Recent Progress on the Bridge Damage Detection Technology

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ABSTRACT

The damage detection can provide important basis for the normal use and maintenance of bridges, which also is an important approach to ensure the safety of bridge. This article reviewed the content and importance of bridge damage detection, and introduced the important progress in the current detection methods of bridge. In addition, some suggestions were put forward to promote the development of bridge inspection.¹

KEYWORDS

Bridge Damage Detection; Methods; Countermeasures

THE IMPORTANCE OF BRIDGE DETECTION

The bridge is an important part of transportation system in each country. In recent years, many vehicles are seriously overloaded with the improvement of people's living standards and the number of car purchases, which caused great damage to the bridge, such as structural distortion and fracture and bridge fracture. And the bridge must be demolished and rebuilt once irreparable damages happen, which bring great losses to the country. Usually, the bridge would not be demolished according to its service life. A series of scientific tests need to be carried out, and the accurate inspection results should be taken as the basis of judgment, what’s more,

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the bridge can be effectively maintained and remedied according to the actual situation. Therefore, regular inspection of bridge has become an important part of urban development process, and the construction quality should be ensured in the construction process, and the regular maintain should be done after the work completion in order to ensure the stability and safety of the bridge. The quality problems in the construction process can be discovered through regular inspection, so we can take effective measures to eliminate the existing or potential safety hazards promptly, to ensure people's life and property safety. What’s more, the bridge detection is also a data collection stage, a test and optimization of detection technology, which can provide reference for better technology development [1].

THE TESTS OF BRIDGE DETECTION

Visual Inspection

Because the service conditions of the bridge can be shown directly through the appearance, the appearance detection of the bridge is the most direct and the simplest method. Through the visual examination of the bridge's external situation and structure, the bridge cracks and other problems would be further detected, and the test results can be directly used as a reference for conservation strategy.

Material Test

Material test refers to the use of related technical means to obtain bridge information indicators. Taking the reinforced concrete inspection as an example, the test includes the detection of the actual thickness of the outer protective layer, the corrosion degree of rebar and the carbonation depth of the concrete. Material test can provide reference for bridge maintenance, and the test results can also determine the direction of methods and timing for bridge reinforcement.

Load Test

Load test is to detect the actual working state of bridge partial structure through related experiments. It is also one of the most widely used bridge state inspection technologies at present. The results of load test can determine the overall level of bridge operation, and we can maintain bridge in accordance with the corresponding level.
BRIDGE INSPECTION METHODS

Radio Inspection Technology

Due to the vehicle's pressure on the bridge is usually repeated and not periodic, the bridge will crack when it can't bear the load of the vehicle, which will cause cracks in the bridge and miss the optimum maintenance time, resulting in the safety hazards of bridge operation. Then the radio detection technology can come in handy in this situation. Radio detection technology is to install a number of sensors at different locations of the bridge, and the sensors will automatically receive radio waves. Therefore, radio inspection technology can clearly control the steel structure of the bridge, and definite the overall situation of the bridge steel structure, the distribution and forms of cracks and so on. This technology is convenient for technical personnel to work out effective rectification and reinforcement measures according to the strength of the received radio waves [2].

Optical Fiber Detection Technology

Optical fiber sensor detection technology is one of the most advanced technologies of bridge detection. The range of this technology is wide, the accuracy is high, and the error range can usually be maintained at around 0.02 mm. But in the construction process, once the stress accumulates, it will affect the engineering quality. Therefore, the sensors will obtain relevant information in the case of light to understand the actual stress situation to determine the construction situation, find the problems in time, and take effective measures to solve the problem, in order to improve the accuracy of the construction project [3].

Non-destruction Measurement

Non-destruction measurement is more reasonable and safer in the existing bridge detection technologies in our country. Compared with other detection techniques, it has the following advantages: firstly, the amount of work in preparation is small; second, there is no need for a large amount of preparations. Secondly, the test results can be analyzed directly. The last, the damage extent of detected sample is within the tolerance range, while some samples are not damaged. But there are still limitations in some aspects, for example, the foundation of the bridge must reach a certain standard strength, the test surface of the bridge must be dry and clean, and there shall be no other interfering substances which will affect the inspection, the installation position of sensors must be up to the test requirement.

Ultrasonic Test

The basic principle of ultrasonic test is the use of high frequency pulse as transmitter, it will emit ultrasound when the detected object appears, and then the
receiver will be used to receive the reflected ultrasonic. When the ultrasonic wave propagates inside the bridge, it will meet the different defects of the bridge, which lead to the change of the physical properties of the ultrasonic wave in order to find out the defects in the bridge and take corresponding measures in time. The advantage of this technology is that the internal defects of the bridge can be found without breaking the internal component of bridge. And the disadvantage is higher specialty level for operating personnel.

**New Detection Technologies**

The traditional bridge detection technology is constantly being shocked or even eliminated, with the development of informatization and intelligentize in our country. The detection technology is no longer complex, because of the interference of computer intelligent detection. High efficiency detection technologies are gradually coming into view, such as laser detection technology, new sensing system technology and intelligent support technology. They are innovative in many areas such as accurate coordinate data, fast reaction speed, and super analytical ability, which reduce the workload of technical personnel to a great extent and enrich the detection function of the bridge. They can complete the diversified overall inspection of the bridge for enterprises and generate scientific and systematic data automatically for technician to analyze [4].

**CONCLUSIONS**

Bridge damage detection plays an important role in the use and maintenance of the bridge. Therefore, the non-destruction measurement which is new, convenient, low cost should be developed and the accuracy of test results should be enhanced to promote the continuous improvement of the detection level. Meanwhile, the advanced testing equipment should be actively purchased and promoted to use, and the technical personnel should be professional trained regularly to improve the comprehensive quality and professional ability continuously. Besides, in the bridge project, we should strengthen the inspection and maintenance work, and introduce relevant policies as soon as possible. And the safety level of bridges will be improved continuously through the above efforts.

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