

Research on Engineering Lean Management based on Building Information Modeling

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Abstract: With the emergence of Building Information Modeling (BIM) technology, all the participants in the engineering construction industry can collaborate and communicate around the BIM data platform, and put forward their own suggestions for the final completion of the whole project. Whether the enterprise or the individual user who can really skilled use of BIM can achieve better results and improve work efficiency, but also improve the competitiveness and profitability of enterprises. Based on the author's learning and practical experience, this paper first analyzed the concept of BIM technology and its technical characteristics, then discussed the problems of lean management in the implementation of construction projects, and finally put forward the value of lean based on BIM technology in lean construction.

1. Introduction

BIM is a digital representation of the physical and functional features of a construction project. It is also a shared knowledge resource, a sharing of information about the facility, and a process of providing a reliable basis for all decisions made throughout the life cycle of the facility from concept to demolition. At different stages of the project, different stakeholders insert, extract, update and modify information in the BIM to support and reflect their respective responsibilities for collaborative operations. The integration effect of BIM provides the possibility for engineering to realize lean management, and is widely used in the three aspects of cost lean management, schedule lean management and quality lean management. Domestic and foreign research on this area has gradually become a hot topic.

2. The Concept and Characteristics of BIM Technology

2.1 The concept of BIM Technology

The basic idea of BIM technology is to use computer visualization technology to realize virtual modeling, simulation operation and visualization of building information. The technology can realize the status of each stage in the project life cycle through virtual modeling, and realize the management and control of the possible problems in different stages through the application of modern computer data processing technology, to achieve the goal of full-directional control for the building system. BIM technology is often understood as a kind of software. In fact, BIM technology represents the idea of architectural information management. As the most advanced building model information processing technology, BIM technology is integrated by computer processing a large amount of data information, and finally achieves the goal of controlling the overall management of construction project.

2.2 Characteristics of BIM Integration effect

(1) Visualization and parameterization: BIM can simulate the architectural model and display it in the form of 3D modeling in the aspect of visualization, so it can realize the effect of 3D view in every stage in the life cycle of the construction project. Generally, BIM 3D models are widely used in all stages of the building life cycle. It can clearly reflect the progress and implementation of the project, at the same time, it can find the shortcomings in time. BIM parameterized design makes the

simulation software more convenient. The control and transformation of the model can be accomplished by various control parameters without writing complex programs. (2) Integrated operation: BIM technology can accomplish the coordination between different specialties in the process of building construction. In terms of traditional architectural design, HVAC, electrical, architectural, structural and other majors use CAD graphic drawing to complete their work content, and communicate with each other through verbal communication to express the progress and plan, which is easy to miss. BIM technology can be used to map 3D effects of different specialties, so that they can understand each other's progress. At the same time, it is responsible for part of the progress and planning which can be reasonably deployed, eventually making the professional design more convenient, more time-saving. In addition, BIM can show the design problems in time, so that all the professional designers can make timely rectification, avoid the design changes in the later construction process, and save the precious cost and time for the whole construction stage. The structure of the BIM team building model for a company in the actual project is shown in figure 1. (3) Construction phases of data management: As a new technology of information processing of current building model, BIM can efficiently aggregate the information of each stage of construction and display it in the management window in the form of data model. In order for the management to deal with the problem in a timely manner.

