

# Road and Bridge Construction Technology and Quality Control Measures and Analysis

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**Abstract:** *With the rapid development of China's social economy, urban construction has undergone qualitative changes, and road construction and bridge engineering construction have become increasingly perfect, playing an important role in urban development and construction. Municipal road construction projects cover a wide range, with urban bridge construction running through them, effectively improving environmental and traffic issues, but there are still many areas that need improvement. This article proposes corresponding solutions for monitoring the construction quality of municipal roads and bridges, as well as the problems that arise, based on the development status of the city and the actual situation.*

**Keywords:** Roads and bridges; Construction technology; Quality control; measure.

In the construction of urban infrastructure projects, the construction of roads and bridges has promoted communication and exchange in various aspects such as economy, technology, and culture between countries, provinces, and cities. It has played an extremely important role in improving urban population mobility and has achieved significant results in the construction of national urban roads. With the continuous development of the social economy, people's standards for improving people's livelihoods and urban image have significantly increased. Especially in the construction of municipal roads and bridges, engineering quality issues have become the primary concern of the general public. It is necessary for relevant departments to conduct strict quality control and strategic analysis to ensure the quality of road safety construction and bridge engineering construction.

Since the 18th Party Congress, China has implemented a series of policies to combat air pollution, water pollution, soil pollution and other environmental problems, environmental regulation has become an important influence in China's economic innovation and development. At the same time, the party's twentieth report pointed out that: "innovation is the first power to lead development, determining the speed, effectiveness and sustainability of development; green development is to solve the problem of harmonious symbiosis between human beings and nature, and the protection of the environment is the protection of productive forces." [1] Therefore, green technological innovation has become the key to the synergistic development of China's economy and environment in the new era, and environmental regulation is an important means to promote the development of green technological innovation. However, at present, academic research on the relationship between environmental governance and economic growth, enterprise green technology innovation has not yet formed a consistent conclusion, so the study of China's environmental regulation of green technology innovation effect, help to clarify this academic controversy, and for the government's environmental policymaking and enterprise to realize the development of green technology innovation to provide a useful reference.

In the study of coupling coordination degree, Xinxin Wang (2023) studies the coupling relationship between green supply chain efficiency, technological innovation and economic development [2]. Chen Zhifang (2023) constructed a coupled coordination evaluation model to study the coupled coordination relationship between industrial structure optimization and ecological environment governance[3] Cui Liang (2023) constructed a coupled coordination evaluation model to study the coupled coordination relationship between industrial structure optimization and ecological environmental governance. Cui Liang (2023) constructed a coupled coordination degree model to study the relationship between digital logistics, ecological environmental governance and regional economic growth[4] Cui Liang Xueqian Ding (2022) constructed a coupled coordination evaluation index system of land use, high-quality economic development and carbon emissions, and used the coupled coordination model to measure the coupled coordination of the three systems.[5] The model of coupling degree of coordination is used to measure the coupling coordination of the three systems.

In the research on the relationship between environmental regulation and green technology innovation, Du Ke (2023) combines institutional theory and natural resource base view, constructs a framework of green technology innovation driving mechanism based on dual strategy perspective, explores the relationship between heterogeneous environmental regulation, environmental dual strategy and green technology innovation, and

explores the differences of driving mechanism in different enterprises' life cycle stages[6]. Li Ping (2023) showed that there is a significant "inverted U"-shaped trend in the impact of environmental regulation on enterprise green technology innovation, and there is heterogeneity in the impact of environmental regulation on enterprise green technology innovation; enterprise digital transformation and regional digital inclusive finance can significantly promote enterprise green technology innovation, and there is a significant difference in the impact of environmental regulation on green technology innovation. The impact of environmental regulation on green technology innovation has both a threshold effect and a moderating effect[7]. According to Ye Juanhui (2022), there is a "local-neighborhood" non-consistent effect of environmental regulations on green technological innovation, which shows a "U" shaped relationship in the local area that is first suppressed and then raised, and an inverted "U" shaped relationship in the neighboring area that is first promoted and then suppressed. "U"-shaped relationship in the local area, and an inverted relationship in the neighboring area, which first promotes and then inhibits green technological innovation.[8] Zhou Xuefeng (2023) argued that Zhou Xuefeng (2023) argues that the digital economy can help alleviate corporate financing constraints, improve social responsibility, and then improve the sustainability of green technology innovation[9]. Su Bin (2020) shows that environmental regulation and green technological innovation have obvious promotion effects on the high-quality development of the economy, and there is a stable and balanced cointegration relationship in the long term, and the effect of green technological innovation is greater than the effect of environmental regulation.[10] The effect of green technology innovation is greater than the effect of environmental regulation.

