

# Countermeasures for On-site Construction Management of Municipal Road and Bridge Engineering

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**Abstract:** As a crucial part of urban infrastructure, the construction quality and safety of municipal road and bridge engineering directly relate to the operational efficiency of the city and the quality of life of residents. This paper deeply analyzes the importance of on-site construction management in municipal road and bridge engineering, explores in detail the numerous problems existing in current on-site construction management, and proposes a series of practical countermeasures in response to these issues. It aims to provide valuable references for enhancing the level of on-site construction management in municipal road and bridge engineering and ensure the high-quality and efficient completion of projects.

## 1. Introduction

Municipal road and bridge engineering serves as the arteries of urban development, playing an irreplaceable role in promoting regional economic exchanges, improving residents' travel conditions, and enhancing the city's image. With the acceleration of urbanization, the construction scale of municipal road and bridge engineering continues to expand, and the construction difficulty also increases day by day. Under such circumstances, the importance of on-site construction management becomes increasingly prominent. Effective on-site construction management can rationally allocate resources, ensure construction safety, improve project quality, control project costs, and ensure the smooth progress of the project according to the predetermined objectives. However, there are still numerous problems in the current on-site construction management of municipal road and bridge engineering, which restrict the smooth progress of project construction. Therefore, conducting in-depth research and adopting targeted countermeasures to solve these problems hold significant practical significance.

## 2. The Importance of On-site Construction Management in Municipal Road and Bridge Engineering

### 2.1 Ensuring Project Quality

Project quality is the lifeblood of municipal road and bridge engineering, directly related to its service functions and durability. On-site construction management ensures project quality through a strict quality control system<sup>[1]</sup>. It strictly inspects raw materials, components, and equipment, prohibiting unqualified materials from entering the construction site. It also conducts real-time supervision of construction processes and operation procedures to ensure that each process complies with design specifications and standards. For example, during concrete pouring, managers closely control the mix proportion, pouring sequence, and vibration quality to prevent quality defects such as honeycombing, pitting, and cracks. By adopting refined construction management practices, the probability of common quality problems can be effectively reduced, and the overall quality level of the project can be improved, laying a solid foundation for the long-term use of municipal road and bridge engineering.

### 2.2 Ensuring Construction Safety

The construction environment of municipal road and bridge engineering is extremely complex, involving high-risk operations such as high-altitude work, deep foundation pit excavation, and large-scale machinery operation. Any negligence can easily lead to safety accidents. On-site construction management ensures safety by establishing a sound safety production responsibility system, clarifying the safety work obligations of managers and operators at all levels, and ensuring the effective implementation of safety measures. Regular safety education and training and emergency drills are conducted to strengthen the safety awareness and emergency response capabilities of construction personnel. Clear safety warning signs are set up on the construction site, and necessary safety protection equipment is provided. Hazardous areas are isolated and protected. By adopting a comprehensive safety management approach, the occurrence and reduction of safety accidents can be effectively prevented, ensuring the life safety and health of construction personnel and maintaining social order.

### **2.3 Controlling Project Costs**

Municipal road and bridge engineering generally involves a large investment scale, and cost control directly affects the project's economic and social benefits. On-site construction management controls costs by optimizing construction plans, properly arranging construction schedules and resource allocation, preventing idle labor and unnecessary resource consumption, strengthening engineering change management, strictly controlling the scope and costs of changes, and preventing cost control failures due to changes. Furthermore, it strengthens cost accounting and analysis to grasp the dynamic trend of costs in real time and issue warnings and make adjustments for projects that exceed the budget. By adopting a refined cost management model, project costs can be minimized to the greatest extent while ensuring project quality and safety, enhancing the project's economic effectiveness<sup>[2]</sup>.

### **2.4 Enhancing Corporate Image**

Municipal road and bridge engineering generally attracts a high degree of social attention, and a company's construction management level directly affects its image and reputation in society. On-site construction management enhances the corporate image by regulating construction behavior, maintaining a clean and orderly construction site, reducing interference with the surrounding environment and residents' lives, and demonstrating the company's sense of social responsibility. High-quality project results and good safety records can win the recognition and trust of owners, supervisors, and all sectors of society, establishing a good brand image for the company. An excellent corporate image helps the company stand out in the fierce market competition and win more project opportunities, achieving long-term and stable development.

