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Technical Management in Safety Risk Prevention and Control of Construction Projects

Hongtao Zhuang*

Shenzhen Baohai Construction Group Co., Ltd., Shenzhen 518000, Guangdong, China

**Author to whom correspondence should be addressed.*

Abstract: Construction safety accidents mainly occur because engineering technicians fail to take effective measures for safety risk prevention and control, which leads to safety incidents during the construction process. Technical management in construction projects is one of the important tasks and also a very important part of engineering quality management. When construction engineers carry out effective technical management, they can control safety risks within the maximum range and ensure the quality of the project.

Keywords: Technical management; Construction projects; Safety risk prevention and control

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1. Introduction

This article conducts in-depth analysis and research on the prevention and control of construction safety risks, and proposes key prevention and control measures for technical management in construction. To effectively curb the occurrence of construction safety accidents, improve project quality and overall efficiency, it is necessary to implement scientific management strategies to provide standardized guidance to technical personnel. This article systematically analyzes the prominent problems in technical management in construction, and proposes practical and feasible technical management measures and methods to significantly reduce the probability of safety accidents. For example, in the construction of deep foundation pit support, strengthening technical management can effectively prevent potential risks and ensure structural stability and construction safety [1]. During the construction process, utilizing advanced technical management methods and measures to carry out risk prevention and control can achieve precise control over multiple dimensions such as project quality, progress, and safety, ultimately promoting the comprehensive improvement of project quality and efficiency.

1.1. Safety risk prevention and control of technical management in construction

During construction, technicians need to investigate the construction site to determine the construction plan for the

building project, and based on this, develop scientific and reasonable technical management measures. Due to the complexity and variability of environmental factors in construction, various problems often arise, which can affect the construction process and safety. By adopting effective technical management measures to prevent and control risks, the probability of construction risks and safety accidents can be reduced.

1.1.1. The significance of safety management in construction is significant

Safety management is a crucial core link in construction, which directly affects the guarantee of construction quality and progress. Only by effectively strengthening safety management can the incidence of safety accidents be reduced, thereby ensuring construction safety and overall project quality. In the process of construction engineering, many uncertain factors such as natural environment and construction site conditions often significantly increase the difficulty of construction. Once there is a safety hazard, it may lead to serious consequences. Therefore, it is necessary to attach great importance to safety management and strengthen on-site control and supervision mechanisms. The existence of these uncertain factors in construction projects can easily lead to schedule delays.

During the construction process, the ability to prevent and control safety risks should be enhanced, and the probability of accidents should be significantly reduced through scientific technical management measures and means. For example, in the field of building construction formwork support, adopting targeted safety technology management measures can effectively prevent risks such as collapse, ensure structural stability and personnel safety [2]. To achieve the goal of zero safety accidents during construction projects, thereby effectively ensuring the safety of the lives and property of construction personnel.

1.1.2. The role of technical management in security risk prevention and control

Technical management work is the core guarantee for ensuring the smooth progress of various activities in construction projects. In the construction process of a construction project, technicians should develop detailed and comprehensive construction plans based on the actual situation, use efficient technical management methods and measures, and effectively control safety risks during the construction period, thereby ensuring the quality and overall safety of the project. The impact of technical management on construction is crucial, and only through scientific and effective technical management can the orderly progress of various tasks be ensured. At the same time, improving the level of technical management can significantly promote the economic and social benefits of engineering projects, and promote the sustainable development of the construction industry [3].

1.1.3. Safety risks in construction

The safety risks in construction mainly involve three levels: construction personnel, mechanical equipment, and construction environment, among which construction personnel are often the main factor causing safety accidents. During the construction process, technical personnel need to fulfill their responsibilities of safety risk prevention and control, effectively prevent accidents, and ensure the quality of the project. Due to numerous uncertain factors in construction, technicians need to undertake multiple key tasks, including engineering planning and design, material selection, construction scheme design, and environmental impact assessment.

Unreasonable engineering planning and design or improper material selection may lead to the inability to guarantee the quality of the project. For example, in the material selection process, if the actual needs cannot be met, it will lead to insufficient procurement quantity or material quality problems, which will directly affect the

overall project quality [4]. In the stage of construction scheme design, if the scheme preparation lacks scientificity and rationality, it will lead to frequent safety hazards during the construction process. As for environmental impact, it mainly comes from the interaction between climate conditions and on-site environment. If construction is carried out in areas with harsh environmental conditions or in extreme environments such as high temperature and humidity, it may seriously weaken the quality of the building.

2. The current situation of safety risk prevention and control in construction through technical management

Due to the weak awareness of safety risk prevention and control among management and technical personnel in construction, they are unable to timely detect and control hidden dangers during construction. During the construction period of the building project, due to the technical personnel's unfamiliarity with the on-site construction environment and insufficient understanding of the construction plan, it is impossible to formulate reasonable safety risk prevention and control measures. The phenomenon of equipment failure or damage caused by improper use of technical personnel during construction.

