

Displacement Fields in Footing-Sand Interactions under Cyclic Loading

Authors : S. Joseph Antony, Z. K. Jahanger

Abstract : Soils are subjected to cyclic loading in situ in situations such as during earthquakes and in the compaction of pavements. Investigations on the local scale measurement of the displacements of the grain and failure patterns within the soil bed under the cyclic loading conditions are rather limited. In this paper, using the digital particle image velocimetry (DPIV), local scale displacement fields of a dense sand medium interacting with a rigid footing are measured under the plane-strain condition for two commonly used types of cyclic loading, and the quasi-static loading condition for the purposes of comparison. From the displacement measurements of the grains, the failure envelopes of the sand media are also presented. The results show that, the ultimate cyclic bearing capacity (qultcyc) occurred corresponding to a relatively higher settlement value when compared with that of under the quasi-static loading. For the sand media under the cyclic loading conditions considered here, the displacement fields in the soil media occurred more widely in the horizontal direction and less deeper along the vertical direction when compared with that of under the quasi-static loading. The 'dead zone' in the sand grains beneath the footing is identified for all types of the loading conditions studied here. These grain-scale characteristics have implications on the resulting bulk bearing capacity of the sand media in footing-sand interaction problems.

Keywords : cyclic loading, DPIV, settlement, soil-structure interactions, strip footing

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