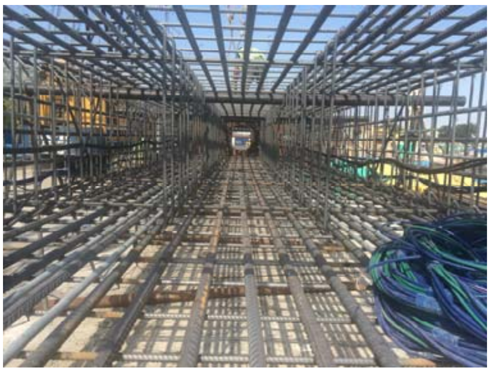
LOADTEST
O-Cell® Test on a Preliminary Test Barrette at Istanbul Strait Road (Eurasia Tunnel) Project, Istanbul / Turkey

Project overview

Typical cross-section of the tunnel



Tremie Pipe access past O-cell elevation

Cage placement with O-Cell assembly

Project:

The Eurasia Tunnel Project is the construction of a 14.6 km road link between Kazlıçeşme and Göztepe regions in Istanbul, Turkey, including a 5.4 km tunnel, that is being undertaken to address Istanbul's increasing traffic problems. The project is expected to reduce the travel time between Kazlıçeşme and Göztepe from 100 minutes to just 15 minutes. The twin-deck tunnel will be built underneath the seabed of the Bosphorus, also known as the Istanbul Strait. Construction of barrette type load carrying deep foundations is required at the top-down section of the Yanikapi underpass.

The project's participants are the General Directorate of Infrastructure Investments representing the Ministry of Transportation, Maritime and Communication as the administrator, Eurasia Tunnel Operation, Construction and Investment Inc. as appointed company, and Yapı Merkezi İnşaat ve Sanayi A.Ş, SK Engineering & Construction Co. Ltd Joint Venture as the Contractor.

Testing Arrangement:

A nominal 2800 x 1000 mm, 29.60 m deep test barrette was constructed with a hydrofraise by Kasktaş A.Ş. - a subcontracting company specialised in construction of deep foundations. A single level, O-cell bi-directional loading arrangement with two 430 mm O-cells with a total rated capacity of 25.0 MN was utilised for the preliminary load test.

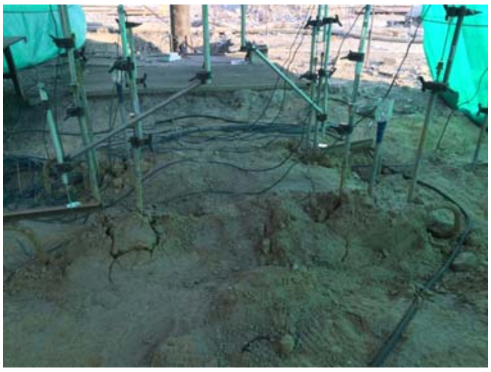
The test was designed by the Contractor to validate the geotechncial parameters and determine the foundation's behaviour under load in the Yenikapı area. The test barrette was instrumented with seven levels of strain gauges to determine the stress distribution and skin friction values throughout the length of the barrette. These sensors were also monitored during the concrete curing for changes in strain and temperature.

www.fugro-loadtest.com

LOADTEST
O-Cell® Test on a Preliminary Test Barrette at Istanbul Strait Road (Eurasia Tunnel) Project, Istanbul / Turkey

O-cell test setup

O-Cell test setup at the top of the excavation



Visible soil disturbance at ground level at the end of the O-cell test.

The sub-surface stratigraphy at the general location of the test barrette consisted of loose-medium dense alluvial sands at the surface, underlain by hard clay.

The top of concrete was deliberately left at over 7 m below ground level and back filled with sand. Compression gauges in this zone confirmed negligible contribution from the sand to the total frictional resistance. Top of barrette movement was measured with respect to a reference frame and connected directly mechanically with the top of concrete.

The test mobilised a load of more than the designed 20.0 MN allowing the full geotechnical behaviour of the barrette to be interpreted together with an assessment of the distribution of friction.

Conclusions:

O-cell technology proved a perfect solution for static load testing of the barrette without the need for anchor reaction piles so only the hydrofraise excavation machinery was required to be mobilised. No reaction beam was required and the applied load is spread across the whole barrette section safely within the shaft and contained at depth.

