

Highway Bridge Maintenance and Management in China: Strategic Priorities for Transport Infrastructure Sustainability

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Abstract: *The rapid expansion of China's transportation sector has underscored the strategic importance of highway bridges in facilitating economic growth and improving mobility. Effective bridge maintenance, rigorous management, and advanced technological quality are paramount to ensuring operational reliability and public safety. This paper argues that priority should be given to systematic bridge analysis and research, as these directly influence the longevity and performance of transport infrastructure, ultimately contributing to a sustainable and efficient transportation environment.*

Keywords: Highway Bridges, Bridge maintenance, Infrastructure management, Transportation development, Technological quality.

1. Preface

Highway bridges are an important link in modern transportation engineering, affecting China's traffic safety and the economic development of the entire society. According to the actual application of highway bridges, appropriate maintenance measures not only ensure people's life safety but also promote the development of China's transportation industry and economy. However, in terms of the current actual development situation of highways and bridges in China, the lack of maintenance awareness has led to serious waste of finances, manpower and materials. Facts have proved that it is necessary to maintain and manage highway bridges, especially bridge maintenance and management.

2. Current Situation of Highway Bridge Maintenance Management

With the rapid development of the transportation industry, there are more and more large transport vehicles. These vehicles have large loads, which exert great pressure on highway bridges, cause serious damage, and have a serious impact on China's transportation industry.

1) In the early stages of highway and bridge construction, China's transportation industry developed rapidly. However, relevant managers did not consider the transportation of large vehicles, meaning that the quality of highway and bridge technology cannot meet current transportation requirements. At the same time, due to the maintenance of highway bridges, long-term transportation pressure, or damage to highway bridges, the service life of highway bridges will be shortened; in severe cases, highway bridges will no longer be usable, which will have a serious impact on transportation.

2) Highway and bridge construction lacks quality support. Some early highway and bridge projects built in China were affected by various factors such as technology and economy, making highway and bridge technology unable to withstand the workload after being put into use, requiring technical personnel to maintain and manage highway bridges. However, there are currently many problems in the maintenance of

highway and bridge projects in China, and there are many issues such as safety risks in highway and bridge construction during long-term development. We must focus on maintenance management and place maintenance work at the core of highway and bridge management to ensure the safety of road and bridge construction.

3. Problems in Highway and Bridge Maintenance Management

3.1 Outdated Awareness of Maintenance Management

The maintenance of highway bridges is affected by many factors, so it is necessary to analyze various influencing factors in the actual operation process and formulate detailed management and maintenance mechanisms so that subsequent maintenance can meet the necessary standards. However, the technical level of many maintenance personnel is still insufficient, and the actual management mechanism has not yet been established. Without deepening the service depth of highway bridges, it is difficult to implement control in an appropriate manner. In the actual management process, management tasks are not strictly implemented based on management mechanisms, and when managers lack management awareness, the difficulty of final maintenance management increases.

3.2 Inadequate Maintenance Management Measures

China has proposed a series of measures to address highway and bridge maintenance work. However, the actual maintenance of highway bridges requires support in terms of materials, economy, and human resources to play a good role in maintaining highway bridges and effectively control materials, funds, and human resources. However, due to the influence of various bridge contractors, bridge maintenance work is difficult, and it is also difficult to adopt a unified maintenance management method. In addition, due to maintenance interruptions may occur during certain maintenance processes.

3.3 The Technical Level of Maintenance Personnel Needs Further Improvement

With the continuous increase in the number of vehicles and the continuous development of highway and bridge technology, the importance of modern highway and bridge construction has become evident, leading to the promotion and application of various maintenance methods and technologies. However, many highway and bridge engineers are limited in terms of overall functionality. During maintenance periods, various measures and technologies cannot be fully utilized, resulting in significant differences between the overall maintenance quality of highway and bridge projects and the expected requirements.

3.4 Maintenance Funding Support Needs to Be Increased

Maintenance work in the field of highway and bridge technology requires a high level of financial support. However, with the strengthening of connections between different regions, traffic volume is gradually increasing, the total number of transportation roads and bridges will rise, and more funds need to be invested in the construction of highway bridges and road maintenance. Without sufficient financial support, maintenance and management work will be incomplete, which will affect the development of highway bridges and their quality.

