Project Experience

Bi-directional O-Cell® testing of Barrette Foundations

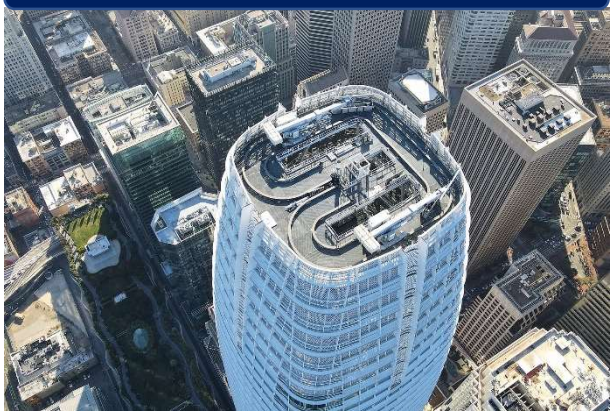
Fugro LOADTEST have been performing O-Cell® tests for Barrette foundations for more than 30 years and participated directly in some of most challenging projects globally. From the tallest tower in Africa to a tunnel that connects the European and Asian parts of Istanbul, Fugro Loadtest has always been there to deliver the most professional and accurate geotechnical data.

Barrettes are often used as an efficient load carrying foundation element capable of sustaining very high loads. Full scale testing of barrettes by traditional top loading has often been impossible and optimisation of the barrette solution could not be demonstrated until the introduction of O-Cell bi-directional load testing.

Large loads and deep foundations are not a problem with the O-Cell methodology which also allows to the load to be evenly distributed throughout the cross section of the barrette. Loads applied using the O-Cell method often exceed 50 MN and can be applied directly to the stratum of interest, even on shafts deeper than 100 meters.

The following examples are just a small selection of some projects that have successfully used our O-Cell technology to test the foundation barrettes.

Salesforce Tower – USA



The 61 story skyscraper is part of the San Francisco skyline. The 326 meter tower required foundations as deep as 100 meters and due to the significance of the project and the uncertainty regarding the soil characteristics the O-Cell methodology was requested on 2 test barrettes.
In the early test design phase, two 3200 x 1500 mmm barrettes were tested to obtain the necessary geotechnical information. One of the barrettes was socketed 3 meters and the other 15 meters in rock and by using the O-Cell methodology the client was able to directly load the barrettes at the specific rock socket depths.
The load test results and analyses allowed the client to redesign the foundations for maximum economy, safety and functionality.

Mohammed VI Tower - Morocco

The 250 metre-high Mohammed VI Tower, in Rabat, is designed to be visible from a distance of 50 kilometres and is scheduled to be the tallest tower in Africa.
Fugro Loadtest executed 2 tests using the O-Cell methodology on Morocco's longest barrettes. The 2700 x 1200 mm and more than 60 m deep barrettes were equipped with O-Cell assemblies capable of exceeding 40 MN.
The O-Cell tests were able to safely mobilise both the end bearing and the skin friction, revealing the full geotechnical behaviour of the barrettes. These results were critical for the tower foundation designers who relied upon these results to design a safe and cost-effective foundation solution for the impressive and prestigious Mohammed VI project with confidence.

VietinBank Tower - Vietnam

VietinBank Business Centre Office Tower is a supertall skyscraper in Hanoi and aims to be the second tallest building in Vietnam. The design of the building incorporates environmental and green concepts intended to deal with the tropical humidity that Vietnam can experience.
Fugro Loadtest was engaged to conduct two O-cell bi-directional tests, one of them in a 2800 x 1000 mm barrette constructed by a trench rope grab up to a depth 45 metres.
TO achieve the desired test loads a combination of 610 mm O-cells to was installed together with instrumentation to measure the distribution of loads along the element during testing.
Testing was successfully completed with a load of approximately 32 MN applied to each barrette.

The Tower at Dubai Creek Harbour

A new venture from Emaar Properties, Dubai Creek Harbour is scheduled to be both financially viable and ecologically responsible.
For this, Fugro Loadtest carried out three multilevel bi-directional O-Cell tests in the centre core of the foundations in parallel with the geotechnical investigations. Nominal dimensions for the section of the barrettes were 2800 mm x 1200 mm and of 50 m, 80 m and 90 m depth.
In addition, three fully instrumented conventional tension and lateral tests were proposed to simulate the pile behaviour from the pull out effect of the tension cables. By using the bi-directional O-cell technique, Fugro Loadtest mobilised a total reaction of 320 MN, 360 MN and 363 MN using two levels of 3 x 870 mm O-cells in each of the tests, breaking the previous World Record for the highest test load in a single foundation element.

