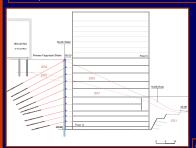
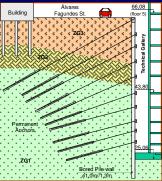
Deep excavation for the new Central Library of Lisbon

Excavation profonde pour la construction de la nouvelle Bibliothèque Central de Lisbonne A. Pinto, A. Pereira & M. Villar (Paper number 206)

A 40 m deep excavation was performed for the construction of the new Central Library and Municipal Archive of Lisbon.



Cross section A-A



Cross section of the South-West side



Plan view of the excavation

Geology:

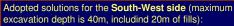
ZG3 - Heterogeneous fills with thickness varying between 1,5 and 20m, with the major thickness at South - West, close to Álvares Fagundes St;

ZG2 - Miocene sands and clays with fossils, with NSPT values under 60 and a maximum thickness of 19m;

ZG1 - Sands, clays and loam limestones with NSPT values over 60.



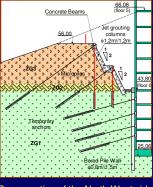
South-West side view



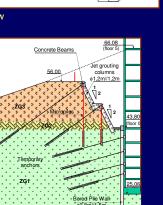
Bored pile wall supported by 10 levels of permanent anchors. Jet-grouting columns was performed for protect the soil between the piles in the depth of ZG2 and ZG3. Reinforced shotcrete was used in ZG1.

Adopted solutions for the North-West side:

- Bored pile wall supported by 4 levels of temporary anchors bellow floor 0 with shotcrete to protect the soil between piles.
- Slope stabilization using jet-grouting columns above floor 0, in the depth of ZG3, supported by temporary anchors



Cross section of the North-West side



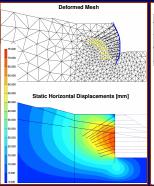
Final Excavation (40m depth maximum)

The building could not support the earth pressures caused by the differences of the ground level (30m) at both

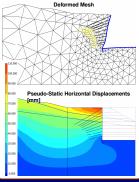
longitudinal sides of the site (South-West and North-East).

Streets, services and structures nearby the construction

- Executive difficulties caused by the topography of the site.



Example of results of static numerical calculation for the South-West retaining wall



Example of results of pseudostatic numerical calculation (seismic coefficient $(\beta) = 0.1$) for the South-West retaining wall



Location of the monitoring equipments

Example of the displacements of the retaining wall in the direction normal to the wall obtained from inclinometer I3 (located in the South-West side). Positive displacements are those occurring towards the excavation.

Measurements were performed the day after each excavation phase

Considering the depth of the excavation (H=40m), the obtained displacements were small $(\Delta h/H = 0.012/40 = 0.03\%)$ and in general lesser than the design prediction.





