

Research on Detection and Reinforcement Technology of Steel Structure Bridges

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Abstract: With the rapid development of the social economy, the traffic volume has also shown a rapid growth momentum, which leads to the increasing load on the bridge, coupled with the corrosion and damage of the old bridge and the low limit of the original design load, so the general bridge capacity is insufficient. The problem began to appear. Traffic volume, increased vehicle load capacity and bridge damage have become increasingly prominent. The bridge is the throat to ensure the smooth flow of traffic. The key lies in the bearing capacity and transportation capacity of the bridge. The lack of bearing capacity of the bridge is the key to limiting the traffic capacity of the road. Therefore, it is an urgent and important task in the road traffic field to accurately evaluate the actual bearing capacity of the bridge and to choose a reasonable and effective method to strengthen the old bridge to ensure the normal operation of the bridge from the economic and social benefits.

1. Introduction

The international steel structure emerged at the end of the 19th century and developed rapidly, especially the Bayesian converter steelmaking method proposed by the United Kingdom in 1855 and the open hearth steelmaking method invented by the French in 1865. These two types of steelmaking methods began in 1870. Successfully promoted to form steel with high strength and good toughness, and gradually replaced wrought iron materials in the construction field. Since 1890, it has become the main building material of metal structures. The welding technology of the early 20th century and the emergence of bolts (high-strength bolts) in 1934 quickly advanced the development of steel structures. China's steel structure began after the founding of New China. During the first five-year plan, China invested and built a large number of steel structure bridges and workshops. However, due to limited technical level, the development of steel structure has been restricted and there is no capacity to apply to major In the engineering project. With the implementation of China's reform and opening up and rapid economic development, the output of steel products has increased year by year, and steel structural materials and technologies have also developed rapidly. The main construction materials for traditional bridge construction are reinforced concrete or stone. In recent years, with the continuous development of modern steel structures, the bridge structure has developed toward the steel structure and large span. Steel structure is widely used in the design of railway bridges, highway bridges and pedestrian bridges due to its light weight, high strength and good toughness. Representative steel bridges include Shanghai Nanpu Bridge, Guangzhou Lasha Bridge and Guangdong Humen Bridge. Tianjin Jiefang Bridge, Lanzhou Zhongshan Bridge, etc.

2. Damage of steel structure

Current steel structure damage has not been clearly defined. Building steel structures are used in harsh environments and are subject to dynamic cyclic loads, plus various defects in steel processing and steel welding. These defects can cause micro-cracks to continue to develop under the joint action of the surrounding environment and load. As a result, the section or node stiffness is degraded, and even severely, it becomes a steel fracture. In addition, the steel may be classified as a steel structure damage due to the strength degradation of the steel and the plastic deformation of the steel due to various natural disasters. Damage to the steel structure can lead to a serious decline in the rigidity, load carrying capacity and stability of the steel. In some cases, the overall structure of

the bridge may be unbalanced and cause a safety accident, which requires effective monitoring and evaluation of existing bridges. The disease mechanism of steel structure bridges generally has the following points: the corrosion of steel caused by corrosion in the natural environment for many years; the fatigue damage of bridge structure under cyclic load or overload; the natural disaster to the existing steel bridge Structural damage, etc. The service life of bridges is as small as several decades and hundreds of years. The causes of disease are diverse, and there are inevitable links between various factors. The damage of steel structure bridge can be divided into component damage and regional damage of node position, because the structure of the node domain is more complicated and has the existence of general residual stress, which often becomes the gathering area of bridge damage.

3. Necessity of inspection and reinforcement of steel structure bridges

In the natural environment, steel bridges are affected by temperature, atmospheric corrosion, load and frequency in the use environment, fatigue of materials and structures, bridges gradually accumulate over time, and are irreversible. the process of. With the rapid development of the national economy, road traffic, traffic volume has increased significantly, traffic density and vehicle load have increased, more and more heavy vehicles are driving on existing roads and bridges, and quite a few of the hundreds of thousands of ancient bridges The state has been unable to meet the requirements of use, especially the bridges built before the 1980s, which have been running for decades, and many bridges are already overloaded. The existence of these old bridges, restricting the development of transportation, must attract our attention. By the end of 2006, there were more than 533,600 road bridges nationwide, 20.39 million meters, including 1,036 large bridges. Many bridges have safety hazards. For example, there are 10,000 total hazards identified for roads and bridges, accounting for 3.45% of the total, of which 6,282 are classified as Category 5 hazard, ie, "some important components of the technical situation are at risk." Damage, bridge bearing capacity is significantly lower, direct crisis bridge safety." Tianjin is known as the "Jiuhe lower tip" reputation, according to statistics, at the end of 2011, Tianjin National Provincial Highway and county roads totaled more than 2,400 bridges, about 220,000 meters, nearly one-third of the bridges built before the 1990s, maintenance and reconstruction is a major burden and work.

