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Problems and Solutions of Safety Production Management of Expressway Maintenance

Weiping Li*
Shandong Transport Vocational College, Weifang 261000, Shandong Province, China

***Corresponding author:** Weiping Li, 546718705@qq.com

Abstract:

The safety management of expressways during maintenance is faced with many challenges, which aggravate the safety risk in the maintenance process and affect the overall safety and durability of the road. The detailed analysis of the root causes of these problems can provide a valuable reference for the formulation of follow-up countermeasures. Given the existing problems, the implementation of effective and practical measures has become particularly critical to enhance the effectiveness of safety management and ensure the smooth progress of expressway maintenance operations. This paper discusses several management solutions, aiming to provide guidance and suggestions for relevant industry practices.

Keywords:

Expressway
Maintenance
Safety production management
Problem
Solution

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1. Introduction

The maintenance condition of the expressway directly determines the safety level of the road and its service life. As vehicle traffic increases, maintenance tasks become more complex and critical. Unfortunately, in many expressway maintenance projects, the problems of ineffective implementation of safety management systems and insufficient preventive measures are widespread [1]. Therefore, it is necessary to conduct a comprehensive discussion on the safety management of the current maintenance operations on the expressway and put forward specific and effective improvement strategies to improve the safety and efficiency of the work.

2. Problems existing in expressway maintenance and safety production management

2.1. Poor management systems

At present, there are some deficiencies in the safety management system of expressway maintenance, which are mainly manifested as unclear responsibility definition and fuzzy management level. Due to the lack of clarity in the functional scope and authority of managers,

the authority and execution of safety management are lacking. In this environment, once there is a problem, the relevant personnel often shirk their responsibilities to each other, and lack the necessary cooperation and support, which affects the overall safety management effect. In addition, the communication channels between senior managers and on-site staff are not smooth enough, and the information feedback mechanism is lacking, which further aggravates the potential security risks. These defects in the system make it difficult for safety work to form effective synergies, and the implementation of a safety responsibility system is not in place, which ultimately makes the actual effectiveness of safety management unsatisfactory and increases the risk of safety accidents [2,3].

2.2. Imperfect operation specifications

Currently, there are obvious deficiencies in the systematic norms and standards in the maintenance work of expressways, which directly leads to the frequent occurrence of non-standard operations in the field operation process. Such informal operation mode not only weakens the overall quality of maintenance work, but also brings risks and hidden dangers to safety production that cannot be ignored. Front-line staff generally have a low awareness of the established operating procedures, poor ability to implement them, and lack detailed operational guidance support, so they are prone to misoperation or improper behavior in the actual execution of tasks [4]. At the same time, due to the lack of clear operational guidelines, it is often difficult for employees to take appropriate measures quickly in the face of emergencies, and this uncertainty further increases safety risks and affects the safe operation efficiency of expressways.

2.3. Insufficient personnel training

In the field of road maintenance, the safety education and training of construction personnel are generally systematic and targeted. Many workers fail to accept comprehensive and in-depth safety guidance and have a vague understanding of potential risks in the working environment, which directly leads to their weak safety awareness [5]. The current safety training mainly focuses on the study of theoretical knowledge but lacks the teaching link closely combined with practical operation. This mode cannot effectively improve the practical operation skills of employees and their ability to respond to emergencies. Due to the lack of such education, front-line workers not only lack effective coping strategies when they encounter safety threats, but also reduce their enthusiasm to comply with safety regulations, which significantly increases the possibility of accidents during construction.

2.4. Adverse climates

Climatic conditions have a significant impact on the safety management of expressway maintenance projects, especially under extreme weather conditions. For example, severe weather conditions such as heavy rainfall, strong wind, and low temperatures often lead to construction machinery failure, thus interfering with the normal operation process [6]. In addition, such adverse weather conditions can reduce workers' productivity, cause delays in project schedules, and increase the likelihood of accidents. Working with obstructed vision leads workers to be prone to bad judgments, which undoubtedly increases the risk of accidents. In addition, the slippery ground caused by climate change or other potentially dangerous factors also increases the security risks of the construction site.

