

Owner: Direction des Travaux Publics de la Wilaya  
Design Engineer: COWI A/S  
Consultant Engineer: Dar al Handasah  
Foundation Contractor: Trevi SpA  
Location: **Project Description:**



Completed Project



Pier under construction



O-cell assembly



O-cell bi-directional testing setup

The Constantine Viaduct is a new bridge crossing the River Rhumel in Constantine, Algeria. Constantine is situated on a plateau at 640 metres above sea level with the city framed by a deep ravine and having a dramatic appearance due to a number of bridges and viaduct crossing the valley.

The geology of the site is highly influenced by previous seismic activities (medium severity) and erosional features of the river Rhumel. The soil/rock deposits are dominated by Marls of different strength underlain by Marlstone and very competent Limestone.

Initial boreholes, intended to discover the strength of the lower Limestone, led to the discovery of cavities within the Limestone on one side of the valley. Redesign of the piles consisted of founding the pile in the Marlstone and reinforcing and grouting the cavities below the pile toe to allow load transfer into the Limestone. The risk of differential settlement meant a complicated and well defined grouting scheme was required.

**Bi-directional load test arrangement:**

In order to verify the original Limestone rock socket and the concept of the new foundation design, O-cell bi-directional tests were undertaken on both sides of the ravine on 2000 mm diameter working piles. Twin 870 mm O-cells were installed in the pile reinforcement approximately 1 m above the toe of each pile. The first, into the rock socket, was 46 m deep and the second in the Marlstone 27 m long.

**Test Results:**

A maximum gross load of approximately 40 MN in each direction was applied. Strain gauges and mechanical extensometers were used to measure the skin friction distribution.

**Conclusion:**

The results of the testing allowed evaluation of the capacity of the Limestone rock socket and of the additional remedial works to overcome the existence of cavities. The testing program gave the confidence to the designers that the cavity remedial works were sufficient and that future settlements of the new bridge foundations would be within acceptable tolerances.