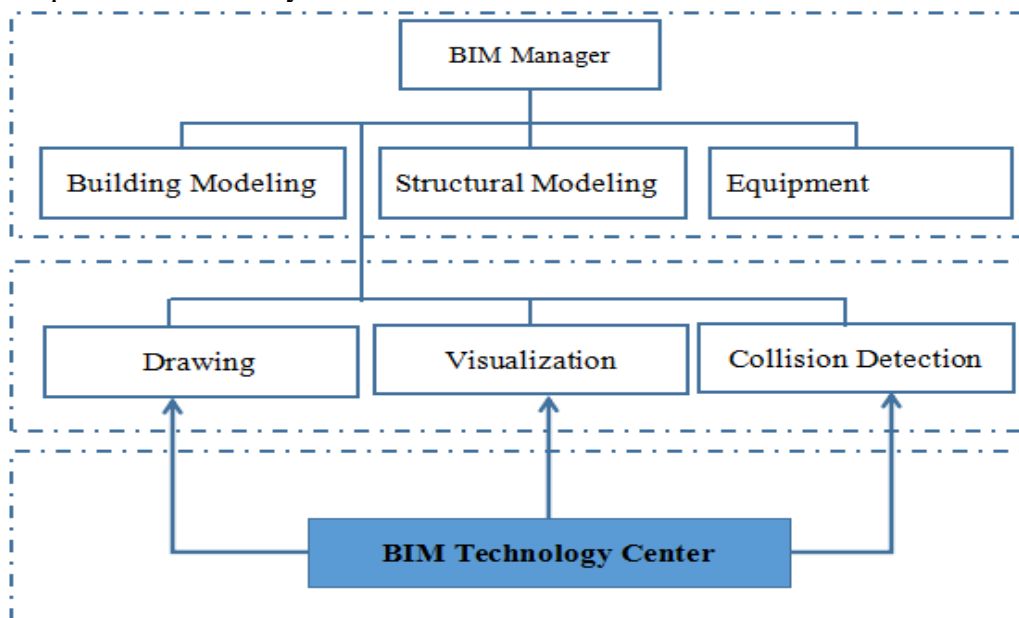


Fig. 1 Management characteristics and composition of BIM

Compared with the traditional data management methods, the information can be transmitted to the managers through different ways to BIM information processing, so it can save valuable time, and can really and effectively transfer the specific situation, avoiding a lot of unnecessary time or resource conflicts. In order to realize the model display and information processing in each stage of construction, BIM requires the integration of each information module. BIM usually combines graphics processing techniques such as Autodesk, 3D MAX to display information graphically. In the past, AutoCAD technology was used to display all parts of building components in computer windows through 2D plan to complete the display of information model. The current BIM implements an upgrade, in which building information is displayed through 3D models, so that each part of the component can clearly display. 3D display enables different majors to understand each other's current situation so that they can adjust themselves and notify each other of the adjustments they need to make, so that each major can coordinate with each other through the BIM information exchange platform.

3. Problems of Lean Management in Construction Project Implementation

From the emergence of the construction industry, the extensive management mode of

construction projects has never been fundamentally changed. According to the relevant data, the rework in the construction process accounts for 25% - 30%, the waste of labor also accounts for 30% - 60%, and the irrational use of construction materials accounts for 10%. The construction industry should be like the manufacturing industry to learn an efficient scientific management model. Although the manufacturing industry started later than the construction industry, the scientific management model of the manufacturing industry has far exceeded that of the construction industry. The lean management model developed recently by Japan's Toyota Company has pushed work efficiency to its peak. The core of lean management mode is to use the management thinking of the system to meet the needs of consumers to the maximum extent and to continuously reduce waste through the whole life cycle. Although the concept of lean construction has been put forward for more than 20 years, there are few cases that really create great value in practice. Especially at present, the engineering projects are becoming more and more complex and the factors are becoming more and more numerous. As the business of the construction enterprises becomes more and more extensive and the area is becoming more and more dispersed, the company's management of the project department is becoming more and more loose and directly subcontracted. Charging a certain management fee has become the normal. BIM technology for the survival of construction enterprises. It alleviates the problem that there is no better management in the return of construction enterprises and brings dawn to the sustainable development of buildings.

4. The Value of BIM Technology in Lean Construction

BIM provides a digital representation process that provides technical support for reliable decision making through the sharing of knowledge resources throughout the life cycle. Generally speaking, the core concepts of BIM in lean management include two aspects: (1) BIM provides an open information platform for designers to digitally express the physical and functional features of their thinking. Decision makers can realize virtual construction of engineering projects through databases associated with multi-dimensional building information. Decision makers can communicate efficiently through visualization. (2) BIM also provides an efficient collaborative platform for participants to update the actual progress of the project from time to time. At the same time, the data in the database is not static with the update of the information. In this way, the construction side, the designer, the owner and other professional stakeholders can synchronously understand the progress of the project, and can more effectively provide the decision makers with reliable basis and information during the life cycle.

5. BIM is a Powerful Tool for Lean Construction

5.1 BIM construction concurrent engineering

The core connotation of concurrent engineering is to shorten the development cycle and reduce the cost of R & D by parallel integration of related processes. It is a key technology of lean construction system. In our country, design and construction are separated, because the actual situation in the construction process, measures and node information are not well considered, so the design works still need to be constantly changed. When dealing with the design of different specialties, the coordinated design results are also faced with some difficulties, and different types of work are also faced with the difficulties of coordination in the implementation of on-site work. BIM technology integrates different professional information into a building information model and provides a visual platform for different types of participants. Then, using 3D to share and communicate the data, we can realize the coordination between different majors and different teams, so as to realize the problem of simulation construction in the design stage of IPD model.

5.2 BIM can reduce changes

Because of the complexity of the project and the variability of the construction environment, it is inevitable to change the project and it will bring huge waste at the same time. Through the virtual construction of BIM technology, the whole construction process can be previewed on the computer

in advance, so that the problems in the construction can be exposed in advance, and the construction design can be optimized ahead of time, so the waste caused by the change can be reduced.

5.3 BIM can reduce waste of resources

The biggest characteristic of BIM is that it can increase the time dimension on the basis of the traditional 3D, that is, BIM can calculate the utilization of various resources at each time point according to the construction plan and the actual progress of the construction. This can effectively avoid the traditional mode of material management, reduce the loss of materials and storage fees, but also help to reduce the situation of the site, reduce labor costs, improve the utilization rate of equipment, reduce rental costs. Effective improvement of the current construction process under the efficiency of the use of resources, serious waste of resources phenomenon.

5.4 BIM can improve Engineering value

In engineering practice, it is shown that BIM can effectively control the project cost, carry out cost control, and then improve the profit space of the construction project. In the process of constructing BIM information model, the owner can increase the use value of the project without changing the quality and cost of the project according to the surrounding environment of the project. According to "create-maintain-share" BIM system, it can meet different requirements of lean management and improve the value of the project space.

6. Summary

The emergence of BIM technology provides reliable technical support for lean construction. Through the BIM technology platform, participants can integrate lean management ideas into their work, and then realize lean construction. Lean thought has been well embodied in BIM, and has also reflected the humanization of technology, the efficiency of communication and coordination among teams has been effectively improved, also, the sharing and transparency of information have been substantially improved. Virtual flat information will guide the construction industry into a new era.

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