Due to the low design standard of the existing steel structure bridge, the designed bearing capacity can not meet the current driving needs, and the lane width is not enough. In addition, it is in disrepair and lacks regular maintenance and repair. A considerable number of bridges have different degrees. The disease has become a dangerous bridge, especially the damage caused by various heavy-duty vehicles on roads and bridges, which has led to a rapid growth trend in China's dangerous bridges in recent years. Because of vehicle overload, overspeed, ageing, corrosion, construction defects, accidental disasters and other causes, concrete materials are powdered, spalled, cracked and rusted, direct results of crack propagation, as well as bridge structure stiffness reduction deflection and other Defects such as diseases. Bridge safety, applicability and durability, these factors have a great impact, resulting in different degrees of decline or even loss of bridge bearing capacity, seriously endangering the safe operation of the bridge, it is necessary to take measures to limit weight, speed limit, and even close the old crisis bridge. Practice has proved that it is a wise move to accurately monitor and evaluate bridges, select appropriate reinforcement techniques to strengthen and expand bridges, and improve the structural stability and bearing capacity of old bridges to meet current traffic demands. First of all, the reinforcement of bridges can save a lot of economic costs compared to the construction of new bridges. Second, through the reinforcement and maintenance of the old bridges, the safety problems caused by the bridge's own diseases can be solved and the bearing capacity of the bridges is improved. Improve the capacity of roads. Old bridge reinforcement and maintenance work should be said to be a technically feasible and economically reasonable measure. The bridges in foreign countries are also facing the same problem. The repair and reinforcement of the old bridges and the improvement of the load rating of the bridges are effective ways to solve the shortage of bridge bearing capacity, and have received more and more attention around the world. With the continuous development of society, bridge

health monitoring and vibration control technology has become the main way to study the evolution of large bridge structures. The perfect bridge health monitoring system can verify the construction quality of the bridge and monitor the structural damage of the bridge, which provides effective help for bridge safety and durability evaluation. The installation of the health detection and vibration control systems of these bridges is equivalent to the establishment of an “all-weather” doctor for the bridge to comprehensively diagnose the diseases in the construction and use of the bridge.

4. Main methods of bridge repair and reinforcement

When steel bridges are carried for a long time, cracks will occur in some places. Such cracks can be reduced by increasing the pre-stress. The method of increasing the pre-stress can also coordinate the original deformation so that the bending strength is greatly improved. Therefore, this method can be used to repair cracks in some links in the maintenance of steel bridges. For some of the main load-bearing links of steel bridges, this method can be used for reinforcement, which can make the added steel plate share the load of the original structure and increase the strength of the original steel structure. This method is very simple.

This kind of technology is more advanced, but it is more difficult to implement. It mainly makes the bearing load of the bridge more uniform by increasing the lateral connection of the bridge, and avoids the possibility of a part of the bridge being stressed. After a certain period of time, the bridge will be fully tested. If the bridge is found to have some defects through inspection and evaluation, it will not be able to meet the needs of pedestrians and cars for comprehensive maintenance and repair, or according to traffic flow and The freight volume is appropriately widened. As the economic development of various cities in China is very rapid, some old bridges will inevitably be impacted. Therefore, the safety of bridges cannot be ignored. After discovering problems, repair and maintenance should be carried out according to actual conditions. Possible cost and time savings so as not to affect the economic development needs, but also to ensure that the bridge can be stronger and more durable after the recent maintenance and maintenance. In the maintenance, the main structure of the bridge must be guaranteed. The main structure of the bridge cannot be changed at will, so as to avoid violating the original design principle of the bridge. For some environments where the bridge is located, damage should be avoided as much as possible, because the environment will also affect the steel structure bridge. The characteristics, so protect the environment around the bridge.

For how to choose the bridge maintenance plan, we should refer to some advanced technologies at home and abroad, and apply some advanced technologies to the maintenance of the bridge, so as to ensure the firmness of the bridge in a short time. For the construction side, some dust noise should be avoided. The bridge should be restored after the maintenance. This is mainly because some bridges are a symbol of the city.

5. Conclusion

In recent years, with the rapid development of new materials and processes, China's bridge industry technology has also been greatly improved and improved, but also brought a broader space for improvement. Although the detection, evaluation and reinforcement of China's bridge industry have been greatly improved, it is still far from the developed countries. The assessment technology and testing instruments of China's bridge industry are still quite backward. And the practical applicability of the assessment method is not enough. However, the accuracy of detection technology and evaluation method is crucial for the reinforcement and maintenance of bridge engineering. Therefore, we should increase the research on bridge inspection technology and evaluation theory to form a complete evaluation system to provide more for the detection of bridges. Accurate platform to further accelerate the development of the bridge industry. At the same time, it is necessary to strengthen the daily maintenance work of the bridge, and quickly and timely discover the bridge disease to timely deal with it, reduce the occurrence of bridge dangerous accidents, and fundamentally reduce the maintenance cost of the bridge.

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