Original Article

BLUEPRINTS TO BUILDINGS: BIM TECHNOLOGY'S TRANSFORMATION OF CIVIL ENGINEERING SITE MANAGEMENT

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Abstract: BIM technology is increasingly being used in the management of civil engineering project sites, where it can be used to monitor the entire construction process in real-time, identify problems as they arise, and take additional steps to raise the bar on engineering construction in order to achieve the goal of raising the standard of engineering construction.The article briefly discusses the characteristics of BIM technology, and from six perspectives—collision check, safety management, project cost, quality management, and project progress—discusses the specific application of BIM technology in the project site management. Based on the application of BIM technology needs to improve the analysis of the problem, a number of suggestions are made to increase the effectiveness of the application. It could be able to offer some assistance to those who work in the same field.

Keywords: BIM technology; civil engineering project; on-site management; specific application; problem analysis; suggested countermeasures

1. Introduction

As a kind of data tool, the application of BIM technology has completely solved the problems of lagging management and incomplete information acquisition in the past, and provided assistance for the realization of collaborative project management. From the actual application of technology, BIM technology plays an extremely important role in the intensive utilization of resources and data sharing, effectively improving the quality of site management. For this reason, it is extremely critical to improve the attention to the integration of BIM technology and on-site management system, which is a key factor in promoting the sustainable development of China's construction industry.

2. Characteristics of BIM technology

Visualization, simulation, and coordination are the main application characteristics of BIM technology. The first is visualization. Based on the BIM software can be constructed for the threedimensional model of the project, the contents of the drawings and engineering reality in threedimensional physical form to show to the construction personnel, and then ensure that the interaction between non-components and components of the object feedback

effect, to achieve what you see is what you get[1]. For the management of the construction site, the same can be carried out in the visualization of the background of science, so as to effectively avoid information bias in the process of communication and discussion, resulting in an impact on the subsequent work of communication and coordination;

Second is the coordination characteristics. Based on the BIM software can be the original time and space restrictions to be broken, to ensure that the transmission of information in real time, you can BIM model as the core of the videoconference, the existence of management problems for centralized discussion, the development of targeted solutions and timely implementation[2]. For example, professional conflicts can be effectively resolved, so that all units can work together to achieve the corresponding cooperation goals;

Finally, simulation. Based on the BIM software can play out its logical operations and data processing advantages, to ensure that the user can be in the software tool with the help of the contact master information to carry out simulation experiments. For example, 4D or 5D can be used in the form of construction process simulation, analysis exists in the project progress management and cost control problems, and then according to the specific problems of construction organization plan adjustment, reduce construction risk.

3. The specific application of BIM technology in the process of civil engineering project site management

3.1 Three-dimensional technical briefing

Due to the application of BIM technology specificity, the BIM three-dimensional visualization model can be used as the application credentials in the technical briefing scene, and then realize the original plane drawings and paper material substitution. The personnel involved in the construction of the project can observe the physical graphics in the model, together with the animation demonstration of the construction process, and refine the labeling information in the model, such as component specifications and dimensions, etc., so as to ensure that the handover personnel can be a comprehensive understanding of the construction intentions, operation methods, processes, etc., which is also a key measure for effectively avoiding cognitive errors[3]. From the practical application of the situation, based on the BIM technology for the work, is the construction efficiency to be improved and effectively control the project rework rate of the important foundation.

3.2 Collision check

From the traditional project site management situation, the use of two-dimensional plane drawings is to determine whether there is a data conflict in the main form, not only low efficiency, and the application of complex structures in the inspection of the actual effect is not good, it is difficult to meet the demand for refined management. If the plane drawings are used as the main inspection method for on-site civil engineering projects that are increasingly expanding the scale of construction, the risk of professional conflict problems will be increased due to the incomplete inspection of complex node locations, which will in turn increase the rework rate of the project[4]. For this reason, in the field of collision checking, BIM software should be used to carry out the three-dimensional level of proofreading operations, in order to accurately determine whether there is improper spacing or solid space cross-collision and other situations. In addition, the software can generate the inspection report corresponding to the corresponding data, and the collision situation can be comprehensively displayed in the report, and all the collision points can be color-coded. In this way, the automated adjustment of the design scheme can be realized, the limitations of the plane drawings to be effectively broken, in order to reduce the risk of design changes.

