

Construction Safety Research Based on BIM Technology

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Abstract

With the rapid development of construction industry, the rise of accident rate cannot be ignored. BIM is mainly used to simulate and analyze the construction progress. This paper analyzes the main types of accidents, the main causes of accidents and the research status at home and abroad, and studies the construction safety management technology of BIM. In the construction safety management based on BIM Technology, hazard identification and management, construction safety inspection, auxiliary formulation of safety indicators, construction simulation protection performance, safety coordination quality management, to improve the construction quality and reduce the number of casualties.

Keywords

BIM, Construction safety.

1. Research status at home and abroad

In recent years, with the rapid development of digital technology such as BIM, the safety work of engineering construction has begun to show the characteristics of digitalization. Chantawit puts forward a 4dcad safety model that combines safety planning with construction project management, which can identify and manage the unsafe hidden dangers in the process of project implementation, such as mechanical and electrical equipment, chemicals and physical state; Benjamin puts forward a four dimensional CAD model, which integrates safety design, planning and control into the process of construction management, and can automatically identify the more complex high Zhang put forward a structural information model using Bim and 4D technology, which can show the structural security situation at any given time, and can allocate resources for the security needs of the situation. Teizer and others use ultra wideband technology to track workers, and design scientific safety management and logistics deployment scheme by analyzing workers' movement trajectory, so as to improve the safety level of construction. At present, it is an important trend of BIM research to expand the physical model of BIM to the combination of physical model and artificial intelligence model to realize the intelligent development of BIM Technology. In the stage of design and operation maintenance, some researches have begun to explore such problems; in operation management, the multi-agent model with the main content of describing user behavior is combined with BIM to realize operation optimization; in building emergency management, the multi agent model is used to represent the evacuation rule of human in emergency, and the physical model of BIM is extended to physical model and artificial intelligence model Type. After reviewing the development of Bim in the past 20 years, merchbrock and others also pointed out that establishing the relationship between BIM functions and people is the core development direction in the future.

Although some researches at home and abroad use information technology to study construction safety related behaviors, they only make passive management feedback based on human behavior, and do not explore the root cause of the problem. The related research of BIM Technology in

engineering construction mainly focuses on how to eliminate the unsafe state of things, not fully considering the role of people, and the systematic analysis of unsafe behavior is not deep enough. As an important participant in engineering construction, construction personnel's relevant behaviors are closely related to engineering accidents, and their behaviors will also determine whether the unsafe state of objects can be eliminated, but there is no in-depth discussion on the interaction between management behaviors and workers' behaviors. Therefore, we should focus on the systematic causes of unsafe behaviors. With the widespread application of BIM Technology in the construction industry, the previous research has been unable to meet the needs of the actual safety management of the construction site. It is necessary to systematically study and discuss the construction safety according to the new information technology, and innovate the traditional construction safety management theory and method to meet the needs of the actual safety management.

2. Causes of modern construction management accidents

The number of construction safety accidents remains high. Based on the statistics of the safety accidents of the housing and municipal engineering of the Ministry of housing and urban rural development from January to may 2017, the following main types of accidents are analyzed.

The safety control of the construction unit is not strong, which makes it difficult to supervise the construction site. The construction company's weak management of construction safety is reflected in the weak quality awareness of the construction company, the emphasis on economic benefits and the neglect of personnel safety, etc., especially in the current situation of the construction company's lack of attention and experience in the allocation of on-site construction personnel, which leads to a great hidden danger of on-site construction accidents. In addition, the quality management of construction equipment is also negligent. Some construction equipment is not put into use correctly, which leads to improper operation of construction personnel and buries potential safety hazards for construction.

The safety awareness of construction personnel is not strong, which leads to the long-term existence of potential construction hazards on site. In the construction, safety awareness is particularly important. No matter the management personnel or construction personnel of the construction unit, safety problems exist in the whole construction process. The traditional safety management mode is backward, many construction workers have not received special training, even if there is construction technology, but there is no professional safety knowledge education and measures in the face of danger, leading to a greater potential safety hazard in the construction process.

The complexity of construction project is high, which leads to the pressure of construction management. The technology of modern construction projects is generally complex. At present, with the continuous development of large-scale projects, and a large number of construction personnel, materials and construction equipment concentrated on the construction site, the construction site has many cross operations, a large amount of work, and a high degree of difficulty. All of these have laid a huge hidden danger to the construction safety on the site, and also put a huge pressure on the construction management on the site.

Construction management standards are not uniform, resulting in different levels of construction on site. The development of regional economy and environment in China is different, which leads to the imbalance of construction industry development. In addition, the construction technology, management level, construction scale and region of each construction unit are different, the safety management standards of construction are different, and there is no perfect system to restrict the safety management of site construction. At the same time, the construction safety management modes are different, and there are potential safety hazards.

