Research on the Application of Intelligent Construction Site in Construction Site Management

Meng Zhang\textsuperscript{1,*}

\textsuperscript{1}School of Management, Tianjin University of Technology, Tianjin, China

*Corresponding author e-mail: 1198657277@qq.com

Abstract. China's construction industry has developed rapidly, and the traditional management methods can no longer adapt to the current construction projects. It has become an inevitable trend to change the management methods of construction sites by using information technology. The use of information technology to manage personnel and the site, and the application of intelligent worksite to the construction site, can better manage the site and bring more efficient management methods to the construction site. This paper mainly analyzes the quality and safety problems in the construction site, and uses the implementation methods of training, teaching and technical methods to reduce the quality and safety problems in the construction site with the help of the concept of intelligent construction site, so as to achieve the purpose of improving the management efficiency of the construction site.

1. Introduction

With the rapid development of the national economy, the construction industry, which is the basis of material production, has seen rapid growth in investment scale and industry contribution. At the same time, the large scale and complex environment of the construction site and the large number of participants and construction machinery have led to frequent safety accidents in the field of engineering construction. Therefore, the safety and quality control of the construction site has become the top priority of the site control. Under the high pressure of policy supervision, the need for traditional construction enterprises to transform and upgrade to fine and digital construction becomes more and more urgent.

At present, BIM, cloud computing, big data, Internet of Things, mobile Internet and artificial intelligence technologies are maturing day by day, providing technical guarantee for digital transformation of construction enterprises and becoming a new trend in industry development. How to reduce the quality and safety problems on the construction site and improve the management efficiency of the construction site by using the concept of intelligent construction site has become a hot issue.

2. Literature review

2.1. Research Status of Quality and Safety Management in Construction Sites at Home and Abroad

The construction quality is the basic factor for the normal construction of the project. Effective management measures can improve the construction quality. Babu A.J [1] believes that the accelerated construction of the project will affect the quality of the project. Site construction personnel are the key
to construction quality management and to reduce the probability of construction safety accidents [2]. Many scholars in China have also conducted in-depth research on this, believing that quality management is the most important [3, 4, 5] in the management of construction projects, and certain measures need to be taken to control the safety and quality of the construction site.

2.2. Research Status of Information Technology in Management

With the development of science and technology, information technology is gradually applied to all walks of life, mainly including information model technology, Internet of Things technology and positioning technology. The information model has operability. Zhang yanjie uses 3DSMax modeling software to build the actual scene, and trains the UAV’s terrain acquisition ability in it. The Internet of Things technology can use the network to identify and track management objects so as to make corresponding decisions conveniently. Positioning technology is widely used in detection [6], automobile [7] and other industries. All of these have laid a foundation for the application of intelligent worksite in site management.

2.3. Research Status of Intelligent Site Application in Site Management

The application of intelligent worksite management at home and abroad is mainly divided into two aspects, one is to put forward the theory [8, 9, 10]; the second is the use of information management methods [11, 12]. The construction site is characterized by large flow of people and complicated identities, so the importance of personnel management is most prominent. Therefore, in terms of management, it is necessary to fully consider the problems existing in the site, realize real-time management and control of the construction site, improve management efficiency, and enable the site to be managed better and faster.

3. Applied research and analysis of intelligent worksite

3.1. Analysis of Construction Site Management Problems

Problems arising from construction site management are mainly divided into two categories, one is the construction quality problem, the other is the construction safety problem.