3.3 Safety management control

BIM technology used in the field management process of risk early warning, accident analysis and other areas is more common. The first is the safety check. Based on the BIM software, the site information can be collected to establish the corresponding safety inspection model, and the model can be updated in real time according to the site changes[5]. Managers can fully grasp the site management situation based on the established model to ensure the timeliness of the location of hidden safety hazards, and effectively implement the corresponding management measures to eliminate the hidden risks. At the same time, BIM technology can be fully utilized to arrange the camera in the appropriate location on the site, through the remote control of the camera angle to obtain the corresponding monitoring screen. The information shown in the screen can be used to create a spatial model with the help of BIM software, giving full play to the advantages of the dynamic monitoring function of the software, which can be used to realize the remote inspection of the situation after the implementation of the site area;

Secondly, in the process of accident analysis, the BIM database can be used to extract appropriate data, and the situation before and after the accident can be traced in the model, for example, the operating condition of the equipment, the operating behavior of the personnel, etc., in order to clarify the type of accidents and find out the causes. Afterwards, by summarizing the experience of handling accidents, we can formulate and implement appropriate improvement measures in time, and improve the content of the plan to avoid similar accidents;

Finally, in the risk warning scenario, BIM technology can be used to build a risk warning system. Based on BIM technology, the control program can be imported into the system to automatically carry out simulation tests in the construction scenario. If during the simulation found that there is a risk of structural cracking or pit collapse, you can automatically send the early warning signal to ensure that the management personnel can be pre-empted to grasp the risks and hazards, to develop and implement measures to reduce the risk of accidents.

3.4 Project cost control

From the perspective of project cost, BIM technology is mainly used in the field of basic data analysis such as data statistics and cost analysis, which can replace the manual calculation form, and can take 5D simulation test to predict the cost situation[6]. In the construction stage, for example, through the use of BIM software on the site of the material consumption to be real-time statistics and calculations, including procurement prices, storage, etc., if the material storage is lower than the set warning value, you can pass the warning signal to the management personnel, to develop a targeted supply of purchasing programs, which can play a role in avoiding large-scale loss of materials and insufficient supply of the impact of the project construction progress. During the project settlement period, based on BIM technology can automate the collection and organization of data information, process optimization, program review and other work, to be used to reduce the construction cost expenditure to continue to ensure the accuracy and authenticity of the settlement results.

3.5 Quality Management Control

Analyzed from the perspective of quality management control, BIM technology can be based on the provision of appropriate data to the site management personnel to assist the conditions, such as the automatic uploading of construction logs, process results of automatic verification, etc., which can be divided into two types of on-site signal monitoring and information device acquisition, so as to ensure that the collection of on-site construction information in a comprehensive manner, such as specifications of the components, the location of the installation,

etc., and uploaded to the calculated information in the BIM software, automatically comparing the technical standards[7]. If a mismatch with the standard is found during the calculation, the color standard can be applied to the quality points in the model. Based on the BIM platform, the management personnel can remotely transmit the corresponding quality problem information to the field personnel, formulate targeted rectification measures, and ensure that the rework of defective parts can be organized in a timely manner. The use of BIM technology can also carry out construction simulation, simple verification of the future construction situation, reduce the risk of quality problems, and can be adjusted to the defective quality management program.

3.6 Engineering progress control

4D simulation and dynamic progress control are important application scenarios of BIM technology. First of all, the 4D simulation scene, can be based on software tools for the remaining amount of engineering results statistics, and has the on-site construction conditions, organizational plans, technical programs verification function, can be used for the prediction of the subsequent construction conditions, including completion time, real-time completion of the progress, etc.[8]. In this way, the process flow can be scientifically adjusted based on simulation results to ensure a match between the construction organization plan and actual construction needs. This may involve extending the construction time or increasing the number of equipment, among other measures, to keep up with the construction process and to ensure that the corresponding project can be delivered on schedule according to the expected construction program. Additionally, dynamic progress control can be achieved through the use of BIM software to collect relevant project information. This software can generate progress charts to visually compare the anticipated progress with the actual progress. Managers can use the comparison chart to determine whether there is a delay in the schedule and formulate corrective programs for specific reasons.

4. Civil engineering project site management process in the application of BIM technology need to improve the problem

4.1 Lack of building information technology modeling professionals

Management personnel is the important foundation of traditional civil engineering management, requiring talents to have good expression, coordination and disposal ability. However, with the development of modern construction technology, it has been discovered that integrating BIM technology can simplify site management. This comes with higher requirements for technical personnel; for instance, a manager needs to have the ability to skillfully operate BIM software. They also need to make scientific adjustments to the functional structure of site management, based on the actual situation, and provide upgrades for the software system to ensure supportive conditions[9]. At present, part of the civil engineering site management is still a lack of personnel in the construction of building models, although most of the personnel have accumulated more experience, but failed to deeply understand the BIM technology, and are not familiar with the operation of the professional software, which increases the risk of site management.

4.2 High cost of developing professional building information modeling software

Most of the BIM software are developed by foreign research and development, such as 3DSMax, although full-featured but relatively high procurement costs, and the development of China's construction industry and the actual situation of the project management requirements there is a certain difference between. In the face of high

software development costs, there are still some construction units on the software there are certain concerns, failed to incorporate professional software into the development of subsequent units in the system.

