-120.

[3] Ping, T., & Huang, Q. L. Application of BIM technology in the design and construction management of prefabricated buildings [J]. Architecture & Decoration, 2025(13): 121-123.

[4] Meng, J. The value of intelligent construction technology in the construction management of prefabricated building projects [J]. Intelligent Building and Engineering Machinery, 2025, 7(5): 55-57.

[5] Li Lijuan. Discussion on the Application of Prefabricated Building Construction Technology in Construction Management of Building Engineering [J]. Architecture Building Materials Decoration, 2025(16): 184-186.

[6] Liu Zhenzhen, Huang Renhui. Research on the Application of Intelligent Construction Technology in Construction Management of Prefabricated Building Engineering [J]. Foshan Ceramics, 2025, 35(1): 173-175.

[7] Wang Hui, Xie Bo. Research on the Construction Safety Management Method of Prefabricated Building Projects Based on BIM Technology and Association Analysis [J]. Journal of Jiamusi University (Natural Science Edition), 2025, 43(4): 100-103+134.

[8] Lu Guocheng. Analysis of Steel Structure Construction Technology and Management Countermeasures in Prefabricated Building Engineering [J]. China Building Decoration, 2025(4): 183-185.

[9] Wang Pengfei, Pang Mingwei. Analysis of the Application of Prefabricated Building Construction Technology in Construction Management of Building Engineering [J]. Architecture and Decoration, 2025(9): 187-189.