TITLE:

Numerical modelling of soil-pile axial load transfer mechanisms in granular soils

ABSTRACT

The purpose of the work presented in this thesis, which has a theoretical and numerical character, is the analysis and numerical modelling of soil-pile load transfer mechanisms, in granular soils, when the pile is subjected to axial vertical loads. In the three dimensional elastoplastic finite element model used, particular attention is paid to modelling soil-structure interface behavior.

The necessary numerical tools were implemented and the existing ones enhanced so that, the analysis of the soil-pile interaction problem is feasible. Two newly implemented 3D constitutive laws, in the GEFDYN finite element code, are proposed: an interface model and, for soil, an axisymmetric formulation of the existing ECP multimechanism model, also known as Hujeux model.

The performance of both constitutive models is compared with experimental results. First, using soil-structure direct shear tests and then, using results of static pile load tests of centrifuge physical models. The theoretical formulation and numerical implementation of the constitutive models proved to be adequate for the analysis of the soil-pile load transfer mechanisms for different soil initial states, soil-pile surface roughness conditions, and different geometries.

Finally, the applicability of the proposed models, is also studied for a real case study of pile static load tests carried out in the ISC'2 experimental site, at the occasion of the 2nd International Conference on the Site Characterization. Soil's laboratory characterization tests and in-situ pile static load tests on bored and CFA piles are simulated, and results successfully compared.

KEY-WORDS:

Pile

Sand

Axial load

Soil-structure interaction

Finite element model

Nonlinear elastoplastic interface model