Bassin d'orage d'Austerlitz - France

This water storage basin, of 50 metres in diameter and more than 30 metres deep, will store over 50,000 cubic metres of water. This project is an important investment of the Parisian city to control and manage the wastewater that currently is discharged into the Seine.
To obtain the necessary geotechnical information to confirm and improve the foundations of this project, Fugro Loadtest were requested to test a 2800 x 1000 mm barrette. An instrumented 74 metre deep barrette was installed with an O-cell assembly capable of delivering a total of 35 MN.
During testing the barrette was successfully mobilized and several geotechnical parameters were acquired allowing the use of the software CEMSOLVE to estimate the skin friction and end bearing behaviour.

The Okhta Centre - Russia

The Okhta Centre was the planned new contemporary design for the headquarters of Russia's state-controlled gas company Gazprom.
Originally intended for the centre of St Peterburg, but was not given approval so the location was moved to a location 21 km NW to become the Lakhta Tower.
Piles and barrettes were initially tested in the Vendian clay.
Five test barrettes 85 m deep were subsequently constructed at three separate positions to give more detailed geotechnical information. Two independent test barrettes were constructed, with a further three with multi-level O-cell arrangements for the group tests.
The density of barrettes envisaged for the overall foundation solution prompted evaluation of a group of three adjacent barrettes to be tested simultaneously.

Eurasia Tunnel – Turkey

The Eurasia tunnel project consists of a 14.6 km road link between Kazlõçeşme and Göztepe regions in Istanbul and includes a 5.4 km twin-deck-tunnel. To validate the geotechnical parameters and determine the foundation behaviour under load of one section of the tunnel, a 2800 x 1000 mm barrette (29.60 m deep) was tested using the O-Cell methodology. During the test loads mobilised were higher than the designed expectation of 20 MN.
The instrumentation installed was able to acquire valuable information regarding the stress distribution and skin friction values throughout the length of the element. This same instrumentation as also used during the concrete curing phase to monitor the strain and temperatures changes. In all the test phases the O-Cell methodology proved its value to the client.

Centre de Maintenance Secondaire - Switzerland

Transport Public Genevois (TPG) is undertaking the construction of the Centre de Maintenance Secondaire Tram and Bus Depot in Geneva. The project involves the construction of a three-story building with a total gross floor area of 80,000 m^2.
For this project, Fugro Loadtest executed a bi-directional O-Cell test on a twin section barrette with nominal dimensions of 4000 x 800 mm and 1500 x 800 mm. The oversized upper section was deliberately designed and constructed to provide additional skin friction without the need for any additional reaction at the barrette head.
The test barrette was successfully loaded up to 41 MN, illustrating the technical and economical merits of the O-Cell methodology and providing detailed geotechnical information.

Nahkeel Harbour Tower - UAE

The Nahkeel Harbour Tower had been planned to be over 1000 m tall. Sitting in the World's only inner city harbour at the heart of The Nakheel Harbour, a development precinct of 2.7 square kilometres, the 200 floor tower would be the largest of 40 towers planned for the development.
The project, located at the intersection of Sheikh Zayed Road and the Arabian Canal, with Waterfront to the west and Deira to the east. Had its own metro station.
The tests were constructed in a multi-level O-Cell configuration, using two levels of 2 x 870 mm O-Cells in each of the 2800 mm x 1200 mm barrettes installed to depths of approximately 65 m and one barrette at 95 m with cut-off levels 19 m below ground. The arrangement provided the ability to achieve a gross loading capacity of 220 MN.

R1 Ring Road - Belgium

As part of a large infrastructure project to close the R1 ring road around the city of Antwerp, four test barrettes, with depths ranging between 40 and 45 metres, were tested. Due to the site's space restrictions and the desired test loads, the four 2800 x 800 mm barrettes were tested with the O-Cell® bi-directional methodology to calibrate the design parameters.
All the barrettes were installed with O-cell assemblies able to mobilise more than 24 MN. The barrettes were heavily instrumented with several different fibre-optic sensors to acquire more geotechnical information.
Since all the barrettes were in a small area, it was possible to monitor the influence of loading each barrette on the adjacent panels.