COMPARING THE SHEAR STIFFNESS OF CALCAREOUS AND SILICATE SANDS UNDER DYNAMIC AND CYCLIC STRAINING

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The shear stiffness (G) of granular soils is a key parameter in major geotechnical applications involving deep excavations and tunnels, liquefaction evaluation, soil-structure interaction, or earthquake ground response analysis. The shear stiffness of silicate soils under different conditions has been investigated by many geotechnical researchers (Jafarian et al., 2014; Zhang et al., 2005).

Calcareous sediments are located in temperate and tropical areas and cover approximately 40% of the ocean surface. The skeletal remains of marine organisms mainly form this type of sediments. Therefore, a wide variety of engineering properties can be found in these soils due to different locations and fauna that contribute to their formation. Origination of calcareous soils from processes and minerals different than those known for the silicate soils clarifiesthe necessity for comprehensive research on geotechnical properties of such soils. Shahnazari and Rezvani (2013) studied on the effects of different parameters on the particle breakage of calcareous sands. Cyclic simple shear behavior of calcareous sand from Hawaiian Islands at strain levels between 0.05 and 1% were investigated by Brandes (2011).

In the current study, shear stiffness of Hormoz calcareous and (from northern coast of the Persian Gulf) and Babolsar silicate sand (from southern coast of the Caspian Sea) were measures and compared. This parameter was calculated at small and large strains using resonant column and cyclic triaxial tests. The grain size distribution of the tested sands were synthetically attained with an identical curve, as shown in Figure 1. The soilsare classified as poorly graded sand (SP) according to the USCS (ASTM D2487).

The values of shear stiffness (G) in resonant column and cyclic triaxial tests were obtained using equations 1 and 2, respectively.

$$G = \rho . V_s^2 \tag{1}$$

$$G = \frac{\tau}{\gamma} \tag{2}$$

where, ρ is the mass density, V_s is the shear wave velocity, τ is the shear stress, and γ is the shear strain.

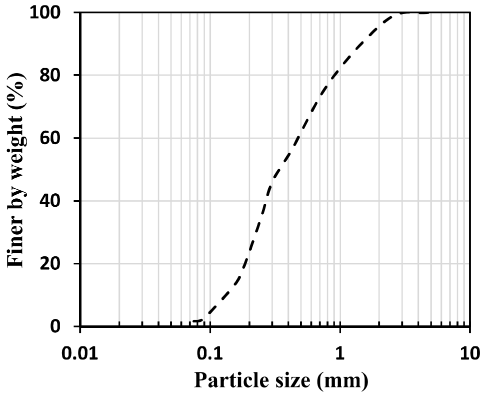

Figure 1.The identical particle size distribution of the tested sands

The shear stiffness curves of the Hormozcalcareous and Babolsar silicate sands are shown in Figure 2. The tests results as shown in Figure 2, clearly show that the shear stiffness (G) decreases with increase in shear strain amplitude (γ_a), as expected. Moreover, the shear stiffness of tested soils increases with increase of mean effective confining pressure (P'_0).

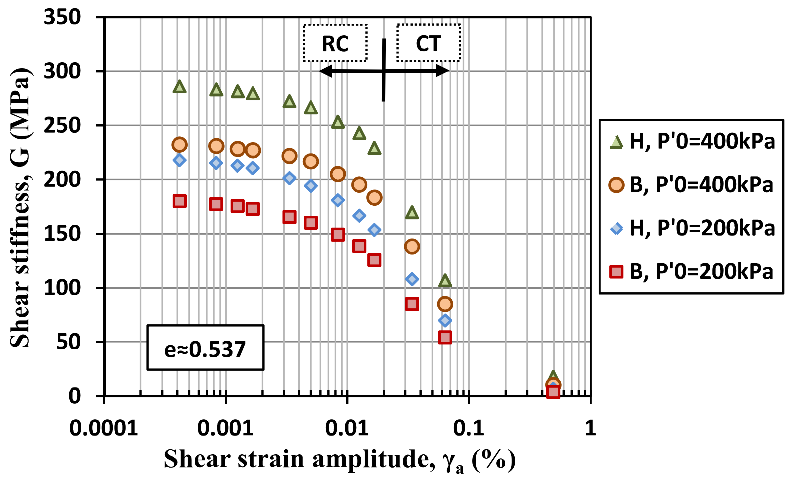

Figure 2.The effect of mean confining pressure on the shear stiffness curves (H: Hormozcalcareous sand, B: Babolsar silicate sand, RC: resonant column test, CT: cyclic triaxial test)

As seen in Figure 2, the shear stiffness of Hormozcalcareous sand is higher than that of the Babolsar silicate sand under the identical conditions. The observed difference in the G-reduction curves reveals importance of mineralogy and soil origin in the dynamic properties of soils. However, this fact is commonly ignored in the practice.

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