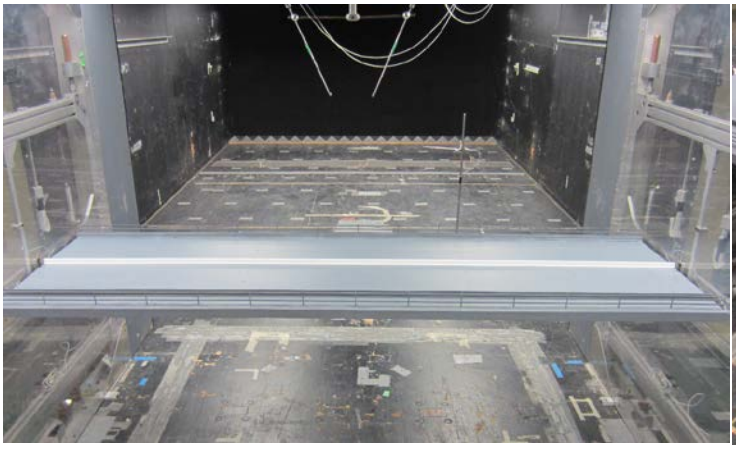
Gordie Howe International Bridge, Detroit, MI / Windsor, ON

Wind Engineering Study



Client: HDR Engineering Inc.	*Year Tested: 2017*	*Total Length of Bridge Span: 1445 m*
Pylon Heights: 233 m	*Deck Width: 38 m*	*Deck Section Model Scale: 1 to 60*

The Project

The preliminary design for the Gordie Howe International Bridge consists of a 1445 m cable stayed bridge which connects Interstates 75 and 94 (in Michigan) to the Rt. Hon. Herb Gray Parkway and Highway 401 (in Ontario). The two towers are referred to as the M-Tower (Michigan side) and the O-Tower (Ontario side). Each back span is supported by three piers: M3, M2, and M1 on the Michigan side, and O1, O2, and O3 on the Ontario side. Each tower extends to a height of approximately 233 m above ground. The bridge deck consists of an orthotropic deck section over the main span, while the back spans are steel boxes with a composite deck. The external geometry of each cross-section is the same. The elevation of the bridge deck at mid-span is approximately 55.4 m, and the maximum width of the deck is 38 m. The center barrier is offset by approximately 1.435 m from the centerline of the deck. The critical construction stage includes the Michigan span of the bridge, comprised of the M Tower and the deck to mid-span, reflecting the maximum cantilever stage. Each of the back spans is supported by 23 cables (at a spacing of 11.4 m), while the main span is supported by 46 cables (at a spacing of 18 m).

The study of the wind action on the preliminary design of the Gordie Howe International Bridge was performed in the Boundary Layer Wind Tunnel Laboratory at the University of Western Ontario.

The Wind Tunnel Studies

A section model of the preliminary design of the bridge deck was designed and constructed at a geometric scale of 1:60.

The wind tunnel tests of the bridge deck section model included static and dynamic section testing, as well as estimation of the Aerodynamic Derivatives. The information from the static and aerodynamic derivative experiments were used to perform a 3-D buffeting analysis of the bridge at various stages of construction. The section model tests were primarily based on the Initial Configuration of the bridge deck (as provided in March 2017), but also investigated the influence of a central median barrier which may be installed in the future.

The aims of the study were:

1. To provide basic aerodynamic information for the bridge deck;
2. the determination of static force coefficients of the deck under both smooth and turbulent flow conditions;
3. the investigation of the aerodynamic stability of the deck from the dynamic section model test in smooth flow;
4. the definition of the dynamic behavior of the deck due to buffeting in turbulent wind;
5. the estimation of the Aerodynamic Derivatives; and,
6. the equivalent static wind loads on the structure.

The Boundary Layer Wind Tunnel Laboratory

Western

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