

Research on Maintenance and Management Strategies for Municipal Roads and Bridges

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Abstract: This paper focuses on the research of maintenance and management strategies for municipal roads and bridges. As critical infrastructure for urban transportation, the maintenance of municipal roads and bridges is of great significance, concerning the smooth operation of urban traffic, the safety of residents' travel, and having a profound impact on sustainable urban development. But even at present, it has a lot of problems – such as unclear responsibilities in the management mechanism; low total amount of funding and unreasonable allocation; relatively backward technical methods; personnel quality is uneven. To solve these problems, this paper puts forward the management strategies from aspects of optimising the management mechanism, strengthening financial guarantee, innovating technical methods and improving personnel quality to promote improved level of repair.

1. Introduction

Municipal roads and bridges are an important element of urban infrastructure, the surf is a lifeline component of urban transportation, urban economic development widely influence the vivalesture citizens and city image. As urbanization accelerates and the volume of traffic increases, there is more pressure on municipal road and bridge maintenance and management than ever before. Proper maintenance and management strategies could enhance service life of roads and bridges considerably, reduce lifecycle costs as well as improve quality and safety of their operation. This fact shows that it is of great practical importance to carry out comprehensive research on the maintenance and management of municipal roads and bridges.

2. Problems in the Maintenance and Management of Municipal Roads and Bridges

2.1 Imperfect Management Mechanism

The present condition of the maintenance & management system of municipal roads and bridges is alarming in China, where serious multi-headed management phenomena are evident. At present, functions between departments are vaguely divided and not clear in the maintenance of roads and bridges. What this gives rise to in real life, however, is easily passing on the blame and then deferring all responsibility, leading to poor management processes with a negative effect on work efficiency. In addition, departments lack efficient coordination and transmission channels, leading to untimely and inaccurate paper information and making it difficult to form a consensus management force. There are also shortcomings in the access and exit mechanisms that affect maintenance. Market access threshold is not high, and the qualification review of enterprises is not strict enough, resulting in many low-quality enterprises without professional capabilities and technical level enter the market. The maintenance work can not be sure of quality, which brings hidden danger to road and bridge safety. Meanwhile, without a clear exit mechanism, there are no effective ways to weed out illegal businesses or low quality firms, rendering the market economy irregular. The difficulties of high-quality enterprises to stand out, hinder the healthy development of the overall maintenance market ^[1].

2.2 Insufficient Funding

Municipal roads and bridges involve significant public expenditure but current government funding is clearly insufficient in this area. All aspects of road and bridge maintenance are affected by tight budgets, resulting in a backlog of essential maintenance work that is not performed on time. There are some defects on roads and bridges that may become more serious when not repaired in time, which can shorten the service life of these facilities and increase the maintenance costs imposed later. In addition, construction is emphasized compared to resilience and maintenance in the case of urbanization. Most of the money goes to building new roads and bridges, but not much is spent maintaining existing infrastructure. This unreasonable allocation of funds means that roads and bridges lack necessary upkeep and maintenance during long-term use, their technical condition gradually deteriorates, safety performance declines, and they cannot provide stable and reliable support for urban traffic [2].

2.3 Backward Technical Methods

In today's rapid technological development, the technical methods for maintaining municipal roads and bridges in some regions of China have failed to keep pace with the times. In terms of detection technology, there is still heavy reliance on traditional manual inspection methods. This approach is not only inefficient but also easily affected by the experience and subjective factors of inspectors, leading to low accuracy in detection results and difficulty in identifying potential internal defects in roads and bridges. Advanced non-destructive testing technologies and intelligent monitoring systems have not yet been widely adopted in some areas. Maintenance technology is also lagging. Repair processes in some areas use conventional building techniques and materials, which are inadequate for durability and reliability, without guarantees of quality. Traditional repair methods are often time-consuming, which greatly affects urban traffic and the effective operation of urban transportation [3].

