The Tawatina Bridge, Edmonton

Wind Engineering Study

Client: Ove Arup & Partners Ltd.	*Year Tested: 2016*	*Length of Bridge: 210 m*
Tower Height: 56 m	*Deck Width: 11.67 m*	*Section Model Scale: 1 to 50*

The Project

The proposed Tawatina Bridge consists of a 110 m long main span and 100 m long back span single tower extra-dosed (cable-stayed) rail bridge crossing the North Saskatchewan River Valley in Edmonton along the alignment of the existing Cloverdale Footbridge, which is going to be demolished. The deck cross section includes a 3.4 m deep concrete box girder with a deck width of 11.67 m and a lightweight suspended shared-use cycle pedestrian path. The path is suspended by pairs of pre-stressing rods at 4.2 m spacing across the deck and 5.0 m centre-to-centre spacing along the bridge. The pedestrian deck has a total width of 8.3 m and is located 5.3 m below the deck box girder.

A comprehensive study of the Bridge using the section model approach was performed in the Boundary Layer Wind Tunnel Laboratory for the following configurations:

1. The service stage box girder deck section, including the suspended walkway and final appendages such as side parapets or barriers.
2. The construction stage box girder deck section, excluding the suspended walkway and external appendages such as side parapets or barriers.
3. The suspended walkway (separated from, but in the presence of the box girder deck section).

The Wind Tunnel Studies

This wind study was consisted of a 1 to 50 scale section model. The aims of the study were:

1. to provide basic aerodynamic information for the proposed bridge deck in both construction stage and service stage configurations;
2. the determination of static force coefficients of the deck in smooth and / or turbulent flow conditions, depending upon the relevant configuration under test;
3. the investigation of the aerodynamic stability of the deck in both service and construction stages, based upon the dynamic section model testing in smooth flow conditions;
4. the estimation of the values of aerodynamic damping;

Dynamic tests were performed using the structural properties as provided by ARUP to assess the responses of the bridge in the fundamental modes of vibration in both test configurations. Static tests were performed for three test configurations with the model fixed to a sensitive force balance in order to evaluate the static force coefficients. An estimate of the equivalent aerodynamic damping was made from a measurement of the aerodynamic derivatives of the deck in smooth flow conditions using the System Identification approach.

The Boundary Layer Wind Tunnel Laboratory

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