Research on The Way of Prefabricated Building Information Sharing Based on Computer Software BIM

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Abstract. With the rapid development of construction industry, prefabricated building (hereinafter referred to as PB) has gradually become the future development direction. With the wide application of BIM Technology, BIM will become the future application software of PB. Through BIM, we can closely link the whole process chain from the design stage to the completion and operation of PBs, which can effectively improve the design, construction level and economic benefits of construction projects. In China, the modern construction industry actively promotes "green building, energy conservation and emission reduction". BIM Technology also plays a very important role in promoting the transformation and development of the construction industry. Through BIM Technology, we can effectively coordinate the communication problems such as architectural scheme design and scheme change among various units, which will reduce the conflicts in design, structure and electromechanical aspects of PBs. Therefore, BIM based PB Information sharing (hereinafter referred to as IS) is of great significance.

Keywords: Bim Technology, Prefabricated Building, Information Sharing

1. Introduction
PB structure has the advantages of high construction efficiency, short construction period, energy conservation and environmental protection, which will become the development trend of China's construction industry. China's PB system has been out of service for more than 30 years, which makes the design and construction experience and construction technology relatively backward[1]. Prefabricated construction project is a kind of integration of the whole industry chain of construction industry, which contains chain like production process. In the whole life cycle of PB, there are many participants in each stage, and the information produced is various and large in quantity[2]. Therefore, in the traditional construction project, the IS in the process of project management is always the most difficult, which hinders the improvement of the level and efficiency of prefabricated construction project management. At present, people begin to realize that in order to improve the management level of the whole construction industry, advanced information management technology and methods must be adopted[3]. Therefore, the IS approach of PB based on BIM Technology has become an important development trend in China.
2. Classification of PBs

2.1. Classification according to the characteristics of component materials
According to the different physical characteristics of basic materials, buildings can be classified into heavy and light materials. Concrete is a typical heavy material, which is used together with other materials to make composite materials. For PBs, walls and maintenance materials need to be combined in the factory in advance, and then the load-bearing units are assembled by components at the construction site. For heavy PBs, the connection structure construction is complex, which will affect the transportation efficiency of components\(^4\). The types of lightweight PB materials include wood structure, membrane structure, glass fiber reinforced plastic structure, glued bamboo structure, etc. Light material is light in weight, which does not require more processing. Therefore, lightweight materials are more likely to be used as fabricated building materials. Steel structure is usually used for large-scale building structural materials, and other lightweight materials are generally used for small buildings, such as membrane structure, tension membrane, frame membrane and inflatable membrane\(^5\).

2.2. Classification according to the mechanical characteristics of components
According to the different mechanical characteristics, PBs can be divided into wall bearing system, frame bearing system and frame wall bearing system. According to the different building scale, we can choose different bearing system. For components, the connection method is mainly concrete pouring, which requires binding reinforcement after connection and pouring on site. Modular integration is a unique type of PB. The building is made up of modular blocks. The structural system of each unit in the stack is very reasonable, and the strength of monomer and overall connection meet the requirements. In the process of on-site construction, we need to stack the units first. Then, through the preset connection mode, we can connect many pipelines embedded in each unit\(^6\).

3. The development stage of digital engineering in construction industry
BIM Technology originated in Europe and America. In the promotion stage, BIM development is mainly reflected in some countries in Asia. Hong Kong has reached a certain level of proficiency in BIM Technology and established BIM society in 2009. The development stage of digital engineering in construction industry is shown in Figure 1.

![Figure 1. The development stage of digital engineering in construction industry.](image)

4. Analysis on the necessity of BIM application in PB management mode

4.1. Realize highly organized engineering
Based on BIM management mode, we can take the general contractor as the project leader. The general contractor is responsible for formulating the overall construction objectives of the project according to the construction requirements proposed by the owner, which will comprehensively
coordinate the design unit, production unit and construction unit. Based on BIM information platform, the general contractor can understand all 3D building information, which will manage the PB as a whole. The sub-contractor of the project shall formulate the sub-objectives of the project according to the overall objectives of the project proposed by the general contractor. Each specialized technology according to the division goal of each unit. We can achieve a high degree of organization by dividing the sub-objectives into different levels.