## **3. Problems in On-site Construction Management of Municipal Road and Bridge Engineering**

### **3.1 Personnel Quality Issues**

**Insufficient Professional Level of Managers:** Some on-site managers lack systematic professional knowledge and sufficient practical experience, and have an inadequate understanding of construction specifications and technical requirements. As a result, they are unable to accurately guide construction implementation in management work and find it difficult to efficiently handle technical problems that arise during construction<sup>[3]</sup>.

**Uneven Skill Level of Construction Personnel:** Municipal road and bridge engineering requires a large number of construction personnel of different trades. Some construction personnel have poor skill levels, lack necessary training and assessment, and operate in non-standard ways, which may affect project quality and construction safety.

**Weak Safety Awareness of Personnel:** Some construction personnel do not pay enough attention to safety regulations and operation procedures, hold a fluke mentality, and do not wear safety protection equipment as required, bringing great safety hazards to the construction site.

### **3.2 Material and Equipment Management Issues**

**Inadequate Control of Material Quality:** During material procurement, some procurement personnel seek personal benefits and choose materials of substandard quality, or they are lax in reviewing supplier qualifications, resulting in unreliable quality of materials entering the site. During material storage, there is a lack of effective management measures, and problems such as material dampness and deterioration are common.

**Insufficient Maintenance and Upkeep of Equipment:** Construction equipment is a key tool for ensuring the smooth progress of the project, but some companies do not pay enough attention to equipment maintenance and upkeep and do not carry out regular inspections and maintenance, resulting in frequent equipment failures that affect construction progress and project quality.

**Unreasonable Allocation of Materials and Equipment:** During construction, there is no scientific planning for the allocation of materials and equipment, resulting in situations where some construction links lack material supply or equipment is idle, causing resource waste and low construction efficiency.

### **3.3 Construction Schedule Management Issues**

**Unreasonable Formulation of Schedule Plans:** When formulating construction schedule plans for some projects, the actual situation of the project, such as construction conditions and material supply, is not fully considered, resulting in plans that are too idealistic and difficult to implement during actual construction.

**Ineffective Schedule Control:** During construction, there is a lack of practical schedule monitoring means, and it is impossible to quickly discover schedule deviations and take adjustment measures. There are also no targeted response plans for factors that affect the project schedule, such as bad weather and design changes, resulting in schedule delays.

**Poor Coordination and Communication:** Municipal road and bridge engineering involves multiple participating units, such as the construction unit, the construction contractor, and the supervision unit. There is obstruction in coordination and communication among these units, and information transmission is lagging, which easily leads to delays in the construction schedule.

### **3.4 Safety and Quality Management Issues**

**Incomplete Safety Management System:** Some companies have defects in their safety management systems, with unclear safety responsibility divisions and inadequate implementation of safety inspections and hidden danger investigations, resulting in a large number of safety hazards on the construction site<sup>[4]</sup>.

**Inadequate Quality Supervision:** During the construction stage, quality supervisors do not strictly inspect and control the quality of key processes and concealed works, resulting in phenomena such as missed inspections and misjudgments. For identified quality problems, the rectification time is delayed and incomplete, leading to impacts on project quality.

**Insufficient Emergency Response Capability:** When faced with sudden safety incidents and quality accidents, some companies lack reasonable emergency response plans and mechanisms and fail to take timely rescue and handling measures, resulting in the gradual expansion of accident losses.

## **4. Countermeasures for On-site Construction Management of Municipal Road and Bridge Engineering**

### **4.1 Strengthen Personnel Management**

**Improve the Professional Level of Managers:** Enterprises should regularly arrange for managers to participate in professional training and learning exchange activities, invite industry experts to provide teaching and guidance, update managers' knowledge structures, and improve their professional qualities and management capabilities. They should also support managers in taking relevant professional qualification examinations and obtaining corresponding certificates<sup>[5]</sup>.

**Strengthen Skill Training for Construction Personnel:** Comprehensive skill training should be

provided to construction personnel, covering construction processes, operation regulations, safety knowledge, and other related content. Strict assessments should be conducted at the end of the training, and only those who pass the assessments can go to work. During the construction stage, regular skill competitions and technical exchange activities should be organized to stimulate the enthusiasm and initiative of construction personnel for learning and continuously improve their skill levels.

**Strengthen Safety Awareness Education for Personnel:** Safety awareness and self-protection capabilities of construction personnel should be strengthened through activities such as safety knowledge lectures and safety drills. Eye-catching safety warning signs should be set up at the construction site to remind construction personnel to be careful. A sound safety reward and punishment system should be established to reward those who comply with safety regulations and punish those who violate regulations, creating a good safety environment<sup>[6]</sup>.

