

## Summary:

The Zeil, Frankfurt am Main was the site of the first Osterberg cell test in Germany. In April 2004 the largest, static load pile test on German soil was performed using Osterberg cells, in the heart of Frankfurt. The bi-directional load test was aimed at confirming the foundation design, before demolition of some of the surrounding older structures. The test was performed on a 1.68m diameter test pile 47m long, installed 12m into the Frankfurt limestone.

## Project:

This large site is uniquely located within the heart of the Frankfurt city centre, on the main shopping street, "Zeil". This street is amongst those of the highest pedestrian traffic in Germany.



Artists rendering

The "FrankfurtHochVier" project is a Class-A mixed-use project. The existing buildings, which are currently in use by Deutsche Telekom, will be demolished. Only a small part of the structure will remain, namely, the listed, historical building known as the porticos of the "Thurn und Taxis Palais". The development is one of the most significant in Europe today.

## Bi-directional load test arrangement:

Six O-cells® were installed on two separate levels to allow the behaviour of three elements of the pile in the rock socket to be evaluated independently.

The cage assembly with O-cells® was manufactured off-site in sections and assembled over the bore during installation.



Using to advantage a feature unique to bi-directional tests, only the section of pile in the rock socket was concreted and the remainder of the bore (35m) backfilled with granular material for stabilisation. Subsequently the pile was base grouted and a 5m test section shaft grouted (It is typical practice to shaft and base grout piles in the Frankfurt limestone).



Installation of the bottom section of reinforcing cage

## Pile Test:

The load test was carried out in two stages as is necessary with a multilevel O-cell arrangement:

- In the first stage the upper 5m of rock socket was loaded to 24MN
- In the second stage a lower 5m section was loaded against the bottom 2.5m of pile.

The effective mobilised capacity was 78MN.



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

## Conclusions:

Until now, designers have had to rely on full scale loading test data from 146mm diameter anchors.

In practise, there would have been insufficient space to perform a top down loading test and had it been possible, interpretation of the results from the rock socket would have been difficult.

The test succeeded in mobilising the ultimate capacity in each of the sections of the rock socket.

*Geotechnical engineers:* Ingenieursozietät Professor Dr.-Ing. Katzenbach GmbH  
Dr Matthias Vogler.

*Foundation Contractors:* Bilfinger Berger AG, Bauer Spezialtiefbau GmbH, and Hochtief Construction AG.

*Developer:* MAB joint venture with BPF.

*Architect:* KSP Engel und Zimmerman Architekten; Fuksas Associati S.r.l.

*Local LOADTEST office in Germany:* Scanrock GmbH: Carlos Fischer

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