Original Article

CHARTING ADVANCEMENT: AN IN-DEPTH EXPLORATION OF KEY DOMAINS IN ROAD AND BRIDGE TESTING AND DETECTION

Emily Davies

Transportation Technology Institute, Gold Coast Campus, Queensland, Australia

Abstract: In recent years, the acceleration of urbanization has significantly intensified the demand for road and bridge construction, forming a vital component of the development of a well-planned and efficient urban transportation network. To fully realize the potential and value of road and bridge construction, it is imperative to implement rigorous and effective supervision. The process of road and bridge test detection serves as a fundamental and encompassing facet of this supervisory framework [1]. It mandates that inspection personnel meticulously assess the construction technology and the quality of raw materials, thereby ensuring precision and standardization in the detection process.

As a result, comprehensive research into key areas and breakthrough studies is of paramount practical importance, given the pivotal role played by road and bridge construction in the broader context of urban development and the vital need to maintain quality standards.

Keywords: Urbanization, Road and Bridge Construction, Supervision, Test Detection, Quality Standards.

1. Introduction

In recent years, the process of urbanization has accelerated obviously, and the need of road and bridge construction is more urgent, which is the key to scientific and dense urban transportation network. In order to give full play to the value of road and bridge construction, it is necessary to grasp its supervision. The road and bridge test detection is an essential work in supervision, which is a comprehensive project [1]. It requires inspection personnel to inspect the construction technology of road and bridge and the performance of raw materials, it also needs to ensure the refinement and standardization of detection.

Therefore, the research on the key point's summary and breakthrough studies have practical necessity.

2. Overview of Road and Bridge Test Detection

Under the background of the refined development of the construction industry, the importance of road and bridge test detection is self-evident. First, it should clarify the content of road and bridge test, which is essential to grasp key point of testing work. Road and bridge test mainly includes raw material performance test and construction quality test. Raw material performance test includes tests of concrete raw material and steel quality. Among them, concrete performance detection is the top priority. The quality of cement aggregate and admixture is the key test object, so as to ensure the durability of concrete, which meets the basic requirements of construction. Specifically, cement testing focuses on two dimensions of cement type and strength, while aggregate testing focuses on aggregate grade and other indicators. When testing admixture, it is mainly to ensure that the use of admixture meets the construction conditions. According to the dynamic change of concrete, the type and dosage are adjusted reasonably [2]. The purpose of steel inspection is to ensure that the steel performance is stable. It mainly checks the bending rate, surface shape, size deviation, and weight deviation to ensure that the steel material performance

meets the construction requirements. Construction quality detection mainly involves concrete mixing testing, bridge deck testing and other small items. The test of bridge deck structure focuses on concrete compactness, concrete flatness and waterproof performance. In general, the testing personnel can analyze and verify the relevant parameters of the road and bridge through detailed and standard testing to ensure the excellent quality of the road and bridge construction.

3. Significance of Road and Bridge Test Detection

Road and bridge test detection has multiple meanings. First of all, through the road and bridge test, it can detect the qualified rate of the materials used in the road and bridge construction, so as to determine what kind of materials to choose and whether the materials can be used locally. In addition, through the road and bridge test detection, it can effectively promote the application of new technologies, new materials and new processes in road and bridge construction, and the application of these new technologies, new materials and new processes can improve the quality of bridge construction, accumulate experience for the construction of the project, and promote the rapid development of road and bridge construction [3]. Furthermore, the road and bridge test detection mainly uses scientific methods to test various materials and semi-finished products on the road and bridge construction site, and determines whether these materials and semi-finished products meet the requirements of design and construction. Finally, the road and bridge test can objectively evaluate the quality of the road and bridge, which has unified quality standard. Road and bridge test is conducive to the formulation of a unified road and bridge quality standard.

4. Core Problems of the Road and Bridge Test Detection Technology in Application

4.1. The testing scope of construction materials is uncertain

For the road and bridge test, the test of raw material performance is the most basic and necessary, because the performance quality of raw materials will directly affect the quality of road and bridge construction. The random interference of material detection is large, which makes some road and bridge construction tests expose many problems in material detection. If the scope of material test is not clear or the material performance level is not controlled, it will weaken the effectiveness of testing and affect the development of testing work. Additionally, some units do not pay enough attention to the material test detection, and the material performance and quality detection is not comprehensive and detailed enough. Some units only grasp the basic materials while ignoring the quality detection of corresponding components.