3. Solutions for safety production management of expressway maintenance

3.1. Strengthening safety training

Systematic safety education and training for expressway maintenance and construction personnel is one of the key ways to improve the efficiency of safety management in this field. The first step is to design a scientific and comprehensive training program that covers a wide range of dimensions, such as laws and regulations, operational norms, and emergency handling. Specifically, the training materials need to include the safety regulations issued by the national and local governments, special safety matters to be paid attention to during construction, and ways to identify and prevent common risks, so that every employee can deeply understand and master this knowledge. Secondly, in the process of education, we should not only pay attention to theoretical teaching but also strengthen the practical aspect. Through practical

exercises under a simulated real working environment, participants have the opportunity to directly face and solve various emergencies that may be encountered. Such practical activities have a significant effect on enhancing the practical operation skills and quick reaction ability of employees, which helps them deal with accidents more calmly in practical work. In addition, regular safety knowledge competitions and emergency drills are also effective means to enhance the safety awareness of employees. The former can stimulate employees' interest in learning and encourage them to take the initiative to acquire more knowledge about safety; the latter helps to deepen employees' understanding of emergency plans, thus improving the tacit cooperation and response speed of the whole team in critical times [7]. Such activities are conducive to the formation of a positive safety culture and encourage each member to pay more attention to their own safety responsibilities. Finally, in order to accurately measure the training results, it is suggested to conduct a questionnaire survey after each course to collect feedback from participants, so as to continuously improve the future teaching content and form. This process not only helps to enhance the relevance and effectiveness of the training activities, but also increases the staff's sense of participation and personal identity in the training program, thereby further stimulating their enthusiasm for learning and responsibility for safe work.

3.2. Improving the management system

Improving the safety management system of expressway maintenance is the key to increasing the efficiency of safety management. The first step is to define the specific responsibilities of managers at all levels and ensure that each manager can find his or her own place in the work safety system. By refining the responsibility distribution table, managers can be clearer about the scope of personal security responsibilities and promote the effective implementation of responsibilities, preventing management loopholes caused by unclear rights and responsibilities. Secondly, the construction of a complete set of safety production responsibility systems is also one of the core links of system construction. The safety responsibility of each position should be accurate to the individual, and a top-down responsibility chain should be formed to ensure that every employee can clearly understand their own safety tasks [8]. In addition, management systems should be regularly evaluated and updated in order to better adapt to changes in the working environment and technical conditions. Through the periodic review of the existing system, the shortcomings can be identified and remedied in time, so as to ensure its applicability and implementation effect. In addition, it is also important to encourage front-line employees to actively participate in the system improvement process. Since they have the most direct understanding of the practical problems, their feedback is of great value to further optimize the management system. Establishing an effective communication platform, such as holding regular staff meetings or consultation activities, so that employees' voices are heard, will help improve the actual effectiveness of the system and its enforcement. Finally, the introduction of external professional consultants or references to industry standards can also contribute to the continuous improvement of the system. The new insights and expert advice provided by these professionals can help companies stay at the forefront of workplace safety management.

3.3. Improving operation specifications

In the maintenance of expressways, the establishment of detailed operation guidelines and standards is the basis of operation normalization and standardization. First, it is necessary to prepare operation manuals based on the characteristics of different maintenance tasks. These manuals should cover specific operating procedures, lists of required tools and equipment, safety instructions, and risk assessment and prevention strategies to provide clear operational guidance for workers. At the same time, in order to facilitate understanding, the manual should also contain easy-to-digest verbal descriptions and graphical instructions to help workers better grasp the key points. Second, regular review and adjustment of the code of practice is essential to maintain its effectiveness. In view of technological progress and changes in the construction environment, the original specifications may gradually lose their applicability. Therefore, it is important to establish a periodic review system, involving professionals and front-line employees, and constantly update and improve the content of the code by collecting feedback and case studies to ensure that it is up-to-date.

The implementation of a unified operation process not only can effectively reduce the possibility of accidents but also significantly improve the quality of maintenance work. Consistent operating standards help reduce the incidence of errors and misconduct and enable employees to perform their tasks efficiently within the established framework [9]. In addition, the standardized process also helps to strengthen the ability of team collaboration, ensure that maintenance activities can be carried out in an orderly manner, and further strengthen the safety and efficiency of the expressway. More importantly, the improvement of operation standards also needs to be combined with the application of modern information technology.

