COMPARISON OF CYCLIC AND MONOTONIC BEHAVIOURS OF LOOSE CALCAREOUSE SAND USING HOLLOW CYLINDER TORSIONAL APPARATUS

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Calcareous sediments are located in temperate and tropical areas near offshore hydrocarbon industries and petrochemical reserves such as the Persian Gulf of Iran. These sediments have complicated physical properties which make them completely different from silicate soils. Carbonate sediments are mainly formed by the skeletal remains of marine organisms. Therefore, a wide variety of engineering properties can be found in these soils due to different locations and fauna that contribute to their formation. Therefore, it has been complicated to predict the geotechnical properties and mechanical behaviour of calcareous soils (Shahnazari et al., 2013).

In this study, a set of hollow cylinder torsional tests were performed on calcareous sand specimens to investigate the similarities and differences between the undrained monotonic and cyclic behaviours of calcareous sands. This is an important fact that the monotonic behaviour of a soil specimen can be used to interpret its cyclic behaviour. In this way, the Hollow Cylinder Apparatus (HCA) of Iran University of Science and Technology (IUST) was used to perform the cyclic and monotonic tests under torsional deviatoric loads. It is important to note that torsional deviatoric loads is more accurate and more appropriate for modelling the in-situ behaviour of soil specimens. In this study, the calcareous sand of Hormoz Island in the Persian Gulf is used as the testing soil materials. The particle grading curve of Hormoz sand which was used in this study is presented in Figure 1.

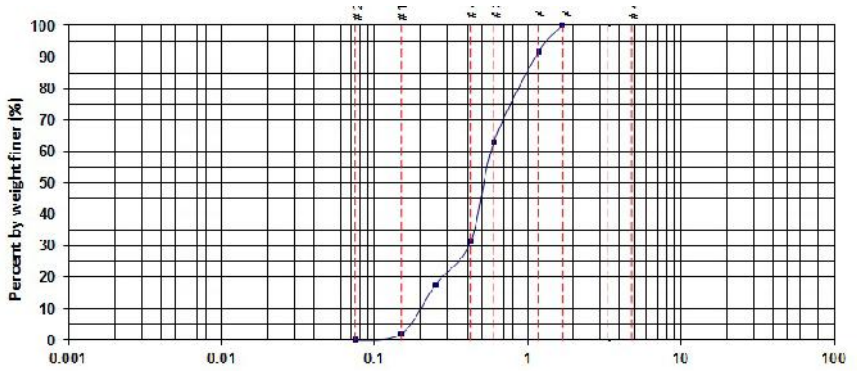

Figure 1. The particle gradation curve of Hormoz calcareous sand used in this study

The experiments of this study were constructed by the Dry Deposition method as described by Ishihara (1992). Table 1 presents the summary of the experiments initial properties.

Table 1. Summary of the undrained experiments on Hormoz Island calcareous sand

No.	Test Name	Confining Pressure	Loading Type	Dr (Before Cons.)	Dr (After Cons.)	B-value
1	T01-C160-Dr32-Mo	160	Monotonic	24.5%	30.8%	97%
2	T02-C160-Dr32-Cy-CSR0.25	160	Cyclic	98%	2.8	98%
3	T02-C160-Dr32-Cy-CSR0.25	160	Cyclic	97%	2.9	97%
4	T02-C160-Dr32-Cy-CSR0.25	160	Cyclic	99%	5.1	99%

The experiments results showed that the first cycle of cyclic tests has some similarities to its monotonic behaviour under same initial condition (i.e., same relative density, same confining pressure).

In addition, after passing the Phase Transformation Line (PTL), presentation of negative pore pressure during cyclic tests was completely obvious. The main reason of this fact is due to transformation of soil specimen from contractive behaviour to dilative behaviour. This fact has been concluded by previous researches (e.g., Shahnazari et al., 2014; Mao and Fahey, 2003). Figure 2 presents the stress path of loose calcareous sand of Hormoz under 160kPa confining pressure.

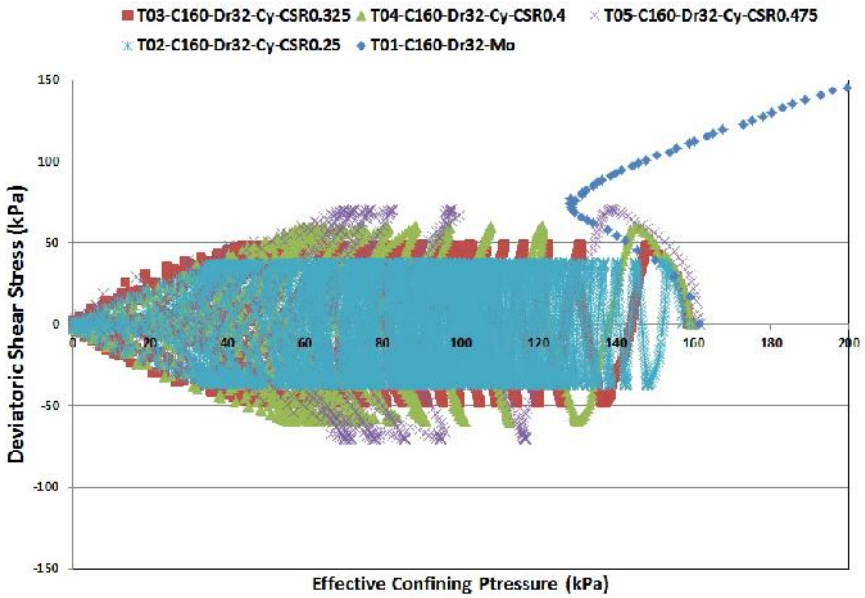

Figure 2. Stress path of cyclic and monotonic tests performed in this study

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