Ganga Dhar Tripathi

Thesis

Pore Pressure Generation under Generalized Loading Conditions

Abstract

The main focus of this research is to extend the application of Skempton's A parameter to generalized loading conditions. This would simplify the characterization of the undrained behaviour of soils under general field loading conditions. The effects of initial stress states (including the major, intermediate and minor principal stresses, and their direction with respect to the bedding plane), and the undrained stress path on the pore pressure generation are assessed using an extensive dataset obtained from the literature and from a series of tests conducted in the laboratory. Laboratory experiments were conducted under axisymmetric triaxial conditions and the dataset obtained from the literature corresponds to 3-D loading conditions. Skempton's pore pressure parameter A has been determined for triaxail and generalized three dimensional loading conditions.

In the research, a number of undrained static tests on Fraser River and Ottawa sands were carried out under conventional triaxial loading mode but at different initial stress conditions. This process enabled the isolation of the effect of initial stress conditions. This Process enabled the isolation of the effect of initial stress state on excess pressure. Tests were carried out both in compression and extension loading modes on specimens consolidated to various initial effective stress states and confining pressures. The effect of membrane penetration is addressed to measure the truly undrained behaviour of the sand confidently. The use of hollow cylindrical torsion shear (HCT) tests permitted independent control of major, intermediate and minor principal stresses, and the direction of major principal stress to the vertical axis. The HCT test data are also used to evaluate the effect of confining pressure, and the intermediate principal stress parameter.

Results show that Skempton's A-value increases as stress state approaches the peak regardless of the initial conditions. A-value increased with respect to intermediate principal stress parameter and principal stress direction. However at a given values of these two parameters, A-value is dependent on effective stress ratio and confining pressure. These results indicate that excess pore pressure generation in sands is strongly dependent on the state of the principal stresses and their directions and on the stress path during loading.

Degree

M.Eng.

Completion

2006

Supervisor

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