LOADTEST
O-Cell® Technology in Copenhagen, Denmark

Project:	**Bryghaus Projekt**
Location:	Christians Brygge, Copenhagen, Denmark
Foundation design :	COWI A/S
Foundation Contractor:	Zublin A/S

Architects rendering of Bryghaus Projekt

Construction of cages underway showing final 4 x 405mm O-cell configuration

Cage Installation in progress

O-cell Test in progress

Project Summary

Bryghusprojektet is composed of a multi-functional building with a number of external activities, primarily initiated by the Danish Architecture Centre (DAC); with a café and restaurant, housing and offices for rent. In addition, there will be a large underground car park. The idea is to gather many activities around the development in one building; a building of outstanding architectural quality. At the same time, the building and its open areas, will help bring more life to the area around Bryghusgrunden, enhancing the link between the inner city and Copenhagen harbour.

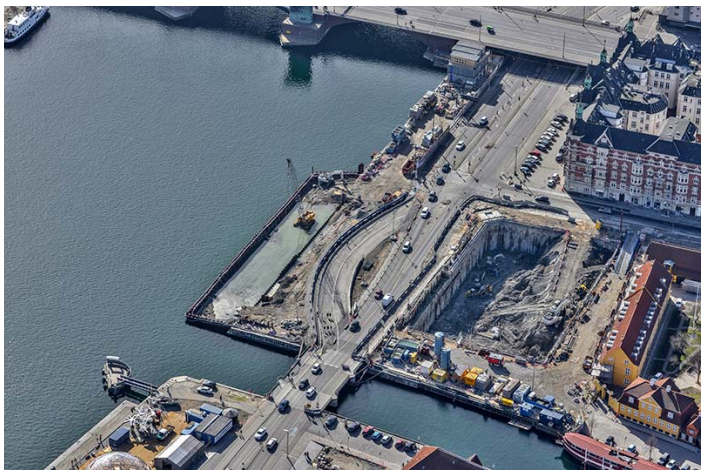
As part of this project, located on Christians Brygge and beside the Frederiksholms Kanal, was a requirement to evaluate the pile capacity in the Limestone rock socket and an Osterberg Cell (O-cell) bi-directional load test was recommended.

Load testing program

A single-level O-cell test was scheduled for a 1200 mm pile installed by Zublin. An initial configuration of five x 405 O-cells was planned to provide a loading capacity larger than the required 40MN and the pile constructed to a total depth of 24.6 metres. Sister bar vibrating wire strain gauges were placed at 5 levels along the pile shaft allowing a profile of net unit skin friction to be determined as mobilised along the pile shaft. Concreting of the piles was carried out to cut off level and base grouting was carried out; pile movements and stresses were monitored by Fugro Loadtest.

Summary

By placing the O-cell at a strategic elevation in the rock socket, Loadtest was able to isolate end bearing and total skin friction loads, mobilising a total reaction of over 54 MN. This test provided evidence of the foundation design, technical merits and economic benefits of O-cell technology.



Ariel view of construction site

LOADTEST O-Cell®, Technology in Copenhagen, Denmark

Project:	**Bridge over Inderhavnen**
Location:	Copenhagen, Denmark
Consultant:	COWI
Main Contractor:	Pihl & Son

Artistic impression of inner harbour bridge

Construction of the test pile underway

Installation of pile casing with O-cell assembly

O-Cell with rock socket seating arrangement

Project Summary

A new Inner harbour bridge to enhance the links around the various sectors of the Copenhagen port. It will be an opening type for cyclists and pedestrians connecting the inner harbour to Christianshavn.

The project forms part of a number of new bridges being developed which will make it easier for pedestrians and cyclists to enter the centre of Copenhagen. As part of this project, Copenhagen became the site for the first Osterberg Cell (O-cell) test to be performed in Denmark.

The bridge will be founded on bored piles with seven sub-structures below water. The outermost spans will be constructed as two parallel box girders of concrete. The bridge is a good example of how design and functionality can go hand in hand. The visual expression of the bridge will be light and transparent.

Minimizing disruption and impact on the environment was of the utmost importance for the whole project. Loadtest provided an alternative solution in the form of bi-directional testing using O-cell technology, which required no kentledge or anchor piles for traditional load testing.

Load testing program

A single O-cell test was performed on a 1000 mm pile steel pile installed by Pihl & son and concreted into a bored rock socket. The pile was constructed to a depth of 17.5m of which 10.5m was below the sea bed, with the top of the steel pile approximately 3.0m below water. The test pile was completely submerged and tested this way. The sub surface stratigraphy at the pile location consisted of sand, sandy silt, sandy clay, clay, upper limestone and lower limestone. Sister bar vibrating wire strain gauges were placed at levels along the pile shaft allowing a profile of net unit skin friction mobilised to be determined.

Summary

The maximum mobilised load was over 12.8 MN. This test provided evidence of the technical merits, economic benefits of O-cell technology and the advantage the method can have by minimizing disruption to the environment and the programme.