Project Experience

Bi-directional O-Cell® testing of Foundations in Reclaimed Land

Fugro LOADTEST have been performing O-Cell® tests for foundations in reclaimed lands for more than 30 years and has been present for some of the most challenging foundations in reclaimed land. From multimillion investment in the smallest countries of the Mediterranean to mega projects in Scandinavia.

For centuries countries have been claiming land back from rivers, seas and oceans for various purposes, but mainly to increase the living area for their population. When cities and countries don't have more space to grow, "invading" the water is a viable solution.

Due to the variety of materials and methods used to create reclaimed land, the construction of any structure in these conditions requires intense study and understanding of the foundations and geotechnic characteristics. Fugro Loadtest have had the honour to be part of many important projects in reclaimed land areas by offering our clients top-of-the-line foundation testing technology that completely adapts to the client's needs and provides the most accurate and professional geotechnical data.

The following examples are just a small selection of some of the most prestigious projects that have successfully used our full scale static load test O-Cell technology to test the foundation elements in reclaimed land.

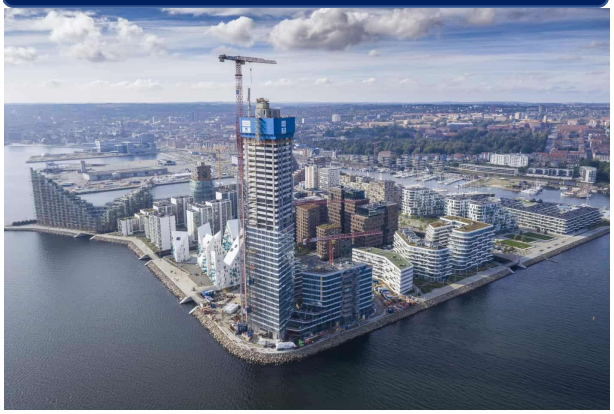
Arabianesirakentaminen - Finland

Due to reclamation of the coastal area using a variety of fill material over unstable glacial deposits, the area of Arabia in Helsinki suffers from continuous settlement. Since the pile design relies solely on end bearing, with significant consolidation, ensuring long term suitability of the pile base capacity was the goal of this static load testing program.
Taking into consideration all the challenges, the use of the O-Cell methodology was clearly the best option as it allowed the test piles to be tested several times without disturbing the progress on site.
Two 530 mm driven piles were installed with 330 mm O-Cell assemblies, to load the soil directly at the base of the element. After to the initial loading test the piles were retested 6 months later from a different ground elevation to determine any changes in performance over time.

Anse du Portier - Monaco

Monaco has one of the highest population densities in the world and to satisfy the needs for increasing housing demand, a new project reclaiming more land from the Mediterranean has been initiated.
Anse du Portier will be the next Monaco neighbourhood with 6 hectares and house 3400 luxury apartments, underground car park and retail shops.
Due to the uncertainty regarding the rock strata and other geotechnical parameters, Fugro Loadtest were commissioned to test several piles with O-Cell methodology. Three 1400 mm diameter piles of lengths 24, 50 and 56 metres and were load tested to over 50 MN.
The test results obtained for all the piles allowed the use of Cemsolve® software to determine the total ultimate pile skin friction capacity, the ultimate end bearing and stiffness.

Light-house Tower - Denmark



The city of Aarhus, Denmark, is characterized by its reclaimed land in the Bay of Aarhus. Within this reclaimed area, Denmark's tallest residential tower with an anticipated height of 143 m is being built.
Due to the limited information on load bearing capacity of the foundation strata and the desire to observe the consolidation of the land fill and its effect on the long-term behaviour of the foundations, Fugro Loadtest was contacted to test two preliminary piles using the O-Cell methodology. The piles installed were of 1.86 m and 2.0 m diameter, each 70 m long and installed with O-Cell assemblies capable of providing a loading test capacity of 70 MN.
Both piles were successfully tested, offering valuable geotechnical information, with of the test piles remotely monitored over a 30 day period under constant load with minimal personnel attendance.

Hassan Centenary Terraces - Gibraltar

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 stratum. In order to verify and improve the design of each block's foundations, three test piles were required. Due to the adaptability of the O-Cell methodology the load was applied directly to the zone of highest resistance, allowing the rock socket of each pile to be assessed directly.
The use of O-Cell methodology solved the space challenges characteristic of projects in Gibraltar, without the need to provide large reaction structures. The test data provided critical parameters for the project foundation designers.

