UNIVERSITI TEKNOLOGI MARA

INVESTIGATING THE SHEAR STRENGTH OF GRAVELS AFFECTED BY PARTICLE BREAKAGE UNDER SATURATED AND UNSATURATED CONDITIONS

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

One of the essential factors affecting the shear strength and volume change behaviour of the granular materials is the phenomenon of breakage undergone on the gravel particles after subjecting to stresses exceed the particle's strength. The potential of particle breakage is increases as the gravel particles subjected to pure rain and acid rain. Particle breakage produces fine particles and small fragments when the neighbouring particles are sheared under specific stresses. However, under unsaturated conditions, the effect of the produced fines due to particle breakage becomes significant due to the development of suction stresses. In this research, two phases of triaxial tests were conducted on limestone gravels; the first phase is the initial shearing, which conducted to produce crushed material which named as the pre-sheared gravels. In this phase, limestone gravels prepared at different conditions; (fresh gravels, water soaked and acid soaked; all tested under fully saturation conditions and fresh gravels tested under fully dry conditions) are subjected to triaxial tests under confining pressure of 1000 kPa. The second phase involves the re-shearing of the pre-sheared gravels at four different suctions using non-axis translation technique and at fully saturated conditions under low confining pressure. According to the test results, it was found that the maximum deviator stress value decreases as the breakage rate increases. Also, great influence of acidic solution and water on the amount of particle breakage which reduces the strength of the particle. Furthermore, the effect of particle breakage on the mechanical behaviour of limestone under saturated and unsaturated condition was found that the pre-sheared gravels gain additional strength at unsaturated conditions resulted from the development of suction stresses. A model for predicting the deviator stress after the occurrence of particle breakage was developed, and the effect of matric suction was incorporated in the model. The proposed model was validated by using experimental data from different types of gravels.

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