2.4 Low Personnel Quality

Maintenance of municipal roads and bridges must have high quality professionalism of personnel, but at present there are few relevant professionals in China. Visualized breakdown of issues Maintenance Personnel Today Due to the need for quick job performance, most maintenance technicians do not receive systematic professional training and are weak in professional knowledge and practical skills from high-level designers or skilled workers needed by modern industries. which leads to shortcomings in their ability to master and apply new technologies and processes. When encountering complex road and bridge defects, they cannot accurately diagnose the cause to take effective repair measures, it is difficult to receive a good repair effect. Management concepts and methods of managers are relatively backward, which can not meet the road bridge maintenance management innovations in the modern era. They lack scientific management knowledge and advanced management methods, and have many deficiencies in project management, quality control, safety management, etc., unable to effectively organize, coordinate, and supervise maintenance work, affecting the overall quality and efficiency of road and bridge maintenance [4].

3. Measures for Maintenance and Management of Municipal Roads and Bridges

Deterioration and maintenance of county roads and bridges Multiple approaches are needed to increase management levels. By perfecting the management mechanism and reducing multi-headed management, improving funding to satisfy maintenance needs by reasonably allocating funds to strengthen maintenance instead of construction, innovating technical means with leading equipment and technology for precise testing and fast repair can effectively solve the problem; improving personnel quality via training gives full play to the role of technical personnel and managerial staff; thus guaranteeing the overall quality in road and bridge maintenance.

3.1 Perfecting the Management Mechanism

Integrating system used for maintenance and management of all municipal roads and bridges is

vital to effectively eliminate the barriers between departments that often results in burdens like unclear responsibilities, coordination difficulties which leads to ill-practise of multi-headed management. Each department is made aware of its assigned responsibilities and its area of jurisdiction over road and bridge maintenance according to the degree which serves to clarify work arrangements and avoid duplication or ambiguity in work effort. Enhancing inter-system coordination and communication, by establishing regular communication mechanisms and joint work platforms, facilitates information sharing and resource integration, production system forming an efficient management synergy collaboration to solve the various problems arising in the process of maintenance together. Furthermore, it is necessary to strictly and supervise enterprise qualifications, set clear market access standards including requirements for technical capability, equipment level, and personnel quality, ensuring that enterprises entering the market possess corresponding strength and conditions. Enterprises that do not meet the standards must be from participating in road and bridge maintenance projects. Establishing a scientific and reasonable exit mechanism, enterprises that have serious quality problems, violations, or poor operation in maintenance work should be according to laws and regulations, maintaining the healthy and orderly development of the market. Enterprises also need to develop detailed assessment indicator systems covering maintenance quality, work efficiency, safety management, cost control, and other aspects, regularly assessing and evaluating maintenance work. Based on the assessment results, reward and recognize outstanding enterprises, enterprises with problems, enterprises to continuously improve management levels and service quality, promoting the overall development of the municipal road and bridge maintenance industry [5].

3.2 Ensuring Funding Investment

As an important part of urban infrastructure, the maintenance of municipal roads and bridges is related to urban traffic safety and normal operation. There is a requirement and obligation for the government to be able to provide this necessary cash. Incorporate road and bridge maintenance funds into the annual fiscal budget through pre-arranged fiscal budgets to assure a guaranteed source of funding. Create special fund allocations for big road and bridge repairs, renovations and emergency rescue that would ensure the proper implementation of projects. In addition, the issuance of municipal bonds, attract local social funds for road and bridge maintenance construction, diversify financing channels. The key to improve the efficiency of fund use is to optimize the fund allocation structure and capital ratio between construction and maintenance. The phenomenon of advocating for construction rather than maintenance in urban construction has existed in China for a long time, but the road and bridge maintenance funds have relatively lagged behind. As such, but we must change the concept by investing more and ensure that the maintenance funds are available in a timely manner so as to ensure prompt repair of roads and bridges. Based on factors such as the service life, technical condition, and traffic flow of roads and bridges, scientifically and rationally allocate funds, the maintenance needs of key roads and bridges and those with serious defects. Explore diversified funding channels, introduce social capital to participate in road and bridge maintenance, adopt models such as, PPP (public-private partnership), attract. Enterprises as the significant sources of regulated capital, technology and management advantages can play a role in road and bridge maintenance [6].

