

# Study on Traffic-induced Vibration of a Four-Pylon Continuous Cable-stayed bridge and its Vibration Serviceability

CHEN RONGXIU

Keywords: Traffic-induced vibration, cable-stayed bridge, vibration serviceability

## 【Background】

A four-pylon continuous cable-stayed highway bridge is currently being planned in Japan. It is undoubtedly necessary to on the one hand evaluate dynamic responses of the bridge caused by moving vehicles for guaranteeing its structural integrity, and on the other hand evaluate its vibration serviceability for guaranteeing an acceptable riding comfort of vehicles. To achieve it, an analytical procedure that can realistically simulating vehicle-bridge interaction is in urgent need of development.

## 【Objective】

- To develop an analytical procedure for vehicle-bridge interaction.
- To investigate vehicle-induced vibration of a four-pylon continuous cable-stayed bridge.
- To investigate vibration serviceability of the bridge.

## 【Approach】

The bridge is modelled by finite elements and the three-axle dump truck is modelled as a vehicle model of 8 Dof. The governing equation of motions for vehicle-bridge interaction system is derived by Lagrange equation of motion and then solved by Newmark- $\beta$  method. The dynamic response of the bridge is quantitatively evaluated through the dynamic increment factor (DIF). Vibration acceleration level (VAL) based on the 1/3 octave band spectral analysis is adopted to estimate riding comfort of vehicles.

## 【Publication plan】

- None for the time being.

## 【Results】

An analytical procedure for three-dimensional cable-stayed bridge-vehicle interaction analysis is proposed in this study. The parametric study is carried out to investigate the effect of roadway roughness on dynamic responses and vibration serviceability of the bridge. The result reveals that roadway state has a very little effect on dynamic responses of the bridge, while a bad roadway condition has a tendency to reduce vibration serviceability of the bridge. Regular pavement patching and repair of roadway are therefore highly recommended.

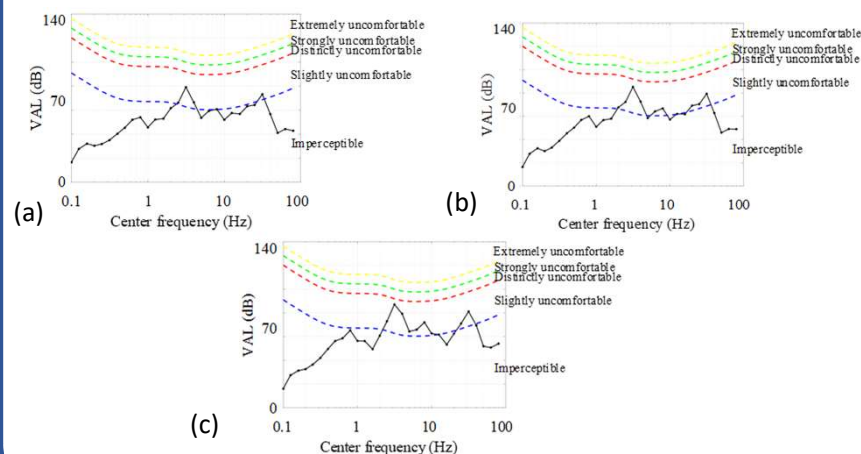


Fig. of VAL: (a) Super good roadway, (b) Good roadway, (c) Bad roadway.