The concrete level can be left at design cut-off level negating the need to remove the upper skin friction from the calculations or to provide low friction sleeving arrangements, something very hard to achieve on a barrette installation.

Monitoring of strain gauges during curing allowed an assessment of whether any residual stresses had built up within the barrette during curing which might have needed to be considered in the interpretation.

Excellent skin friction assessment could be made along the whole length of the barrette shaft by use of sister bar vibrating wire strain gauges and a very good correlation to the design values initially estimated. Interpretation of the load-settlement behaviour also reveal the underlying base behaviour.

www.fugro-loadtest.com

LOADTEST
O-Cell® Technology in Turkey

Project:	**Golden Horn Metro Crossing – Halic Bridge**
Location:	Golden Horn Istanbul, Turkey.
Client:	Istanbul Metropolitan Municipality Presidency of Transportation
Contractor:	Astaldi-Gulermak Joint Venture
Consultant:	GEOgrup Construction Industry and Trading Co.

Golden Horn Istanbul, Turkey (2010)

Haliç Metro Geçiş Köprüsü Temsili Resmi

Haliç Metro Geçiş Köprüsünün Unkapanı'ndan Görünümü

Haliç Metro Geçiş Köprüsünün Unkapanı Tarafı Açılır-Kapanır Bölümü Animasyonu

Golden Horn Metro Crossing (2010)

Location:

The Golden Horn is an historic inlet of the Bosphorus Sea, dividing the modern day city of Istanbul and forming a natural harbour that has sheltered Greek, Roman, Byzantine, Ottoman and other ships for thousands of years. It is a scimitar-shaped estuary at the point where the Bosphorus strait enters the Sea of Marmara, thus forming a peninsula, the tip of which is the location of the site of ancient Byzantion and Constantinople.

Project:

Istanbul is a busy thriving and expanding metropolis. In order to expand, the city requires new infrastructure. The project includes the construction of a 387 metre long steel cable-stayed bridge and a 120 metre long swing bridge, which will open to allow access for shipping as one part of the expansion plan for a new metro line from Taksim to Yenikapı. The whole project is estimated to cost in excess of €200M

Fugro LOADTEST are delighted to have been part of a modern solution to load testing in such a beautiful and historic location.

Project Summary:

The load testing program specified by consultants required three piles to be tested by the Osterberg Bi-directional Load Testing using the ASTM 1143 specification.

The first pile test performed was on a 1 metre diameter, 39.50 metre long, preliminary test pile located two metres off-shore to provide an estimation of the strength of the rock which is primarily weathered sandstone and siltstone at this location. The preliminary pile was planned as a 31 MN maximum load test using four 330 mm O-cells placed 5 metres above the toe of the pile. This load was reached with a little over 30mm expansion of the O-cells. Loading was continued until a bi-directional load of 18.4 MN was achieved giving a top down equivalent load of 36.4 MN. Cemset modeling predicted an ultimate of 25 MN skin friction and an ultimate end bearing of 27.5 MN, giving an estimated total capacity of 52.5 MN and providing valuable information of the parameters of the rock and confidence in the pile design. Strain gauges placed below the O-cell level indicated a net mobilized skin friction in the rock socket of over 1100 kPa.

Making ready for installation

Installation

Test pile head & instrumentation

The working pile tests were performed on permanently sleeved 2200 mm working pile of 85.5 metres in length located 90 metres off-shore. The piles was permanently cased with a 2500 mm sleeve and the main reinforcement needed to deal with the requirements of seismic activity common place in Istanbul. The piles were tested to gross loads of 47 MN and 65 MN with very little movements being caused under the maximum test load. The off-shore location proved to be no problem for the load testing operation, the O-cell instrumented cages were constructed on-shore and moved to the pile test location by barges. However, the logistics of providing tug boats and off-shore drilling in such a congested and busy waterway proved a little more challenging for the contractor, Astaldi-Gulermak joint venture. The pile was grouted after testing to allow for inclusion in the working structure.

This project could not have been undertaken by traditional top-down methods and proved again that the Osterberg method is the ideal method of load testing of rock sockets, both on-shore and off-shore.

www.fugro-loadtest.com