

# LOADTEST O-Cell® Technology in Fundex Piles



## Foundation Contractor:

Gebr. Neumann GmbH. & Co. KG.

Geotechnical Consultants: Schmitz and Beilke Ingenieure GmbH of Gruppe Ingenieurbau.

Project Management: Enercon GmbH.

Fugro LOADTEST Germany: Scanrock GmbH.

## Summary

A new wind farm by Enercon GmbH near Barenburg, Germany had several geotechnical issues. The site is located within an onshore oil field. A number of wind turbines have already been constructed with more underway, founded on large excavated raft foundations.



Excavated raft foundation of wind turbine

Due to the location of this project within the German oil fields, many of the remaining locations would mean excavation of potentially contaminated materials. The option of a displacement pile foundation solution would be an attractive environmentally friendly alternative avoiding contaminated spoils.

## Pile type profile



One pile type considered was the Fundex screw displacement pile. A sacrificial cast iron boring tip is sealed to a hollow pipe drilling mandrel, installed by using torque and crowd force from a rotary head on the hydraulic piling rig. By monitoring the

hydraulic pressure applied to the rotary table, a relative measure of ground resistance can be obtained. Once the pile tip has penetrated sufficiently into the desired bearing strata and/or the desired depth has been reached, a steel reinforcing cage is lowered into the hollow section mandrel and concrete is placed.

The mandrel is then extracted by oscillation leaving the pile tip, concrete and cage in place, creating a cast-in-situ reinforced concrete displacement pile. Test piles to prove the system in the foundation material were required, one method of testing used the O-cell bi-directional loading technique and the other would be using traditional static loading from the top using reaction beams and anchor piles.

For the test piles, the pile tip was fitted with a pipe from the top of the mandrel to inject high fluidity grout under pressure while the pile is penetrating the soil. This assists the penetration by increasing the pore pressure at the tip and temporarily reducing the effective stress of the soil below.

Although this enhanced technique has been used elsewhere, this is the first time grout tip injection has been used on German soil.

## Pile Tests

A single 330 mm diameter O-cell, capable of mobilising 7.8 MN in each direction, was attached to the base of the reinforcement cage and lowered into the mandrel. As with the normal construction technique, all instrumentation connections, hoses and pipes required for testing were attached to the inside of the reinforcement cage. Since this technique does not require the use of a tremie pipe, the size of the O-cell used is only limited to the internal diameter of the mandrel.

## Load testing program

The testing was programmed under the direction of the geotechnical engineers Schmitz and Beilke Ingenieure GmbH.

Since the traditional top down test was on identical piles in close proximity, it was a good opportunity to correlate the results from the two test methods.



O-cell test alongside a traditional top down assembly

## Conclusion

Bi-directional testing of the Fundex pile allowed direct measurement of the characteristics of the pile tip under loading. It had not been possible to measure the end bearing characteristics of this pile type previously.

