Measures to Control Vortex-induced Vibration for Shangba Branch Channel Bridge in Nanjing

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Abstracts

An all-steel cable-stayed bridge with steel towers, steel box girders and cables for a main span of 500m is rarely seen at home and abroad. Due to the low damping ratio of all-steel structure, wind-induced vibration is likely to occur, especially for a single column steel tower, and twin-box girder with a total width of 54.4m is also more susceptible to vortex-induced vibration. In this paper, the aerodynamic shape of the main girder is optimized by sectional model wind tunnel test, and an aerodynamic configuration as the combination of wind fin plate and wind baffle plate to control the vortex-induced vibration (VIV) has been found. The damping effect of the main girder was also studied. The VIV and buffeting performance of the freestanding steel tower and its combined system with tower crane and construction platform were also studied.

Key words: separated steel box girder; cable tower; tower crane; free-standing state; vortex-induced vibration; wind deflection angle; wind tunnel.

1 Project overview

Pukou-Yizheng Highway Shangba Branch Channel Bridge, an important control project on this highway, is a cable-stayed steel box girder bridge with two towers and two cable planes in full floating structure system, with spans of (50+180+500+180+50) m, as shown in Figure 1. For this bridge, twin-box girders are used, with girder height of 4.0m and width of 54.4m, the steel cable towers are composed of single column of box section, with a total height of 166m and a height of 130.7m above the bridge deck.

Figure 1. Photo of the main bridge of Nanjing Shangba Branch Channel Bridge

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