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Reproducibility of Shear Strength Parameters Determined from CU Triaxial Tests: Evaluation of Results from Regression of Different Failure Stress Combinations

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Abstract : Test repeatability and data reproducibility are a concern in many geotechnical laboratory tests due to inherent soil variability, inhomogeneous sample preparation and measurement inaccuracy. Test results on comparable test specimens vary to a considerable extent. Thus, also the derived shear strength parameters from triaxial tests are affected. In this contribution, we present the reproducibility of effective shear strength parameters from consolidated undrained triaxial tests on plain soil and cement-treated soil specimens. Six remolded test specimens were prepared for the plain soil and for the cement-treated soil. Conventional three levels of consolidation pressure testing were considered with an effective consolidation pressure of 100 kPa, 200 kPa and 300 kPa, respectively. At each effective consolidation pressure, two tests were done on comparable test specimens. Focus was laid on the same mean dry density and same water content during sample preparation for the two specimens. The cement-treated specimens were tested after 28 days of curing. Shearing of test specimens was carried out at a deformation rate of 0.4 mm/min after sample saturation at a back pressure of 900 kPa, followed by consolidation. The effective peak and residual shear strength parameters were then estimated from regression analysis of 21 different combinations of the failure stresses from the six tests conducted for both the plain soil and cement-treated soil samples. The 21 different stress combinations were constructed by picking three, four, five and six failure tresses at once at different combinations. Results indicate that the effective shear strength parameters estimated from the regression of different combinations of the failure stresses vary. Effective critical friction angle was found to be more consistent than effective peak friction angle with a smaller standard deviation. The reproducibility of the shear strength parameters for the cement-treated specimens was even lower than that of the untreated specimens.

Keywords : shear strength parameters, test repeatability, data reproducibility, triaxial soil testing, cement improvement of soils
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