I-4 Pedestrian Bridge (Maitland), Orlando

Wind Engineering Study

Clients: Jacobs Engineering Group Inc.	*Year Tested: 2016*	*Main Span Length: 600 ft*
Arch Height: 140 ft	*Deck Width: 13.7 ft*	*Deck Section Model Scale: 1 to 20* *Arch Section Model Scale: 1 to 20*

The Project

The proposed Maitland Pedestrian Bridge crosses the I-4 at Maitland Blvd. in Orlando Florida. The bridge is situated over ten lanes of the Interstate as well as seven lanes of off/on ramps. The proposed cable-supported arch bridge has a bridge length of 600 ft, with the 13'-8" wide deck curved in plan. There is a single, rectangular, tapered arch rib, which is inclined to the vertical and rising to approximately 100 ft above the bridge deck and 140 ft above ground level. Twenty pairs of cables spaced at 25'-0" support the deck from the arch rib. There are two curved steel girders forming the main deck structure, to which cross-beams and welded frames form the cable anchorages. The lightweight concrete deck is composite with the steel girders.

The section models of the I-4 Pedestrian Bridge deck and arch rib were studied at the Boundary Layer Wind Tunnel Laboratory of the University of Western Ontario.

The Wind Tunnel Studies

Section models of the bridge deck and arch rib were designed and constructed at a geometric scale of 1:20.

The Wind Tunnel Studies (Cont.)

The primary objectives of the section model study were to investigate the aeroelastic stability characteristics of the deck and arch rib in high wind conditions and to define the wind speeds associated with possible flutter (or galloping) instability and / or vortex shedding induced oscillation. An aim of the investigation was also to define the dynamic response characteristics of the bridge deck and arch to turbulent wind over a full range of wind speed. Analytical estimates of the critical wind speeds for flutter (or galloping) and the responses of the bridge to turbulent buffeting, as well as the equivalent static wind loads were carried out using a 3-D multimode analysis, which integrates the findings of the experimental study with the dynamic modes and frequencies of the structure.

Additional objectives were to ensure pedestrian comfort under typical wind conditions when pedestrians would be likely to use the bridge as well as under various types of pedestrian loading. An assessment of the likelihood of cable vibration due to parametric, wind and rain-wind excitation is also an important objective.

The Boundary Layer Wind Tunnel Laboratory

Western

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