Research on Safety Management of Construction Site Based on BIM

Zhihong Yu

Institute of Safety Engineering, China University of Labor Relations, 45 Zengguang Road, Haidian District, 100048, Beijing, China

Email: yuzhihong2003@126.com

Abstract. With the development of social economy at this stage, the construction industry has also increased certain progress, in the construction engineering construction, construction safety management is very important. Compared with the traditional construction safety management, BIM Technology can find the hidden danger in the construction project in time, and check the potential safety hazard in time, so as to ensure the safety of construction. In this paper, BIM Technology is used to manage the safety management of construction site in time and space, and the fall protection control based on BIM is studied. Hope to be able to provide a certain reference and reference for future related project safety management, so as to ensure that the overall construction safety management ability and quality of the construction project can meet the requirements to the greatest extent.

Keywords. BIM, smart construction site, safety management.

1. Introduction

Safety management is a core content of production management in construction enterprises. In recent years, with the increasing requirements of relevant policies on the safety management of construction enterprises, the proportion of safety management in the rating of construction sites and construction enterprises is also increasing, and each enterprise has begun to increase the investment in safety management. Safety management based on BIM Technology refers to the use of information technology to improve the level of safety management and better achieve the goal of safety management. In the aspect of BIM Technology in the field of construction safety information management, foreign scholars have made some related research, such as Chan sik Park and hyeon Jin [1] Kim proposed that the safety management of construction site should increase the side gravity degree in the aspects of construction plan, safety education and site management, make rational use of the development of visualization technology, create SMVS safety management comprehensive visualization system and improve risk identification ability through the combination of BIM Technology and information technology such as AR and VR. Kasirossafar [2] and others stressed that BIM Technology has the characteristics of collaborative function, aiming at improving the safety of construction site and formulating reasonable safety construction plan. BIM Technology has the unique performance that can cooperate with the safety management of construction and can prevent the occurrence of danger. It is necessary to define the functions and advantages of BIM to apply the technical advantages to specific security management more effectively. Based on the relevant literature at home and abroad, the practice of BIM in foreign countries is relatively mature, and the theoretical and technical research on smart construction site in China is also gradually launched, but

the application in practice is not popular, and the scope of application is more limited to BIM technical consultation, construction design stage and preparation before construction.

In this paper, we try to combine the application of BIM Technology with the safety management of construction projects effectively, summarize and analyze the factors affecting the safety of construction projects, and conduct special analysis on high-risk accidents, enumerate the methods of BIM Technology in solving high-risk accident risks, and combine with specific construction cases, formulate scientific and reasonable countermeasures, and apply BIM Technology to safety management To ensure the smooth operation of the entire construction project.

2. Analysis of Safety Accident Data

Due to the complex construction environment, low education level of construction personnel, safety investment and the characteristics of buildings, the incidence of construction safety accidents in China has been high. With the continuous improvement of national construction safety laws and regulations and the deepening of safety supervision and management, the current situation of safety production is still very serious, although it has been improved, the number of safety accidents and the number of deaths in the construction field in recent years is still not optimistic.

According to Figure1, the statistics of the national housing and municipal engineering production safety accident information reporting and statistical analysis system, from January to November 2018, a total of 698 production accidents occurred in housing and municipal engineering, with 800 deaths. Compared with the same period last year, the number of accidents increased by 55 to 47, up 8.55% [3] and 6.24% respectively [4].
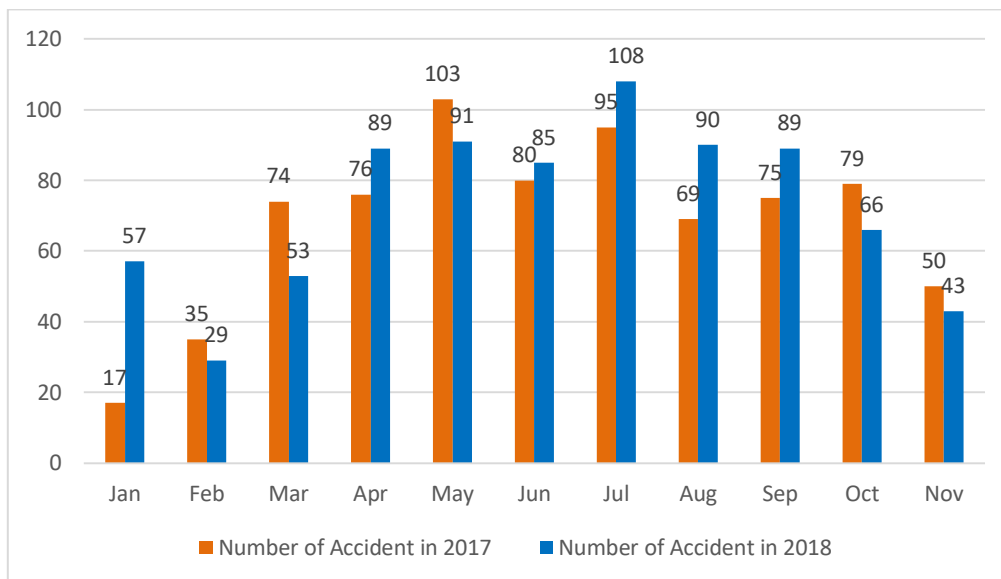

