How does intelligent construction promote the development of prefabricated buildings

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Abstract: With the continuous introduction of strong support for the development of assembly building guidelines and related policies, assembly building has become an important trend of China's construction industry development and innovation, it should not only pay attention to engineering quality and work efficiency, but also pursue to reduce artificial dependence, and achieve the goals and effects of energy saving and emission reduction. However, there is no good synergy between the traditional construction mode and the assembly-type building system, which requires the introduction of intelligent construction methods and technologies, in order to further improve the level of assembly-type buildings, and promote its long-term development.

Key words: Intelligent construction; Prefabricated building; Development

Prefabricated construction refers to the mode of replacing the on-site operation in traditional construction engineering with factory processing, and the components needed for construction are made in advance by the factory, and then the construction task is completed by on-site assembly. The building mode has higher requirements for design drawings, component sizes, connection methods, etc., so it is divided into structural system, decoration system, peripheral protection system, equipment pipeline system and other parts. Obviously, the prefabricated building mode and the traditional building construction mode has a big difference, it not only needs the design, production, construction and management of multi-party staff and departments of cooperation, but also has higher requirements for each step of the handover and management. With the deepening integration and development of information technology and construction industry, intelligent construction has become an important condition to further promote the upgrading and transformation of the construction industry, and has also opened up new ways and channels for the development of prefabricated buildings, especially after reducing manual dependence and improving the level of intelligence, it can significantly improve the safety, cost performance and reliability of prefabricated buildings.

I. The development status of prefabricated buildings

With the continuous introduction of the Chinese government to promote the development of prefabricated building policies, China's construction enterprises are mostly in the transformation to the prefabricated building model, but in the transition period also generated more problems. First, there is a coordination problem between the designer and the construction side, resulting in the parts produced by the factory can not be coordinated connection, or more matching problems occur in the connection installation process. Second, the development of prefabricated buildings in our country is relatively short, the number of related industrial work is obviously insufficient, and the talent demand gap is large. Third, because a perfect industrial system has not yet been formed, the cost of most enterprises in the application of prefabricated building mode is higher.

Although the development of prefabricated buildings faces many problems, the number of prefabricated buildings in our country is increasing year by year. Especially in the development process of intelligent construction, information technology and intelligent technology further solve the practical problems in the production practice of the prefabricated building mode, which not only provides a convenient cooperative relationship for design and construction, but also effectively reduces the production cost through the intelligent factory and the assembly line production mode of building accessories, thus making the prefabricated building obtain a better development space.

II. Intelligent construction provides support for the development of prefabricated buildings

Intelligent construction provides important technical support for the development of prefabricated buildings, especially under the support of intelligent systems such as BIM system, intelligent equipment collaborative management system and intelligent warehouse management system, prefabricated building projects can not only optimize the life cycle of design, production, construction and management by means of information integration, but also further achieve the goal of "two increases and two decreases".

1. BIM collaborative platform system

Different from the traditional building mode, the prefabricated building mode needs to do a lot of basic work in the front link. BIM collaborative platform system can provide a visualization and data window for the prefabricated building work flow, so that designers, construction personnel and management personnel can understand the building process, model and effect in advance, thus providing an integrated service system for the design, construction and management of construction projects. Therefore, by building the BIM collaborative platform system, related problems of work cooperation can be solved for prefabricated buildings.

Specifically, the construction and application process of BIM collaborative platform system is divided into four steps. First of all, in the design stage, designers in architecture, structure, water, heating and electricity and other fields participate in the design, and rely on BIM technology for collision detection and omission analysis, to solve the possible problems in professional intersection, space height,

design depth and other aspects, and then provide design drawings for the subsequent construction links. Secondly, in the component production process, the visualization function of BIM system can be used to design integrated three-dimensional models of reinforcement, electromechanical pipelines, reservation and embeddedness, etc., and then through the docking of model integration data and component production data, repetitive design can be avoided, and the data can be guaranteed accurate and complete. Then, in the construction link, the virtual construction technology of BIM system can be given priority to simulate construction and practical demonstration, so as to avoid the problems that may exist in the production and assembly link, and at the same time, it can identify the dangerous sources of construction, so as to realize the optimization and improvement of the construction process and establish a safe and civilized construction plan. Finally, in terms of management work, BIM system can be relied on for the whole process of simulation, so as to provide managers with the necessary decision-making assistance, and reasonable application and configuration of manpower, materials, machinery and equipment. In terms of schedule control, the simulation process and the required equipment and materials can be predicted in advance to ensure that the construction task is completed within the construction period. In terms of cost control, it can also simulate and calculate the total cost required for the whole process of production and construction, and choose the appropriate materials and equipment according to the guidance of the big data system. On this basis, the participating parties can also interact and communicate through the BIM collaborative platform system, and set different use rights for different sectors according to the responsibilities and tasks of different participants, so as to achieve the effect of information circulation and sharing, which plays an important role in improving the efficiency and quality of prefabricated buildings.

2. Intelligent equipment collaborative management system

Prefabricated buildings have high requirements for engineering quality and construction accuracy, and the traditional artificial construction mode is difficult to meet its needs, so intelligent equipment instead of artificial on-site construction has become an inevitable trend of the development of prefabricated buildings. In the context of intelligent construction, the intelligent equipment collaborative management system has become an important technology to support the intelligent construction of the site. It can control the intelligent equipment, and reasonably allocate tasks and scheduling, so as to achieve efficient, scientific and reasonable collaborative work effect, and at the same time, it can control the working position, working status, task data, work log and other information content of the intelligent equipment in real time. Thus, the construction links and processes can be better controlled.

