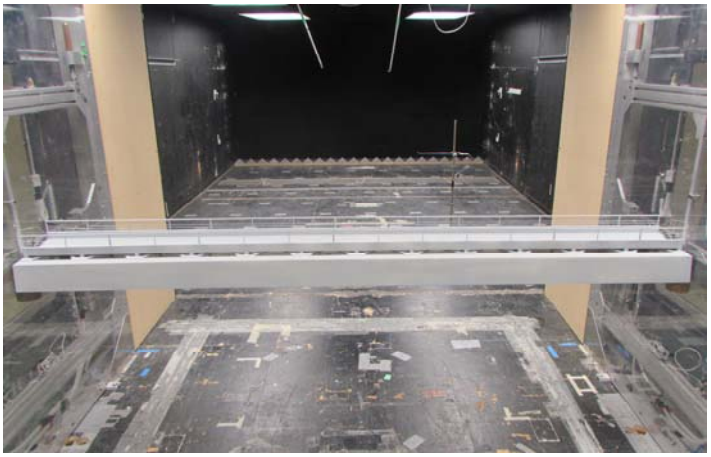
Pensacola Bay Bridge, Florida

Wind Engineering Study



Clients: WSP / Parsons Brinckerhoff Group	*Year Tested: 2017*	*Main Span Length: 375 ft*
Arch Height: 152 ft	*Deck Width: 22 ft*	*Deck Section Model Scale: 1 to 21.5*

The Project

The proposed Shared-Use Path (SUP) Tied Arch Bridge is part of the Pensacola Bay Bridge Replacement across Pensacola Bay, in Northern Florida. The bridge replacement project is approximately three miles in overall length and contains both vehicular as well as separate pedestrian / cycle-path bridges which flank the vehicular bridges. The high-level navigation span includes two tied-arch shared-use path structures which have a span of 375 feet. The vehicular bridge is a three-span continuous plate girder structure in each of the westbound and eastbound directions. These “twin” structures are comprised of a 59’-1” concrete deck and 5 steel plate girders having a 10’-10” web depth. The tied arch structure is separated from the vehicular bridge by 4’7”, with the deck elevation somewhat below that of the vehicular bridge in elevation. The arch rib is a rectangular steel box section 4 feet in width and 2’-9” in depth, with a crown centerline 78’-3” above the tie centerline. The ties are trapezoidal box sections with outer dimensions of 6 ft (depth) by 3’-1” (width). The 11’-4” wide pedestrian deck is supported by transverse floor beams spaced at 12’-4.75” and connected to the tie at the top of the trapezoidal section. Longitudinal bracing in an “X” arrangement is located between successive transverse floor beams.

The section model of the Pensacola Bay Bridge deck was studied at the Boundary Layer Wind Tunnel Laboratory of the University of Western Ontario.

The Wind Tunnel Studies

The primary objectives of the section model study were to investigate the aeroelastic stability characteristics of the bridge deck 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 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.

An assessment of the likelihood of cable vibration due to parametric, wind and rain-wind excitation was also an important objective.

The section model test set-up consists of one deck of the SUP bridge as well as one deck of the vehicular bridge, which allows for testing of the following configurations (i) Isolated SUP, (by removing the vehicular bridge deck), (ii) SUP Upwind (by placing the SUP bridge on the upstream side) and (iii) SUP Downwind (by placing the SUP bridge on the downstream side).

The Boundary Layer Wind Tunnel Laboratory

Western

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