Discussion on Safety Early Warning Management in Building Construction

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Abstract. With the continuous development of social economy and the improvement of people’s living standards, the construction industry has been further developed. People attach great importance to the quality of construction. In construction, safety accidents threaten the safety of construction personnel, affect the stability of construction, and definitely affect the quality of later projects. In order to ensure the sustainable development of construction projects, it is necessary to establish and improve the safety early warning system, reduce the occurrence of safety accidents, and promote the sustainable development of construction enterprises. Following is a detailed analysis of the safety early warning management in building construction, in order to provide effective reference for promoting the sustainable development of the construction industry.

1. Introduction
The construction industry is an important component of the basic livelihood industry in China. It is of great significance to promote economic growth and improve the living standards of the residents, and can promote the harmonious development of the socialist society[1]. However, since its birth, the construction industry has been accompanied by safety problems. Construction safety threatens the safety of construction personnel, and is liable to cause safety accidents, huge property losses and adverse effects. Therefore, the following analyzes the safety early warning management in building construction in detail, points out the importance of safety early warning management in building construction, and puts forward how to do a good job in construction safety early warning management after understanding the content of early warning management.

2. The Importance of Safety Early Warning Management in Building Construction
According to the statistics of emergency management departments in China, in the first half of 2018, the form of safety accidents in construction industry was severe, there were 1732 accidents and 1752 deaths in construction industry, with year-on-year growth of 7.8% and 1.4% respectively. The total number of accidents has been ranked the first in industrial, mining, commercial and trade accidents for nine consecutive years. The number of accidents and deaths has been rising continuously since 2016. Falling from height and collapse were the main types of accidents in the construction industry. In general accidents, accidents of falling from height accounted for 48.2% of the total accidents, and object strikes accounted for 13.6%. In larger accidents, collapse accidents accounted for 45.1% of the total accidents.
2.1 Budget Analysis of Project Safety Level to Reduce Accident Probability

Through the research on the development of China’s construction industry, it is found that safety accidents are concentrated in such aspects as object strike, falling from height, electric shock, construction collapse, equipment damage, etc. It is necessary to adopt safety early warning management technology, establish a scientific management system, set early warning index parameters according to the existing data, establish key construction links, and take into account the safety detection of construction content to reduce the occurrence of safety accidents. Through the early warning system, it can alarm in time when an accident occurs and deal with it urgently after the accident, so as to reduce the impact of the accident[2].

2.2 Promoting Construction Enterprises to Optimize Safety Management Model

The management of safety early warning in construction can ensure that the safety management of construction enterprises keeps pace with the development of the times. According to the current situation of construction enterprises, safety management is carried out in accordance with construction units, project parts and construction teams. However, scientific management of overall construction resources is not carried out, resulting in the lack of unified management of safety tasks. When management is implemented in practice, different levels of management restrict each other[3]. In addition, the safety management of enterprises is greatly influenced by human factors. Although enterprises attach importance to system construction, the implementation of the system is insufficient. The construction personnel do not realize the importance of norms. They often construct by experience, and safety management becomes a mere formality. Construction enterprises need to constantly expand new safety management mode, take safety early warning management in construction as the core, and put safety innovation management into practice.

3. Content of Building Safety Early Warning Management System

The building safety early warning management system needs to be established, including, acquisition and investigation system, safety analysis system, early warning signal system, early warning countermeasures system and so on.

Table 1 Composition of building safety early warning management system

| Safety early warning system | Acquisition and investigation system | Safety analysis system | Early warning signal system | Early warning countermeasure system |
|-----------------------------|-------------------------------------|-----------------------|----------------------------|-----------------------------------|

Figure 1. Types and proportions of building safety accidents
3.1 Collection and Investigation

Collection and investigation is the precondition of early warning. Accurate data are needed and the investigation should be carried out to scientifically judge accidents. Under normal circumstances, the monthly and quarterly data support should be used. Building safety early warning data information does not need to be collected in accordance with time. Considering the nature of building safety early warning system, comparing the probability of accidents, comparing and analyzing its own data with other projects, drawing lessons from other accidents, the system provides dynamic information for construction and ensures real-time information for construction projects[4].

3.2 Safety Analysis

Safety analysis is a detailed analysis of collected information, mastering the probability and regularity of different safety accidents. Through establishing an early warning index system, the fluctuation of different indicators can be mastered, and the relationship between construction safety and different indicators can be understood. Comparing with other construction projects, the unstable factors in the project can be found by safety analysis, and the early warning measures and emergency treatment measures can be formulated[5].