4. Reasonable Measures to Solve Problems in Highway and Bridge Maintenance Management

4.1 Improve Reasonable Understanding of Highway and Bridge Maintenance Management Work

Strengthen staff training, clarify work tasks, systematically build a management system, and promote the rapid development of highway and bridge maintenance technology. At the same time, formulate detailed maintenance work plans suitable for the content of road and bridge infrastructure, improve maintenance management methods, and ensure the smooth operation of maintenance management. Maintenance personnel need to ensure that all forms of control are met during the actual operation process; personnel must understand the development forms in the highway and bridge construction process, conduct detailed investigations and analyses of the actual situation of highway and bridge projects, enabling them to respond to the development of highway bridges. Bridge archives contain important information about bridges. After the completion of construction, the final report should be submitted to the management department in accordance with regulations. The final report needs to include the following parts: original design drawings of each bridge, modified design drawings, structural parameters, etc. After the completion of bridge maintenance work, the maintenance department should regularly organize technical personnel to conduct quality inspections and record the inspection results.

4.2 Establish a Sound Maintenance Management Measures

Maintaining highway bridges is a complex task. In the specific work process, it is necessary to investigate the process and improve maintenance methods. In the specific work process, relevant transportation departments should conduct regular inspections and maintenance of highway

bridges according to the actual situation to ensure their normal development and timely check whether road construction meets usage requirements. A standardized and appropriate bridge maintenance plan is an effective way to control maintenance costs and improve maintenance efficiency. Based on the bridge evaluation results, formulate maintenance plans, and if necessary, formulate targeted maintenance plans to effectively reduce maintenance costs.

4.3 Improve the Comprehensive Quality of Staff

The construction of maintaining highways and bridges is a very important task, which is highly complex in content. Maintenance personnel must possess sufficient qualities to carry out their work. In daily business processes, to improve the overall quality of employees, management departments should organize appropriate education and training, comprehensively assess the specific situation of employees to acquire advanced skills, thereby further enhancing employees' skills, ensuring that the quality of maintenance management meets requirements, and enabling employees to make accurate assessments and formulate appropriate solutions in various situations. Management departments must focus on talent cultivation, promote the introduction and promotion of talents, and continuously improve the professional knowledge of the entire team.

4.4 Increase Capital Investment

To ensure the normal use of highway and bridge projects and extend their service life, management and maintenance departments bear the scientific responsibility for managing the actual work process, needing to select construction technologies and use them reasonably, with maintenance funds corresponding to highway and bridge projects. In addition, maintenance plans for highway and bridge projects should be formulated, and maintenance objectives should be set based on the specific application status. The maintenance department fails to arrange professional personnel to regularly clean the bridge deck; excessive debris leads to poor drainage, severe water accumulation during the rainy season, and icing in winter. These issues result in higher safety risks for vehicles driving on the bridge deck. At the same time, the accumulated debris on the bridge deck reduces the driving smoothness and increases driving risks, and the longer the time, the greater the damage to the bridge deck, shortening the service life of the bridge. Improve daily maintenance processes to ensure the smooth implementation of maintenance plans.

5. Conclusion

This paper first analyzes the current situation of highway and bridge maintenance management, then analyzes the problems existing in highway and bridge maintenance management from four aspects: backward maintenance management awareness, imperfect maintenance management measures, the need to further improve the technical level of maintenance personnel, and the need to increase maintenance fund guarantees. Finally, it proposes reasonable measures to solve the problems in highway and bridge maintenance management from four aspects: improving the correct understanding of highway and bridge maintenance

management work, constructing perfect maintenance management measures, enhancing the comprehensive quality of staff, and increasing capital investment. In conclusion, the maintenance and management of highways and bridges is a complex task. Maintenance personnel must continuously strive to carry out maintenance work in the actual operation process, improve the level of maintenance management, enhance the technical quality of highways and bridges, and create a good traffic environment for people.

References

- [1] Miao Yuquan. Problems and Countermeasures in Highway and Bridge Maintenance Management[J]. Engineering Construction and Design, 2018(4):183-184.
- [2] He Xiurong. Analysis of Problems and Countermeasures in Highway and Bridge Maintenance Management[J]. Science & Technology Vision, 2018, 250(28):273-274.
- [3] Wang Yanli. Problems and Response Measures Standards in Highway Bridge Maintenance Management[J]. China Standardization, 2016(18).
- [4] Li Baojian. Analysis of Several Problems and Countermeasures in Highway Bridge Maintenance Management[J]. Sichuan Cement, 2015(9).