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Experimental Determination of Shear Strength Properties of Lightweight Expanded Clay Aggregates Using Direct Shear and Triaxial Tests

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Abstract : Artificial lightweight aggregates have a wide range of applications in industry and engineering. Nowadays, the usage of this material in geotechnical activities, especially as backfill in retaining walls has been growing due to the specific characteristics which make it a competent alternative to the conventional geotechnical materials. In practice, a material with lower weight but higher shear strength parameters would be ideal as backfill behind retaining walls because of the important roles that these parameters play in decreasing the overall active lateral earth pressure. In this study, two types of Light Expanded Clay Aggregates (LECA) produced in the Leca factory are investigated. LECA is made in a rotary kiln by heating natural clay at different temperatures up to 1200 °C making quasi-spherical aggregates with different sizes ranged from 0 to 25 mm. The loose bulk density of these aggregates is between 300 and 700 kN/m³. The purpose of this research is to determine the stress-strain behavior, shear strength parameters, and the energy absorption of LECA materials. Direct shear tests were conducted at five normal stresses of 25, 50, 75, 100, and 200 kPa. In addition, conventional triaxial compression tests were operated at confining pressures of 50, 100, and 200 kPa to examine stress-strain behavior. The experimental results show a high internal angle of friction and even a considerable amount of nominal cohesion despite the granular structure of LECA. These desirable properties along with the intrinsic low density of these aggregates make LECA as a very proper material in geotechnical applications. Furthermore, the results demonstrate that lightweight aggregates may have high energy absorption that is excellent alternative material in seismic isolations.

Keywords : expanded clay, direct shear test, triaxial test, shear properties, energy absorption
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