The Palm - United Arab Emirates

The original plans for the tallest skyscraper at the time on the archipelago was for a 1 km high tower, Pinnacle Tower, in the centre of the 5 km diameter Palm Jumeirah, Dubai, United Arab Emirates.
The foundation design was based on the use of barrettes as they are more efficient in transferring the load to the more competent lower strata. Full scale testing of the barrettes was planned using O-Cells.
The outer breakwater was envisaged to be a continuous barrier, but by preventing natural tidal movement, the seawater within the Palm would become stagnant. The breakwater was modified to create gaps either side and bridges were required. A test pile for the East Crescent Bridge was loaded over water using O-Cell methodology to demonstrate and verify the geotechnical design.

Barcelona Port - Spain

The port of Barcelona is the third largest container port in Spain and the ninth in Europe and continues to expand and modernize.
Fugro Loadtest has provided foundation testing services for several of the port's expansion projects, all on reclaimed land from the sea. Numerous full scale loading tests have been performed using O-Cell methodology in both preliminary and working piles.
The tested piles were typically installed through the backfilled areas and founded in the silty sandy stratum beneath at depths of between 30 and 50 metres.
In some tests the applied test load surpassed 10 MN without the necessity of external reaction frames and with a small test footprint.

Vigo Spain

The port of Vigo is a valuable infrastructure to the region of Galicia in Spain and accommodates commercial, touristic and fishing activities. It's considered one of the biggest fishing ports in the World, unloading more than 750,00 tonnes of fish per year.
To accommodate all these operations and to offer the best conditions, the Port of Vigo has been expanding and improving over the years. For the latest expansion project, a 32 metre deep working pile was installed and tested using the O-Cell methodology. The test pile was loaded up to 6.6 MN and allowed for confirmation of the client's design.
Following conclusion of the test, the gap around the O-Cell assembly and its interior were grouted to reinstate the structural continuity and the test pile was integrated into the foundation group.

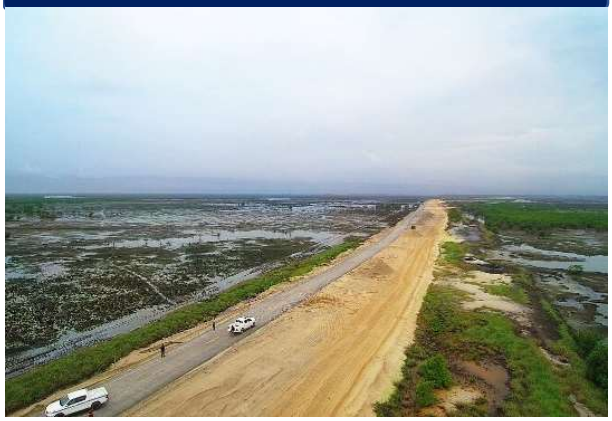
Brighton Marina - UK

Brighton Marina is the largest artificial marina in the UK. It features a working harbour and residential housing alongside a variety of leisure, retail and commercial activities. The initial construction of the marina itself took place between 1971 and 1979, although developments within it have continued since. The marina covers an area of approximately 127 acres.
As part of a more recent development, the addition of several tall apartment blocks, various new retail provisions including shops, a new central square and an ECO park were planned. These 28 storey and 16 storey buildings would require their foundations to be founded in chalk and a testing programme of a CFA pile in chalk was commissioned using an O-Cell bi-directional test which more than demonstrated the competency of the foundations for the design loads required.

Marina Botafoc in Eivissa Port – Spain

On the north shore of Ibiza harbour, lies Marina Botafoc. It is one of the most important ports and marinas in the Mediterranean with 428 berths and moorings for cruise liners.
One working pile installed over water, was tested using the O-Cell methodology to characterize the end bearing behaviour of the foundations and to optimise the foundation design for a new jetty.
The 1650 mm diameter test pile was 41.3 metres deep, installed in 10 metres of water. The test was safely executed applying 32 MN, without the need for constructing a reaction system at the pile head. The results from the testing allowed the working piles have a shorter penetration into the rock.
After the conclusion of the loading test, the void created around the O-Cell assembly and the inside of the O-Cells were grouted to allow the pile to be used as part of the foundations for the marina.

Bodo Bonny Road - Nigeria



The new Bodo to Bonny Road in Nigeria is 37.9 km long with 13 bridges across forests, swamps and creeks and will allow safer and faster travel for both locals and shipments to the oil terminals at Bonny Island.
Parts of this road pass through some very challenging terrain including swamps through the Rivers State area of Nigeria.
Fugro Loadtest are proud to have been involved with this project, performing many tests on bridge foundations along the route. The Afa Creek Bridge was the first to be completed and, like several of the following bridges, was constructed on sand fill due to the poor nature of the local ground which required over 3,100,000 m^3 of sand dredging.
Testing of the bridge foundation piles took place using O-Cell methodology in conjunction with local contractor Julius Berger, over several years during the course of the project.