Hudayriyat Island Cycle Track, Abu Dhabi, UAE

Wind Engineering Study

Clients: Calatrava International LLC	*Year Tested: 2024*	*Cable Stayed Bridge Length: 65 m* *Total Cycle Track Length: ~7 km*
Pylon Height: ~39 m	*Deck Width: 9.9 m*	*Deck Section Model Scale: 1 to 20* *Pylon Section Model Scale: 1:8.6* *Pier Section Model Scale: 1:3.2*

The Project

The proposed Cycle Track is in Hudayriyat Island (West), Abu Dhabi, UAE and consists of a series of elevated and at-grade bridges that run in a continuous loop over about a 7km stretch. The elevated bridges consist of a series of viaducts ("continuous" bridge) with typical spans of 20m to 25m, and a cable-stayed bridge with a clear span of about 65m and side spans of 32.5m supported by two sets of split "kite"-shaped pylons in the original design and hexagonal-shaped pylons with longitudinal openings in the updated design. The "Continuous Bridge" is supported by three types of "cross"-shaped pier legs. The viaducts and the bridges all have the same symmetrical deck cross-section and are without any superelevation.

The section models of the Elevated Cycle Track deck, pylon and pier were studied at the Boundary Layer Wind Tunnel Laboratory of the University of Western Ontario.

The Wind Tunnel Studies

A meteorological / site analysis was performed to evaluate the expected wind conditions at the project site. The analysis of hourly wind data is detailed to develop characteristics of wind speed and direction at the bridge site. An evaluation of turbulence characteristics at the site is also presented.

The Wind Tunnel Studies (Cont.)

The primary objectives of the section model study of the Elevated Cycle Track were to investigate the aeroelastic stability characteristics of the bridge deck and pylon in high wind conditions and to define the wind speeds associated with possible flutter (or galloping) instability and / or vortex shedding induced oscillation. An aim of the investigation was also to define the dynamic response characteristics of the bridge deck and pylon to turbulent wind over a full range of wind speed. Static test of the pier section was performed to provide the static coefficients required in the wind load analysis.

Analytical estimates of the critical wind speeds for flutter (or galloping) and the responses of the bridge to turbulent buffeting were carried out using a 3-D multimode analysis, which integrates the findings of the experimental study with the dynamic modes and frequencies of the structure. Another major output of the analytical study is the equivalent static wind loads, which are used to verify and improve the wind load distributions used for design of the structure.

An assessment of the likelihood of cable vibration due to parametric, wind and rain-wind excitation was also an important objective.

The Boundary Layer Wind Tunnel Laboratory

Western

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