People are the most important factor in the construction process of construction projects. Human factors include the operators, commanders and organizers who directly participate in the construction of construction projects. In the process of construction, it is undoubtedly of great significance to take the human factor as the control object to avoid operational errors. The causes of construction quality problems are shown in the table 1.

| difficulty | Status of construction site |
|------------|-----------------------------|
| Data recording is not intelligent | Dealing with liquidity through traditional paper work is very difficult in updating information |
| Information recording cannot be perceived dynamically | The way of information transmission is reported through forms and reports, and information lags behind. |
| Labor personnel information cannot be integrated | Can't establish construction personnel information base, can't systematically review access personnel information |
| The attendance system is chaotic. | No valid information can be extracted from the personnel entering the site, challenging the implementation of work regulations. |
| Construction personnel lack practicality. | It is easy to cause later rework and quality impact. |
There are two main types of unsafe behaviors in the construction site: the first is caused by subjective behavior factors of construction personnel, such as the most common personnel falling from high places; the second category is caused by the presence of objective factors on site, among which the most unsafe factors are outdated strikes and hoisting injuries. The specific analysis of construction safety problems is shown in the table 2.

**Table 2. Falling Phenomenon and Causes.**

| Number | Accident classification | Dangerous phenomena in construction |
|--------|-------------------------|-------------------------------------|
| 1      | Falling accident due to illegal operation | Project management personnel use workers who have not obtained the shelf work certificate to build and dismantle scaffolds. |
| 2      | Workers who have not obtained the qualification certificate for working at heights do so without authorization. | Unauthorized climbing of non-specified passages and failure to pass through the specified passages to enter the operation surface. |
| 3      | Accident of operation platform falling from height | Safety protection facilities are not established in accordance with regulations and no special personnel are set up to monitor and protect the dismantling of formwork support system, scaffold, hoisting machinery or tic-tac-toe frame. |
| 4      | Human error accident | Do not wear personal protective equipment such as safety belt, safety helmet and anti-skid shoes for high-altitude operation. |
| 5      | Falling occurs due to stepping on empty space and sliding during the operation of the adjacent hole and foundation pit. | Fall due to forgetting to wear safety belt in time or not fastening safety belt during operation. |
| 6      | Operators fall down due to improper cooperation when installing building components. | |

**Table 3. Mechanical Safety Management Issues.**

| Safety management issues | The cause of the problem |
|-------------------------|-------------------------|
| Project construction sites are scattered | The shortage of professional equipment management personnel and maintenance personnel makes equipment management difficult. |
| Equipment supervision is not in place | Equipment usage is large, equipment maintenance is difficult, equipment status is difficult to grasp, and there are potential safety hazards. |
| Confused operation and management | The increase of uncontrollable factors for management and operation safety can only depend on the responsibility of the operators. |
| Equipment information delay | It is difficult to supervise large-scale equipment. The operation safety is mainly based on personnel experience and lacks monitoring measures. |

3.2. Settlement of Construction Site Management Problems

In order to solve the management problems of the construction site, BIM technology can be used to train the construction personnel so as to solve the management problems from the root, thus improving the management efficiency of the site. The application of BIM technology to construction site management can not only strengthen the information circulation on the construction site, but also strengthen the information exchange of the construction site staff. In addition, BIM safety model can
be built to predict possible safety problems in advance and prevent them from happening. The BIM software interworking process and the dynamic process model of safety training are shown in the fig.1 and fig.2.

Figure 1. BIM Software Interworking Process.

Figure 2. Model Dynamic Flow of Safety Training.

4. Conclusion
Nowadays, the construction industry is booming and construction sites are everywhere. However, due to the frequent occurrence of quality and safety problems, how to use information technology to solve the problems and improve the construction status are the problems that need to be solved in the popularization of intelligent construction sites. In this paper, through the research on the quality management of the construction site, combined with information technology, the implementation of intelligent construction site is studied. This paper makes an in-depth analysis of the construction site
management problems, and puts forward the use of BIM technology for information exchange and safety pre-judgment, and the use of information technology to avoid unsafe factors in advance to reduce the occurrence of safety problems.

Generally speaking, intelligent construction site is a newly emerging technology. Its appearance makes the construction site change the traditional management mode. The application of information technology can bring better effects to the way of project construction and realize the value and significance of information technology itself.

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