The Shenzhen Western Crossing, Hong Kong SAR, PRC

Wind Engineering Study

Client The Highways Department of Hong Kong, SAR, PRC	*Engineer* Ove Arup and Partners	*Year Tested* 2004
Length of Superstructure 458.2 metres	*Main Span Length* 210 metres	*Deck Width* 38.6 metres

The Project

The Shenzhen Western Crossing is part of the new fixed crossing between Hong Kong and Shenzhen in the North West of Hong Kong in Deep Bay. The cable stayed bridge includes a continuous steel box-girder deck supported by a single cable plane and inclined central tower. The 210m main span of this cable stayed bridge is flanked by side spans of 99m and 2 at 74.6m. The side span cables are connected to the deck over an 18m distance on either side of an anchor pier. The top level of tower is at 160m above the water level; whereas the deck level at mid main span is at 38.5m.

A tuned-mass damper (TMD) was designed by the engineers for the inclined pylon of the bridge in order to inhibit lateral motion of the inclined pylon, anticipated for winds longitudinal to the bridge axis. This was to be a major focus of the wind tunnel study.

The Wind Tunnel Studies

A full bridge aeroelastic model of the Shenzhen Western Crossing was designed and constructed at a geometric scale of 1 to 125 relative to the prototype. Tests were performed for four bridge configurations, which included: the completed bridge, the completed bridge with traffic, one under-construction stage, and the bridge with the tower TMD. The under-construction stage was comprised of the full-length cantilever of the main span, immediately prior to final deck completion at Pier 3. Three rows of vehicles in the windward lanes were used to simulate stalled traffic convoys on the bridge deck. Three different TMDs for the tower were designed with differing mass ratios. These TMDs were installed at the top of the tower and were tuned to a nominal structural damping of 3.2% of critical.

The behaviour of the full bridge aeroelastic model was tested under three wind profiles; firstly, a very low turbulence condition, secondly, a low turbulence boundary layer profile and finally, a high turbulence boundary layer flow. Measurements of bridge responses were taken at five wind azimuths to the bridge of 0^o, 22.5^o, 45^o, 90^o and 180^o for the completed bridge.

Alan G. Davenport Wind Engineering Group

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