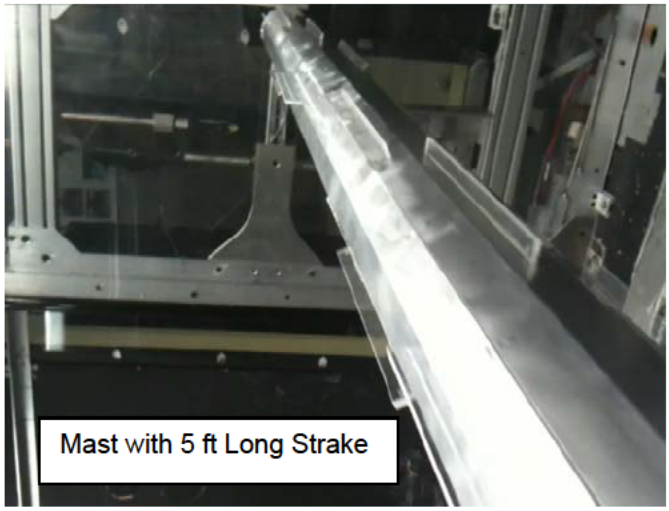
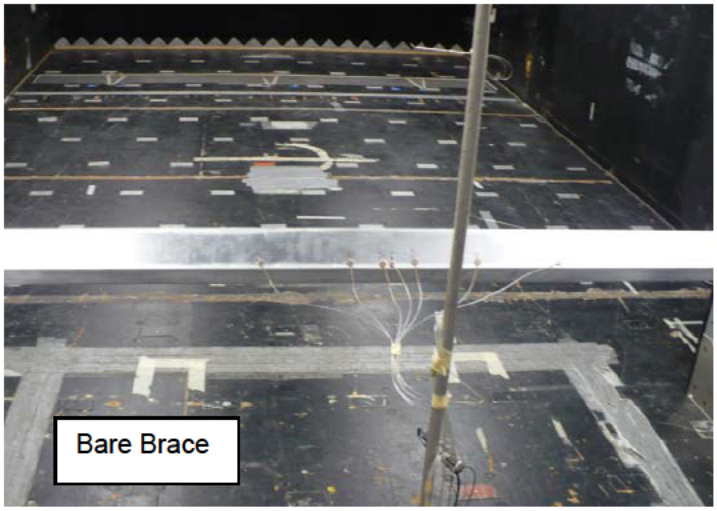
Tubular Transmission Tower - Nevada

Wind Engineering Study





Client: Nevada Energy	*Year Tested: 2012*	*Section Model Scales: 1:8, 1:3.33 and 1:7.13*
Characteristic Dimensions of Sections: Mast, 2.5 ft; Brace, 1.18 ft for Bare Section, 2.0 ft for Section with 10" Fin, and 2.26 ft for Section with 5" Fin (up) & 8" Fin (down); Cross-arm, 2.22 ft		

The Project

The Tubular Guyed V transmission structures consist of 12-sided tubular sections on the main members. Initial response to mitigate vibration problem included measures of installation of diamond-shaped cross brace members at 2/3, ½ and ¼ heights and secondary guying connecting at the 2/3 height to the ground level.

The Laboratory has been working with Power Engineers to study potential problems associated with vortex-induced vibration of the structures in the ON Line 500 kV line. An initial assessment of the wind effect of the dodecagonal (12-sided) cross-section was carried out through an analytical study, which indicated unstable vortex induced motions if the structural damping was less than 0.3%~0.6% of critical depending on the mode of vibration.

Significant vibration was observed on one of the test structures erected at the Harry Allen Substation near Las Vegas. This led to the installation of cross-bracing member at the ¼ and ½ heights of the masts, as well as secondary guys from the 2/3 height to the primary guy anchors, as a mitigation measures. Further full scale monitoring was carried out on the modified configuration. Another episode of wind-induced vibration under significant wind condition resulted in the addition of a third cross bracing member at the 2/3 height of the mast.

The Wind Tunnel Studies

Section models of the mast were designed and constructed at a geometric scale of 1 to 8, while section models of the brace sections were made at 1 to 3.33. The section model for the cross-arm used a length scale of 1:7.13.

The purpose of the investigation is to define the aerodynamic characteristics of the sections. The specific objectives of the study were to determine the following:

1. the aerodynamic damping of the cross sections under smooth flow wind condition,
2. dynamic responses within the range of design wind speeds,
3. static force coefficients,
4. the correlation of pressures in the wake of the cross section,
5. specifically the aerodynamic behaviour of the mast, cross-arm and crossing bracing members in a range of wind speeds up to the design wind speed, and
6. the aerodynamic parameters specific to the cross sections in order to predict the dynamic responses and the potential for aerodynamic instability.

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

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