# Study on Improving the Matching Degree of Between Site Construction and Design of Prefabricated Building

Yanfang Wang

Fuzhou University of International Studies and Trade, Fuzhou, Fujian,350202, China.

## Abstract

**With the increase of labor cost and the enhancement of related technical level, the scale of prefabricated buildings in China had been expanding under the promotion of government policies. However, there were also some realistic development problems such as a low level of market acceptance. In addition to the cost that had been still higher than the traditional cast-in-place building, the key problem to be solved was that the site construction effect could not meet the design requirements. In this paper, the precision control of assembly process, improvement of on-site detection technology and technical level of on-site construction personnel were briefly described, and some thoughts were put forward for the cultivation of prefab architecture talents in Higher vocational and technical colleges and application-oriented undergraduate colleges. It would contributed to the research on improving the matching degree of between site construction and design of prefabricated building.**

## Keywords

**Prefabricated building, Precision control, Detection technology, The cultivation of prefab architecture talents.**

## 1. Introduction

With the development of economy, society and technology, the prefabricated building in our country under the government's policy support and guide [1] there had been a significant improvement, but the market acceptance for commercial residential projects of prefabricated construction was still relatively low, the real estate enterprise development will was still insufficient. In addition to the higher cost compared with traditional buildings[2], the mismatch between the actual construction process and the design had become another significant factor, that is, the construction process on site could not meet the design requirements [3]. For example, when there was on-site reinforcement bars collide, or joint grouting and irrigation could not go down, the construction workers, due to their weak safety awareness and insufficient professional quality, directly cut the reinforcement bars during the operation, thus failing to meet the design requirements; The component factory produced dimensional errors in processing, or the dimensional accuracy control was not in place in the process of transportation and hoisting, resulting in the failure of on-site assembly to complete with normative precision; During grouting operation, it was difficult to meet the design standards, and even due to improper protection of connection casing, various situations of internal grouting holes were often blocked. It was difficult for the construction personnel to accurately judge the internal grouting situation of the grouting board through some routine operations. Therefore, how to effectively improve the match between site construction and design, that is, how to improve the site construction quality to meet the design requirements, would be the key and guarantee of the quality of prefab construction project, would become a factor restricting the development of prefab construction. This paper would analyze the precision control of prefabricated process, would improvie the technical level of field testing and the technical level of field construction personnel, and would put forward some thoughts on the training of prefabricated construction personnel in Higher vocational and technical colleges and application-oriented undergraduate colleges, It would contributed to the research on improving the matching degree of between site construction and design of prefabricated building.

## 2. Precision control of prefabricated building construction

In the field construction, the construction precision control was often not in place, leading to a lot of quality problems, such as the component size deviation, resulting in that joints were not smooth, uneven and that elevation was not correct in the wall plate joint construction process; Due to the large error in the positioning of the sleeve, the position of the steel bar and the sleeve of the member was greatly deviated, or even directly dislocated, resulting in the failure to connect the steel bar and the sleeve. In the actual operation of the site, the construction personnel generally taked two measures, one was to focus on the new drilling pipe, the other was to directly cut the steel reinforcement that could not go through, but no matter which measure, it would not be consistent with the original design. Therefore, the key and guarantee for the quality of prefabricated construction project is the control of precision, which should permeate the whole process of construction, including the processing of components, transportation of components, on-site hoisting, adjustment and fixation, and the final pouring of concrete [4].

During the processing of precast members, the dimension error of the members shall be within the allowed range stipulated, and the embedded parts and reserved holes in the members shall be precisely positioned. Before concrete pouring, the corresponding molds, supports and the steel bars and embedded parts that have been installed shall be accurate.

Members must reach the design strength before transportation. It is better to use low flat car for transportation, and equipped with the support which be with enough sufficient strength, stiffness and stability

The storage site of prefabricated components shall be hardened, and four fulcrum points shall be set on the block plate.

The precast members shall ensure the accuracy of their level, perpendicularity and plane position before being hoisted into place. During hoisting, appropriate slings, lifting tools and lifting equipment shall be selected according to the weight and lifting distance of prefabricated components. Four-point hoisting shall be adopted to ensure the balance of components during hoisting and facilitate the adjustment and control of construction. In this process, protection of vulnerable parts of components shall be strengthened.

In the process of the concrete is poured, the pouring speed should be slowed down to reduce the adverse effects of vibration and side pressure on precast components, The pouring should be carried out continuously as far as possible, each construction procedure should be closely linked as far as possible, the operation area should be reduced and concentrated as far as possible, the operation sequence should be strictly followed, and special personnel should be assigned to stand by to correct deviation in time.

In addition, in order to avoid the influence of objective factors such as light and weather and improve the precision of building assembly process, the monitoring technology of installation process could be optimized and BIM can be used for high-precision control analysis of installation process. At present, background subtraction and adjacent detection difference method[5] had been commonly used in China.

