

ASCE 2008 Structures Congress
April 24-26, 2008, Vancouver BC, Canada

Wind Engineering for the Confederation Bridge – Validation of Wind Tunnel Model Studies Through Full Scale Monitoring

J. Peter C. King¹, Bilal Bakht^{1,2}, F. Michael Bartlett²

¹Boundary Layer Wind Tunnel Laboratory, The University of Western Ontario, London, Canada
jpck@blwtl.uwo.ca

²Dept. of Civil and Environmental Engineering, Faculty of Engineering, The University of Western Ontario, London, Canada

Abstract:

The Confederation Bridge was the subject of extensive wind tunnel studies to define the response characteristics and the wind loads for design. The wind climate at the site was studied to better define the wind speeds for design of the completed structure as well as loads during construction. Both section model and full aeroelastic model techniques were employed. In addition, the questions of snow accumulation on the deck and the overturning of vehicles were examined. The principal results of these studies are presented.

Validation of wind tunnel model tests of long span bridges is an important component of the wind engineering of these structures. Full-scale monitoring permits a corroboration of the predicted wind-induced responses and loads and also a confirmation of the dynamic properties of the structure. Few bridges have been monitored over an extended period of time, permitting the collection of significant wind "events" in comparison with design return periods; therefore extrapolation well beyond the annual extreme is necessary. The Confederation Bridge has an extensive array of instrumentation which has been in service since the construction of the bridge in 1997. The aims of the monitoring program at the outset were focused on the ice and traffic loads on the bridge as well as an assessment of the structural properties post-construction. However, an opportunity to assess the performance of the bridge under extreme winds and hence compare to the design loads was presented during several winter storms of exceptional severity. The paper focuses on the performance of this bridge to strong wind and compares the observed behaviour to the wind tunnel tests of a full aeroelastic model in addition to the development of wind loads used for the design.

Paper to be considered for the special session on the "The Confederation Bridge - The First 10 Years of Service"