

Enhancing Safety Infrastructure on Chinese Highways: Challenges and Strategic Responses

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Abstract: *Highways serve as critical transportation arteries essential for daily mobility and economic activity. However, rapid vehicle growth and increasing congestion have led to a marked rise in traffic accidents in China. This paper systematically identifies the major deficiencies in highway traffic safety facilities and proposes targeted countermeasures to address these challenges. The aim is to enhance the quality of safety infrastructure, effectively reduce accident rates, improve travel safety, and ultimately augment the economic returns of highway projects.*

Keywords: Highway safety facilities; Traffic accidents; Countermeasures; Infrastructure quality; Traffic safety management.

1. Main Problems Existing in Highway Traffic Safety Facilities

1.1 Inconsistent Highway Traffic Signs and Markings

Relevant regulations on highway traffic signs and markings clearly state that the transmission of traffic sign information must maintain continuity and progression. However, due to differences in regions, construction units, and time periods, it is difficult to ensure the uniformity and continuity of highway traffic safety facilities. To address this issue, relevant management units at different levels should unify the construction of highway traffic safety facilities and enhance the continuity of their construction in the work of designing, planning, and building highway safety facilities.

1.2 Incomplete Installation of Highway Traffic Safety Signs and Markings

Due to the incomplete installation of information signs on some highways, with no information signs or place-name signs available, especially for certain administrative village names, drivers cannot determine their specific geographical location during their journey. For example, the absence of restriction signs, missing release signs, or radar speed detectors all pose hidden dangers to safe driving.

1.3 Unscientific Construction of Highway Boundary Guardrails

Although the design of highway routes has gradually matured, the incidence of road traffic accidents has continued to increase. Fundamentally, this is because the construction of guardrails at the boundaries of most highways is unscientific, failing to provide effective protection. The guardrails are not properly positioned and cannot fundamentally protect vehicles or reduce damage.

1.4 Inadequate Installation of Isolation Devices in the Middle of High-Grade Highways

The purpose of installing isolation devices in the middle of highways is to prevent vehicles from crossing the center line and causing traffic accidents. In fact, many high-grade highways do not strictly install isolation devices in the median

as required, making these sections accident-prone areas, especially at the bends of two-lane highways.

1.5 Excessive and Unreasonable Influence of Human Factors in the Design of Highway Traffic Safety Facilities

In the design of highway traffic safety facilities, influenced by human factors from government departments and engineering units, excessive emphasis is placed on aesthetics and "face." To reduce highway damage in accidents, guardrails are mostly designed as rigid or semi-rigid, while the importance of driving safety is ignored. The lack of humanized design causes fatal injuries to drivers in accidents.

1.6 Neglecting the Importance of Management and Maintenance of Traffic Safety Facilities

Typically, highway maintenance and management work in China only focuses on the maintenance of the road surface, while neglecting the management and maintenance of traffic safety facilities. In the overall highway maintenance index, due to the overly vague evaluation indicators and incomplete evaluation system for highway traffic safety facilities, the index for evaluating highway traffic safety facilities is too small and difficult to find. This results in a lack of basis for the maintenance and supervision of highway traffic safety facilities, leaving potential safety hazards.

2. Countermeasures for Establishing and Improving Highway Traffic Safety Facilities

2.1 Improve the Construction of Guardrails, Traffic Safety Signs, and Markings

Strengthen guardrails. First, while using guardrails to guide drivers' sight, effectively prevent pedestrians from crossing the guardrails to form a safe route for separating pedestrians and vehicles. Second, reinforce the safety guardrails on both sides of the highway to protect the safety of cars, pedestrians, residences, etc., and avoid personal and property damage caused by car driving errors. Third, select the type of guardrail (pipe network, chain link, steel mesh) based on the surrounding environment of the highway.

Improve traffic safety signs. Traffic safety signs are not only

an effective way to maintain highway traffic order and ensure highway traffic safety and smooth flow; they are also a common method to convey traffic information and regulate traffic order. There are many types of traffic signs, and regardless of their form, they are used to remind drivers to drive carefully and indicate the direction of travel and the geographical location. Usually, traffic signs are installed on the roadside or above the highway, except for special circumstances.

