LOADTEST
O-Cell® Technology at Malpensa Airport, Italy

Project:	**Malpensa Airport Expansion Project, Milan**
Location:	Milan, Italy
Client:	Codelfa, Spa.
Foundation Contractor:	Fondamenta Spa.
Project Description:	

O-cell assembly

Malpensa Airport redevelopment

Pile head test arrangement showing reference beam during O-cell bi-directional loading in progress.

Summary:
Redevelopment and expansion of Malpensa Airport, Milan required installation of large diameter bored piles as part of the new foundation. Pile diameters up to 1800 mm with working loads of 15 MN were specified for this project. A test load of 22.5 MN on a production pile made traditional top-down static load testing a very expensive option. Soft soils would have necessitated the need for kentledge, but with unstable soils consisting of sands and gravel, a deep cut-off and small test area, it would have been impractical. Bi-directional static load testing offered a cost effective alternative meeting all the difficult requirements with ease.

Project:
Malpensa is one of three intercontinental airports located within a 50 kilometres radius of Milan. As with most major airports in Europe, Malpensa has seen a rapid growth of air traffic over recent years, necessitating a major expansion of the airport. The construction of this third satellite terminal together with a third runway will enhance the capacity of the airport for future traffic.

The construction and redevelopment contract was awarded to Codelfa Spa, the piling and foundation works forming a major part of this project.

The 1800mm diameter test pile would be incorporated into the foundation structure post testing, once grouting of the O-cell and the annulus created around the O-cell was completed.

Bi-directional load test arrangement:
A single 670 mm O-cell was used to provide the 22.5 MN load required. The O-cell test assembly was welded into the instrumented steel cage at a level of 3.30 m above the toe.

This was then installed into the pile shaft which had been constructed under bentonite to a depth of 19.8 m.

Three levels of strain gauges were placed within the cage to allow calculation of unit skin friction, one level located below the O-cell assembly and two levels above.

Pile Test:
A maximum sustained bi-directional load of 14.6 MN was applied to the pile. At the maximum applied load, the displacements above and below the O-cell assembly were recorded as 5.6 mm and 24.2 mm, respectively. Using these results, a top down equivalent curve was constructed allowing a predicted settlement from the top of the pile of approximately 6.2 mm under the working load of 15 MN. These values were within the load settlement criteria and the pile was successfully incorporated into the structure.

Conclusions:
Bi-directional load testing was performed on a working pile where traditional top down static load testing would have proved to be difficult and expensive. Geotechnical information was obtained to confirm the design parameters used and to give confidence in the pile design.

With a small testing footprint and no surface loading required in soft ground conditions, bi-directional static load testing proved to be the perfect solution to the testing needs on this site.

Source: airport.malpensa.com

www.fugro-loadtest.com