M.Sc. Thesis Project

The soft floor of Netherlands: how to build dikes on peatland

MultiScale Mechanics (UTwente) and Geo-Engineering (TU/Delft)

Goal: Modeling the interaction between peat soils and dikes, via numerical simulations and lab experiments.

Background: A significant part of The Netherlands is covered by peats and many Dutch dikes are indeed built on peat soils. However very little is known about these structures until now.

- We know that peats are composed by a flexible and loose stacking of plant fibers in a fluid matrix (Figure 2).
- We know that peat might be stronger than previously assumed, thanks to fibers.
- We don't know why and in which conditions this happens.

The fibrous and water-rich structure of peat is clearly very different from the assemblies of hard grains in sand and the stacks of flat particles in clay. Current civil engineering, however, often assumes that peat soils share the mechanical behavior of sand and clay undergrounds, corrected by an ad hoc safety margin, by lack of a better model for peat soils. A better understanding may lead to a much wider utilization of peat as construction or substrate material.

The MSc project will focus on the modeling of peat across different scales, comparing numerical simulations and laboratory experiments.

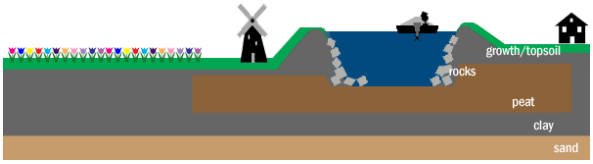

Figure 1: Cross-section of a typical Dutch dike

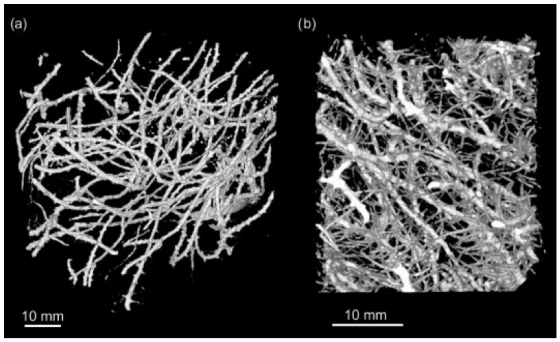

Figure 2: 3D reconstruction of peat fibers

Method: A particle-level numerical simulation technique known as the Discrete Element Method (DEM) will be used to improve the knowledge of peat internal structure. The numerical method is state of the art in the MSM group, where the algorithm has been recently adapted to mimic fibers. Simulations will be conducted in parallel with lab experiments at Geo-Engineering lab at Tu/Delft. By an accurate comparison of the approaches, numerics will reveal aspects of the peat behaviour of peats that are difficult to observe by classic laboratory tests.

Plan: The thesis project will include:

1. optimization of the numerical method for the modeling of peats;
2. simulations of triaxial tests and uniaxial tests on peats to reproduce the condition induced by a dike in the field;
3. comparison with existing experimental data;
4. study of the micromechanics of the samples during compression.

The M.Sc project will be run in collaboration with the chair of Dikes and Embankments, Geo-Engineering at TU/Delft, where the laboratory experiments are carried out. The project will include an internship or short visits to Delft in order to perform complementary experiments. The experimental plan and the actual length of the internship will be arranged with the M.Sc candidate and the partner universities.

Contact people:
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