4.2. Detection methods are relatively backward

Road and bridge test detection is systematic and comprehensive, which needs a variety of efficient detection methods to support. The accuracy of test results will be affected by different detection methods and different detection emphases. At present, most construction units have realized the importance of test detection, but they pay less attention to the flexible application of testing methods in the process of promoting testing. Many units follow the traditional testing technology, and the testing results are not accurate enough, so the reference value of quality supervision is not high. For example, following the method of surface detection, the detection results has little significance. Due to the backward detection method and inflexible application, the detection results are inaccurate. In the future detection, it should pay more attention to the new detection methods and effective selection of detection technology.

4.3. Testing personnel have low professional quality

The testing experience and professional level of the testing personnel will affect the testing quality. The testing personnel should have high professional quality and rich practical experience, so that they can identify the detection points in the complex test detection, break through the detection difficulties, and complete the testing work seriously and responsibly. Therefore, it is necessary to ensure the standardization and refinement of the test detection. In view of the road and bridge construction testing includes different stages such as sampling testing,

once there is a wrong operation error or cognitive deviation of testing personnel, the detection effect will be greatly reduced.

4.4. It lacks a sound test detection system

A sound test detection system is a favorable condition to ensure the test effect. However, at present, there is a lack of a sound scientific test system in road and bridge construction test detection, which leads to the lack of guidance and standardization of testing work. Relevant departments do not take a longterm view and do not establish a clear testing process and testing system in time. In the process of the test detection, the detection department has certain subjective arbitrariness because there is no specific reference. In addition, the existing detection personnel have weak ability and weak sense of responsibility, and there are external constraints and internal constraints at the same time, which exposes various problems in the test detection. Although many units have set up special testing departments, most of them are empty shells. Detection personnel lack crisis awareness and work enthusiasm, which is easy to lead to the deviation of detection results due to detection mistakes.

5. Breakthrough Suggestions on Application Difficulties of Road and Bridge Test Detection

5.1. Strengthen the raw material test and testing

Raw material testing is very necessary, so it should pay attention to the performance testing of raw materials, so as to drive the cost and quality control of raw materials by the performance testing of raw materials. In order to ensure the comprehensiveness and accuracy of raw material testing, testing personnel should be careful and responsible in testing, and fully grasp the raw material manufacturer qualification, market reputation and other information [4]. For example, testing personnel should make horizontal comparison between multiple material manufacturers, and choose a manufacturer with good qualifications and high reputation for long-term cooperation. This can ensure the reliability and stability of raw materials to a certain extent. During the test detection, they should also pay attention to the process and use of raw materials, ensure the quality and safety of raw materials, timely compare the test results with material use standards, and timely block inferior materials outside the construction site. If defective products are found in the test, the construction unit should be urged to replace the materials in time.

5.2. Optimize road and bridge test detection technology

In the road and bridge test detection, the test technology should be continuously optimized to improve the accuracy of the test results. With the vigorous development of the construction industry, there are more types of road and bridge construction testing technologies, and the testing tends to be refined. People begin to focus on the detection of compaction degree, concrete structure strength, road bending detection and other small testing items, corresponding to different detection technologies. When carrying out the road and bridge construction test and detection, the testing personnel should choose the corresponding optimized testing technology according to the requirements of the testing task, and scientifically test based on the specific situation of the road and bridge construction.

5.3. Improve the working ability of testing personnel

The quality and ability of testing personnel directly affect the test results. Therefore, it should build a high-quality test team, so that they have the ability and responsibility to do a good job in the test work. This requires testing institutions to strengthen the skill training of testing personnel in their daily work, infiltrate the advanced ideas of professional testing, and strengthen the guidance of the front-line testing work of testing personnel. At the same time, the testing personnel should be reasonably selected and hired to ensure that the test personnel have the corresponding test qualification certificate, and it also enables the testing personnel to consciously learn, accumulate experience, and conscientiously do a good job in the road and bridge test detection work. In their daily work, testing institutions should guide testing personnel to learn new testing theory, testing methods and testing process, consciously improve their professional quality and ability, and lay a solid foundation for testing. In the process of road and bridge construction test, the testing personnel should comply with the test specifications

and requirements with rich experience in operating testing equipment. In addition, since the test data are obtained through these equipment, the testing personnel should pay attention to the management of the testing instrument to ensure the reliability and accuracy of the testing instrument. Because the test data during the test process is obtained through the instrument.