Owing to the technical personnel's lack of understanding of new processes and technologies, they did not operate according to the specifications. For the reason of the unfamiliarity of technical personnel with the situation on the construction site, safety risk prevention and control measures were not properly formulated during the construction period. Once there are safety hazards, they cannot be dealt with in a timely manner, leading to safety accidents. As a result of the weak awareness of safety risk prevention and control among technical personnel, effective measures were not taken to prevent and control safety risks even after the existence of safety hazards.

2.1. Application status of technical management in construction

There are still many shortcomings in technical management work, specifically manifested as follows:

(1) The importance of technical management has not been fully recognized, and insufficient attention has been paid to the application of construction technology management;

(2) A complete technical management system and incomplete engineering quality and progress control have not been established;

(3) Many people believe that there is a lack of understanding of risk management on construction sites, and that potential problems that may occur during construction have not been prevented and controlled in a timely and effective manner.

The existence of such problems leads to safety accidents in the project and causes significant economic losses to the enterprise [5].

2.2. Common safety risk cases in construction

During the construction process, the lack of effective technical management measures by technical personnel can easily lead to various safety risks and accidents. Specific manifestations include as listed:

(1) The construction site did not set up or dismantle scaffolding according to regulations, resulting in structural instability;

(2) The construction unit failed to carry out safety education and training in accordance with regulations, resulting in weak safety awareness among construction personnel.

Failure to strictly comply with relevant requirements during the erection and dismantling of scaffolding has

resulted in potential safety hazards. Furthermore, failure to inspect, repair, and maintain construction machinery and equipment in accordance with regulations has resulted in equipment failure. Especially if the deep foundation pit support and formwork support system are not regularly inspected and maintained as required, it is highly likely to cause safety accidents.

For example, a high-rise building project experienced a collapse accident during construction. The accident occurred during the dismantling of the formwork support system, and due to the failure of technical personnel to inspect and maintain it according to regulations, the system became unstable and collapsed. After the investigation, it was confirmed that the accident was caused by the technicians' neglect of the standard inspection and maintenance requirements in the demolition process. The use of BIM technology management platform can effectively enhance the risk control capability during the construction phase and reduce the occurrence of similar accidents [6].

3. Challenges in safety risk prevention and control of technical management in construction

During the construction period, technical management is crucial to ensure the quality of the project, but there are still many problems with technical management in actual operation, which seriously restrict the improvement of the quality and level of technical management. If some engineering project technicians do not follow the relevant construction plans and technical standards during on-site construction, or do not follow the prescribed procedures, the safety risks are increasing.

Some engineering projects do not pay attention to technical management and have not formed a sound technical management system and institutional framework, resulting in a low level of safety risk prevention and control. Prior to the construction of some engineering projects, on-site investigation, analysis, and research were not carried out, and technical standards and specifications were not strictly implemented and enforced during the construction period. These issues greatly constrain the improvement of technical management level and pose significant challenges to the prevention and control of construction safety risks.

3.1. Safety accidents caused by inadequate technical management

During the construction process, safety accidents caused by inadequate technical management mainly manifest in the following aspects:

(1) Technical management personnel lack in-depth understanding of engineering technology, have insufficient understanding of new technologies and processes, and fail to accurately grasp the technical points and operating procedures, resulting in the occurrence of safety accidents during the construction period;

(2) The implementation of the construction plan was inadequate. During the implementation of the project, a scientifically reasonable construction plan was not developed based on the actual situation, resulting in significant deviations between the actual operation and the design drawings, making it difficult to ensure the quality of the project [7];

(3) There was insufficient analysis of issues during the construction process. The technical management personnel did not supervise and manage the construction process properly, and failed to discover and solve problems in a timely manner.

Once a safety accident occurs, the consequences are often further exacerbated due to the lack of effective

response measures.

3.2. The problem of incomplete safety management system

The imperfect safety management system is an important reason for the frequent occurrence of safety accidents during the construction process. Due to the large scale and high construction difficulty of construction projects, it is necessary to establish a sound safety management system to ensure construction safety. Only by implementing effective technical management measures, scientifically controlling safety risks, and building a sound safety management system can we ensure the smooth implementation of engineering projects. However, some enterprises have not yet established a complete safety management system, which makes it difficult to ensure the effectiveness and rationality of safety management during the construction process, leading to safety accidents.

In addition, during the project construction period, some enterprises have insufficient management of technical personnel, resulting in uneven quality of technical personnel and difficulty in ensuring their technical level. During the construction process, technical personnel need to effectively manage materials and equipment, strictly implement equipment maintenance, ensure the normal operation of equipment, and effectively reduce safety risks.

