The West Bay Arch Bridge (New Design), Doha, Qatar

Wind Engineering Study

Owner: Public Works Authority (ASHGHAL), State of Qatar	*Design: Santiago Calatrava Mideast LLC*	*Year Tested: April 2014*
Total Span Length: 693 m	*Deck Width: 36.9 m* *Arch Width and Height: 11.8 m & 114.5 m*	*Deck Section Model: 1 to 75 scale* *Arch Section Model: 1:54 scale*

The Project

The West Bay Arch Bridge consists of a single span arch structure that supports the road deck from a series of cables. The bridge is unique in this overall project in the fact that there is also a pedestrian walkway supported from the centre of the road deck and a cable car transit system running along the length of the arch. The overall deck width of the bridge is 36.9 m, and the total deck span length is 693 m. The width and height of the arch are 11.8 m and 114.5 m respectively.

The section models of the deck and arch of the West Bay Arch Bridge were studied at the Boundary Layer Wind Tunnel Laboratory of the University of Western Ontario.

The Wind Tunnel Studies

The primary objective of the section model study is to investigate the aeroelastic stabilities of the bridge deck and arch sections in high wind conditions and to define the wind speeds associated with possible flutter and / or galloping instability as well as vortex

The Wind Tunnel Studies (Cont.)

shedding induced oscillation. The investigation also defines the dynamic response characteristics of the deck and arch sections to turbulent wind over a full range of wind speed and provides equivalent static loads, which are suitable for the design of the bridge structure against wind effects.

The study was consisted of a 1 to 75 scale section model of the bridge deck section, and a 1 to 54 scale section model of the arch. Static section model tests were performed to obtain the static coefficients for both section models. Dynamic tests were also performed for both models in smooth flow to investigate the overall aerodynamic stability of the deck, and in grid-generated turbulent flow to define the buffeting response characteristics of the section. Aerodynamic derivative tests were performed for the deck section model to study the motion related aerodynamic force parameters. The static force coefficients and the aerodynamic derivatives were then used in wind buffeting analysis and in the development of the equivalent static wind Loads for the bridge structure.

The Boundary Layer Wind Tunnel Laboratory

Western

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