

Analysis on Hidden Dangers and Countermeasures of Safety Management in Prefabricated Building Construction

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Abstract

With the implementation of the concept of sustainable development, there is an urgent need for active transformation and change in the construction industry, and the emergence of prefabricated buildings has become the key to transformation and upgrading. With its own advantages, prefabricated buildings are favored by the public and widely promoted and applied. However, compared with traditional construction methods, the construction technology of prefabricated buildings is more complicated, Safety management is more important. This paper analyzes the importance of safety management of prefabricated buildings, evaluates the hidden dangers of safety management at this stage, and puts forward corresponding countermeasures on this basis. The purpose is to further improve the safety management level of prefabricated buildings and reduce the probability of safety accidents.

Keywords

Prefabricated Buildings; Construction; Safety Management.

1. Foreword

As a new construction mode, prefabricated buildings have attracted wide attention of the whole society. Prefabricated buildings can not only save construction materials, reduce unnecessary waste of resources, but also cause little environmental pollution. Based on the above advantages, with the strong support of the government, the development of prefabricated buildings has achieved certain results. But, The development of prefabricated buildings in China is still in the initial stage, the management system is not perfect, and there are big defects in safety management, which restrict the development of prefabricated buildings. Therefore, it is necessary to deeply analyze the main hazard sources existing in the construction and take certain measures to control the safety accidents in the bud. To ensure the smooth progress of prefabricated building construction.

2. The Importance of Safety Management in Assembled Building Construction

As an important part of building construction management, safety management plays an important role in guaranteeing the construction quality and safety of prefabricated buildings. Prefabricated building is to transport the prefabricated components of the factory to the construction site, and then splice the components to complete the construction of the building. Although this construction method greatly reduces the amount of on-site construction work, it increases the construction difficulty. It brings great challenges to safety management. The special construction technology and complex construction environment of prefabricated buildings determine the diversity and complexity of potential safety hazards in the construction process, which leads to the continuous renovation of

safety accident modes. The occurrence of safety problems not only affects the overall quality of prefabricated building construction, but also seriously threatens the safety of people's lives and property, causing huge economic losses. Bring extremely bad social impact.

3. Hidden Troubles in Safety Management of Prefabricated Building Construction

3.1 Hidden Troubles in Transportation, Storage and Hoisting of Prefabricated Components

Prefabricated components are the core building materials of prefabricated buildings, which have great influence on the construction quality of buildings. Due to the variety, quantity, volume and weight of prefabricated components in prefabricated buildings, there are great risks in the transportation, storage and hoisting of components. During the transportation of components, the following problems often occur: First, the order of component shipment is chaotic, resulting in repeated loading and unloading; Second, there is no clear transportation route in advance, poor road conditions and inadequate anti-collision measures, resulting in component damage[1]. During the storage of components, the ground in the storage area of prefabricated components was not flat in classification code, which caused the components to overturn and be damaged. At the same time, if the storage area layout is unreasonable and closed management is not implemented, Irrelevant personnel mistakenly intrude into the component storage area, which brings potential safety hazards. In the process of component hoisting, in order to facilitate the construction, two-point hoisting method is often used for component hoisting, while designers generally consider three-point hoisting method, which leads to the fact that the actual stress of a single point becomes larger than the design value, and the uneven stress causes component damage[2]. In addition, If the embedded lifting ring is unqualified, the concrete strength is not enough, and the lifting point position is unreasonable, the connection part will fail, resulting in unhooking, falling from a high altitude, and threatening the life safety of ground equipment, materials and personnel.

3.2 Mechanical Hidden Trouble

In the prefabricated building construction, there are many aerial work and hoisting work, which need a variety of mechanical equipment to cooperate with the construction. Commonly used mechanical equipment includes tower cranes, material hoists, etc. Scientific and rational use can greatly improve the construction efficiency. As tower cranes are widely used and have many hidden dangers, this paper takes tower cranes as an example for analysis. The selection of cranes is very important, If the hoisting capacity is not calculated based on the construction experience alone, the maximum lifting capacity and the maximum rated lifting capacity may not meet the actual construction requirements. There are also some problems in the position layout of cranes. Many cranes work at the same time in the construction site, and the crossing of the slewing ranges of the booms is easy to cause collision accidents between booms. When hoisting components, When the crane is overloaded for a long time, it is easy to break down, and there may be the risk of arm breaking or even collapse. At the same time, the precision of component hoisting is required to be controlled in millimeter level, while cranes mostly adopt inching type to control amplitude, and the inertia reaction of crane starting and stopping is large, which threatens the life safety of construction workers[3]. When the building construction exceeds a certain height, in order to prevent the tower crane from losing stability, It is necessary to install the wall attachment device on the crane. If the arrangement is unreasonable and the attachment is not firm, it will damage the building structure and cause safety accidents.

3.3 Cross-operation Hidden Trouble

Compared with the traditional construction work, the prefabricated building construction needs more cross-work, that is, multiple units, multiple types of work and multiple jobs are carried out in the same area at the same time. Although crossover operation can improve the construction efficiency and shorten the construction period, it puts forward high requirements for construction and is prone to safety problems. During crossover operation, there are many on-site constructors, It may belong to

different subcontractors, and the work docking of each subcontractor is not in place, and the information communication is incomplete, which increases the difficulty of safety management to a certain extent. When formwork support, wall building, decoration and upper and lower interchange operations are carried out, simultaneous operations in the same vertical direction are not allowed. When the lower layer is carrying out construction operations, According to the height of the upper layer, the possible falling range of components should be determined, and the construction position of the lower layer should be outside the falling radius to avoid falling objects[4]. If the above conditions cannot be met, it is necessary to set a safety protection layer in the middle to ensure the safety of construction personnel. In addition, before the crossover operation, the construction area should be completely closed. Set up safety signs or warning lines at a certain distance outside the construction area to ensure smooth construction and prevent accidents.