Perfect traffic safety markings. In the marking construction of traffic safety facilities, the construction department, in order to achieve beautiful and smooth markings, should, on the one hand, combine with the road alignment and fit it as much as possible; on the other hand, use bright and eye-catching materials for the marking lines to ensure that driving vehicles can find the marking lines in time under any circumstances.

2.2 Increase Lighting Equipment

Statistics show that lighting facilities can not only effectively reduce the incidence of night accidents but also improve road utilization. While eliminating pedestrians' unsafe psychological factors, they also improve driving comfort and adaptability, ensuring that drivers can increase their speed by 1.1 to 4.6 kilometers per hour while driving safely. Therefore, it is very necessary to install continuous or partial lighting equipment on necessary highways.

2.3 Strictly Control the Construction Quality of Safety Facilities

On the one hand, since design drawings are the most important basis for highway traffic safety facilities construction, the design work of safety facilities must strictly implement relevant national laws, regulations, and industry standards, and strictly control the design. On the other hand, in the construction of traffic safety facilities, since the quality of raw materials is directly related to the construction quality of traffic safety facilities, the quality of raw materials for traffic safety facilities must be strictly controlled. First, materials entering the construction site must undergo strict inspection and can only enter the construction site if they meet relevant regulations; second, relevant management personnel must strengthen the supervision of raw materials to prevent shoddy materials from entering the site and ensure that the quality of materials used in construction meets the standards.

2.4 Introduce Intelligent Traffic Safety Facilities

Currently, intelligent traffic safety facilities are in a stage of rapid development. With the continuous advancement of science and technology, the application of intelligent traffic safety facilities has been gradually promoted, and intelligent transportation (such as radar speed measurement, real-time tracking, and real-time positioning) is ubiquitous. Since intelligent transportation was introduced relatively late in China, its application is not yet fully mature and cannot fundamentally and effectively solve the problem of traffic safety order. Although it can effectively reduce the incidence of traffic accidents, there is still room for further development in preventing traffic accidents and reducing the degree of target damage.

2.5 Do a Good Job in the Management and Maintenance of Traffic Safety Facilities

Traffic safety facilities related to highway engineering have been gradually improved with the continuous progress of society, and their quantity has been increasing. The original management and maintenance work of traffic safety facilities can no longer adapt to the current rapidly developing traffic engineering. In order to achieve the goal of comprehensive development of highway traffic safety facilities construction, it is necessary to do a good job in the management and maintenance of traffic safety facilities. While making full use of existing social public resources, combined with the original management and maintenance methods of highway traffic safety facilities, the intensity of management and maintenance should be increased. On the one hand, relevant management departments should actively explore new management methods while considering the specific conditions of highways, focus on new goals under the new situation, authorize traffic safety facilities production and construction units with strong professional capabilities to manage the corresponding traffic safety facilities, scientifically and rationally divide departmental functions while scientifically avoiding awkward situations, and improve the utilization rate of resources while enhancing the management efficiency of traffic safety equipment. On the other hand, while making full use of modern information technology, establish an intelligent management and control system for highway traffic safety facilities. Attach importance to the establishment of a data information database. Using the established data information database can quickly search and count relevant information, monitor in real time, and timely record the construction, operation and use of traffic facilities, so as to intelligitize and automate the management and maintenance of highway traffic safety facilities.

3. Conclusion

To sum up, highway traffic safety facilities play a crucial role in the entire traffic engineering system and their function cannot be underestimated. In order to better solve the main problems existing in China's current highway traffic safety facilities and achieve the goal of improving the overall quality of China's highway engineering while enhancing enterprise economic efficiency, it is necessary to attach great importance to the construction of highway traffic safety facilities, go deep into the construction site, combine the specific conditions of highway engineering, start from the design, planning and construction of highway traffic safety facilities, address the main problems existing in China's current highway traffic safety facilities, strictly control the material quality, minimize the impact of human and natural factors, do a good and comprehensive job in the construction of guardrails, traffic safety signs and markings, add lighting equipment in necessary sections, and do a good and strong job in the management and maintenance of traffic safety facilities while introducing advanced intelligent traffic safety facilities.

References

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