COMPRESSIBILITY CHARACTERISTICS OF UNSATURATED SOIL

Krichikeshan I.* and Kulathilaka S.A.S.

Department of Civil Engineering, University of Moratuwa, Moratuwa

Conventional Terzaghi's consolidation theory is developed for saturated soil. However, in practice the concept is used with unsaturated soils as well. The behaviour of unsaturated soils is quite different due to the presence of the air phase and the contractile skin- the boundary between air and water phases. In many places in the country residual soils formed by the weathering of parent metamorphic rock are present at the surface level and there is a zone of unsaturated soils just below the ground surface. Loads from many structures are applied on this zone and the understanding of the compressibility of this zone is very important. Also, there is high variability in this zone.

The objective of this research is to identify the variation of compressibility characteristics of different soils with the saturation level. Due to the existence of air phase in unsaturated soil, excess pore water pressure is not equal to the load applied when the soil is compressed under an undrained loading condition. To get an accurate reliable equation we need to consider both pore water pressure and pore air pressure. If the excess pore air pressure and excess pore water pressure are allowed to dissipate, the excess pore water and air pressure will dissipate gradually with time. The volume change of the unsaturated soil is not equal to the water drainage in unsaturated condition. And also, it is necessary to consider the saturation level. The main parameter that causes the difference from saturated soils is matric suction.

As such in this research a controlled uniform saturated sample is obtained, and it was brought to equilibrium under different matric suctions. The compressibility characteristics of the same soil under different matric suctions are evaluated. The parameters are evaluated under the framework of Terzaghi model. An attempt was made to establish a relationship between the matric suction and the consolidation parameters. Identical samples were tested on conventional Oedometer and a Rowe Cell of diameter 75 mm.

The void ratio, natural moisture content, compressibility index are the features which can be obtained from standard Oedometer consolidation test and Rowe cell consolidation test. Available data states that the compressibility characteristics of unsaturated soils are usually very nonlinear and cannot be considered in some conditions.

Compressibility of unsaturated soil depends on many factors. Some of them include particle size distribution, saturation level, temperature, permeability. Compression index (C_c) and Recompression index (C_r) decrease in the initial stage and then increase with matric suction. m_v value for the saturated sample was greater than unsaturated soil and with the increase of stress level, the m_v value of all the samples decreased.

Keywords: compressibility; oedometer test; Rowe Cell test; coefficient of consolidation

* Correspondence: krichikeshan1996@gmail.com