

The Key Technique Development of Fatigue Researches on Steel Bridges and Its New Achievements in China

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Summary

This paper first describes the historical development of steel bridge in China, and then mainly introduces the technique development of fatigue for research on steel bridges in China. There are two main aspects of fatigue research for steel bridges, one is the research on existing steel bridges to evaluate the remaining life of steel bridges, in order to decide whether to reinforce the old bridge or replace the old bridge with a new one. The other aspect is the researches on newly built steel bridges to determine suitable structural details for bridges, such as anchorage structure unit fatigue experiments, orthotropic steel deck fatigue experiments, bi-axle structural detail fatigue experiments, etc. Furthermore, the future of steel bridge fatigue research in China is proposed.

Keywords: steel bridge, fatigue, details, orthotropic steel deck, life

1. Introduction

There has been over 100 years of use of steel bridges in China, but rapid developments of steel bridge construction have only been in recent 20 years, especially for long span steel bridges. Sutong highway bridge is a cable-stayed bridge over Yangtze River with a main span of 1088m, which is the longest span of the same type of bridge in the world. Nanjing Dashengguan bridge is a steel arch bridge with main span of 336m, which is on the Beijing-Shanghai high speed railway line. There are also some other long span steel bridges being built. Because fatigue failure will result in huge disaster, fatigue is always the important topic of research in the field of steel bridges, especially for the new type of great bridges. With the increase of traffic across steel bridges, and also increase in the load and speed of trains, many fatigue researches are being made not only on existing steel bridges but also on new type of steel bridges. The research results have been used in the construction of new steel bridges. With the successful application of engineering, the fatigue design code has been revised.

2. Research on existed steel bridges

Some of the existing steel bridges have been in service for nearly 100 years. With the economic development of the country, there are big changes in the use of environmental conditions for steel bridges. Load, traffic intensity, and speed have increased rapidly. These were not considered at that time the bridges were designed, therefore, it is a fundamental task to evaluate the current condition of existing bridges. The study of the remaining life of existing steel railway bridges was started in 1980s. At that time, many existing steel railway bridges had been in use over 50 years. There were differences in design codes and materials for different steel railway bridges. The transport capacity and speed of trains has greatly changed, hence it is important to evaluate the remaining life of existing steel railway bridges with the new situation. Some typical steel railway bridges on main railway lines have been investigated. The real train load was continuously observed and recorded over several days, then stress distribution on main steel bridge details were analysed. The fatigue strength of main steel bridge details were obtained by analysis or experiments. By use of Miner's