3. Applicability of BIM

BIM Technology can be used to control and manage the construction stage of a project in an all-round way by building a building information model, simulating the construction process, finding or avoiding problems in advance. At the same time, through the integration of information and sharing to a greater extent, to ensure that all participants in the project can get comprehensive and accurate information in a timely manner, to avoid the occurrence of decision-making errors due to errors or loss in the process of information transmission. Next, the adaptability of BIM applied to construction safety management is analyzed from the perspectives of technology, economy and environment.

3.1 Technical applicability analysis

Construction of bim5d + security model. Bim5d + safety model combines certain safety specifications and hazard source information with 3D modeling technology and schedule, resource plan, cost plan, etc. it can identify and find the possible safety problems in the construction process in advance, and control the safety risks effectively through optimizing the construction safety plan and visualized safety education and training, etc.

BIM based information sharing and communication in the whole life cycle. The information of construction project has the characteristics of huge quantity, complex type, wide source and scattered storage. In BIM environment, the problem of information mutual use and sharing can be better solved. If the participants of the project adopt a unified data format, they can extract the required information in the same BIM system, so as to improve the efficiency of information utilization and avoid information loss and repeated work.

3.2 Economic applicability analysis

Compared with other building software, BIM software is relatively expensive. This kind of expensive is not only reflected in the software itself, but also in the requirements of computer configuration. At the same time, the cost of BIM training for enterprise employees will increase. However, once a safety accident occurs in the construction site and causes casualties, the construction unit will pay a huge price for it. The realization of BIM not only plays an insurance role, but also brings great benefits. According to relevant statistics, the implementation of BIM can eliminate 40% of the change of extra budget cost, the accuracy of cost estimation is within 3%, the time of cost estimation is reduced by 80%, the contract value saved through conflict detection is up to 10%, and the project duration is shortened by up to 7%, which brings huge economic benefits to the construction project.

3.3 Environmental suitability analysis

Modernization, industrialization and informatization are the development trend of the construction industry, and BIM, as an important carrier to realize the construction engineering technology and management informatization, will play a huge role in the safety management with the continuous expansion of the connotation of construction engineering project management and the huge demand of construction engineering for safety management. Rising to the government level, BIM vigorously promotes BIM Technology after entering the key projects of national science and technology support plan of the 11th five year plan. Under the condition of actively learning from the experience of BIM promotion and application in western developed countries, the Chinese government issued the outline of information development of construction industry in 2011-2015. The outline points out the direction of BIM development in China during the 12th Five Year Plan period, and creates favorable policy conditions for the further promotion and use of BIM Technology in China.

4. Key technologies of construction safety management based on BIM

4.1 Hazard identification and management

In order to improve the effect of safety management, the first consideration should be given to the hazard sources, which are divided into personal injury, material loss and environmental impact, etc. the possible hazard sources during construction should be systematically sorted out by combining

BIM Technology, and the hazards such as falling from height, appliance and object injury should be controlled by analyzing the formwork support system and deep foundation pit support system. Combined with the effective parameter analysis, the construction risk of high rise buildings can be reduced as much as possible.

At the same time, BIM Technology can optimize safety education and training to solve the problem that the quality and ability of construction personnel are not strong. This technology is used as a carrier to simulate the real scene. By simulating the impact, the construction personnel can truly feel the potential danger source, enhance the prevention ability and improve the safety awareness. In addition, BIM model and virtual roaming can be used to show all links of construction, and relevant hazard sources can be marked systematically, so as to enhance the overall safety awareness of construction, grasp the hazard sources of different links during the whole construction period, and achieve the purpose of safety training.

4.2 Construction safety inspection

BIM Technology through different construction links, construction process to simulate, so as to facilitate the overall grasp of relevant parameters, combined with visual analysis to strengthen the effect of safety inspection, according to the inspection model to correct the problem of potential safety hazards, and develop an effective construction safety plan to reduce the loss of personal and property safety.

4.3 Assist in the development of safety indicators

BIM Technology plays a positive role in assisting the formulation of safety indicators, making the technical safety indicators more clear, improving the accuracy of budget and statistics. The analysis in the early stage of construction safety management is more important, combining with the calculation results of relevant parameters to clarify the key points of safety management, and combining with the management planning measures of science to enhance the effectiveness of safety management.

4.4 Safety coordination quality management

According to the BIM Technology to build the system monitoring platform, the relevant safety management principal issues instructions to achieve the effective grasp of the whole monitoring system, collate and store the management and control data, and combine the monitoring platform to achieve the assessment of the management principal and relevant personnel, to ensure the standardization of site construction safety management.

5. Epilogue

With the rapid development of China's construction industry, construction accidents can not be ignored. Safety and quality is an important part of construction management. Combined with visual concrete model, it can effectively and truly reflect the potential safety and quality hazards of construction, and plan relevant solutions in combination with relevant hazards. The application of BIM Technology is not mature, but with its continuous popularization, it will effectively play its application value. It is also necessary to strengthen the research of BIM Technology, and provide corresponding management reference basis through real-time monitoring, so as to effectively guarantee the construction quality and personal and property safety of the project.

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