5.4. Improve the quality system of road and bridge test detection

In the process of road and bridge test and detection, the relevant testing departments and engineering units need to gradually establish a perfect road and bridge test detection quality system in the continuous testing practice [5]. In the process of test and detection of road and bridge construction, relevant departments and personnel can plan and implement work strictly according to the requirements of the system. A perfect test and detection quality system can play a certain role in guiding and restricting the development of the testing work, and scientifically divide the post authority of inspection personnel to ensure the smooth development of testing work.

6. New Technology Promotion of Road and Bridge Test Detection

In the process of project implementation, road and bridge construction units should fully realize the importance of road and bridge construction test and detection. They should entrust an authoritative testing institution to carry out the corresponding testing work, and audit the instruments and equipment used by the testing institution to ensure the advanced nature of its testing equipment and instruments, and avoid the use of backward testing equipment and instruments, resulting in a large error between the obtained test results and the actual test results. In road and bridge construction projects, concrete structure detection is an important testing content. If there are quality problems in concrete structure, there will be large quality and safety problems in road and bridge construction, which is not conducive to the safe passage of vehicles. Therefore, in the road and bridge construction test, the concrete material grade should be tested scientifically. For example, advanced equipment such as ultrasonic detector can be used to detect cracks and structural strength of concrete, and the test results can be used to guide practice. At present, geological radar detection technology and ultrasonic detection technology are worth popularizing.

6.1. Geological radar detection technology

Geological radar detection technology is also known as detection radar technology, which is a detection technology with many advantages. Geological radar detection technology is to emit high frequency electromagnetic wave into the detection object through geological radar. After receiving the high frequency electromagnetic wave, the object will produce certain reaction, through which the internal situation of the object can be judged. The detection process of road and bridge quality detection by geological radar detection technology is as follows: first, detection personnel send corresponding instruction information to the control unit through the computer or laptop; then, after receiving the command information from the computer, the control unit transmits the antenna signal, and then receives the signal sent by the antenna; after that, when the transmitter triggers the signal, the transmitting antenna sends a high-frequency electromagnetic wave to the ground. If the detection position or the medium of the object is not uniform, the electromagnetic wave will receive different electrical targets and interfaces when it meets different media. Part of the electromagnetic wave is reflected to the ground, which is then received by the receiving antenna on the ground, and transmitted back to the control unit in the form of data unit, back to the computer or laptop computer, and displayed in the form of images. Finally, analyzing and processing these images yields the internal situation of the detected object.

6.2. Ultrasonic detection technology

Ultrasonic technology can also be used to detect the quality of the bridge. The basic principle of ultrasonic detection technology is that ultrasonic detector and acoustic transducer can detect and analyze the ultrasonic pulse in the object, main frequency and amplitude, and then analyze whether these index data changes, so as to judge whether the object has quality defects. When using ultrasonic detection technology to detect the quality of the bridge, ultrasonic wave can penetrate the concrete structure of the bridge, and spread in the concrete structure,

with the characteristics of safe use and simple operation. When using ultrasound to detect the quality condition of the road bridge, the method of multiple measurement point data comparison is usually used to detect the road bridge, and then the relevant principles and methods of probability statistics are used to deal with the detection data and evaluate the defects of the road bridge.

7. Conclusions

With the speed of new urbanization construction, the highway bridge construction has achieved unprecedented development. Road and bridge projects are closely related to people's daily travel, which is a matter of national economy and people's livelihood. Therefore, relevant departments should attach great importance to road and bridge test detection, grasp the key points of testing technology, directly hit the key points and difficulties of road and bridge test detection, and actively promote the advanced detection technology such as ultrasonic and low quality radar. In this way, the quality of road and bridge test can be effectively improved, thus laying the quality foundation of road and bridge construction application.

References

Verstrynge E., Lacidogna G., Accornero F., & Tomor A. (2021). A review on acoustic emission monitoring for damage detection in masonry structures. Construction and Building Materials, 268, 121089.

Huseynov F., Kim C., Obrien E. J., Brownjohn J. M. W., Hester D., & Chang K. C. (2020). Bridge damage detection using rotation measurements–Experimental validation. Mechanical Systems and Signal Processing, 135, 106380.

Hüthwohl P., Lu R., & Brilakis I. (2019). Multi-classifier for reinforced concrete bridge defects. Automation in Construction, 105, 102824.

Malekjafarian A., Golpayegani F., Moloney C., & Clarke S. (2019). A machine learning approach to bridge-damage detection using responses measured on a passing vehicle. Sensors, 19(18), 4035.

Zheng M., Lei Z., & Zhang K. (2020). Intelligent detection of building cracks based on deep learning. Image and Vision Computing, 103, 103987.