

Equipment for precision measuring of movements in pile foundations – *by means of fibre-optic sensors*

Background

Building structures in areas with soft soil often necessitates the use of pile foundations, which in Denmark are normally established by driving concrete piles into the ground. A pile foundation serves to transfer the load of the structure as well as natural loads to deeper, stable soil layers without causing structural failure or too many settlements in the structure. Calculating the necessary foundation depth requires knowledge of, e.g., the soil's mechanical properties and insight into soil-foundation/pile interaction.

To gain this insight, you can conduct full-scale tests on driven piles. Traditionally, past tests were based on point measurements, which involve measuring movements and forces in the soil as well as the pile in a highly limited number of points by means of individual sensors.

The application of fibre-optic sensors (distributed) represents state-of-the-art in precision measuring of movement in soil and structures in connection with construction and building activities. These sensors measure the backward reflection of laser light in a simple and standard fibre-optic cable, and allow for a vast amount of measuring points along the entire length of the ultrathin cable in use.

Purpose of the equipment

Professor, MSc Kenny Kataoka Sørensen, Aarhus University, has been granted DKK 150,000 to purchase fibre-optic measuring equipment to be used for, e.g., full-scale tests of concrete piles driven into soft soil. The project will be carried out in relation to the industrial PhD project entitled "Soil-pile interaction in soft soils", which is carried out in cooperation between the Department of Engineering, Aarhus University, cp test a/s and Per Aarsleff A/S.

Expected results

This equipment will enable more accurate determination of movements and forces in the pile and the interaction between pile and surrounding soil than what has been possible so far using traditional measuring equipment. Based on the collected data, the aim is to gain a better understanding of how forces are transferred from pile to soil and vice versa, in order to enhance the design of pile-foundation buildings in areas with soft soil.

In addition, the plan is for Aarhus University to use the equipment on a number of other projects to uncover movements in different materials and structures when exposed to external impact such as loads.