



Effect of cyclic stress ratio on the process of approaching to liquefaction in Anzali shore sand

[Amir Abbas . Mohammadi محمدی امیرعباس
[Abbas . Qadimi عباس قدیمی]

Key Words: *Shore sand, Liquefaction, Cyclic stress ratio, Triaxial test, Pore water pressure, Critical state*

Abstract

Shore sands are considered to be susceptible to liquefaction due to their fine and uniform grading. One of the most important factors affecting the liquefaction strength of sands is the cyclic stress ratio induced during seismic loading. A series of monotonic and cyclic triaxial tests were carried out on reconstituted samples of Anzali shore sand in order to study the effect of cyclic stress ratio on the process of pore water pressure generation until occurrence of liquefaction. The results were interpreted through critical state soil mechanics framework. It was found that the cyclic response of Anzali shore sand could be simplified as an exponential function of cyclic stress ratio in any given initial state.

Introduction

Liquefaction is the term commonly used to describe the sudden, intensive strength loss which usually occurs in sands during seismic loading. If a liquefiable soil is subjected to undrained cycling with sufficient intensity, the soil tendency to contraction will cause the pore water pressure to be continuously increased which results in continuous reduction of the effective stress. When the effective stress reaches zero value, the soil becomes totally powerless and liquefied. Occurrence of liquefaction during many of the earthquakes has caused significant damages to the structures constructed on the liquefiable soils. Extensive laboratory and field investigations have been performed on sandy soils to fundamentally study this phenomenon. These researches have generally shown that the finer sands having a uniform grain size distribution would be more liquefiable (e.g. [1-6]). Therefore, the shore sands are considered to be of great liquefaction potential due to their fine and uniform grading. Increasing of the constructing inshore and offshore structures such as residential and recreational facilities, ports, breakwaters, oil platforms, etc. proves the necessity to conduct practical studies on the liquefaction potential of shore sands and the factors affecting it.

One of the most important factors controlling that whether or not a site subjected to seismic loading will liquefy is the cyclic stress ratio induced during earthquake. Various researches have demonstrated the direct influence of cyclic stress ratio on the generation of pore water pressure during cycling (e.g. [7-9]). Qadimi [10] found the pore water pressure generation to be an exponential function of cyclic stress ratio in a carbonate sand. Shiri & Qadimi [11] and Rangchi Kordestani [12] also reported the same relationship for Anzali shore sand. But these works included only the early phases of soil response and did not cover the complete process of approaching to failure phase on which the concentration of the present work will be.