4.3 Poor software compatibility

From the point of view of the actual development of modern civil engineering, part of the building scale is large, the need for multiple types of BIM software support, so as to meet the actual needs of onsite construction management under the conditions of complementary functions of different software. However, it should be noted that, due to some of the software in the software attributes and portability standards are not the same, can not be modified in the existing conditions directly under the simulation operation, the need to re-edit the design of the software program, so as to ensure that the BIM technology can be quickly applied to the new system use environment[10].It is due to the existence of this problem, so that the overall site management workload has increased significantly, which puts forward relatively high requirements on the site management personnel's own professional level and information technology literacy. However, from a practical point of view, the incompatibility of the software application level leads to frequent system crashes, and even data loss and other phenomena, affecting the smooth progress of the subsequent work process.

5. Suggested Countermeasures to Improve the Application Effect of BIM Technology in Civil Engineering Management

5.1 Strengthen the data management platform

For the project site management work, the management problems faced by the complexity of the process, the number of departments, the huge amount of data, etc., which also makes the final management decision can not give full play to its management advantages of the main reason, which can not guarantee the timeliness of information communication for the key factors affecting the results. In order to give full play to the advantages of the application of BIM technology, a construction unit should be given to BIM technology to build a corresponding data management platform to match the further improvement of the management mechanism. In the construction of management mechanism, BIM software can be based on the construction of three-dimensional information model, and then provide to the project construction before and after the change of relevant information, to provide to the managers of the project construction situation to be intuitive understanding of the basic conditions. In addition, supporting optimization tools can be used to promote manual processing of complex information data more comfortable, to achieve the simplification of complex issues, and can be based on the optimization results to participate in the decision-making process, to ensure that the feasibility of the issued project site management program. Analyzing from the perspective of data management platform construction, it is necessary to design the data analysis and management platform with the actual situation and needs of site management, requiring online editing, data retrieval, automatic backup, remote download, chart analysis and other functions, so as to realize automated data collection and classification and arrangement under the support of the system's application and to respond to the commands issued by the system users in a timely manner, thus improving the quality and efficiency of the processing of data and information. **5.2 Create evaluation mechanism based on BIM technology application**

From the effect of BIM technology applied in the field of civil engineering site management, its site control has been significantly improved. However, due to the lack of corresponding comprehensive evaluation standards in

this process, the construction unit cannot guarantee the objectivity of the evaluation of the application of BIM technology, which is also not conducive to the application of the advantages of the technology, and has a greater impact on the selection of software tools and the determination of the direction of development[11]. For this reason, the construction unit should be based on the set technical standards, linked to the actual situation of the project construction, to create a perfect evaluation mechanism based on the application of BIM technology, on-site management of the actual situation of the evaluation and scoring. For example, the construction unit can judge the application and maturity level of BIM technology based on the national building information modeling standards after weight calculation, during which the evaluation items can be refined, including responsiveness, timeliness, data management capability, life cycle, graphic information.

5.3 Strengthen the application of BIM technology during the whole process of management

The whole process of civil engineering construction requires the participation of BIM technology to create a perfect on-site management system, which improves the degree of articulation of different stages of work and ensures that the fundamental goal of system management can be realized in a short time[12]. For this reason, the construction unit should continue to expand the actual application of BIM technology in different stages, such as the simulation design of the site, on-site modeling, project quantity statistics. During the construction process, the drawings can be simulated on site, including data management, all kinds of pipeline position checking and other specific content. During the settlement period, the cost indexes can be compared based on BIM technology, or the function of expanding facilities can be tested and fault alarms can be provided. In addition, the management advantages of the BIM database can be fully utilized to collect all the information during the project life cycle, providing support for the subsequent strengthening of management activities at different stages.

5.4 Further Improve Construction Safety Indicators and Organize Safety Training

Based on BIM technology, it is possible to further improve the safety management indexes in the project to ensure that the content of the indexes is refined in the context of the application of technology, so as to maintain a good state of management. Through the setting of safety indicators, it can ensure the accuracy of the construction period and risk elements of the construction project, and then formulate a practical safety control program to ensure construction safety. At the same time, the safety assessment of the project should be carried out based on such indicators to ensure the rationality of the project construction and eliminate the possible accident risk factors.

In addition, in order to ensure that each construction manager can form the correct safety management awareness, need to focus on organizing safety training. During the training, the application value of BIM technology should be emphasized to ensure that the managers can grasp the safety information in the dynamic model based on BIM technology, memorize the content of safety training more intuitively, and lay the foundation for improving the level of operational standardization. From a practical point of view, centralized training can help managers form a sense of crisis and actively analyze the existence of security risk elements to ensure that the value of the application of BIM technology is fully demonstrated.

6. Conclusion

In summary, for modern civil engineering, in the process of the development of project site management system informationization and standardization, the application of BIM technology is a necessary element of development, but also a key measure to improve the site control ability, to ensure the project benefits. For this reason, a

construction unit should improve the attention to BIM technology, sort out clear and clear technical application ideas, and contact the actual situation of the construction of the project to be used to improve the on-site construction management system, to lay a solid foundation for the smooth development of civil engineering construction work.

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