ALTERNATIVE BACKFILL MATERIALS FOR GEOSYNTHETICALLY REINFORCED MSE WALL

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ABSTRACT: This study aims to facilitate the use of Recycled Concrete Aggregate (RCA) and Recycled Asphalt Pavement (RAP) in lieu of natural aggregates as alternative backfill for Mechanically Stabilized Earth (MSE) walls. Although several studies on RCA and RAP have been conducted for use in roadway construction applications, only a few studies have been conducted to evaluate RCA and RAP for specific use as MSE wall backfill. The selection of RCA, RAP and Geosynthetic reinforcements considered costs and environmental benefits. The use of RCA and RAP as backfill can reduce the costs associated with mining and transportation of natural aggregates, which can dominate the total cost of a MSE wall. In addition, the disposal of RCA and RAP into landfills is costly and can pose environmental risks to air and groundwater alike. The suitability of RCA and RAP as backfill for geosynthetically reinforced MSE walls is investigated in this study. Mechanical interaction between these recycled aggregates with four types of geosynthetic will be presented. The index and mechanical properties of RCA and RAP also were measured. Interface shear resistance between geosynthetics and the recycled materials was measured using a pullout table and a large-scale direct shear machine. Two types of geotextiles (woven and non-woven) and 2 types of geogrids (uniaxial and biaxial) were used. The interface friction angle between RCA, RAP and each of the four selected geosynthetics were evaluated by large-scale interface direct shear test. RCA samples were compacted at 22°C while RAP samples at 22°, 35° and 50°C. All tests were performed at normal pressures of 50, 100 and 200 kPa. A displacement rate of 1 mm/min and the total test travel distance of 50 mm were used. Pullout tests were performed on RCA and RAP samples reinforced with woven geotextile and uniaxial geogrid. Normal stresses of 20, 30, 50, 100 and 200 kPa were applied. A pullout displacement rate of 1.0 mm/minute was used as well during a total travel of 100 mm. A large scale triaxial test apparatus was used to evaluate the angles of friction of RCA and RAP. The results of the triaxial tests allowed the internal friction angle and apparent cohesion of RCA and RAP. These values were used in the calculation of pullout capacity tested. The pullout capacity is used to measure the length of the reinforcement used in different sections of the wall. The results indicate that RCA and RAP can be used in geotechnical construction. Internal friction angle (Φ') and cohesion (c') obtained from RCA was 48º and 78 kPa; and from RAP was 29.2º and 25 kPa. Interface friction angle (δ) of RCA generally range between 18º and 36º, and of RAP between 17º and 40º, with efficiency factor (E_ϕ) between 0.30 to 0.62; 0.56 and 1.50 for RCA and RAP respectively. Interaction coefficients (C_i) from the pullout test ranged between 0.13 and 0.52 for RCA and between 0.11 and 0.32 for RAP.

KEYWORDS: MSE WALL; GEOSYNTHETIC; ALTERNATIVE BACKFILL.