There are not many studies on modeling the coupled coordination degree of environmental regulation and green technology innovation. Li Guozhu (2022) measured the coupled coordination degree of environmental regulation of the two subsystems of formal and informal environmental regulation from 2011 to 2018, and explored the effect of the coupled coordination degree of environmental regulation on the green technological innovation of enterprises. The results show that: the coupled coordination degree of environmental regulation in China is poor, and most of the regions are in a state of dysfunction[11]. Based on entropy value method, Li Nanbo (2021) explored the coupling and coordination mechanism and coupling and coordination level among green technology innovation, green finance and environmental regulation[12]. Based on the coupling coordination model and panel vector autoregressive model, Wang Binhui (2022) investigated the impacts of environmental regulation, green technological innovation and high-quality economic development, and the results showed that there is regional heterogeneity in the impacts of environmental regulation intensity on green technological innovation.[13].

Existing research rarely involves the coupling coordination degree of environmental regulation and green technology innovation, and most scholars define the coupling coordination model subjectively, and lack of environmental regulation and green technology innovation as a whole, to study the degree of their coupling coordination on different administrative units. This paper utilizes the synergy theory to objectively define the coefficients, which can better reflect the synergistic effect of environmental regulation and innovation development, and can be a useful reference for realizing the development of good green technological innovation.

## **1. THE IMPORTANCE OF ROAD AND BRIDGE CONSTRUCTION TECHNOLOGY AND QUALITY CONTROL**

### **1.1 Effectively ensuring construction quality and efficiency**

In the process of China's socio-economic development, road and bridge construction has made a very important contribution to social and economic development. However, these problems still have a certain impact on the current Roadworks technology and quality control. The construction process of roads and bridges will involve many aspects. Therefore, it is necessary to strengthen various construction technology links and ensure quality control in each link during construction, in order to effectively ensure the quality of road and bridge construction. Safety and quality control refers to the management of materials, equipment, and construction personnel during the construction process. Due to the direct impact of construction materials and equipment on construction quality, in order to improve the economic benefits of enterprises, it is necessary to do a good job in construction technology and quality control.

### **1.2 Effectively ensuring construction safety and enterprise benefits**

Construction quality control is a very important task in road and bridge construction. There is a very close relationship between safety and quality. In the construction of a road and bridge project, if safety issues cannot be effectively addressed. The quality of the construction of this engineering project cannot be effectively guaranteed.

The important significance of quality control in road and bridge construction is mainly reflected in the following aspects: firstly, it further improves the construction organization ability of the construction unit, allowing it to accumulate more safety management experience; The second is to maintain the construction environment, laying a good foundation for the safe construction of roads and bridges, greatly promoting the recycling of resources and improving the efficiency of engineering construction; Thirdly, the construction technology level has been optimized and improved. Through the implementation of safety management work, the operational skills and safety awareness of construction personnel have been further improved, while also effectively ensuring the quality of construction, promoting the economic and design benefits of road and bridge construction projects to be effectively improved.

### **1.3 Effectively ensuring construction safety and enterprise benefits**

Construction quality control is a very important task in road and bridge construction. There is a very close relationship between safety and quality. In the construction of road and bridge projects, if safety issues are not effectively guaranteed, the construction quality of the project cannot be effectively guaranteed. The significance of quality control in road and bridge construction is mainly reflected in the following aspects: 1) the construction organization ability of the construction unit has been further improved, and a lot of safety management experience has been accumulated; 2) Maintaining the construction environment has laid a good foundation for the safe construction of roads and bridges, greatly promoting the recycling and utilization of resources, and improving the construction efficiency of the project; 3) The construction technology level has been optimized and improved. By implementing safety management, the operational skills and safety awareness of construction personnel have been further improved.

## **2. PROBLEMS IN THE CONSTRUCTION OF MUNICIPAL ROAD AND BRIDGE ENGINEERING**

### **2.1 Road Bridge Transition Section Issues**

In road and bridge construction, a key and special issue is the issue of road bridge transition sections. If the problem of road bridge transition sections is not properly handled during construction, it may lead to vehicle jumping when the road is put into use. Under normal circumstances, jumping during vehicle operation can pose a significant safety hazard. If the transition section

If not properly managed, it will slow down while driving, which can easily lead to congestion on the road. On the other hand, when dealing with the soft foundation of the transition section, if the treatment is not meticulous enough, it can lead to uneven bridge pavement, seriously affecting the smoothness of the road surface, and leading to the occurrence of vehicle jumping at the bridge head.

