O-cell® Technology in Jeddah, Kingdom of Saudi Arabia

Summary:

February 2008 saw the first bi-directional load test performed in The Kingdom of Saudi Arabia. Utilizing O-cell technology, two tests were undertaken at the site of the new Lamar Towers project in Jeddah, situated by the shores of the Red Sea.

Project:

Jeddah is situated on the West coast of the Arabian Peninsula and is nicknamed "The Bride of the Red Sea". Known throughout the kingdom for its shops, restaurant and cafes, Jeddah also hosts the longest Corniche in Saudi Arabia.

Lamar Towers will be the first high rise development in Jeddah. Positioned on the Red Sea coastline along the Corniche, this $2.5 Billion SAR, 7 star luxury project will offer residential, commercial and retail space plus spa all as part of one project.

Artists impression of finished project

At 70 storeys, the twin structures would exert more loading at foundation level than has ever been experienced in the area. The characteristics of the coral founding strata under loading were completely unknown.

In order to verify the piles would have sufficient load bearing capacity, a static load test was required on two test piles. These tests would also be required to determine the friction characteristics of the coral layer.

Installation of one of the O-cell assemblies

The magnitude of load required would not be cost effective with traditional top-down techniques since the concrete cut-off level was almost 7 metres below piling platform level, making the O-cell bi-directional test method ideal for this project.

Bi-directional load test arrangement:

Two 540mm diameter O-cells were installed in each of the 1500mm test piles. Both test piles were base grouted to a depth of 6 metres below the toe before testing commenced.

Lifting of O-cell assembly prior to installation

The O-cell assemblies were positioned within the 50 metre long piles (bored to 58 metres) at a depth of approximately 33 metres and within the coral strata. To provide more detailed information regarding skin friction distribution characteristics, twelve levels of vibrating wire strain gauges (Geokon 4911-4 model) were placed within the pile section, 7 levels below the O-cell assembly and 5 levels above.

Test Results:

A maximum gross loading of 30 MN was required to verify the load bearing capacity of the piles. A settlement criteria was specified for top down static load testing. The resulting derived equivalent load settlement values proved to be well within this criteria. At the maximum applied load, skin friction resistance above the O-cell level resulted in upward top plate movements of 1mm and 3.7mm for TP1 and TP2 respectively.

Combined end bearing and lower skin friction below the O-cell level produced downward bottom plate movements as low as 3.1 mm.

Testing in progress sheltered from the elements

Conclusions:

The two test piles allowed the geotechnical design characteristics to be determined within the coral strata, previously unknown mobilised unit shaft friction values to be measured and successfully proved the piles could attain the factor of safety required.

Project Management Company:
Turner Arabia
Consultant:
Saudi Diyar Consultants (SDC)
Developers:
Cayan Investment and Development
Foundation Contractors:
Kasktas Arabia Ltd.

April 2008