3.4. Strengthening emergency management

Building a sound emergency management system is significant to ensure construction safety in the maintenance of expressways. First of all, a detailed emergency plan should be developed to deal with various potential emergencies, such as natural disasters (such as heavy rain, strong winds, and snow), mechanical failures, and personnel injuries [10]. These plans need to clarify specific procedures for different emergencies, the allocation of responsibilities, and communication coordination mechanisms so that the relevant departments can work together quickly and efficiently in times of crisis. Secondly, holding regular emergency drills is an effective means to improve employees' emergency response skills. By simulating real emergencies, participants can better grasp emergency procedures and improve their adaptability. This will not only increase the safety awareness of individuals but also give management the opportunity to identify problems in existing plans and fix them. In addition, the provision of the necessary emergency supplies and facilities is also a critical component of emergency management. This includes emergency lighting systems, communication tools, first aid supplies, and firefighting equipment, which are designed to enable timely rescue operations when emergencies occur [11]. Especially in the face of extreme weather conditions, special emergency plans must be developed to ensure the safety of the construction site, such as specific countermeasures for heavy rain or snow. In addition, it is particularly necessary to establish an effective information exchange mechanism to report the details of the accident. This helps speed up emergency response and gives stakeholders timely access to the dynamics on the ground to make quick decisions. Strengthening emergency management can not only minimize the damage caused by accidents, but also protect the safety of expressway maintenance projects. Good emergency management is not only a direct reflection of emergencies but also a strong support for daily safety management, which is conducive to ensuring the continuous development of conservation activities.

3.5. Strengthening the supervision mechanism

It is important to construct a perfect production safety supervision system to enhance safety management during expressway maintenance. The first step is to perform regular safety reviews, which is a key step in ensuring the safety of the construction site. By carefully planning the inspection process, managers can fully cover all maintenance projects and construction phases and identify potential risk points in a timely manner. Safety audits should not only pay attention to whether the equipment and materials meet the regulations, but also focus on whether the workers comply with the safe operation procedures to ensure that all work is performed in accordance with the established standards [12]. The results of each review should be documented in detail and analyzed in depth so that targeted improvement measures can be taken. Secondly, the application of modern technology can greatly improve efficiency and real-time supervision. For example, the installation of video surveillance equipment in important construction areas enables managers to grasp the safety situation of the site in a timely manner and respond quickly to any abnormal behavior. At the same time, integrating all kinds of safety information with the help of information management systems can help managers quickly assess the overall safety situation, formulate reasonable countermeasures, and improve decision-making levels [13]. In addition, encouraging the public and the media to participate in safety management is also one of the effective ways to strengthen the supervision mechanism. By regularly announcing the safety situation of maintenance projects and inviting all sectors of society to jointly supervise, it is conducive to creating a good atmosphere for the whole

society to share responsibility. This not only increases the transparency, but also enhances the responsibility of the construction unit, and further promotes the improvement of the level of safety management. Regular training and exchange activities to familiarize relevant personnel with the latest security policies and technological developments are also an indispensable part of strengthening supervision. Through multi-party cooperation, the establishment of a comprehensive safety management system will provide a more solid safety guarantee for the maintenance of expressways.

3.6. Handling security accidents

In the process of expressway maintenance and safety management, it is very important to deal with safety accidents properly. First of all, a detailed accident response plan should be formulated to clearly specify the disposal process of various accidents and the allocation of responsibilities. Such a plan should cover on-site response in emergencies, casualty rescue measures, accident investigation mechanisms, report writing, etc., so as to ensure rapid and effective response in the event of an accident and minimize casualties and economic losses [14,15]. Secondly, we must pay attention to the collection and analysis of information in the process of accident handling. Once an accident occurs, on-site evidence should be collected immediately, and detailed investigation and research should be carried out to deeply analyze the causes of the accident, so as to identify possible safety hazards. Through thorough analysis of accident cases, it can provide a valuable reference for future safety management and prevent similar incidents from repeating. In addition, it is necessary to inform all relevant parties of the results of the accident treatment in a timely manner and carry out safety education training based on actual cases. This not only helps to sum up the experience and lessons, but enhances the safety awareness and vigilance of employees, so that they more strictly abide by the safety norms in their daily work. Finally, it is critical to strengthen communication with local authorities, law enforcement agencies, and the media to ensure an open and transparent process. Through rapid and accurate information dissemination, it can not only maintain the good image of the enterprise, but also enhance the public's confidence in the maintenance of the expressway. In the face of possible legal problems, it is necessary to consult with legal advisers in advance to ensure that the entire processing process complies with the requirements of laws and regulations [16]. During this period, the proactive attitude of management, the courage to take responsibility, and the effective remedial measures are essential to enhance the external trust in the level of expressway maintenance safety management.

4. Conclusion

Expressway maintenance safety management is critical to ensure smooth traffic and improve maintenance quality. To address the existing challenges, an effective solution must be constructed from multiple perspectives, including but not limited to management strategies, professional training, and standardized operations. By strengthening the safety awareness education of the staff, improving the relevant management system, optimizing the on-site operation process, strengthening the ability to respond to emergencies, strengthening the supervision, and properly handling all kinds of accidents, the possible risk factors in the maintenance process can be significantly reduced to ensure the smooth progress of all kinds of work.

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