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Effect of Dynamic Loading by Cyclic Triaxial Tests on Sand Stabilized with Cement

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Abstract : Liquefaction of saturated soils due to dynamic loading is an important and interesting area in the field of geotechnical earthquake engineering. When the soil liquefies, the structures built on it develops uneven settlements thereby producing cracks in the structure and weakening the foundation. The 1964 Alaskan Good Friday earthquake, the 1989 San Francisco earthquake and 2011 Tōhoku earthquake are some of the examples of liquefaction occurred due to an earthquake. To mitigate the effect of liquefaction, several methods such use of stone columns, increasing the vertical stress, compaction and removal of liquefiable soil are practiced. Grouting is one of those methods used to increase the strength of the foundation and develop resistance to liquefaction of soil without affecting the superstructure. In the present study, an attempt has been made to investigate the undrained cyclic behavior of locally available soil, stabilized by cement to mitigate the seismically induced soil liquefaction. The specimens of 75mm diameter and 150mm height were reconstituted in the laboratory using water sedimentation technique. A series of strain-controlled cyclic triaxial tests were performed on saturated soil samples followed by consolidation. The effects of amplitude, confining pressure and relative density on the dynamic behavior of sand was studied for soil samples with varying cement content. The results obtained from the present study on loose specimens and medium dense specimens indicate that (i) the higher the relative density, the more will be the liquefaction resistance, (ii) with increase of effective confining pressure, a decrease in developing of excess pore water pressure during cyclic loading was observed and (iii) sand specimens treated with cement showed reduced excess pore pressures and increased liquefaction resistance suggesting it as one of the mitigation methods.

Keywords : cyclic triaxial test, liquefaction, soil-cement stabilization, pore pressure ratio
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