Form 2

Dissertation Abstract

Report no.	(Course-based) No.1108	Name	Ali Murtaza Rasool
Dissertation title	Mechanical behavior and instability of unsaturated soil under water infiltration conditions (不飽和土の力学挙動と水分浸透に伴う不安定化)		

Abstract

※The abstract should be in keeping with the structure of the dissertation (objective, statement of problem, investigation, conclusion) and should convey the substance of the dissertation.

In order to mitigate the damages associated with rain induced slope failures, the triaxial tests can be used to study the mechanical behavior of soil knowing its initial state, boundary condition and loading type. However, the detail studies of the evolution of shear stress due to water infiltration simulating field stress paths have seldom been performed in the laboratory. Moreover, the shear strength behavior due to water infiltration and final shear state under different stress paths has not been verified. In the light of such, the main aim of this study is to evaluate the mechanical behavior and instability of unsaturated soil as a result of water infiltration following the field stress paths via a series of laboratory triaxial tests. In addition to this, the effect of stress paths on final shear state is also studied. Most of the previous studies have been performed under constant shear stress conditions. Whereas, the current study has been performed under both constant matric suction and constant shear stress conditions to study mechanical behavior and instability of unsaturated soil slopes. The constant matric suction refers to ordinary triaxial tests performed in drained conditions. In this condition matric suction was first decreased to start water infiltration then it was kept constant throughout the shear process. Three stress paths has been followed in constant matric suction plane. In first path, the shearing process was started simultaneously by decreasing matric suction i.e. opening the drainage valve for the pore water pressure. In second and third path, the soil specimens were first infiltrated with water by keeping deviatoric stress constant. Once the water infiltration completed the specimens were sheared by opening and closing the valve for pore water pressure respectively. No remarkable decrease in shear strength was observed due to decrease in matric suction. It was also observed that specimens produced same deformation state (i.e. degree of saturation) which produced same stress paths and final shear state of specimens and all stress paths fall on the same failure surface. The constant shear stress refers to triaxial test with water infiltration carried out at 80-85% of peak deviatoric stress. In this condition, matric suction was

decreased to start water infiltration by keeping shear stress constant. Three stress paths have been followed in constant shear stress plane. In the first and second path, the soil specimens were first sheared to 85 & 100% of qmax respectively in constant water content conditions then water was infiltrated by keeping deviatoric stress constant. It was observed that the water infiltration alone caused failure in the specimens as a result deviatoric stress decreased depending on the increase in water content. Consequently, the stress path moved along the failure surface and failed. In the third path, the soil specimens were first sheared to 25% of qmax then water was infiltrated by keeping deviatoric stress constant, no failure was observed during the course of water infiltration. Therefore, specimens were sheared again in constant water content conditions, the stress path also moved along the failure surface during water infiltration and recovered during second shearing. Finally, six stress paths have been carried out under constant matric suction and shear stress planes it was observed that all stress paths fall on the same failure surface forming the state boundary surface. The reduction in shear strength of the soil depends on the drainage condition and increase in water content as per the conducted study.