Figure 1. Number of monthly accidents comparison between 2018 and 2017.

According to Figure 2, the classification, analysis and comparison of the types of accidents occurred in the past two years, from 2010 to 2017, among all kinds of construction engineering accidents in China, the proportion of falling from height was 52.14%, collapse accident was 13.40%, object strike was 13.68%, and lifting injury was 34%, which accounted for 87.55% of the total number of accidents [5].
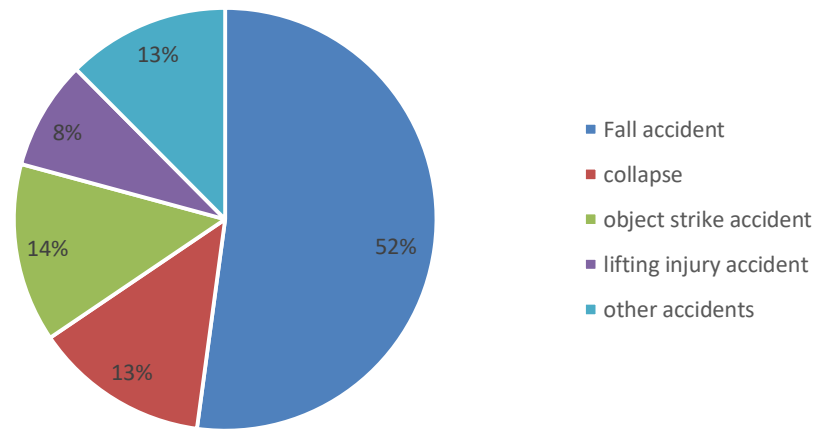
Figure 2. Distribution of major types of construction accidents in China from 2010 to 2017.

3. Applicability Analysis of BIM Technology in Construction Safety Management

With the support of BIM, the paper summarizes and summarizes the production factors of the construction site [6], controls and manages the specific construction status, identifies the hazard sources in the whole project in time, and provides important support and help for the formulation of project safety decision, and ensures the smooth progress of the construction project [7].
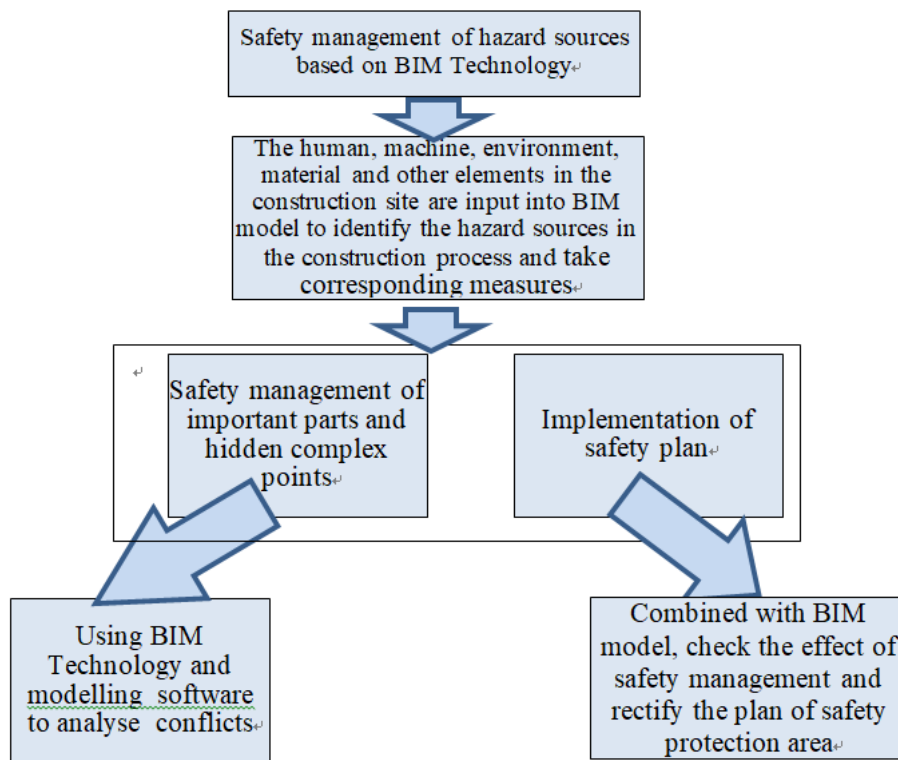

