Journal of Education and Culture Studies
ISSN 2573-0401 (Print) ISSN 2573-041X (Online)
Vol. 8, No. 1, 2024
www.scholink.org/ojs/index.php/jecs

Original Paper

Analysis of the Application of BIM Technology in the Quality Management of Assembly Type Residential Construction Project

Jiarui Luo[1]

[1] Xihua University, Chengdu, Sichuan, 610039, China

Received: January 19, 2024 Accepted: February 17, 2024 Online Published: February 21, 2024

doi:10.22158/jecs.v8n1p73 URL: http://dx.doi.org/10.22158/jecs.v8n1p73

Abstract

The rapid development of China's information technology and our various industries, the development of China's construction industry is also very fast. At present, there is a large space for improvement in the quality management of assembly building projects, and it is of great significance to build a set of quality management system to meet the construction of assembly building projects, which is important for the smooth and rapid development of assembly building. The core idea of BIM technology lies in the management of informationization by transforming the physical construction works into informationized models. During the continuous development of China's modern construction industry, it has objectively promoted the optimization and improvement of technical processes in the engineering field, especially under the background of information technology, and has also derived more advanced technologies. BIM technology is an important technology in the construction field. In the process of applying BIM technology to assembled buildings, it can be effectively modeled according to the building situation, and then the problems existing in the project can be analyzed and refined, so as to accelerate the solution of various problems and ensure the safety and stability of the project. This paper addresses the shortcomings of quality management of assembly construction projects, relies on the advantages of BIM technology in informatization and synergization, explores its application in the quality management of assembly construction projects, and evaluates its application effect, with a view to providing a reference for other similar projects relying on BIM technology for quality management, and further promoting the development of China's assembly construction.

Keywords

Assembly building, Quality management, BIM technology

1. Introduction

With the development of the construction industry and the continuous progress of construction technology, assembly building has been widely noticed and applied as an efficient and sustainable construction mode. In the assembly building project, construction quality management and control is an important link to ensure the success of the project construction. BIM technology, as an advanced digital tool, provides comprehensive support for the construction quality management of assembly building. Specifically, as a new type of building construction method, assembly building often has obvious regularity characteristics, and should be able to achieve the same effect as the engineering planning in construction. Therefore, through the application of BIM technology, it is of great significance to be able to collect and organize various data information in the project, and then properly deal with the details during the construction of the assembly building, so as to realize the expected construction goals of the assembly building. Reasonable application of BIM technology in the quality management of assembly building project can effectively improve the effectiveness of assembly building project construction, facilitate timely detection of deficiencies in assembly building project construction and timely correction shortcomings, and make timely corrections. Based on this, this paper describes the main features of assembly building and BIM technology functions and the main problems of assembly building construction quality management, and discusses and analyzes the application of BIM technology in the quality management of assembly building project.

2. The Main Characteristics of BIM Technology

2.1 Comprehensive

BIM technology can integrate information from many aspects of a construction project, including geometric information, structural information, equipment information, material information, cost information, time information and so on. By integrating this information into a unified building information model, it can realize collaborative work and data sharing between various areas, and promote cooperation and communication among project parties. Different participants can share information and coordinate their work through the BIM platform, thus improving the overall efficiency and quality of project construction (Zhang, Dong, Zhang et al., 2019).

2.2 Data Sharing and Collaboration

BIM technology can realize collaborative work and data sharing among different participants through the sharing of building information models. It serves as a centralized platform that integrates information from all relevant parties, including designers, builders, suppliers and owners. Different participants can share information on the BIM platform and work together in real time to reduce duplicate information entry and delivery errors. Through data sharing and collaborative work, the coordination and consistency of the project can be improved, errors and conflicts can be reduced, and the overall quality of the project construction can be improved.

2.3 Visualization and Simulation

BIM technology provides visualization display and simulation analysis functions to help designers and owners better understand and evaluate design solutions. Through BIM technology, the building model can be transformed into a realistic virtual scene to achieve the visual display effect. In addition, BIM technology also supports simulation analysis of building models, such as structural analysis, energy analysis, collision detection, etc., so that designers and owners can find and solve problems earlier, optimize the design scheme, and improve the performance and efficiency of the building.