## 3. Improvement in detection technology of Prefabricated building

“Standard of prefabricated residential building detection technology" had been approval by housing in urban and rural areas development as industry standards, and had been formally implemented in June 1, 2020. The standard highlighted that the components and connections of the prefabricated residential buildings should be inspected on site in the construction stage of the project, and the problems found in the inspection should be rectified in time. The implementation of the standard basically solved the problems such as unclear testing procedures, no unified testing items, testing frequency and testing methods. It also avoided the neglect of quality testing in the construction. That would greatly improve the reliability of testing result. However, there were still some problems in the

detection system, such as the related detection technicians were not familiar with the equipment, and their operation was not standard, and their detection level was not up to the standard; The operation of relevant detection technology required a long time and a high cost, which had a great impact on the cost and construction period; The basic idea of the standard was mainly based on the idea of integral concrete, which lacked sufficient effective theory or data support in many aspects, and even could not be representative to some extent [6]. Therefore, at present, we would still need to continuously develop and innovate the related quality testing technologies, attach importance to the introduction and learning of advanced testing technologies, and make appropriate adjustments and changes according to our own conditions; Relevant units shall strengthen the systematic training of testing technicians on knowledge, skills and operation procedures of prefabricated buildings [7] or send technicians to advanced prefabricated construction units at home and abroad to learn, encourage some workers to transform and to improve their technical operation level and professional ability, so as to improve the accuracy and accuracy of testing.

## 4. Improvement of technical level of on-site construction personnel

A survey found that 79.55% of the people said that improving the cultivation of talents related to prefabricated buildings was an urgent problem to be solved in the promotion process of prefabricated buildings [3]. At present, most of the personnel engaged in the prefabricated building were transferred from the traditional cast-in-place construction team, without professional learning of the basic knowledge and technology of the assembly construction, and the existing talent training was also limited to the internal development of the enterprise. In order to truly improve the construction technology and construction quality on site, it was far from enough to rely solely on the internal training of enterprises. The most direct and sustainable method was the specialized and systematic training of the prefabricated building talents in higher vocational or applied undergraduate colleges.

Assembly-style personnel training in higher vocational colleges and application-oriented undergraduate colleges had been carried out successively [8-9]. Based on the practice of scientific and technological personnel training in Jianzhongbased on school-enterprise cooperation in 2018, the author puted forward some thoughts on assembly-style personnel training

### 4.1 Cooperation between schools and enterprises

Nowadays, there was a strange phenomenon that it was difficult for graduates to find jobs and enterprises to recruit workers. The main reason lied in that the new students could not immediately produce benefits for enterprises, and some enterprises lacked mature talent training mechanism, "enterprises only use people, not cultivate people". Cooperation between schools and enterprises was one of the effective ways to solve this dilemma. The Jianzhong class of my college was the cooperation between the school and the enterprise under the Order Mode. His successful practice could also provide some reference and inspiration for the cultivation of prefabricated building talents. From the perspective of the whole life cycle of prefab buildings, the talent demand was mainly in the design stage, PC component production stage, site installation and construction stage, and late operation and management stage, and the emphasis of talent cultivation was different in different stages. According to their own demand and demand direction, enterprises would place orders to schools, and sign school-enterprise cooperation agreements with schools. Schools would make corresponding talent training plans according to the orders and agreements, and students would sign employment agreements with enterprises after graduation according to the orders. This kind of oriented training mode could make students and enterprises achieve a win-win goal and is conducive to the sustainable development of school-enterprise cooperation. Of course, directional training was also a two-way selection process, which was easy to generate interest disputes. Therefore, relevant departments would need to improve relevant laws and regulations to ensure the legitimate rights and interests of both parties

### 4.2 Construction of curriculum system

Schools, enterprises and society should work together as soon as possible to formulate the professional standards for each post. Schools should formulate the talent training plan for the corresponding post according to the standards, and built the curriculum system and selected the curriculum content. First of all,the curriculum system could be reconstructed under the original curriculum system of civil engineering major, the core theoretical courses such as introduction to prefabricated building, in-depth design of prefabricated building structure, production and management of prefabricated components, construction and organization of prefabricated building, information management of engineering projects (BIM) ,Geometric Description Language and so on were established, Secondly ,replaced the courses of steel structure and budget estimate with the courses of fabricated steel structure and budget estimate of prefabricated building ,Finally,practical courses such as production training of prefabricated building components, prefabricated concrete structure technology and in-depth design training of prefabricated building were added.It was worth noting that BIM technology was favored by the assembly construction industry for its visualization, coordination and information completeness, which fully demonstrates its great practical value in the stages of design, component production, assembly construction and later operation and maintenance management, for example, using BIM technology to check the reinforcement in advance and adjust and optimize the layout design of the reinforcement according to the corresponding suggestions could effectively solved the problem of reinforcement collision on site.

### 4.3 Construction of training base

The construction of training base and the establishment of training courses were the guarantee of the training of technical talents.After the theoretical knowledge teaching, a lot of practical skills training was needed. However, the new practical training equipment was relatively fast and expensive, which was difficult for the general application-oriented universities to bear.Based on the above situation, on the one hand, the school could used the experience of cooperative enterprises to build a training base, and teachers could also lead students to enter the construction site for cognition practice and replacement post practice to complete practical teaching,on the other hand,the school can also use VR laboratory to establish a training room that conforms to the simulation training of prefabricated buildings, through the experiments in the school and the practice outside the school, the multi-level practice teaching could be formed, at the same time, the close combination of theory and practice could be achieved.

## 5. Conclusions

With the active promotion of the government, the market scale of prefabricated buildings in China had expanded rapidly, but it still faced many development obstacles. How to effectively improve the on-site construction technology, so that the construction effect and design match, to meet the design requirements, was to improved the market acceptance of prefabricated buildings and promoted the healthy development of prefabricated buildings was an important part.

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