Figure 3. Applicability analysis of BIM in safety management.

4. Application Examples of BIM Technology

4.1. Space Considerations Project Background

S project is an old building reconstruction project, the total construction area of the project is 494073.00 m2, covering an area of about 32802.60 m^2. The construction site is close to the main road: only 24 meters away from m road; 36 meters away from n Road, falling objects are easy to cause injury to vehicles and pedestrians; in high-altitude operation, due to the weather, cement slurry and oil pollution generated by the operation are easy to splash, causing environmental pollution and economic claims[8]. The following will analyze the control process of BIM Technology in the fall accident.

4.2. Accidents at High Altitudes and Their Causes

Falling accident is the highest incidence of accidents in the construction site [9]. The parts prone to fall accidents include: personnel falling from the edge and opening; falling from the scaffold; falling from the gantry material elevator and tower crane in the process of installation and demolition. The cause analysis of falling from height is shown in the figure 4.
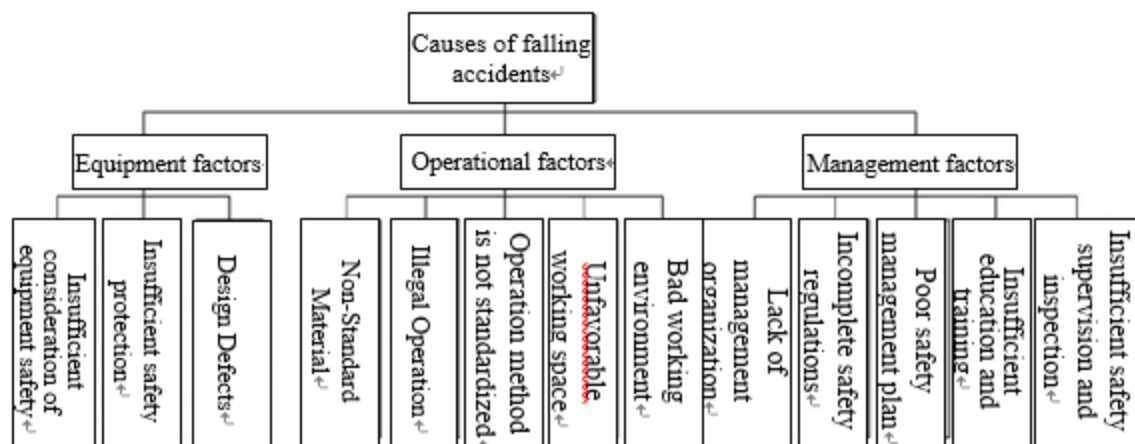

Figure 4. Causes of falling from height.

4.3. BIM Technology's Control Procedure for Falling Fall

After the overall model of the building is imported into the platform, the whole building can be viewed in an all-round way, which is convenient for the managers to identify the potential hazard sources during the high-altitude operation on the construction site, and provide convenience for taking safety management measures in the later stage. At the same time, BIM Technology can track the components in real time, automatically generate a unique two-dimensional code for each component, and can track the components, and timely rectify the marked parts on site [10].

