UNIVERSITI TEKNOLOGI MARA

PULLOUT BEHAVIOUR OF ANCHOR BLOCK UNDER SATURATED AND UNSATURATED SOIL CONDITIONS

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ABSTRACT

There have been many cases of wall failure by bulging. The potential causes of this type of wall failure are might due to the over-estimate the shear strength at the lower part of wall, the influence of a hydrostatic pressure at lower part of the retaining wall and the soil in the retaining wall transformed from unsaturated to saturated condition. This is anticipated to be the cause of wall bulging. This illustrates the importance of applying the right shear strength which can be achieved through the curved surface envelope shear strength model. This also gives the implication that the application of the curved surface envelope shear strength model will be more conservative than the Terzaghi's, 1936 model.

This thesis presents the results of an investigation into soil-reinforcement interactions under saturated and unsaturated conditions by means of pullout tests. Especially for this purpose, an apparatus able to contain 2 cubic meter sample of backfill material was designed by the author in order to perform real scale tests. The pullout tests were conducted on granular material, silica sand. The properties related to this backfill material, including gradation curve, proctor curve and specific gravity are presented in this thesis. An anchor block attached to steel rod act as reinforcement were used in conjunction with the silica sand.

The testing program has been designed to evaluate the soil-reinforcement interlock capacity by means of pullout testing. A few series of pullout tests were conducted on various water content of backfill material under various vertical pressures. Once the vertical load was applied, a second hydraulic actuator was started to pull the anchored rod out from the box at a rate of 1 mm/min. The test was continued until constant or decreasing pullout force was obtained and a maximum of about 200 mm travel was recorded. The test data, including the vertical load, the pullout force and displacement, were collected. The applied vertical pressure were 50, 100, 200 and 300 kPa and the backfill material were varies from dry, 1%, 2%, 6%, 12% of water content as well as under the saturated condition.

Prior to the pullout tests, the soil water characteristic curve were developed by the pressure plate extractor apparatus which gave a result of residual suction of 10 kPa. The variations of shear strength with relate to suction for saturated and unsaturated tested sand was developed in this study. The shear strength variation with respect to suction was found to be non-linear for the entire test which in accordance to the curved-surface envelope soil shear strength model (CSESSM) of Md. Noor and Anderson, 2006. Consolidated drained triaxial test were conducted on the soil specimens, both under saturated and unsaturated conditions with different moisture content of 1%, 2%, 6% and 12% which were adopted according the soil-water characteristics curve done in this study.

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