4. Countermeasures for Safety Management of Prefabricated Building Construction

4.1 Strengthen the Construction Site Management.

In the prefabricated building construction, due to the complex construction site environment, frequent personnel and equipment entering and leaving, and many cross-operations, it is necessary to deal with a variety of risk factors in the management to ensure the orderly progress of the construction. In terms of transportation management, the transportation route of components should be planned in advance in combination with the road conditions during the transportation period. In terms of storage management, reasonably plan the storage area of components and shorten the transportation distance of components as much as possible. The storage area should be hardened to meet the requirements of flatness and bearing capacity. On-site components shall be placed in classification code according to the hoisting sequence and category, so as to facilitate the management and hoisting of components. For hoisting management, disclosure shall be made by layers and components before hoisting. Ensure that the disclosure task is completed before construction. During hoisting, focus on inspection of lifting points, and operate in strict accordance with lifting requirements. In terms of machinery, the size, weight, lifting height and other factors should be comprehensively considered in the selection of cranes. Before formal hoisting, try hoisting, check the stress of each part, and then formally hoist after troubleshooting. At the same time, It is also necessary to regularly check and maintain mechanical equipment to ensure the normal operation of the equipment. In the layout of special group towers, it is necessary to consider the safe distance between adjacent cranes and try to avoid the intersection of slewing ranges. During crossover operation, the general contractor shall strengthen the management of subcontracting, implement safety measures related to crossover operation, and keep the crossover passage unblocked.

4.2 Improve the Safety Awareness of Construction Personnel.

As an important part of the whole construction process, construction personnel's comprehensive quality and technical level will directly affect the engineering quality of prefabricated buildings. From the actual construction personnel composition, most of the on-site construction personnel are migrant workers, which are prone to safety problems due to their generally low quality, thin awareness of safety in production and irregular operation of mechanical equipment. So, It is essential to improve personal safety awareness. Firstly, strengthen the professional skills training of construction personnel, analyze the important and difficult problems in construction operation combined with the concrete example of prefabricated building, and give effective solutions, so as to standardize the operation of construction personnel and better guide workers in construction. Second, regularly conduct multi-level safety education and training for construction personnel, Assess the construction personnel by stages, root the concept of "safety first, prevention first" in the heart, and improve the safety protection awareness of the construction personnel. At the same time, a reward and punishment mechanism should be set up, and the responsibility should be assigned to people, so as to fully arouse the enthusiasm of construction personnel and increase the importance attached to safety production.

4.3 Establish BIM Collaborative Supervision Platform

Aiming at the safety risks existing in the construction of prefabricated buildings, this paper explores a new safety management mode of applying BIM technology to the construction of prefabricated buildings. That is, BIM building information model, which has four advantages: visualization, simulation, optimization and coordination, can help to complete construction site planning, construction scheme optimization, hazard identification and analysis, safety education and training, etc. So as to realize the intelligent management of prefabricated buildings. Using BIM technology to establish a three-dimensional visual model can simulate the real construction site, help to arrange the construction site scientifically and reasonably, and avoid the collision and conflict in location. Combined with the construction schedule, a four-dimensional model is established to dynamically simulate the construction process, and through collision detection, potential safety hazards in construction can be found in time. It is convenient to further optimize the construction scheme. Combined with the construction safety rules, the hazard sources are identified and analyzed, classified and marked according to the danger level, and the safety analysis report is output, which is convenient for managers to scientifically formulate construction safety solutions[5]. Integrating BIM and sensors in construction can achieve real-time dynamic monitoring of the construction process. BIM can also help visual training, simulate safety accident scenes in the form of animation, and deepen the concept of safe operation of construction workers.

5. Tag

In recent years, the process of China's construction industrialization has gradually accelerated, and prefabricated buildings will become the inevitable trend of the development of the construction industry. To promote the sustainable development of prefabricated buildings, the key is to solve the problems of construction safety management. Aiming at the hidden dangers in the safety management of prefabricated buildings, effective preventive measures are taken to minimize the probability of safety accidents. While ensuring the life safety of construction workers, it can ensure the construction quality, improve the construction efficiency and promote the high-quality development of prefabricated buildings.references.

References

- [1] Liu Jincheng, Chen Qingfeng, Zhao Quanwei. Research on key measures of safety management of prefabricated buildings [J]. Project Management Technology, 2020,18(04):130-134.
- [2] Zhang Dongliang. Quality and safety control strategy of prefabricated building supervision under BIM technology [J]. Jushe, 2021(15):157-158.
- [3] Li Guowei, Xu Feng, Zou Xiaofeng. Research on the management of five unsafe factors in prefabricated building construction [J]. Building Safety, 2019,34(09):45-48.
- [4] Li Yadan, Zhao Jinhui. Exploration on safety management of prefabricated building construction [J]. Jushe, 2021(33):127-129+132.
- [5] Duan Wanguo, Liu Kai, Gong Liming, Yue Guangxin. Application research of safety management of prefabricated buildings based on BIM [J]. Intelligent Building and Smart City, 2021 (09): 52-53. doi: 10.13655/j.cnki.ibci.2021.09.018.