3.3 Early Warning Signal System

In the system design, early warning signal truly reflects the project situation. Supporting by data processing, the indicators are synthesized. The indicators and synthesized indicators are compared and analyzed in the form of traffic signals. After sending the corresponding signals, the change of signals is observed. The development trend of engineering safety can be predicted combined with historical data. Corresponding safety management personnel should adopt scientific control measures according to the change of signal to avoid the occurrence of safety accidents.

3.4 Early Warning Countermeasures

Early warning countermeasures are the core of safety early warning management system in construction. After forecasting project construction safety by early warning signals, combining with forecasting results, safety management is implemented by scientific regulation and control to ensure the stable implementation of construction projects. In order to ensure the stable construction of the project, it is necessary to understand the particularity of the indicators under different safety conditions, explore the possible impact of different indicators, understand the hidden dangers of accidents, and take corresponding measures to solve the problems according to the specific construction conditions.

4. Strategic Analysis of Establishing Construction Safety Early Warning Management System

4.1 Strengthening Safety Education and Raising Safety Awareness

Personnel play a subjective and active role in the construction of construction projects. To strengthen the early warning management of construction safety, attention should be paid to the safety education of personnel to enhance the safety awareness of participants[6]. By means of education and training, the safety consciousness of construction personnel can be strengthened and their operation level can be improved. Management departments and supervision departments should supervise and establish safety early warning system, make safety slogans, learning documents and learning plans for staff, integrate reward and punishment system into staff learning, give oral reward and bonus support to those who are active in training, give notification criticism and appropriate economic punishment to those who are not active in training, and organize unified assessment after learning. Those who pass the examination are put into construction, but those who fail the examination need to continue learning. The learning content should be set up, including legal knowledge, on-site safe electricity use, high-altitude safety protection, civilized construction, on-site first aid, emergency treatment and so on. In view of the low educational level of some construction personnel, it is necessary to strengthen the universal education of basic construction safety knowledge, and improve the ability of personnel to
deal with safety accidents through case education and examination.

4.2 Carrying out Periodic Safety Inspection and Implementing Safety Measures
In order to improve the efficiency of safety accident prevention, regular safety inspection is needed to eliminate potential safety hazards. Regular safety inspections should be carried out during construction, and safety measures should be put into practice. Personnel should be always alerted to attach importance to self-protection and safe construction, and safety construction policies should be profoundly implemented[7]. Enterprises need to carry out a comprehensive inspection of construction equipment, personnel and environment, and put forward feasible safety early warning measures for equipment with potential safety hazards. Safety inspection should be carried out in practice, carefully checked, and attention should be paid to the details which are easily overlooked. After inspection, serious potential safety hazards should be dealt with immediately. General potential safety hazards must be solved within a certain period of time to ensure the safety of construction. In the actual construction of buildings, there may be safety accidents that the inspectors neglect. Some inspectors are too familiar with the safety inspection steps and easily neglect some links. Therefore, attention should be paid to the inspection effect, so that the inspectors should cross-check, find problems, and solve problems, to effectively prevent potential safety hazards.

4.3 Strengthening Technical Guarantee and Defining Responsibility and Obligation
Reasonable safety technology in construction can greatly reduce the risk of safety accidents. Safety technology guarantee is one of the important contents in construction. Most safety accidents caused by construction technology are large-scale, and have bad impact and low emergency treatment effect. Therefore, the following aspects should be paid attention to in construction: on the one hand, the workers need to strictly check the quality of various equipment and tools, timely replace aging and malfunctioning equipment, and strengthen the maintenance of normal equipment; on the other hand, the enterprises need to be familiar with the construction process, understand the composition and operation mode of the construction personnel, construct in accordance with national standards, and improve the scientific and technological system. They should select technicians with comprehensive safety quality, clarify their responsibilities and obligations, select skilled personnel to hold important posts, and implement supervision and management[8].

4.4 Continuous Improvement and Perfection of Safety Regulations
Safety regulations are indicators of construction safety. The safety regulations should be constantly improved to avoid the emergence of security holes in the system. It is necessary to have a clear understanding of construction safety regulations and systems, actively absorb the advantages of other project systems, and create diversified safety early warning models. It is also necessary to expand the scope of safety early warning and implement safety supervision and management before, during and after construction with the support of detailed safety operation rules. In addition, in order to ensure the safety of construction personnel, the state should promulgate corresponding policies and enterprises should implement them. At the same time, the construction enterprises themselves should establish safety management content to improve the construction industry.

5. Conclusions
To sum up, through the research on the safety early earning management in construction, it is necessary to establish a corresponding safety early warning management system and strengthen safety management. Construction enterprises should adhere to the “people-oriented” and “safety first” concept, profoundly implement the safety management work, improve the safety construction awareness of construction personnel, and effectively reduce the occurrence of safety accidents, so as to promote the sustainable development of the construction industry, and make outstanding contributions to national economic growth.
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