Case study

Bi-directional O-Cell® testing for safely mobilising high test loads in piles in Gibraltar

Source:
www.hassancentenaryterraces.gi

Project
Hassan Centenary Terraces

Client:
Casais

Piling Company:
Terratest

Location
Eurocity, Gibraltar

Period
2020

Services
O-Cell® load tests

Another successful project in Gibraltar

Fugro LOADTEST have performed 3 O-Cell® tests for the new Hassan Centenary Terraces project in Gibraltar. Another successful foundation design optimisation in Gibraltar.

Challenge

When completed, the new Hassan Centenary Terraces, beside the Eastern beach in Gibraltar will have 665 luxury properties divided into 6 blocks.

As with much of the area surrounding the rock of Gibraltar, it is mainly reclaimed land with backfill overlying a competent strata. In order to verify and improve the design of each block's foundations, three test piles required.

The piles were founded in the bearing strata of strong Shale and weathered Chert. The Osterberg Cell® method of loading was chosen as the ideal static loading test, using the pile itself to provide the reaction for the test. One of the unique features of bidirectional testing is that the load can be applied directly to the zone of highest resistance, allowing the rock socket to be assessed directly.

Three bored piles were installed for the test piles, one 1800 mm diameter with one 690 mm O-cell® and two 1000 mm diameter each with a single level assembly comprising two 330 mm O-Cell® devices.

O-Cell® assembly

Solution

The bi-directional load tests revealed both the skin friction above the O-Cell® assembly, and the downward skin friction and end bearing characteristics under loading. The O-Cell® tests were also used as the method to obtain more geotechncial information and as proof of the pilling methodology already underway. All three pile test results proved to be excellent, exceeding the intital geotechnical design.

The perfect elevation of the O-Cell® assembly in the pile allowed a balanced test regarding the downward and upward behaviour of the piles. This information allowed a Cemsolve® analysis to be undertaken to determine skin friction and ultimate end bearing capacity and stiffness for all the piles.

Conclusion

O-Cell® tests were able to safely mobilise the underlying rock base, revealing the geotechnical behaviour. By installing Geokon sister bar strain gauges, the mobilised unit skin friction within the rock was able to be determined, which would not be possible with conventional top down techniques due to the requirement to load the overburden above. These parameters were critical for the project foundation designers, allowing design confirmation and providing vital feed-back for further analysis.

The use of the O-Cell® methodology solved the space challenges characteristic of projects in Gibraltar, without the need to provide multiple rock anchors for a traditional reaction system or large and potentially unsafe kentledge in the small working area. During the test phase the client proceeded with the drilling activities, at a safe distance from the test piles, without compromising production.

Reinforcing cage, O-cell® and instrumentation ready for installation into the pile bore

O-Cell® test in progress. The steel beam is for reference only

Case study

First Bi-directional O-Cell® load testing of piles in Gibraltar

Source:
https://www.eurocity.gi/

Project
Eurocity

Client:
Sacyr

Piling Company:
Terratest

Location
Eurocity, Gibraltar

Period
2019

Services
O-Cell® load tests

The first O-Cell® tests in Gibraltar

Fugro LOADTEST have performed the first two of several tests using the Osterberg Cell® methodology in Gibraltar

Challenge

When completed, the new Eurocity in Gibraltar will provide an architectural eco-friendly mixed use development in the business heart of Gibraltar. Comprising of three lozenge shaped towers with a landscaped podium at street level and 360 residential apartments, 120,000 m^2 of retail and office space set in a green and shady complex.

The foundation piles were to be founded in the bearing strata of Silexite (an igneous rock mainly quartz in composition) rock fragments. The precise nature of this material was unknown prior to construction.

Project architectural design rendering

In order to verify and improve the design of the tower foundations, two test piles were required by client Sacyr Construction (Gibraltar), part of the Sacyr Engineering and Infrastructure group of companies.

Solution

The Osterberg method of loading was chosen as the ideal static loading test, using the pile itself to provide the reaction for the test within the pile shaft. One of the unique features of bidirectional testing is that the load can applied directly to the zone of highest resistance, allowing the rock socket to be assessed directly. Since there was no requirement to bring the concrete to ground level, the top of pile was left at 1.4 m below test level, with the open bore filled with granular material for safety.

Two diameters of bored piles were installed for the test piles, one 850 mm and one 1000 mm, each with a single level assembly comprising of two 330 mm and two 240 mm O-cell® devices, respectively.

Strain gauges were placed at several levels along the shaft of the preliminary test pile in order to assess load distribution mobilized during the test.

Reinforcing cage, O-cell® and instrumentation being installed into the pile bore

Conclusion

The test revealed both the upwards behaviour of the skin friction above the O-cell® assembly, and the downward skin friction and end bearing characteristics under loading. Both pile tests proved to be excellent.

The O-cell® tests were able to safely mobilise the underlying rock fragment base, revealing the geotechnical behaviour. These results were critical for the tower foundation designers, allowing design confirmation and providing vital feed-back for further analysis.

The use of the O-Cell® methodology solved the space challenges characteristic of the project in Gibraltar, without the need to provide multiple rock anchors for a traditional reaction system or large and potentially unsafe kentledge in the small working area. During the test phase the client proceeded with the drilling activities, at a safe distance from the test piles, without compromising production.

O-Cell® test in progress. The steel beam is for reference only