

## Summary:

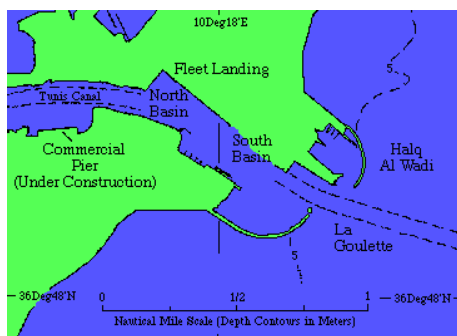
The need to connect the ports of Rades and La Goulette by a land bridge was essential to promoting the development of both North and South Tunis lake areas as well as enabling expansion of the two ports. It was, therefore, necessary to construct a bridge as part of the metropolitan ring road crossing the Tunis Lake canal.

The soft nature of the alluvial soils on this project required a unique testing solution to evaluate the parameters for the pile design. A top down test was considered which would require either anchor piles to lengths in excess of the test pile or heavy kentledge that may be unstable on the soft ground. The loads required would have proved very costly for these testing techniques. A sensible alternative was a bi-directional test in which a sacrificial jack (O-cell) is cast within the pile itself.

One test was performed in a 1500 mm diameter test pile 63.5m deep. The test mobilised a total capacity of approximately 16 MN.

## Project:

This project is seen as the most important construction project that has been undertaken in Tunisia in modern times. At present the route between the ports is either by an ageing ferry for light vehicles or a long circuitous route for heavy traffic. The bridge will span 270 m over the canal at a height of 20 m.



The soft soils at the bridge site left the designers with a problem regarding the pile length. Bore-holes showed that the bedrock was many hundreds of metres below ground level. Using the soft alluvium deposits as a founding material was the only alternative. A bi-directional test would allow assessment of these soil parameters and assist in the calculation of the pile lengths needed in the most cost effective manner.

## Bi-directional load test arrangement:

As is typical of bi-directional static load tests, a specially designed O-cell, was cast in the test pile at a depth where equal resistance can be found above and below the O-cell arrangement.

When pressurised, one element of the pile is used as a reaction for the other; in this manner no reaction system is needed at the surface and no anchor pile nor kentledge are required.



Installation of reinforcing cage with O-cell

The requirement for 16 MN total test capacity was the primary driving force in choosing bi-directional testing. One O-cell® of 540 mm diameter was installed in the test pile, located 21 m

above the tip of the pile. It was assessed that large settlements could be present during the test. To accommodate these movements, an extended stroke O-cell® with a 225 mm stroke was used. Conventional tell-tale arrangements were used to monitor O-cell® expansion and pile toe movements. Strain gauges were placed at the pile toe to monitor the amount of load transferred to the base.

## Pile Test:

The load test was carried out mobilising the whole of the 225mm stroke available. Approximately 110 mm of upward movement and approximately 115 mm of downward movement were mobilised.



Bi-directional test in progress. The steel beam shown in the picture is being used as a reference frame against which pile movement was measured.

## Conclusions:

The test succeeded in mobilising the full capacity of the pile, 16 MN (8 MN in each direction) at a maximum 225 mm displacement, allowing valuable soil parameters to be evaluated for the pile design.

Geotechnical Consultants:

Nippon Koei Co. Ltd.

Foundation Contractors:

STFA Temel Pile Construction Co.

Developer: Taisei Corporation

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