## **4.2 Optimize Material and Equipment Management**

**Strictly Control Material Quality:** A complete material procurement management system should be established, and suppliers with good reputation and high-quality products should be selected. Before material procurement, a comprehensive investigation and evaluation of the supplier's qualifications, reputation, and product quality should be carried out. When materials enter the site, they should be inspected and accepted strictly in accordance with corresponding standards and specifications, and unqualified materials should be resolutely returned. Effective material storage management should be strengthened, and appropriate storage methods should be adopted according to the characteristics of the materials to ensure that the material quality is not affected.

**Strengthen Equipment Maintenance and Upkeep:** A detailed equipment maintenance and upkeep plan should be formulated, and equipment should be inspected, maintained, and serviced regularly. Equipment maintenance and upkeep files should be established to record the equipment's maintenance and upkeep situation and fault handling situation. For key equipment, specially assigned personnel should be selected for management and maintenance to ensure that the equipment is always in good operating condition.

**Reasonably Allocate Materials and Equipment:** Materials and equipment should be allocated scientifically and reasonably according to the construction schedule plan and actual construction requirements. A dynamic management system for materials and equipment should be established to obtain real-time information on the inventory and usage status of materials and equipment and timely adjust the allocation plan to prevent material shortages and equipment idleness.

## **4.3 Strengthen Construction Schedule Management**

**Formulate Reasonable Schedule Plans:** When formulating construction schedule plans, the actual situation of the project, such as construction conditions, resource supply, and technical difficulty, should be fully considered. Advanced project management software should be used to optimize and adjust the schedule plans to ensure that the plans are scientific and feasible. The overall schedule plan should be divided into monthly plans and weekly plans, and the work tasks and objectives of each stage should be defined<sup>[7]</sup>.

**Strengthen Schedule Control:** A complete schedule monitoring system should be established to regularly check and analyze the construction schedule. By comparing the actual schedule with the planned schedule, problems should be discovered in a timely manner and adjustment plans should be implemented. For factors that affect the schedule, such as bad weather and design changes, response plans should be formulated in advance to minimize their impact on the schedule.

**Strengthen Coordination and Communication:** A practical coordination and communication mechanism should be established to enhance information exchange and communication among participating units. Regular project meetings should be held to promptly solve problems that arise during construction. An information-sharing platform should be established to facilitate real-time information transmission and sharing among units and improve work efficiency.

## **4.4 Improve Safety and Quality Management**

**Improve the Safety Management System:** Enterprises should establish a complete safety management system, clarify the safety responsibilities of managers and construction personnel at all levels, define detailed safety operation rules and safety inspection requirements, and strengthen safety inspections and hidden danger investigations on the construction site. If safety hazards are found, rectification notices should be issued immediately, specifying the rectification responsible persons and rectification deadlines, and following up on the rectification results to ensure that the hazards are completely eliminated<sup>[8]</sup>.

**Strengthen Quality Supervision:** A strict quality supervision system should be established to strengthen quality control throughout the construction process. Quality supervisors should strictly inspect the quality of key processes and concealed works in accordance with relevant standards and specifications to ensure that the project quality meets the requirements. For identified quality problems, rectification notices should be issued promptly, requiring the construction unit to complete the rectification within the specified time limit. After the rectification is completed, re-inspections should be carried out to ensure that the quality problems are completely resolved.

**Improve Emergency Response Capability:** Enterprises should formulate comprehensive emergency plans, clarify the emergency organization structure, emergency response mechanisms, and emergency rescue actions. Regular emergency drills should be held to improve the emergency response capabilities and coordinated operation levels of construction personnel. Necessary emergency rescue equipment and materials should be equipped to ensure that rapid rescue and handling can be carried out when sudden safety incidents and quality accidents occur, reducing the losses caused by the accidents.

## **5. Conclusion**

In conclusion, on-site construction management of municipal road and bridge engineering is a systematic project that involves multiple aspects such as personnel, materials, equipment, schedule, safety, and quality. There are still many problems in the on-site construction management of municipal road and bridge engineering, which greatly hinder the smooth progress of the project and affect the project quality. By scientifically and reasonably allocating and training personnel, the overall quality of the team can be improved. Strictly controlling the quality of materials and equipment can lay a solid foundation for the project. Adopting advanced technologies and optimizing plans can promote the efficient implementation of the project. In the future construction of municipal road and bridge engineering, innovative management modes should be continuously explored and flexibly applied according to the actual situation to create more high-quality municipal road and bridge engineering projects and lay a reliable foundation for the prosperity and development of the city, making urban traffic more smooth.

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