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Traffic Safety Management Measures for Highway Reconstruction and Expansion Construction

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Abstract: This article focuses on traffic safety management during the reconstruction and expansion of highways, with the research objective of understanding traffic safety management issues and exploring more effective traffic safety management measures. The research employs practical observation and logical analysis as research methods. Firstly, it elaborates on the connotation of traffic safety management during the reconstruction and expansion of highways, analyzes its key points, and affirms its management value from different perspectives. It provides a detailed analysis of issues such as the weak foundation of traffic safety management systems and the inadequacy of comprehensive traffic safety management, and interprets the restrictive impact of related issues. Based on the manifestation of relevant issues, strategies such as strengthening the institutional foundation of traffic safety management and constructing a comprehensive traffic safety management system are proposed, aiming to provide traffic safety management references for relevant enterprises.

Keywords: Highway; Reconstruction and expansion; Traffic safety management

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1. Introduction

The reconstruction and expansion of highways can have a certain impact on the normal traffic flow of vehicles, making it necessary to ensure traffic safety management during construction to guarantee the safe passage of vehicles. Through analysis, it can be found that many construction enterprises focus more on construction progress, quality, and cost management, while subjectively ignoring traffic safety management during construction. Due to subjective neglect and the influence of many factors, management problems can easily arise, which naturally reduces management effectiveness [1]. Once there are significant deficiencies in traffic safety management, traffic safety risks will subsequently increase, which may even have many adverse effects on highway expansion construction. Therefore, it is essential to explore more effective traffic safety management measures.

2. Overview of traffic safety management during highway reconstruction and expansion

2.1. Connotation of traffic safety management during highway reconstruction and expansion

Traffic safety management during the reconstruction and expansion of highways refers to a series of management methods and measures adopted during construction to ensure traffic safety in and around the construction area, protect the safety of construction workers, passing vehicles, and pedestrians, and thereby reduce the adverse impact of construction activities on normal traffic flow [2]. Management includes personnel safety management, vehicle traffic management, traffic dispersion, and emergency response, covering various aspects that enrich the connotation of traffic safety management.

2.2. Key points of traffic safety management during highway reconstruction and expansion

Traffic safety management during the reconstruction and expansion of highways involves multiple key points. Among them, system construction serves as the foundation for safety management practices, providing an institutional framework for comprehensive management. Ensuring the comprehensiveness of safety management systems is a prerequisite for orderly management, which includes the scientific setup of safety facilities and management evaluation. Safety management cannot be separated from the guidance and regulation of specific systems, making system construction the top priority in traffic safety management during reconstruction and expansion. Secondly, traffic safety management should be implemented throughout the entire construction process, ensuring the simultaneous implementation of various management tasks and a more comprehensive and systematic approach. Apart from these two key points, the scientific arrangement of various facilities in traffic safety management and the evaluation of supervision in management also possess significant importance [3].

2.3. Value of traffic safety management during highway reconstruction and expansion

Traffic safety management during the reconstruction and expansion of highways carries significant value, which is reflected in multiple aspects. From the perspective of protecting life safety, traffic accidents inevitably lead to casualties. Given the high traffic volume and fast vehicle speeds on highways, reconstruction and expansion can alter road conditions. Therefore, implementing effective traffic safety management during construction is crucial for ensuring the safety of construction workers, drivers, and passengers. In terms of maintaining road smoothness, effective traffic safety management can create favorable conditions for the normal passage of vehicles in the construction area, which is also helpful for maintaining the basic traffic capacity of the highway during the construction phase and ensuring road smoothness [4]. From the perspective of reconstruction and expansion, systematic traffic safety management during construction can guarantee the safety of construction workers and equipment, creating a favorable environment for construction.

3. Problems in traffic safety management during highway reconstruction and expansion

3.1. Weak foundation of traffic safety management systems

Some enterprises have made attempts at traffic safety management during the reconstruction and expansion of highways, investing considerable human and material resources [5]. However, upon closer observation, it can be seen that traffic safety management is not standardized, and the institutional foundation for management practices is relatively weak. Many construction enterprises place greater emphasis on construction progress and quality assurance. Although they implement traffic safety management during construction, they fail to establish a solid institutional foundation. Due to the lack of support from comprehensive systems, the level of standardization in traffic safety management is low, and specific management activities are not guided or regulated by these systems.

Affected by this issue, the rights and responsibilities of traffic safety management are not clear, and the content is also ambiguous. This can easily lead to a certain blindness in management practices. More seriously, when the restraining effect of the system is weak, management tends to be more arbitrary. The lack of detailed standards and requirements can easily cause traffic safety management efforts to become mere formalities, potentially burying traffic safety hazards. This can easily lead to construction enterprises becoming increasingly passive in traffic safety management during the reconstruction and expansion of highways.