3.3. The impact of human factors on safety risk prevention and control

Human factors have a significant impact on the occurrence of construction safety accidents. If construction operators make significant operational errors in actual work, it may often directly lead to safety accidents. During the construction period of a building project, relevant personnel must strictly follow the regulatory requirements for operation. However, safety accidents caused by human factors are not uncommon, such as operators' illegal operations or non-standard behavior, which can lead to serious consequences.

Moreover, the occurrence of safety accidents may also be due to inadequate technical management and a lack of professional competence among technical personnel. To this end, it is necessary to adopt scientific and effective technical management measures, comprehensively improve the professional skills and comprehensive quality of technical personnel in construction, and strengthen risk prevention and control through improved technical management methods to ensure the safety of the construction process.

4. Improve the level of technical management and strengthen the prevention and control of construction safety risks

Technical management plays a crucial role in construction projects, and its level directly determines the quality of the project. Therefore, in order to improve the quality of construction projects, it is necessary to attach great importance to technical management work, continuously improve management level, and ensure its efficient implementation. Technical personnel need to continuously enhance their comprehensive qualities, improve their professional knowledge and business capabilities through continuous learning and practice, in order to provide guarantees for construction safety.

At the same time, engineering and technical personnel should timely grasp the latest technology and regulatory requirements of construction, optimize their knowledge structure and professional skills. In practical work, technical personnel need to actively participate in the construction site, fully exert their subjective initiative, strictly follow relevant national standards to carry out construction operations, and actively participate in training and learning activities to continuously improve their professional knowledge and business capabilities. During the

construction process, work should be arranged reasonably according to project requirements and actual situations to prevent the occurrence of safety accidents.

4.1. Strengthen the training of technical management personnel and enhance their professional skills

In construction projects, technical management personnel are the core subject of project implementation, and their professional skills directly affect the quality of the project. To improve the level of technical management, it is necessary to strengthen the systematic training of technical personnel. To ensure construction quality and progress, it is necessary to scientifically arrange construction techniques based on the actual situation on site, promote collaborative efforts among various departments, and thus improve overall work efficiency. Specific measures include as follows:

(1) Strengthening the professional skills training of technical management personnel, organizing the learning of advanced technical knowledge and operating procedures, and ensuring that they are proficient in the forefront experience of the industry;

(2) Strengthen professional ethics education and cultivate correct professional values among technical personnel;

(3) Emphasis should be placed on cultivating professional abilities, encouraging technical personnel to master the application of new technologies, equipment, and materials proficiently, in order to significantly improve work efficiency.

4.2. Improve safety management system and strengthen risk prevention and control measures

In construction projects, the construction unit should establish a sound and comprehensive safety management system based on the actual situation of the project, and formulate detailed safety management standards. The project manager is primarily responsible for establishing, supervising, and implementing safety management systems to ensure their effective implementation. The construction unit should formulate meticulous risk prevention and control measures, comprehensively supervise and control all aspects of construction. Technicians need to strictly monitor the construction site, promptly identify and handle unsafe factors, and report any problems to the project manager immediately and take appropriate solutions. At the same time, establish strict safety management systems and risk prevention mechanisms to ensure the safety and controllability of the construction process.

4.3. Introduce advanced technological means to improve safety management efficiency

Advanced technological means should be actively introduced in construction to improve safety management efficiency and effectively control safety risks. For example, using laser radar ranging systems, drones, and intelligent monitoring technology can achieve real-time and efficient monitoring of construction sites, and timely grasp of on-site dynamics through data analysis. Technical personnel should scientifically apply monitoring techniques and methods for risk prevention and control based on the characteristics of construction. For example, in order to address potential safety hazards during construction, drones can be used to monitor the terrain and geological conditions on site, promptly identifying and eliminating risks.

On top of that, the intelligent monitoring system is based on image recognition technology, which can achieve all-weather monitoring of the construction site and real-time grasp of the construction status. Applying intelligent monitoring systems to engineering construction can effectively identify and resolve safety risks during

construction. Meanwhile, intelligent recognition systems can be used for automated analysis and early warning of security risks, further enhancing the efficiency of security management.

5. Conclusion

In actual construction, technicians need to take effective technical management measures based on the actual situation of the project in order to effectively control safety risks and ensure the quality and efficiency of the construction project. Construction technicians need to develop scientific and reasonable technical management based on the specific situation of the project during actual construction. Effective management has been implemented in the procurement of materials and equipment, as well as in the operation of personnel, resulting in an improvement in the technical management level of construction projects. By strengthening the management and education training of construction engineering technicians, we aim to enhance their professional skills and knowledge, and promote the improvement of their overall quality. Engineering and technical personnel need to timely understand the real situation of the construction project during the actual construction period, and continuously upgrade and improve themselves during the construction period to achieve strengthened management of construction engineering technology. At the same time, effective control and prevention of safety risks during construction are also necessary.

Disclosure statement

The author declares no conflict of interest.

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