



Research on Fatigue Vehicle Models of Yangtze River Highway Bridge

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Abstract

In order to propose an equivalent fatigue vehicle suitable for the actual traffic flow, the vehicle load characteristics and fatigue vehicle load models were investigated based on WIM database in a Yangtze River highway bridge. The research results show that the bridge has the characteristics of large traffic volume, high proportion of heavy vehicles and severe overloading. All the vehicles can be divided into 6 types based on the wheelbase, and the fatigue vehicles with an equivalent vehicle weight greater than 10 t accounted for 85.9%, of which 6-axle vehicles dominated the fatigue damage. Compared with the Eurocode's four-axle standard fatigue vehicle, the single axle weight derived from the actual traffic flow in this paper is 1.30 times that of the standard fatigue load model, which can provide guidance for fatigue design and maintenance of the same type bridges in the area.

Keywords: fatigue loading spectrum; traffic flow; fatigue vehicle model; steel bridge deck; standard fatigue vehicle.

1 Introduction

With the rapid development of China's social economy, people's communication and traffic have become more frequent, and the road traffic flow has increased accordingly. However, the continuous growth of traffic volume has brought great challenges to the operation and maintenance of the bridge, especially the increase of heavy trucks and the existence of overloading vehicles, which results in the fatigue problem of the orthotropic steel bridge decks.

Reasonable and accurate vehicle loads are the key to the safety assessment of bridge structures during the operation. Therefore, it is of great significance to clarify the fatigue vehicle load spectrum for the anti-fatigue design and fatigue life evaluation of steel bridge decks. Numerous studies on fatigued vehicles have been carried out in many countries, and relevant results have been brought

into specifications or codes. The fatigue load of the AASHTO is a 3-axle standard fatigue car with a total weight of 325kN [1], and the load form used in the anti-fatigue design is simple. In contrast, the BS5400 and the Eurocode both give more detailed frequency spectrum of the fatigue load vehicle model [2-3]. Ye [4] investigated the distribution of wheelbase, axle weight and gross vehicle weight and proposed a six-axle fatigue-loaded vehicle model based on WIM system. Maljaars[5] suggested to replace the standard fatigue load model III in the Eurocode with a more accurate five-axis fatigue vehicle through the analysis of Dutch measurement data.

Apparently, vehicle load distribution varies in different areas, European and American standard fatigue vehicle does not reflect the current traffic conditions in China. In addition, the sample size of vehicle is not enough to reflect the operating vehicles and early established fatigue vehicle can not reflect the development and variation of