

Micromechanical investigation of particle size effect of uncrushable granular materials in biaxial test with DEM

P. Wang^{a*}, Z. Lu^{a,b} and Z.Y. Yin^a

^a The Hong Kong Polytechnic University, Kowloon, Hong Kong, China

^b State Key Laboratory of Internet of Things for Smart City and Department of Civil and Environmental Engineering, University of Macau, Macau, China

* corresponding author: peiwan@polyu.edu.hk

Abstract:

The particle size plays an important role in determining the mechanical behavior of sands. In this paper, the effect of particle size on the shear strength of sand in biaxial test is investigated using discrete element method (DEM). Firstly, the DEM parameters are calibrated against experimental results to obtain a good match of stress ratio-strain and void ratio-strain curves. Then a series of biaxial tests are conducted on two types of sands with different particle sizes to investigate the effect of particle size on the macro- and micro behaviors of sands. In addition, biaxial tests are also conducted with specimens with different particle shapes, including spherical particles with rolling resistance, triangular particles and elongated particles, to investigate the influence of particle shape on the particle size effect. The results demonstrate that: (1) in the biaxial test, the peak strength and dilation increase with the increase of the particle size; (2) under otherwise similar conditions, the ratio of shear band thickness and average particle size for coarse sand specimen is lower than that of fine sand; (3) the particle size effect becomes more pronounced in specimens consisting of particles with higher angularity.