PARAMETERS FOR ANISOTROPIC OVER-CONSOLIDATED CLAYEY SOILS

L.C. KURUKULASURIYA, Y.L. BISHRULLAH, M.M.M. FAZEEL AND M.T.M. FOWMY

Department of Civil Engineering, Faculty of Engineering, University of Peradeniya

The undrained shear strength of over-consolidated clays has been found to be anisotropic under both plane strain and triaxial conditions. However, three different types of variations can be observed when the direction of compression is changed from a direction parallel to the plane of consolidation to that normal to the plane of consolidation, namely, a) a variation showing a monotonic increase in undrained shear strength, b) a variation showing a minimum value of undrained shear strength when compressed in a direction inclined at 30° to the consolidation plane, and c) a variation showing a monotonic decrease in undrained shear strength.

These different types of variation can be attributed to different rates of micro-structural changes taking place during deformation. In order to incorporate the above variations of undrained shear strength in solving boundary value problems in geotechnical engineering, three parameters were introduced into the Sekiguchi-Ohta elasto-plastic model. The parameters introduced describe the inherent fabric structure by the parameter degree of anisotropy (F), the rate of change of inherent fabric structure during deformation by the constant parameter 'a' and a limiting value to the change of micro-structure by the parameter $J^{\wedge F}_2$. In this study, it is aimed to suggest a method to evaluate the above parameters based on micro-structural observations of the inherent and the deformed structure.

A location where a high percentage of clay exists was identified and triaxial tests carried out on undisturbed samples showed that the undrained shear strength has a variation showing a minimum value when compressed in a direction inclined at 30° ~ 45° to the consolidation plane. Disturbed samples were collected from the same location and clay particles were separated. A slurry was prepared by depositing clay in de-aired water and samples consolidated to a uniaxial pressure of 100 kPa were prepared in a steel mould. A special apparatus was designed and made to hold the samples so that samples for the triaxial tests could be extracted at different inclinations to the consolidation plane. Samples were extracted having an inclination of 0°, 15° and 30° to the consolidation plane. Three samples were extracted from each direction of sample extraction. The selection of above directions for sample extraction facilitates to observe the changes of orientation of fabric structure during shear deformation as the inherent fabric structure can be expected to change noticeably during compression for the above. The samples were isotropically consolidated in a triaxial cell under a pressure of 50 kPa to maintain an over-consolidation ratio of 2. The three samples extracted having a particular inclination were saturated and compressed under traixial conditions until a) failure strain, b) strain corresponding to 60% of peak deviator stress, and c) strain corresponding to 90% of peak deviator stress, was reached.

In the future, the micro-structure of the specimens extracted from the samples compressed as described above would be observed under a scanning electron microscope and an attempt would be made to evaluate the parameters representing the anisotropic behaviour, which can then be used to incorporate into the Sekiguchi-Ohta elasto-plastic model.