3. Characteristics of Assembly Building

First of all, combined with the current requirements of the concept of sustainable development and green economy, compared with the traditional construction mode, the assembly building application can ensure that the design program is more complete, the construction period is shorter, and it is more conducive to the saving of resources, as well as the protection of the ecological environment. However, there is still a need to further optimize the design in the assembly building. At the same time, from the point of view of economic characteristics, assembly building on the one hand can control the duration of the project; on the other hand, it can also control the consumption of materials and resources, and under the guidance of the design, it can complete the various operations in a more orderly manner, so as to achieve the goal of engineering construction. Secondly, in order to promote the continuous development of China's modern construction industry and related technologies, assembly construction has become the overall development direction of the industry, and can be understood as a high-quality fast food construction. In order to ensure that the quality of assembled buildings reaches a high level, it is necessary to be able to optimize and improve the transfer of construction materials, combined with the needs of the project, to develop clear material standards, and synchronize the material inspection, to improve the degree of refinement of project management, to achieve the desired production results.

4. Precautions for the Application of BIM Technology in the Project Management of Assembled Buildings

4.1 Do a Good Job of Project Construction Quality Management

To do a good job of project management in assembly building construction, it is necessary to give full play to the role and advantages of various technologies. Before the production of assembly building components, the staff should first master the design specifications and drawing requirements of the project and combine them organically. In this way, on the one hand, the overall structural optimization of assembled building components can be realized; on the other hand, the quality of the later stage can also be strictly controlled, so as to improve the technical level of the project assembly building.

4.2 Reasonable Application of BIM Technology

At present, with the continuous development of China's information technology and intelligent technology, in the process of its continuous integration into the assembly building, objectively improve

the efficiency and quality of project management. Among them, from the point of view of the rational application of BIM technology, we can mainly start from the following two aspects: First, the use of BIM technology to do a good job in the quality control of the assembly building. In the construction of assembled buildings, compared with the traditional construction mode, it often has greater precision requirements. Therefore, it is necessary for the staff to do a good job of collision analysis of the project through BIM technology and show the location of the pipeline to consolidate the foundation of the project quality; Second, use BIM technology to do a good job of assembly building planning. Progress is the key to assembly building project management, on the one hand, it affects the quality and safety of the project; on the other hand, it also affects the project cost expenditure and benefit issues.

5. Application of BIM Technology in assembly Building Quality Management

5.1 Preparation Stage

5.1.1 Interference Monitoring of Pipeline Synthesis

The 3D information system constructed on the basis of BIM can simulate the information of each participant and each specialty in 3D, so as to achieve the optimal connection and avoid problems such as pipeline conflicts. Using 3D information modeling of BIM instead of the traditional CAD2D drawing method can effectively solve the problems of conflict, omission, inefficiency and waste of time in traditional CAD. In particular, the discovery and rapid response to the pre-engineering stage allows for continuous optimization of the engineering plan. Currently, BIM-based interference detection is commonly used in pipeline synthesis.

5.1.2 Fine Control of Components

With the support of BIM technology, effective control of the prefabricated component production process is realized, which includes project information, component management, mold management, plan management, stacking management, production statistics, mobile production inspection records, remote production line monitoring, automatic printing, component integration query, component in and out of the yard management and other functions. In view of the production characteristics of assembled prefabricated parts, quality control measures are solidified in the system, and radio frequency identification and other methods are used for traceability of their production inspection, transportation and storage.

5.1.3 Unified Management on a Unified Platform

Based on the data modeling of BIM, an enterprise information management platform based on BIM is constructed, which realizes the collaboration between various participating subjects and professions. Before the start of the project, a complete quality control system is developed and requires the active cooperation and obedience of all relevant personnel. The construction process and production management process are visualized and displayed through a unified platform, so that the construction quality management can be achieved by all people, which in turn improves the construction quality.

