

LOADTEST

O-cell Technology in PHC Driven Piles, Korea



Project **Lotte Castle Apartments**

Location **Busan, Korea**

Client **Dong-A Geological Engineering Co. Ltd.**

Consultant **Lotte Engineering & Construction Co. Ltd.**

Project Description

Fugro Loadtest was engaged to carry out an O-cell test on a 600 mm diameter Pre-stressed Spun High Strength Concrete (PHC) driven pile. O-cell testing had been used with several pile construction methods such as bored piles, continuous flight auger piles, driven cast-in-situ piles, barrettes and square precast concrete driven piles, however, for PHC driven piles, this was a new application for the O-cell bi-directional load test method. The method adopted was clever but relatively simple. The PHC pile was initially driven to the required depth or set with a specially designed driving shoe attachment at the tip of the pile.



Pile Testing in Progress



Test Instruments at Pile Head



The O-cell assembly and related instrumentation (and strain gauges in this case) already fixed to a steel reinforcement cage was inserted into the hollow centre of the PHC pile and concreted into place to create a single composite pile. Load testing of the pile was carried out 28 days later by pressurizing the single 330 mm O-cell to a maximum gross bi-directional load of 6.6 MN.

As the O-cell test was conducted on a production pile, after completion of testing, the O-cell and annulus surrounding the O-cell were grouted by the foundation contractor to restore structural integrity to the pile and the pile element was incorporated into the works.



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Project **Myung-Ji Queendom Apartments**

Location **Busan, Korea**

Client **Young Joe Engineering & Construction Co. Ltd.**

Consultant **Dong-A University**

Project Description

Fresh from the successful testing just one month earlier of the first PHC driven pile using O-cell bi-directional method and keen to further develop the technique, the foundation contractor for a new apartment complex development in Busan, Korea was offered the O-cell test method for testing of working piles on the project.

In early January 2007, Fugro Loadtest mobilized experienced test engineers to supervise the assembly works for three test piles. The tests were to be performed on 600 mm diameter PHC driven piles driven to depths of 30 m to 34 m. The maximum test load for each working pile was 3.6 MN (1.5 x working load) and a 330 mm O-cell with a rated capacity of mobilizing 7.6 MN was utilized.



Driving the PHC Test Pile



Installing the O-cell



Prior to driving the first section of pile, a special shoe was inserted into the hollow section of the PHC pile and welded in place. The shoe acts like the plug of soil that forms inside the PHC pile during open-ended driving conditions but also allows for a suitable bearing surface for the base of the O-cell. The O-cell, related instrumentation and strain gauges already fixed to a reinforcing cage were inserted into the hollow centre of the PHC pile and concreted in place.

Testing of the piles was conducted six weeks after installation. The tests were carried out as quick tests with each loading increment held for a period of 5 minutes. As the behavior of the soil resistance was unknown, loading was limited to small increments to make sure the load at which the pile skin friction fully mobilized was accurately determined. For the first two tests, the O-cells were loaded to a bi-directional load of nearly 4.2 MN (test load of 8.4 MN) before the capacity was fully mobilized whereas the third test pile was loaded to nearly 2.9 MN before being fully mobilized. For all three piles, end bearing was approaching ultimate capacity.



Concreting the PHC pile

