

Soil-pile interaction for bored cast-in-place piles in stiff clays and soft rocks Industrial PhD project between Aarhus University and COWI

Today, usage of bored cast-in-place piles for foundations of buildings, bridges or structures, is very expensive in Denmark. This is due to strict code regulations regarding maximum resistance, hence the allowable load on the pile.

The load on the pile is transferred to the soil by shaft resistance on the side of the pile and toe resistance underneath the pile.

However, when calculating the maximum resistance on bored cast-in-place piles, the toe resistance is partly or fully neglected. This is due to the fact, that development of the toe resistance often requires significant vertical displacement. As of today, there are no recognized testing methods, addressing the toe resistance and the corresponding vertical displacement.

A substantial amount of test data is needed to investigate the shaft and toe resistance of bored cast-in-place piles. To the extent possible, this PhD project aims to connect previous, ongoing and future projects to retrieve as much high-quality data as possible. Unfortunately, the numbers of relevant cases are limited.

The industrial PhD project is however connected to an ongoing project, where development of a Flat Jack device is conducted. Development of this Flat Jack enables post-construction stressing to prevent significant vertical displacement of the pile as well as it provides design capacity confirmation. Furthermore, the project provides data from O-cell tests on bored cast-in-place piles in limestone (soft rock).

A planned test program on a test site in Hinge, which involves six static loading tests (tension) and two post grouting's of flats jacks on full-scale instrumented test piles in stiff clays, will also provide valuable and much needed data. The piles will be instrumented with fiber-optic cables, strain-gauges, tell tales, displacement transducers and piezometers in the surrounding soil.

Project partners and timeline

The industrial PhD project is a cooperation between Aarhus University and COWI with industrial PhD student Jannie Knudsen. The project period is from June 2018 to May 2021. Three supervisors are associated with the industrial PhD project. Kenny Kataoka Sørensen (Aarhus University) is university supervisor, Jørgen S. Steenfelt (COWI) is company main-supervisor and Helle Trankjær (COWI) is company co-supervisor.