### **2.2 Safety hazards caused by unqualified materials**

In road construction and bridge engineering construction, it is necessary to use large-scale construction materials as the foundation for construction. Some construction units, in order to reduce construction costs and improve economic benefits, use low-cost and low-quality construction materials when selecting materials. This has led to the use of substandard materials in the later stages of use, resulting in local construction cutting corners and causing serious quality problems in the project. This has caused safety hazards for roads and bridges during use, directly damaging public interests, and causing significant economic losses [2].

### **2.3 During the construction process, there are significant environmental factors that affect the natural environment**

Road and bridge construction is usually carried out in an external environment, so during the construction process, it is very easy to be affected by external factors, such as climate and harsh weather conditions such as rain and snow. These natural environmental factors can to some extent affect the construction of road and bridge bridges, and can also easily lead to safety accidents during the construction period. Therefore, During the construction process of roads and bridges, external natural environmental factors can also have a certain impact on the construction quality.

### **2.4 Limited level of construction personnel**

The road and bridge construction project is actually a very large construction project. Its construction requires a large amount of financial and material resources, as well as a large amount of manpower. Construction personnel play a very important role in it. However, due to the fact that construction workers are mainly composed of some migrant workers, there are still some difficulties in personnel management. In addition, the limited level of construction personnel can also affect the efficiency and quality of engineering construction [3].

### **3. THE PROBLEM OF ROAD BRIDGE TRANSITION SECTION**

#### **3.1 Take reasonable measures to solve**

In the construction of road and bridge engineering, to ensure the smoothness of the road surface, strict control must be exercised during the process of construction. First of all, during the construction, Total station shall be used reasonably and scientifically for paving, and the side wall and tangent line shall be vertical. After the paving operation is completed, the pavement shall be cleaned. Secondly, during the construction of transition section, settlement observation points shall be arranged within its scope, and about four points shall be arranged. At the same time, during the construction, Observation should be conducted once or twice a day. When the settlement is relatively large, the number of observations should be appropriately increased, corresponding records should be made, and the recorded data should be organized. Finally, based on the recorded data information, in-depth analysis should be conducted on the stability of the foundation to determine the compaction requirements of the foundation.

#### **3.2 Strengthen the control of construction raw materials**

Road and bridge engineering, like other construction projects, directly affects the overall construction quality with the quality of construction raw materials. For road and bridge engineering, concrete is the most commonly used material, therefore, the control of concrete mix materials is crucial. Due to the strong variability of sand and gravel materials in concrete, the mud content in crushed stone should not exceed 2%, and the mud content in sand should not exceed 3%, otherwise it will seriously affect the bonding between cement and aggregates. When selecting aggregates, aggregates with low thermal expansion coefficient and mud content should be selected to ensure the Water - cement ratio of concrete and the strength of concrete. Therefore, during the construction process, it is necessary to strengthen the quality inspection of raw materials, take timely intervention measures in response to changes in the moisture content of raw materials, ensure material stability, and thus ensure the stability of construction quality.

#### **3.3 Quality control of concrete construction**

The selection of concrete raw materials, Water - cement ratio and other main mixing parameters of concrete shall meet the specification and design requirements, so that the concrete has good invasion resistance, volume stability and crack resistance. Cement should be either Portland cement or ordinary Portland cement. Fine aggregate should be selected from clean natural medium coarse river sand with reasonable grading, uniform and sturdy texture, low water absorption, and small porosity. Coarse aggregate should be clean crushed stone with reasonable grading, good particle shape, uniform and sturdy texture, and low linear expansion coefficient, and sandstone crushed stone should not be used. Water reducing agent: The use of polycarboxylate high-performance cement concrete water reducing agent can significantly improve the working performance of concrete, reduce the heat of hydration, lower the internal temperature of concrete, and delay the occurrence of temperature peaks. Adding appropriate concrete additives can prevent early shrinkage cracks and creep of concrete, and avoid excessive air holes [5].