4.2. Realize systematic management
Under the BIM based PB mode, the general contractor is responsible for the design, procurement, construction, safety, production and other aspects of the construction project. The general contractor needs to make overall arrangements for all stages of the work, which needs to put forward the overall construction plan and supervise the implementation. In the architectural design stage, BIM greatly facilitates the design of collision check and communication coordination. At the same time, the 3D visualization model can quickly find and correct the design errors of the building. Based on 3D model, BIM can be used for digital virtual construction. By simulating the construction process, BIM can simulate the route of transport vehicles on site. In the production stage and the operation and maintenance stage of PBs, we need the support of Internet of things and RFID technology, which will promote the rapid upgrading and transformation of PBs. The general contractor's work is more inclined to overall management and planning, which will put forward requirements for the work of each Subcontractor from the overall goal. By promoting the achievement of requirements, the general contractor can truly realize systematic management.

4.3. Reduce costs and shorten construction period
Cost is the key point of project management. Based on the digital PB management mode, the general contractor can reasonably allocate the project resources from the overall goal of the project, which can avoid the cost waste caused by different interest demands of the participants in the previous phased management process. The new PB management mode adopts the industrialized mode of production and construction, which will focus on R & D, centralized production and overall consideration of industrial development. Therefore, the industrialized production mode of prefabricated components will be conducive to the market development, which will further reduce the production cost of components. As the centralized production enterprises become more and more perfect and bear, the market price of components will become more and more transparent, which will be conducive to investment budget and accurate accounting of project cost. The general contracting company and component manufacturers can establish a long-term cooperative relationship, which will be more conducive to cost reduction.

5. IS process of BIM
5.1. Establishment of BIM IS
The traditional PB information exchange is point-to-point, which is inefficient and prone to errors. Through BIM, we can change the one-to-one information exchange mode of data, as shown in Figure 2. In the whole life cycle of the project, BIM must provide different software for different positions of the participants in the construction project. If there are n posts, BIM needs to implement each task software and add a variety of management software to N, which will provide the required information and data for all participants in the construction project. According to the different tasks of the project, different information exchange standards are formulated, which can guide the construction site for the project participants.
5.2. Analysis of plan information transfer process

For PB components, the flow chart of hoisting plan information transmission is shown in Figure 3.

Figure 3. Process flow of plan information transmission.

5.3. Manufacturing information transfer process

When the construction unit determines the component size problem, if the design unit or the component production unit makes mistakes, we can upload the problem to the P-BIM database. If the drawing is wrong, the relevant units can modify the drawing. Through the P-BIM database, we can transfer it to the construction unit and the component production unit, which will make the component again. After receiving the problem, the component manufacturer will make the component again. At the same time, the component manufacturing unit can transfer the problem handling report to the construction unit through P-BIM database. The flow chart of manufacturing information transfer process is shown in Figure 4.
Figure 4. Manufacturing information transfer process.

6. Conclusion

BIM is the mainstream idea in the construction industry, which can integrate all the information in the whole life cycle of PBs. Therefore, we must strengthen the timely and effective sharing of PB information, which will better complete the construction period. Therefore, China must promote the development of PB project information management, which is an effective way to achieve high-quality development of PB. At the same time, the development of information management is also the only way for the industrialization transformation of China's construction industry.

References

[1] Lai Huahui. BIM data sharing and exchange based on IFC Standard [J]. Journal of civil engineering, 2018, 51 (04): 121-128.
[2] Liu Jia. Research on quality traceability system of prefabricated building based on Internet of things technology [J]. Housing industry, 2016 (10): 41-47.
[3] Liu Zhansheng. Information solution for prefabricated building construction process based on low power wide area Internet of things [J]. Construction technology, 2018, 47 (16): 117-122.
[4] Qiu Fen. Simulation study on information acquisition of prefabricated building quality inspection [J]. Computer simulation, 2018, 35 (09): 431-434.
[5] Zhang Dehai. How to realize efficient collaborative design of architecture under BIM environment [J]. Civil engineering information technology, 2013, 5 (06): 43-47.
[6] Zhang Nan. Development and application of engineering quality and safety information acquisition system based on mobile terminal [J]. Construction technology, 2016, 45 (18): 29-32.