5.2 Construction Stage

5.2.1 Production Quality Management of Prefabricated Components

The production of precast concrete structural components is closely related to the construction process, and its good or bad production has a great impact on the whole construction process. The navigation system can detect and exclude conflicts in the BIM model. After the detection, the BIM database is updated in time to ensure that the data in the assembly process is accurate and real-time. After updating the data of prefabricated components, they are decomposed according to BIM technology to get the components that can be manufactured. In the manufacturing process of prefabricated panels, RFID technology is used to affix the logo to the production molds, and the employees can enter the data of the components in the logo into the BIM model through the handheld device, which is convenient for all parties of the project to supervise the various aspects of the assembly process, and to carry out comprehensive management and traceability of the products that appeared in the assembly process.

5.2.2 Installation Management of Prefabricated Components

Compared with conventional construction, assembly building has higher engineering technology and higher automation level, making its quality control more and more key points. Using BIM5D software to simulate prefabricated components before they are assembled, once quality problems occur, they can be handled in a timely manner and a new optimized assembly plan can be given. On the basis of BIM modeling, the manager provides construction process guidance to the staff, and the construction personnel can carry out construction according to the drawings and standards, and use portable devices to scan the RFID markings on the prefabricated components to grasp their construction quality needs, so as to realize the multifaceted guarantee of high efficiency and quality of the assembly construction.

5.3 Operation and Maintenance Stage

During the operation period after the completion of the building, based on a complete set of BIM data model, the operation and operation of the building is effectively managed to play a greater role.The main roles of BIM technology in the operation of the building are to locate the building components, data exchange, visibility and positioning, inspection and maintenance, space management, crisis management, energy control and monitoring.The 3D visualization of the BIM technology can allow the operators to clearly locate problem areas and information about equipment.

6. Application of BIM Technology in Quality Management of Assembly Building Project

6.1 The Application of BIM Technology in the Quality Management of Assembly Building Preparation Stage

Doing a good job in the management planning of the construction preparation stage can lay the foundation for the orderly and smooth advancement of the assembly building construction. In the preparation stage, construction resources should be arranged reasonably according to the project cost program, construction contract, bill of quantities, construction design, project construction and use requirements, etc., and the project quality management objectives should be refined.In the BIM project

management model, assembly quality control standards and parts storage and installation requirements are input, and quality standards are formed in the model quality management information database to provide guidance for quality control, progress and cost management. Provide guidance for quality control, schedule and cost management. For the on-site construction links, input the data into the software system to establish the engineering model, and through visual observation, find the possible problems in the pre-construction stage so as to prevent them scientifically.

6.2 Application of BIM Technology in the Integration of Construction Drawings of Various Specialties

Considering that the design of construction drawings is divided into specialties, and these construction drawings are also designed according to the relevant regulations of each specialized field, once these construction drawings are combined together, there are bound to be many contradictions. In addition, the relevant personnel in the construction drawings for review, in order to more quickly into the construction stage, they will be greater extent to shorten the time of the review, once into the actual construction link, the construction process of the construction project will often be problematic, resulting in a significant increase in the construction of the time, so that the construction units and enterprises suffered great economic losses. After applying BIM technology to the design of construction drawings, construction units and enterprises can review the construction drawings in advance, and can make use of BIM technology's strong drawing integration and conflict checking ability, so that the designers of construction drawings know in advance of possible conflicts in the construction process, so as to formulate corresponding countermeasures. Through the use of BIM technology can not only improve the efficiency of the review work, but also avoid the omission of problems in the review work, thus avoiding delays and stoppages in the construction project to a greater extent.

