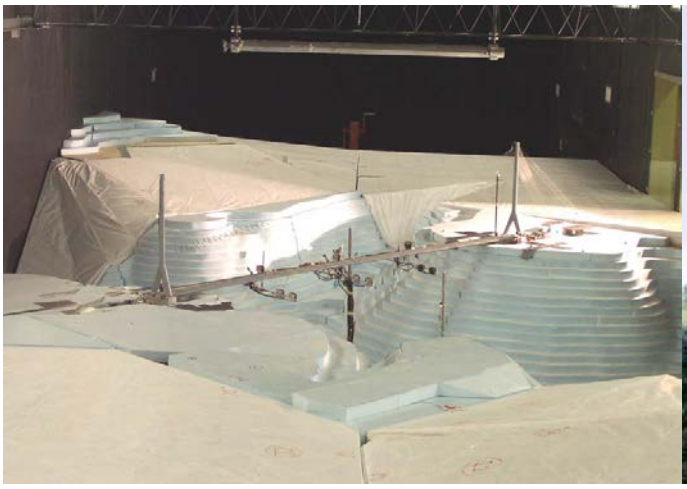
Msikaba Bridge, South Africa

Wind Engineering Study



Client: Haicrow Group Limited	*Year Tested: 2003 and 2017*	*Main Span: 580 m*
Pylon Height: 124.4 m	*Deck Width (3-lane option): 19.62 m for basic deck section and 20.98 m with fairings* *Deck Width (4-lane option): 22.65 m*	*Full Aeroelastic Model Scale: 1:200* *Section Model Scale: 1:50*

The Project

The Msikaba Bridge is part of the N2 Highway through South Africa's Wild Coast Region. The proposed bridge spans the Msikaba River, which lies in a steep-sided gorge around 500m wide and 250m deep. The structure is symmetric in form, with cable stay supporting pylons set back approximately 50m from the cliff face on both sides of the gorge. The bridge deck span is about 580m and is comprised of a composite reinforced concrete slab supported by two longitudinal steel box girders at the outer edges.

Section model and full bridge aeroelastic model tests were performed in 2003 by the Boundary Layer Wind Tunnel Laboratory to study wind action for the original design of the Msikaba Bridge. The tender design has since evolved from the initial study, which is based upon the 4-lane deck arrangement which also includes pedestrian safety barriers and a somewhat different cross-section. The 2017 section model study was performed to confirm the aerodynamic stability and response to turbulence for the 4-lane deck arrangement with a series of tests.

The Wind Tunnel Studies

The primary objectives of the wind study were to investigate the aeroelastic stability characteristics of the bridge in high wind conditions and to define the wind speeds associated with possible flutter instability and / or vortex shedding induced oscillation. An aim of the investigation was also to define the dynamic response characteristics of the bridge deck to turbulent wind over a full range of wind speed. Analytical estimates of the critical wind speeds for flutter and the responses of the bridge to turbulent buffeting, as well as equivalent static wind loads were developed using a 3-D multimode analysis, which integrates the findings of the experimental study with the modal properties of the structure.

In addition, the response characteristics of the aeroelastic model of the free-standing pylon, over a full range of wind speeds and for a range of wind angles were studied; the response characteristics of the full bridge aeroelastic model to smooth flow, as well as three dimensional turbulent wind with site topography over a full range of wind speeds while under construction and after completion were determined.

The Boundary Layer Wind Tunnel Laboratory

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