The Impact Effect of Highway Bridge due to Heavy Vehicle

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Summary

The dynamic response depends on the bridge span, stiffness and surface roughness, and vehicle dynamic characteristics. Unlike earthquake loads which can cause vibration in bridge longitudinal, transverse, and vertical directions, moving vehicles mainly excite vertical vibration of the bridge. The highway bridges have been constructed a lot in Vietnam recently. These bridges have been designed with AASHTO LRFD and moving truck load is HL93 loading. However, the vehicles are actually different with HL93 loading. Moving loads caused the impact effects, the changing of frequencies of bridge structure. The heavy vehicles were considered in this study. The impact effect of the highway bridge due to the actual heavy vehicle is investigated and evaluated. Comparison of results from both computations of dynamic analysis and loading test are shown in the paper.

Keywords: highway bridge; heavy vehicle; dynamic analysis; loading test; impact effect.

1. Introduction

Vietnam Specification for Bridge Design (22TCN 272-05) was established on 2005, based on the AASHTO Load and Resistance Factor Design Specifications (AASHTO LRFD, 1998). The design live-load of these Specifications is HL93 loading, but the actually traffics are different with specification for bridge design. The traffic condition in Vietnam is complicated with lots of overloaded vehicles. This is very important with transport infrastructure in developing countries as Vietnam.

The dynamic loads for moving vehicles are considered “impact” in bridge engineering because of the relatively short duration. The magnitude of the dynamic response depends on the bridge span, stiffness and surface roughness, and vehicle dynamic characteristic as moving speed (Duan *et al*., 2000). The design live-load moment caused by a truck (or lane of traffic) is first estimated by obtaining the maximum truck (or lane of traffic) moment on a single girder. A designer then obtains the design moments for each girder by multiplying the maximum single girder moment by a factor, which is usually referred to as the live-load distribution factor. The moment demand for a particular girder depends on the magnitude and location of the imposed loads and on the properties of the bridge. The design moment in the girder will vary with girder spacing, span, flexural stiffness, torsional stiffness, and on the properties of the deck and diaphragms. The dynamic effects under different speeds of the moving loads were studied by previous researchers (Lee, 2005, Li, 1996, Bruni *et al.*, 2003, Sasaki *et al.*, 2010). These research shown that dynamic loads and especially overloads are one of the factors affecting the cracking of reinforced concrete bridges. Heavy trucks represent major loads to highway bridges. Accordingly, highway bridges should be designed and maintained such that they are able to sustain these loads all the time. Along with economic development, truck loads change their patterns over time, including their magnitudes. Bridge engineers have been striving to manage a rational balance between the truck loads and the bridge capacity. Note that there is an amount of uncertainty associated with both the load and the capacity, which is important to be acknowledged and to be covered in making related decisions. Although the interaction between moving vehicles and bridges is rather complex, the dynamic effects of

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