Chapter 2

Objectives and methodology

2.1 Objectives

Once the problem is defined, obviously the objective shall be to solve it in the measure of this thesis scope.

**Main objective:** To extensively investigate, qualitative and quantitatively, how the generation of excess pore pressures due to pseudostatic testing in saturated sand affects the pile bearing capacity. It should result in a representative loading rate-excess pore pressure-bearing capacity relationship, with its correspondent load-settlement curves, that could be used to predict soil response under these conditions.

A series of secondary objectives may be defined:

1. Investigate relationship loading rate-excess pore pressure⇒Comparison among different loading rate tests in saturated sand
2. Investigate influence of pore pressures in bearing capacity⇒Comparison between saturated and dry conditions (Dijkstra [5] results)
3. Investigate the soil strength effect⇒Comparison among different soil densities

And, consequently:

- Propose correlation pseudostatic-static results
- Evaluate the suitability of importing pseudostatic testing into zones with fine-grained cohesionless saturated soils.

2.2 Methodology

It has been proposed as the main objective to carry on an exhaustive and coherent investigation about the topic in question. In this section how the objective will be met is explained. Therefore, the research can be said to embrace the following fields:

- **Experimental testing:** a series of tests have to be performed in the scale 1g condition model designed by Dijkstra [5]. The chosen test regime and series should meet the different requirements for a complete parametric study: different loading rates (static and pseudostatic), saturated sand, different densities. Analytical and numerical modeling results are to be calibrated with the experimental ones.
2.2 Methodology

Main objective
Investigate generation of excess pore pressures in pseudostatic tests in saturated sand and how they affect pile's bearing capacity

Figure 2.1: Objectives of the research

- **Analytical modeling:** There is no analytical model defined for such a problem. This approach passes by adapting the existing theories to the case and propose a good analytical fit.

- **Numerical modeling:** The experimental tests have to be modeled by FEM with the program PLAXIS. The numerical model should be defined to adjust the numerical results to the experimental ones.

Figure 2.2: Scope of the research

Experimental results are going to be used to validate and calibrate the other models. So, implicitly, we are defining another objective:

- To evaluate the ability of the available analytical and numerical methods to model the problem and predict the soil response.
2.3 Limitations

The scope of the research needs to be properly delimited with restricted boundaries in order to make it feasible in the thesis context.

2.3.1 Experimental testing limitations

- **Pile**: Only one type of pile: 3.33 cm in diameter smooth steel pile
- **Soil condition**: Soil type is kept constant to fully saturated sand. The same sample in prepare again after each test, so we are always working with the same material. It is the same sand as used by Dijkstra [5] so the comparison is possible. The phreatic level is kept constant too. The only variable parameter is the vibration time (that controls the density of the sand), but its efficiency will be discussed. The soil conditions in the tank are not comprehensively known.
- **Amount of tests**: A statistical significant amount of tests should be carried out. The limitation of time need to be accounted for, though.
- **In-situ initial stresses**: They are not fully known or understood. Besides, the calibration chamber and the placement of the vibrators can affect them.
- **Loading system**: Only pressure forces, no tensional stresses.

2.3.2 Analytical modeling limitations

- **Model development**: The shortcoming of the literature presenting available analytical models that fit the case will be seen. Thus, a model will need to be developed, with all its limitations.
- **Applicability**: It is the experimental test that is modeled, thus not the real field case.

2.3.3 Numerical modeling limitations

- **Computer program**: PLAXIS will be used for the modeling. The standard available soil models are the only ones to be used. No user-defined model, which would better fit the case, are developed.
- **Applicability**: It is the experimental test that is modeled, thus not the real field case.
Part I

Experimental testing