#### **3.4 Strengthen the training of construction personnel and improve their comprehensive skills**

To ensure the quality of engineering construction, the first step is to improve the comprehensive skills of construction personnel, especially the frontline construction workers on the construction site. It is necessary to strengthen the training and learning of construction personnel, and provide key training on professional skills that affect the quality of engineering construction. At the same time, a responsibility system should be implemented for construction personnel, so that when problems arise, the responsible person can be quickly found and there is evidence to follow. At the same time, it is necessary to practice and train the professional knowledge of construction personnel, and actively organize regular learning and training. It is stipulated that only qualified personnel who have passed the assessment can work. Through effective learning and training, the quality of

construction personnel can be improved, ensuring that construction personnel have good professional knowledge, and can promptly and effectively solve unexpected situations.

### 3.5 Strengthen supervision of the construction process

To reasonably control the construction progress of road and bridge construction projects, the first thing to do is to strengthen supervision of the construction process, so as to maintain the steady progress of the construction plan and ensure the construction progress of the project. Supervisory personnel play a significant role in this process, as they need to establish the management personnel responsible for each link and release relevant regulatory tasks, and require management personnel to be responsible for each implementation. All construction steps should be strictly supervised and scientific and reasonable methods should be used to control the construction progress. If problems arise during the supervised construction process, they should be promptly resolved and reported to relevant departments to optimize the remaining construction plans.

## 4. CONCLUSION

With the continuous development of China's economy, the stability of urban road and bridge engineering directly affects the development of cities and people's quality of life. Therefore, in the construction process of road and bridge engineering, it is necessary to pay attention to the key points of each part of the construction, such as bridge foundation construction, roadbed construction, and transition section construction, and pay attention to the construction quality issues that are prone to occur in various key points of construction. If problems are found, they should be promptly communicated and resolved, and a good quality foundation should be established. At the same time, at the construction site, management personnel should strengthen employee quality and safety awareness training, strictly control the quality of construction materials, and combine relevant management systems to ensure construction quality. Green technological innovation is the basic driving force of economic green development, and the coupling and coordination level of the composite system composed of green technological innovation and environmental regulation is a decisive factor for whether the regional economy can realize sustainable development. This paper explores the coupling and coordination mechanism and coupling and coordination level of environmental regulation and green technology innovation by utilizing the relevant data of environmental regulation and green technology innovation from 2007 to 2018. The results show that the overall coupling and coordination development of China's environmental regulation-green technology innovation system is at a medium-high level, but there is a large gap in the level of coupling and coordination between regions, with relatively high coupling and coordination in the eastern region and overall coupling and coordination in other regions being biased, and most regions of the country have a large potential for upward mobility.

## REFERENCES

- [1] Zhang Kangyang, Wang Yao Analysis and Discussion on the Current Situation of Road and Bridge Construction Quality [J] Building Engineering Technology and Design, 2020, 8 (25): 189
- [2] Ren Junya Application of Concrete Construction Technology in Road and Bridge Engineering[J] Shanxi Architecture, 2021 (28): 122-123
- [3] Huang Mingwen Discussion on the Application of Prestressing Technology in Road and Bridge Engineering[J] Heilongjiang Transportation Technology, 2020 (8): 99102
- [4] Zhang Minghai Analysis of Construction Quality Problems and Prevention Measures for Municipal Road and Bridge Engineering [J] Henan Building Materials, 2021, (06): 416-419
- [5] Li Weijia Analysis and Prevention of Construction Quality Problems in Municipal Road and Bridge Engineering [J] Building Materials and Decoration, 2020, (42): 239-240
- [6] Huang Mingwen Discussion on the Application of Prestressing Technology in Road and Bridge Engineering[J] Heilongjiang Transportation Technology, 2020 (8): 99102
- [7] Amsden, Alice H. Asia's Next Giant: How Korea Competes in the World Economy[J]. Technology Review,92(4):46-53.
- [8] Xie Tian. Research on the development of cross-border e-commerce logistics model[J]. Farm Economic Management,2022,321(12):22-24.
- [9] SHI Yonghui,DUAN Chao. Analysis of China's Import and Export Trade Flows Based on Trade Gravity Model--Taking 2007 as an Example[J]. Modern Trade and Commerce Industry,2009,21(21): 96-97.

- [10] MEN Hengmin, WANG Wenxiao, YANG Yanxi et al. Research on Transformation and Upgrading of Traditional Foreign Trade Enterprises by Cross-border E-commerce--Taking Jiangsu Province as an Example[J]. China Market,2022,1130(31):187-189.