According to the cause factors of the fall accident in Figure 4, pre control the related factors of "unsafe state of objects". For example, the protection of edges and openings is shown in Figure 5, and the safety control of real-time tracking of components is shown in Figure 6.
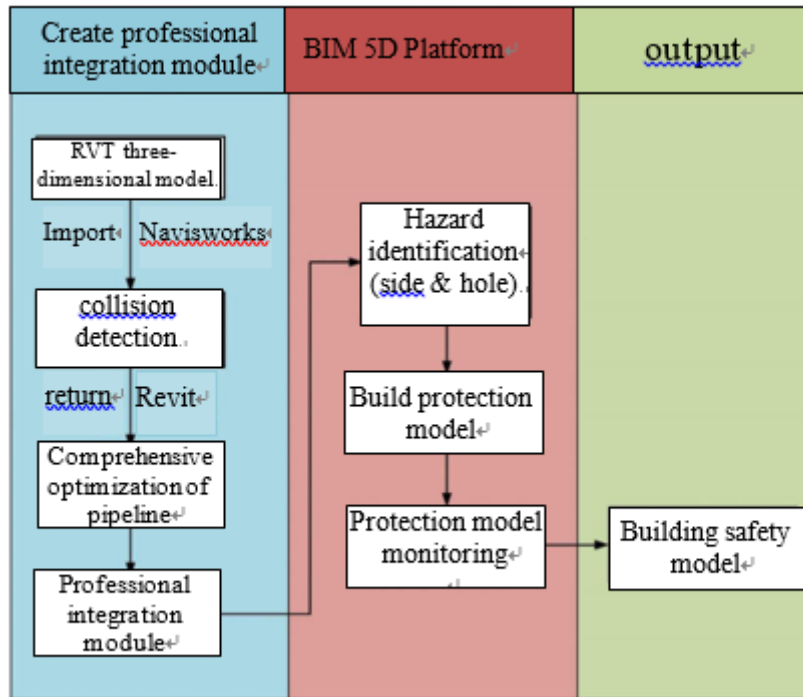
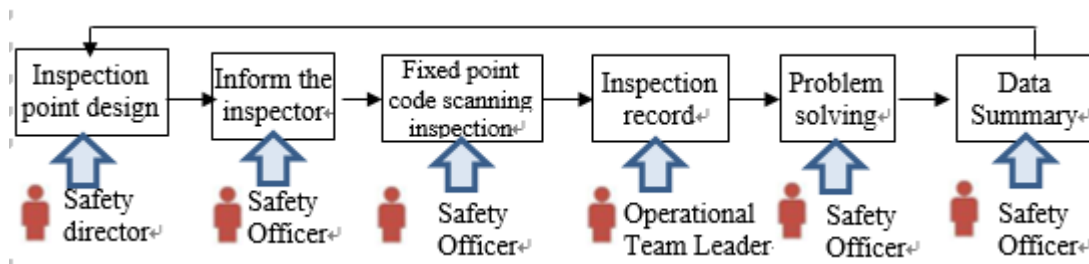**Figure 5.** Protetion process of side&hole.

Figure 6. Tracking and monitoring process.

In view of the "unsafe behavior of human beings", the BIM Technology is combined with the safety training mechanism to give full play to the characteristics of BIM Technology with strong simulation, high visibility and high professional level. The management personnel can make reasonable judgment according to the actual working conditions, analyze the potential safety hazards according to different construction conditions, and summarize the information of hazard sources.

Combined with BIM Technology, the local model of the building is established to simulate the working conditions of the above hazard sources. Through the roaming of the third person and the animation display mode, the matters needing attention in the operation can be explained to the construction personnel flexibly and vividly.

5. Conclusion

In this paper, the accident datas in recent two years are analysed. It is concluded that the incidence of falling accidents is the highest. The causes of falling accidents are analyzed in detail. With the help of bim-5d technology, the "unsafe state of objects" in the process of on-site management is monitored in real time, that is, the protective measures of the edge and the entrance and the unsafe area. The results show that the safety management of construction site has been effectively improved because of the

real-time monitoring function of bim5d and the attention of management personnel to protective measures in the whole construction process.

To sum up, in the current construction process, BLM technology is more and more widely used in the construction safety management, which provides great help for the current construction safety, but there are still some problems that need to be studied continuously by researchers, so that in the future construction, BLM technology can be more widely used. At this stage, with the continuous progress of social economy and technical level, it has a great role in promoting the construction industry, and in a certain sense also promotes the reasonable development of social economy. Therefore, relative to the construction construction, it is necessary to ensure its reasonable management, so as to make the development of the construction industry healthy and orderly.

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