3.3 Innovating Technical Means

Technology is advancing constantly, the detection and maintenance of roads and bridges are innovating and developing. Can accurately detect internal defects and diseases in roads and bridges, such as cracks, voids, and steel corrosion through the use of non-destructive testing technologies including ultrasonic testing, infrared thermography testing, and radar testing so that a scientific basis for maintenance decisions can be provided without damaging the structure instead. Intelligent monitoring systems can be used for real-time monitoring and early warning of roads and bridges. Stress, strain, displacement and temperature are stored continuously in real time by installing different sensors on roads and bridges, then transferred to the monitoring center to analyze. When an abnormality is detected, the system can quickly send early warning signals so that

countermeasures can be implemented well in advance to prevent accidents.

The enhanced durability and reliability of repair projects can be obtained by promoting the usage of new repair materials and workability in construction. High performance concrete as a use principle has some characteristics benefits including high strength, high durability and good workability, can efficiently improve the bearing capacity of road and bridge structures and life works. This approach has led to superior performing lightweight structure composite materials, fibre-reinforced materials which have replaced metal with low density structural/sheet material compounded durability properties of high tensile strength and corrosion resistance when used to repair road and bridge domains as well as increase seismic response from the applied action against degradation (e.g. fatigue). By employing such advanced construction processes as shotcreting, pressure grouting and the whole set technology of bridge-setting (carrying) capacity reinforcement with carbon fiber cloths, etc. Consolidating information construction, building a road and bridge maintenance management information system, realizing the digital management and sharing of road and bridge information. This system can realize the unified and systematic management of basic information, detection data and maintenance records of roads and bridges, so that managers can easily check and analyze. To make better decisions for maintenance, big data and cloud computing technologies have been utilized to mine and analyze roads and bridges information more precisely [7].

3.4 Improving Personnel Quality

Municipal Road and Bridge Maintenance Professional quality of technical personnel need to have solid professional knowledge and rich practical experience. First, Natural Gas Compagny should regularly organized technical personnel to participate in professional training and academic exchange activities, invited industry experts and scholars to guide teaching lectures, so that they can catch the latest corn or other industry business trends and technological development trends and master advanced detection repair technology. Encourages technical personnel to conduct scientific research activities related to technological innovation. Improve the ability of independent innovation and practical problem-solving ability. Second, strengthen the training of managers, to adjust the management concept and means of personnel, improve the ability and level of decision-making in organizations.

In road and bridge maintenance work, managers are the key coordinators and organizer of the whole work system, and the management level directly affects the manœuvre quality. You can let managers learn advanced management theories and methods such as project management, quality management, cost management and comprehensively improve their overall management ability through training courses for managers in the form of case analysis seminars or other ways. At the same time, it is necessary to train managers' strategic vision and innovative thinking, so that they can develop scientific and reasonable development strategies and tactics for bridge and road maintenance work according to the actual situation. Induce experienced professional talents to the road and bridge maintenance industry by formulating preferential policies. These talents bring first-class technology and management experience, and inject vitality and innovation dynamics into the team. Establish a good talent incentive mechanism, provide broad development space and a good working environment for talents, stimulate their work enthusiasm and creativity, and promote the overall development of the road and bridge maintenance management team [8].

4. Conclusion

The maintenance and management of municipal roads and bridges are related to urban traffic safety, economic development, and image quality. Currently, China's maintenance and management of municipal roads and bridges face problems such as an imperfect management mechanism, insufficient funding, backward technical methods, and low personnel quality. To improve the maintenance level of municipal roads and bridges, it is necessary to start from perfecting the management mechanism, ensuring funding, innovating technical methods, and improving personnel quality, and formulate scientific and reasonable management strategies. Through the joint efforts of

all parties, achieve scientific maintenance and efficient management of municipal roads and bridges, providing a strong guarantee for the sustainable development of the city.

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