3.2. Insufficient comprehensiveness of traffic safety management

Traffic safety management during the reconstruction and expansion of highways involves multiple layers of management tasks, requiring distinct management efforts before, during, and after construction. However, many construction enterprises often focus primarily on traffic safety management during the construction phase, while neglecting it during the preparation and post-construction phases. Under the influence of such misperceptions, many construction enterprises fail to conduct detailed planning in traffic safety management, and inadequate planning is a constraining factor that leads to significant limitations in construction safety management [6]. These limitations are reflected in the safety management practices during the pre-construction, construction, and post-construction stages, and limitations at any stage can reduce the effectiveness of management. Due to inadequate traffic safety management preparation before construction, insufficient preparation of various safety warning signs can easily have adverse effects on traffic safety management during the construction phase. When post-construction traffic safety management is poor, untimely cleanup of temporary traffic warning signs, diversion facilities, etc., can adversely affect the smooth flow of vehicles. Once traffic safety management has limitations, these limitations can easily reduce management effectiveness. The insufficient comprehensiveness of traffic safety management is also reflected in the inadequate emergency management mechanisms. Untimely accident handling during traffic safety incidents can also easily have adverse effects on road traffic and construction.

3.3. Unreasonable setting of traffic safety facilities

In traffic safety management during the reconstruction and expansion of highways, the reasonable setting of various traffic safety facilities is crucial. The condition of facilities such as warning signs and markings can directly affect the judgment of road conditions by drivers of passing vehicles. Many construction enterprises do not reasonably set up various safety facilities during highway reconstruction and expansion projects, and there is a strong randomness in the setting of safety facilities [7]. For example, some warning signs are not placed in prominent positions, which significantly reduces their warning effect. When markings are unclear, their guiding effect is weakened. When fences are unreasonably set up, the width of the highway can be affected, and functions such as isolation and warning cannot be fully utilized. The randomness in setting traffic safety facilities and the non-compliance of some warning signs, markings, and fences with technical standards prevent these facilities from effectively supporting traffic safety management. Moreover, improper setting of traffic safety facilities can even lead to misjudgment of road conditions by passing vehicles, which can increase traffic risks and hinder traffic safety management during construction.

3.4. Lack of effective evaluation in traffic safety management

Traffic safety management during the reconstruction and expansion of highways is a dynamic process, and various factors can easily lead to management issues during this process [8]. When the construction duration is longer, there are more uncertain factors in management, which further highlights the importance of management evaluation. However, many construction enterprises do not have a clear evaluation mechanism related to traffic management and do not systematically evaluate traffic safety management during construction. Due to the lack of systematic evaluation of traffic safety management issues, the supervision in management practices is relatively weak, which

is not conducive to timely identifying problems in management practices. Furthermore, inadequate evaluation also hinders construction enterprises from grasping the true status of traffic safety management, leading to a lack of effective references in management decision-making and a disconnection between management efforts and reality. From an optimization perspective, inadequate evaluation also hinders subsequent traffic safety management improvements, as there is also a lack of effective references for management optimization. This indicates that inadequate evaluation is closely linked to issues such as poor process control and inadequate optimization of traffic safety management, and its adverse impact on traffic safety management cannot be ignored.

4. Specific measures for traffic safety management during highway reconstruction and expansion

4.1. Strengthening the institutional foundation of traffic safety management

Traffic safety management during the reconstruction and expansion of highways should first focus on strengthening institutional development, laying a solid institutional foundation to provide institutional support and guarantees for subsequent management practices. For example, a private construction enterprise clarified traffic safety management systems during the construction of a highway reconstruction and expansion project. These systems include the purpose, scope of application, and principles of traffic safety management [9]. The systems require the establishment of a traffic safety management leadership team, which is fully responsible for coordinating the relationships between the construction unit, the construction enterprise, and the supervision unit in traffic safety management. The systems cover safety management tasks such as traffic flow guidance schemes, arrangement of construction time periods, establishment of emergency mechanisms, and vehicle guidance for split-section construction, highlighting the guiding role of the systems. The systems also contain detailed management standards and requirements, further enhancing the role of basic systems in guiding and regulating traffic safety management. For other construction enterprises, they should also prioritize institutional development during highway reconstruction and expansion projects, strengthening the institutional foundation to enhance the guiding and regulating role of the systems, and conducting safety management in a standardized manner to improve the effectiveness of safety management.