6.3 The Application of BIM Technology in the Design and Manufacture of Components and the Design and Arrangement of Buried Parts

With the wide application of BIM technology in assembled buildings, more and more building models are uploaded to the BIM database, including the design, manufacture and arrangement of components and embedded parts, and architects can conveniently call and analyze this information, which greatly improves the design efficiency and ensures the completeness of the design scheme. Component design and manufacturing is the key to the whole assembly building design, in the actual manufacturing process of prefabricated components, manufacturers need to double-check the component parameters with the assembly building construction team, to reduce the manufacturing error of the components, to ensure that the components can be put into use normally. Through BIM technology, the size, material and manufacturing quantity of prefabricated components of the whole assembly building can be uniformly provided to the manufacturer, and the waste of construction components can be analyzed through data. Manufacturers can ensure that the manufacturing of components is more stable through the unified parameters, and shorten the manufacturing cycle, efficiently put into use, reducing time costs and error losses. The layout of the embedded parts is related to the stability of the overall

assembly building, so the embedded parts design needs to be detailed and comprehensive, to ensure that each position of the embedded parts can give full play to its effect. Through the use of BIM technology, the software can simulate the buyer's design layout for pre-embedded processing, analyze the reasonableness of the layout of the embedded parts through the model, and improve the efficiency of the embedded parts design layout. Through the use of BIM technology's information analysis characteristics, can effectively optimize the buried parts layout structure, organic combination of assembly building wall structure design beam structure, promote the beam structure and wall openings can be coordinated and unified, reduce because of the wrong openings caused by the destruction of the wall, improve the quality of the whole assembly building project.

6.4 Application of BIM Technology in on-site Quality Dynamic Supervision

In the process of quality management of assembly construction project, construction materials, prefabricated components and equipment should be transported to the construction site, and the components should be installed according to the design planning and technical standards to ensure the accuracy of each parameter. The application of BIM engineering management technology can comprehensively simulate the on-site construction condition, and transform the construction progress and construction effect into 5D model. Through the construction of simulation scene, it can efficiently identify and target control the hidden quality and safety risks, standardize the application process of assembly technology, and at the same time give solutions in advance for various pre-judged risks, so as to achieve dynamic quality control.

7. Conclusion

In summary, the reasonable application of BIM technology in the quality management of assembly construction project can not only ensure the smooth docking of assembly construction links through the whole process quality supervision system, maximize the control of construction risks, but also enhance the overall allocation efficiency of construction resources, which is of great significance to ensure the smooth implementation of assembly construction project construction, and therefore it is necessary to strengthen the analysis of it. At present, China is vigorously promoting the assembly construction in China, due to its high efficiency, low pollution and other advantages, it has been an important development direction of China's construction industry, therefore, integrating it with China's industrialization process, it can effectively bring into play its advantages in engineering construction, realize the effective control of construction quality, and carry out effective control of construction progress, so as to enhance the construction level of engineering construction. Assembled construction refers to manufacturing prefabricated components in the plant, transporting them to the construction site according to the process of construction, carrying out dry work on the site, assembling them, and finally constituting the overall structure. Compared with conventional structures, it is characterized by higher refinement and high quality in structural design, manufacturing and transportation. Increase the talent pool of BIM technology so as to reduce the total cost of the assembly construction project and

make more enterprises join in the application of BIM technology. China's construction industry, under the rapid change of information technology, will continue to break down industry barriers, cross-discipline and cross-field combination with assembly building, China's assembly building will be accepted by more people, and complete the upgrading of the industrial chain.

References

Sun, Z. X. (2019). Discussion on the application of BIM technology in the quality management of the whole process of assembly building. *Modern Property (Zhongdian)*, *2019*(11), 26.

Tong, W. W., & Li, C. X. (2018). Application of BIM technology in assembly building construction quality management. *Southern Agricultural Machinery*, *49*(12), 93.

Xiao, Y., & Liu, W. (2018). Research on the application of BIM technology in the quality management of assembly building construction. *Value Engineering*, *37*(06), 104-107.

Zhang, Y. L., Dong, Z. E., Zhang, T. T. et al. (2019). Research on the application of BIM technology in the quality management of assembly building construction. *Residential and Real Estate*, *2019*(33), 98.

Zhou, W. (2019). Exploring the application of BIM technology in assembly building construction quality management. *Building Materials and Decoration*, *2019*(32), 190-191.