Soil disturbance during Flat Rigid Dilatometer Test using discrete element method.

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ABSTRACT

In-situ testing does disturb the soil causing difficulties in interpreting testing data to obtain meaningful design parameters. These difficulties comes from the soil complex behaviour, lack of control over boundary conditions in field testing. Hence many in situ tests still depend on empirical correlations with conjunction with laboratory testing.

The numerical methods became a complementary method to field/experimental testing. These numerical models allow internal parameters that are difficult to measure in-situ to be monitored and the additional insight that they provide into CPT-soil interaction can improve interpretation techniques. However boundary value problems involving large strain contact problems in dilatant materials remain difficult to model with continuum-based approaches [1].

The distinct element method, DEM, can be a promising alternative to conventional continuum approaches for investigating the behavior of soils and key aspects of soil material (e.g. [2]) as well to solve larger-scale engineering problems [3], [4], [5]. One essential feature of DEM-based models is that they can be examined at various levels of resolution, i.e. the micro-scale (derived from the basic modelling unit, i.e. contact and particle) and the macro-scale (continuum inspired variables: stress, strain) [6]).

We present an overview of the results obtained in a research project exploring the ability of 3D DEM models to reproduce flat rigid dilatometer test in sand. Two stages are modelled, via. blade penetration and horizontal movement of rigid piston. The discrete material mimicked a well-known reference material, Ticino sand. The blade penetration was found to be in a good agreement with experimental data. It was observed that most of the blade resistance comes from the tip due to high concentration of contact forces. Moreover, the soil close to the device move in a very complex manner; undergo an evident loading and unloading process and a rotation of principal stresses.

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