RESEARCH INTO UNSATURATED SOIL MECHANICS AT THE UNIVERSITY OF PRETORIA

Professor SW Jacobsz

Faculty of Engineering, Built Environment and Information Technology, South Africa

sw.jacobsz@up.ac.za

ABSTRACT

Traditionally soil mechanics courses forming part of most civil engineering programs around the world include an introduction of the theory and principles of saturated soil mechanics. This may be perfectly adequate in many parts of the world where the water table is shallow and soil comprise a mixture of solid particles and water. However, in the African context the water table is often at significant depth, resulting in the majority of soils occurring in an unsaturated state where interaction between all three matter phases, i.e. solids (soil grains), liquids (pore water) and gases (air) are important. The resulting interaction is significantly more complex than under saturated conditions and has resulted in the development of the field of unsaturated soil mechanics.

The lecture will present research work carried out in the field of unsaturated soil mechanics at the University of Pretoria focusing on a number of practical applications as follows:

One of the most important and most difficult parameters to measure in the case of unsaturated soil is the negative water pressure in the pore water in unsaturated soil. Methods of negative pore water measurement will be reviewed and the development of a low-cost high capacity tensiometer at the University of Pretoria will be presented. This will be followed by an overview of the use of fibre optic instrumentation as a means of water leak detection from conduits in unsaturated soils. Finally, the lecture will present research work modelling unsaturated expansive soils by means of physical models in the geotechnical centrifuge at the University of Pretoria. An example from a model study considering piled foundations in expansive soils will be presented.

The presentation will emphasis the need to consider unsaturated soil behavior and will make recommendations on how the subject could be introduced in civil engineering programs at African universities.

Keywords: *soil mechanics, unsaturated soil, negative water pressure, fibre optic instrumentation, modelling, unsaturated expansive soils, geotechnical centrifuge, African universities.*