The current intelligent equipment used in prefabricated buildings can be classified according to the construction needs, and then provide different equipment functions for different systems such as main structure construction, enclosure, decoration, equipment pipelines and so on. For example, in the construction process of the main structure, the intelligent building platform, intelligent cloth machine, ground levelling machine and other equipment can be mainly used. In the construction of the enclosure system, intelligent wall mounting machine and masonry machine can be used. In the decoration link, you can use putty coating machine, decorative panel installation machine, tile laying machine, top paint spraying machine and so on. In the pipeline system installation link, you can use the pipeline installation machine and other supporting equipment, including communication equipment, positioning equipment and transportation equipment. With the support of these equipment, prefabricated buildings can significantly reduce the dependence on labor, and at the same time effectively improve the construction quality and efficiency. In addition, in the overall construction project of prefabricated buildings, the intelligent equipment collaborative management system can also establish a connection with the BIM collaborative platform system, so that through the flow of information and data between each other, to ensure that the construction process is implemented in accordance with the corresponding construction plan, and through the real-time update of data, to form a reliable supervision effect.

3. Intelligent warehouse management system

Because the prefabricated building will be a large number of construction links placed in the factory, so in the component production of all kinds of materials management has higher requirements, material storage management defects, will inevitably affect the speed of component construction, and then affect the construction progress. In the perspective of intelligent construction, intelligent storage management system provides important support for material warehouse management. The system can be connected with the BIM collaborative platform system and the intelligent equipment collaborative management system. On the one hand, the material data can be retrieved from the BIM platform, so as to complete the material statistics in advance and urge the purchasing department to complete the material preparation in advance. On the other hand, according to the task planning of the intelligent equipment collaborative management system, the consumption speed of various materials can be estimated, so as to rationally dispatch the material transportation link and realize the effect of automatic handling, full chain coordination and whole process monitoring. Therefore, the intelligent warehouse management system solves the problem of material reserve in the process of prefabricated building construction, realizes the management effect of accurate procurement and on-demand provision, reduces the cost and also realizes energy saving and emission reduction.

III. The development of prefabricated building products under the background of intelligent construction

1. Mould-free laminated shear wall residential products

In the prefabricated building mode, the shear wall and the superimposed wall often adopt the hybrid construction method of "cast-in-place + prefabrication", which is not only inefficient in construction, but also unable to remove the plastering link, and the external wall can not achieve the full assembly effect. In the development process of intelligent construction, mould-free superposed shear wall products have become an important measure to solve the above problems. It can not only realize the goal of full assembly of external wall and internal wall, but also realize the upgrade and innovation in process technology. The technology mainly adopts the scheme of "cast-in-

place core tube + double leather wall + fully prefabricated enclosure wall", in which the prefabricated components include superimposed beams, superimposed panels, superimposed balconies, retaining walls, double leather walls and so on. At the same time, with the support of the structure, the integrated design of the structure, water supply and drainage, electrical and HVAC systems has been realized, and the synergistic and standardized effect of the pipeline system has been realized.

2. Prefabricated school products

The construction of schools not only has higher safety requirements, but also has unique needs for building function, form and structure. Under the vision of intelligent construction, prefabricated buildings can complete the construction and service of school products with the help of intelligent construction system. The prefabricated school mainly uses efficient and dry connection frame to establish the main skeleton, while a large number of high-performance external walls and superimposed sound insulation floor, in order to create a healthy and comfortable learning environment for students, forming a high quality, cost-effective standardized school products.

This product has the advantage that the traditional building model cannot match. First, the prefabricated school products provide students with more abundant activity space, more flexible layout and more convenient construction links. Second, it mainly adopts the beam-column connection dry operation mode, and the construction speed is fast and convenient. Third, the beam and column specifications are set uniformly, the mold can be reused many times, and the construction cost is significantly reduced. Fourth, adopt the whole bolt connection and controllable plastic hinge scheme, each component can be directly replaced after damage, and improve the seismic ability. In addition, the bolt-welded rigid joint is adopted, which improves the convenience of processing and installation, and has better wind resistance.

3. Skyscraper factory

With the shortage of urban land, skyscraper factories have become an important product for the construction and development of industrial parks. This kind of building requires large space, high load, strong safety and low cost, while the traditional building mode obviously can not meet its requirements. In the context of intelligent construction, the prefabricated building mode can generate such products. Through the design of fully prefabricated components, it can not only effectively save the construction period, but also reduce the amount of labor, water and electricity consumption and waste generation. At the same time, it can also meet the production site demand of skyscraper factories, which is expected to be widely used and promoted in the future.

4. Integrated module

In the development process of intelligent construction, prefabricated buildings are also constantly developing towards integration and modularity. At present, it can produce building modules with different functions such as human settlements, facilities, public construction, and special needs, which has become an important trend of the future development of prefabricated buildings, and also provides ideas for people to achieve customized housing and building goals.

IV. Conclusion

In summary, under the background of intelligent construction, prefabricated buildings have obtained good development opportunities, especially the support of digital technology and intelligent manufacturing industrial building products, which provides a key path for the realization of intelligent construction of prefabricated buildings. The way of assembling components or integrated modules of prefabricated buildings not only reduces manual dependence, but also improves construction efficiency, quality and precision, which has become an important form and trend of the development of industrial buildings. Therefore, in the future society, houses, schools, factories and other buildings with a high degree of standardization can achieve construction goals through prefabricated buildings, and then form a standardized building industry system to realize the integration and development of building industrial chain and information technology.

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