New Bridge Over the St. Lawrence, Montreal

Wind Engineering Study

Client: West Wind Laboratory and T.Y. Lin International Inc.	*Year Tested: 2015*	*Main Span: 364 m*
Pylon Height: 160 m	*Deck Widths: Northbound 21.62 m; Southbound 17.32; Central Box 10.67m*	*Full Aeroelastic Model Scale: 1:150* *Deck Section Model Scale: 1:50* *Tower Leg Section Model Scale: 1:53*

The Project

The project is approximately 3.4 km long and not only includes a new bridge for the St. Lawrence, but a new île des Soeurs Bridge and reconstruction and widening of the federal portion of Autoroute 15. The new bridge for the St. Lawrence corridor project is one of the largest infrastructure projects in North America, which will replace the existing Champlain Bridge. The design includes three lanes in each direction for road traffic, a separated span for public transit and bicycle and pedestrian paths. The new bridge's signature is a single H-shaped tower that has an overall height of 160 metres above the St. Lawrence River or 120 metres above the roadway, with cable-supported main spans of 124 and 240 metres. The deck is separated into 21.62 metre wide Northbound and 17.32 metre wide Southbound roadway boxes as well as a 10.67 metre wide central box for future rapid transit.

The full bridge aeroelastic model tests, as well as the buffeting and equivalent static wind load analysis were performed in the Boundary Layer Wind Tunnel Laboratory, while the section model investigations of the deck and tower were conducted by the West Wind Laboratory.

The criteria for the wind loading and aerodynamic stability for the Bridge were based on a wind climate study performed by Applied Research Associates.

The Wind Tunnel Studies

A primary objective of the full aeroelastic model study was to investigate the overall aerodynamic stability in high wind conditions of the completed bridge and while under construction. The definition of the wind speeds associated with possible flutter instability and vortex shedding induced oscillation of the structure was a primary objective. The investigation was also intended to determine the response characteristics to three-dimensional turbulent wind in expected site wind conditions over a full range of wind speeds.

The general objectives of the section model study were to determine the performance of the proposed bridge deck and tower in strong winds through section model testing and analysis. Specific objectives were to determine the response of the bridge to vortex-induced motions, to determine the critical flutter wind speeds, and to determine the buffeting responses of the bridge. The stability of the bridge is evaluated primarily from the results from smooth flow tests, which are considered lower bound estimates.

Buffeting responses and equivalent static wind loads of the bridge were developed through a comprehensive 3D analytical simulation based upon the wind tunnel data of static and motion-induced wind forces.

The Boundary Layer Wind Tunnel Laboratory

Western

The Boundary Layer Wind Tunnel Laboratory
The University of Western Ontario
Faculty of Engineering, London, Ontario
Canada, N6A 5B9 Tel: (519) 661-3338 Fax: (519) 661-3339
Internet: www.blwtl.uwo.ca E-mail: info@blwtl.uwo.ca

FSBR/ 68 / April 2020 / LK
Last Printed: April 8, 2020