4.2. Constructing a comprehensive traffic safety management system

To avoid limitations in traffic safety management during the reconstruction and expansion of highways, it is of great significance to construct a comprehensive traffic safety management system and conduct comprehensive planning for management practices. For example, a certain enterprise conducted detailed research and planning for traffic safety management during the reconstruction and expansion project of the Liunan Highway in Guangxi. Simultaneously, they formed a management model for the “Five Parties and Three Guarantees” work platform, considering traffic police, road administration, operations, construction (including supervision), and the construction unit as the basic entities of traffic safety management. Under this model, a comprehensive traffic safety management system was established, with detailed arrangements for traffic safety management matters during construction preparation, implementation, and post-construction (as shown in **Table 1**). With the aid of scientific planning conducted beforehand and the detailed arrangements for traffic safety management throughout the construction process, the improvement in management comprehensiveness also promoted the enhancement of management effectiveness.

For other construction companies, they should prepare a traffic safety management plan ahead of time, establish a comprehensive management system, and scientifically coordinate and arrange various management issues. The systematic advantages of traffic safety management should be highlighted to promote the effectiveness of traffic safety management.

Table 1. Traffic safety management system for highway reconstruction and expansion construction

Management Stage	Management Content
Construction preparation	Develop traffic organization plan, prepare safety facilities, conduct propaganda and training, etc.
Construction implementation	Safety facility setup and maintenance, traffic dispersion, management of personnel and vehicles, etc.
Post-construction	Removal of safety facilities, clean-up of construction debris, etc.

4.3. Scientific setup and management of traffic safety facilities

The scientific setup and management of traffic safety facilities are also very important. After preparing various safety facilities ahead of time, construction companies should strictly follow standards and fully integrate the actual traffic safety management in construction to set up traffic safety facilities. For example, in the traffic management of the Maozhan Expressway reconstruction and expansion project, the construction company will set up the first-level warning prompt signs 1.6 kilometers away from the construction area in the direction of incoming traffic, reminding drivers to pay attention to the road construction ahead, and cooperate with electronic displays and dynamic warning facilities to enhance long-distance warning effects. Secondary warning signs are set up 800 meters away from the construction area in the direction of incoming traffic, reminding vehicles to slow down, change lanes, and adjust their driving status in a timely manner through prompts such as “road narrowing”. Speed limit signs are set up 300 meters away, guiding vehicles to change lanes in combination with guiding lines and conical reflective buckets. At the same time, a safety crash-proof buffer vehicle equipped with an active intelligent warning system is created for traffic safety management, providing scientific settings for traffic safety facilities based on technology empowerment [10]. The scientific setup of general traffic safety facilities provides strong support for traffic safety management, and applications such as active intelligent warning systems and the deployment of safety crash-proof buffer vehicles also enhance the innovation of traffic safety management, further highlighting the warning role of the scientific setup of traffic safety facilities.

4.4. Dynamic evaluation of traffic safety management

Traffic safety management in highway reconstruction and expansion projects cannot ignore evaluation matters. In evaluations, it is necessary to control the management process and tightly integrate dynamic evaluations with dynamic traffic safety management. Taking the evaluation of traffic safety management in the construction of Jiangxi Jikang reconstruction and expansion project as an example, the construction company will evaluate the implementation of the requirements, the comprehensiveness of traffic safety management, and the reasonableness of the graded warning prompt signs. Based on dynamic evaluations, construction companies should focus on identifying problems in traffic safety management, analyzing the causes of specific problems, eliminating the impact of related deficiencies, and continuously improving them in subsequent management. In addition, it is also very desirable to evaluate the real-time monitoring and evaluation of traffic flow, the standardization of traffic guidance and reform facilities, and the status of emergency support and joint operation. This greatly improves the comprehensiveness and effectiveness of traffic safety management evaluations. For construction companies, traffic safety management should also be adjusted in a timely manner based on changes in the construction area and traffic flow, and normalized traffic safety management inspections should be used as the basic way to evaluate management, strengthening process control in management. After determining the evaluation mechanism in traffic safety management and using it as a protective mechanism, many common management problems can be better avoided, and the implementation of institutional requirements and the implementation of plans can also be more guaranteed, which naturally helps to improve the effectiveness of traffic safety management.

5. Conclusion

Based on this study, it can be found that traffic safety management in highway reconstruction and expansion projects has rich connotations, and different key points need to be taken into account in management. It is also of great value to do a good job in traffic safety management. Considering that some problems are prone to occur in management practices, institutional construction should be carried out first in traffic safety management to strengthen the guiding and normative role of basic institutions. On this basis, a more comprehensive traffic safety management system should also be established, a scientific setup and management of traffic safety facilities should be carried out, and dynamic evaluations should be conducted in management to grasp the true management status. By continuously striving in the above aspects, construction companies can further improve their traffic safety management capabilities in highway reconstruction and expansion projects.

Disclosure statement

The author declares no conflict of interest.

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