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The Effect of Shredded Polyurethane Foams on Shear Modulus and Damping Ratio of Sand

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Abstract : The undesirable impact of vibrations induced by road and railway traffic is an important concern in modern world. These vibrations are transmitted through soil and cause disturbances to the residence area and high-tech production facilities alongside the train/traffic lines. In this paper for the first time a new method of soil improvement with vibration absorber material, is used to increase the damping factor, in other word, to reduce the ability of wave transitions in sand. In this study standard Firoozkooh No. 161 sand is used as the host sand. The semi rigid polyurethane (PU) foam which used in this research is one of the common materials for vibration absorbing purposes. Series of cyclic triaxial tests were conducted on remolded samples with identical relative density of 70% of maximum dry density for different volume percentage of shredded PU foam. The frequency of tests was 0.1 Htz with shear strain of 0.37% and 0.75% and also the effective confining pressures during the tests were 100 kPa and 350 kPa. In order to find out the best soil-PU foam mixture, different volume percent of PU foam varying from 10% to 30% were examined. The results show that adding PU foam up to 20%, as its optimum content, causes notable enhancement in damping ratio for both shear strains of 0.37% (52.19% and 69% increase for effective confining pressures of 100 kPa and 350 kPa, respectively) and 0.75% (59.56% and 59.11% increase for effective confining pressures of 100 kPa and 350 kPa, respectively). The results related to shear modulus present significant reduction for both shear strains of 0.37% (82.22% and 56.03% decrease for effective confining pressures of 100 kPa and 350 kPa, respectively) and 0.75% (89.32% and 39.9% decrease for effective confining pressures of 100 kPa and 350 kPa, respectively). In conclusion, shredded PU foams effectively affect the dynamic properties of sand and act as vibration absorber in soil.

Keywords : polyurethane foam, sand, damping ratio, shear modulus
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