Delft Cluster

Improvements for the interpretation methods of rapid pileload tests

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The reason for the research

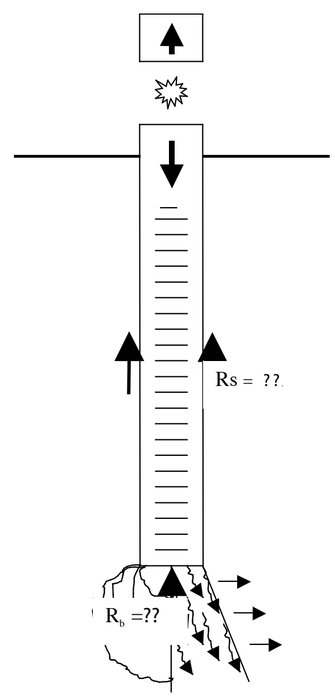
Rapid load tests on piles, such as Statnamic or pseudo-static tests, are considered as an economic alternative for static tests, due to the low costs and fast execution of these tests in comparison with static load tests. In practical interpretation of rapid load tests, the rate effects, i.e. an increase in shear strength of soil related to high rate of loading, are taken into account for clay, but generally neglected for sand. In additional, an excess of pore water pressure during these tests has been observed but the question of its effect on ultimate capacity of a pile is not yet answered.
In order to facilitate the usage of rapid load tests to improve the quality of design in the Netherlands, the two fundamental questions will be answered in this research:

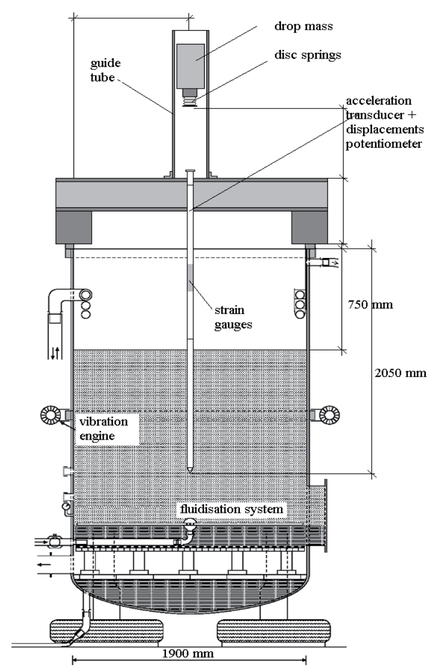
1. **The effect of loading rates on strength of sand and on resistance of a pile embedded in sand;**
2. **The excess of pore water pressure and its effects on stiffness and ultimate capacity of a pile during a quasi-static load test.**

The results of the research will be incorporated in Dutch and European regulations, which will be developed within the Delft Cluster project.

The plan of the project

The first question about the rate effects is investigated experimentally by laboratory fast triaxial tests and fast model pile tests for dry and saturated sand in a calibration chamber.
The second question about the effects of pore water pressure build-up is investigated numerically based on the framework of Biot (1956) for the dynamic response of saturated porous material.
These two studies result in a practical model for incorporation of these two effects during interpretation of Rapid Load tests. This model will be evaluated against a database with field measurements and centrifuge tests for better understand the pile and soil behaviours during a rapid load test are proposed.





The results of the project

Different trends of the rate effect and the build-up of pore water pressure during a rapid load test in sand as well as requirement to understand them has been pointed out from literatures. The laboratory tests found no rate effect on shear strength and resistance of a pile in saturated sand; and the pore water pressure significant affect stiffness of the model pile.
The numerical investigations show the same results.
The findings will be implemented in the interpretation methods for the rapid load tests to have a better predicted static behaviour of a pile from a Rapid Load Test.
The results of the research will be incorporated in Dutch and European regulations, which will be developed within the Delft Cluster project.