Clarification of water absorption failure mechanisms of unsaturated silt triaxial specimen through three-phase elastoplastic finite deformation analysis considering inertia force

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ABSTRACT

Triaxial experimental tests and their numerical simulations were performed as a preliminary step for clarification of failure mechanism of slopes and embankments due to rainfall. In the experiments, unsaturated silt specimens with suction 20 kPa were made absorb water by (A) reducing suction to 0 kPa at a constant axial load higher than the peak value, which was obtained separately in a displacement control triaxial compression test for suction 0 kPa, and by (B) reducing suction to 0 kPa, followed by raising pore pressure at another constant axial load lower than the peak value. Both specimens reached failure with water absorption showing the rapid increase of their axial displacement. The soil-water-air coupled finite deformation analysis code[1)] taking into account inertia force was employed for their numerical simulations. The analysis code incorporated the SYS Cam-clay model[2)] taking into account unsaturated effects[3)]. In the simulations, axial displacement did not converge during the water absorption and the specimen showed failure at an accelerated rate as seen in the tests. That is, the simulation results had good agreement with the experimental results. In addition, it was found that the specimen behavior for case (A) showed softening with plastic volume compression due to increase in saturation degree (decrease in suction), and the specimen behavior for case (B) showed softening with plastic volume expansion above the critical state line in $p' - q$ skeleton stress space.

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