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"Gheorghe Asachi" Technical University of Iasi, Romania

DIRECT SHEAR PROPERTIES OF LIGHTLY CEMENTED SOIL – POLYSTYRENE BACKFILL MATERIAL

Felix Okonta

Department of Civil Engineering Science, University of Johannesburg, P O Box 524, Auckland Park, 2006, Johannesburg, South Africa, E-mail: fnokonta@uj.ac.za, Phone +27115592318, Fax +27115592343

Abstract

Geocomposite materials consisting of lightly cemented mixtures of expanded polystyrene beads (EPS) and backfill soils are commonly used as fillers and for the construction of light weight embankments. The constant normal stress (CNS) and constant volume (CV) direct shear parameters as well as the relationship between gradation properties of four residual granular backfill soils and direct shear parameters of lightly cemented mixture of EPS and backfill soils was evaluated. The maximum density and optimum moisture content of the backfill materials ranged from 1850 kg/m^3 to 1730 kg/m^3 and 9% to 13% respectively. The addition of 1.5% of EPS per mass of dry soil resulted in maximum density and optimum moisture content of the blended specimens of backfills soils and EPS that varied from 1303 kg/m^3 to 1368kg/m^3 and 7% to 9%. For the range of normal stress used, the CNS friction angles of the four light weight composites were greater than the CV friction angles due to changes in initial normal stress and pore water pressure. Results from series of CNS tests show that both the vertical strain induced by consolidation normal stress and the shear induced vertical displacement for consolidation normal stress of 200 kPa and 400 kPa were significantly greater than the magnitudes induced by normal stress of 50 kPa and 100 kPa, due to reduction in bond strength during consolidation. The relationship between friction coefficients of the composites derived from CNS and CV test data and the uniformity coefficient of the backfill soils was non linear and dependent on the ratio of the sand to the gravel fractions. A practical implication of the two modes of tests is that for a composite material to mobilize the same magnitude of CNS friction angle under constant volume condition, a change in soil particle constitution is required. Both CNS and CV shear parameters should be considered in the design of retaining wall and embankments exposed to poor drainage conditions.

Key words: backfills, expanded polystyrene, friction coefficient, shear strength, texture

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