The Rio Tajo & Rio Almonte Pipeline Bridges, Spain

Wind Engineering Study

General Test Set-up (Existing Bridge Shown in Front of the Pipeline Bridge)

Close-up View of the Pipeline Bridge Aeroelastic Model

Client: Oritia & Boreas, Spain	*Year Tested: 2012*	*Rio Tajo Main Span: 230 m* *Rio Almonte Main Span: 180 m*
Tower Heights: 33.1 m ~ 40.7 m	*Size of Steel Pipeline: 1.02 m in Diameter*	*Full Bridge Aeroelastic Model Scale: 1:71*

The Project

The proposed Pipeline Suspension Bridges, over the Rio Almonte and Rio Tajo, near Caçeres, Spain carry a water pipeline over the Rio Almonte and Rio Tajo. The bridges have main spans of 180 and 230m respectively. The structures are similar in design, with a single main suspension cable and suspender ropes supporting the 1.016m diameter steel pipeline. The towers, however are of different design, with the Rio Almonte structure having twin 33.11m high, steel “A” shaped towers and the longer span Rio Tajo structure having twin 40.72m high “double A-frames” as the main towers. Both structures include a maintenance accessway fixed to the pipeline.

The study of the wind action on the Pipeline Bridges was a joint effort by the Boundary Layer Wind Tunnel Laboratory and the Oritia & Boreas, with all wind tunnel tests performed in the Boundary Layer Wind Tunnel Laboratory at the University of Western Ontario.

The wind criteria for the pipeline bridges was based on the wind climate study performed by Oritia & Boreas and was based on the applicable Spanish Codes of Practice.

The Wind Tunnel Studies

A primary objective of the full bridge aeroelastic model study was to investigate the overall aerodynamic stability of one of these similarly-designed bridges in high wind conditions and to define the wind speeds associated with possible aerodynamic instability and vortex shedding induced oscillation of the structure. The investigation also was to determine the response characteristics of the bridge to three dimensional turbulent wind in simulated site wind conditions over a full range of wind speeds expected at the bridge site. Since the span of the pipeline bridge over the Rio Tajo is significantly longer than that of the pipeline bridge over the Rio Almonte, the former structure was chosen as the test-bed for the aerodynamic study. The experimental results from this study were then utilised in an analytical model to develop structure-specific wind loads for each of the bridges.

Two conditions of the pipeline massing of the Rio Tajo Pipeline Bridge were examined in the study, including: a) the empty pipe configuration and b) the full pipe configuration when filled with water. A portion of the topography close to the Rio Tajo Pipeline Bridge was included in the approach flow simulation, due to the complex terrain conditions at the bridge site.

The Boundary Layer Wind Tunnel Laboratory

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