Compression Behavior of Synthetic Lightweight Aggregates

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ABSTRACT

This paper presents the compression properties of a synthetic lightweight aggregate (SLAs) made of fly ash and mixed plastics. SLAs are manufactured through a thermal-mechanical process that, under heat and pressure, mixes and extrudes the plastic and fly ash into a solid die that is granulated to create various size particles resembling natural sand and gravel. In this paper compression properties are presented for SLAs made with a mixture of plastics and high carbon coal fly ash, two waste streams with little to no value. Aggregate fly ash-to-plastic ratio, by weight, was 80:20 with fly ash carbon content ranging from 15% to 30%. A series of one-dimensional compression tests, at moderate and elevated stresses, were performed on SLAs with their behavior compared with traditional aggregates of normal-weight sand and expanded clay/shale lightweight aggregate. All tests were conducted on specimens with similar initial grain size distributions. The results shows that SLAs have relatively substantial elastic deformation compared to the traditional aggregates but also exhibit substantial rebound upon unloading. However, at elevated stresses, the rate of secondary compression for both the SLAs and sand approach similar values, with the SLAs actually exhibiting a slowing rate (i.e., stiffening) of secondary compression. Overall, the compression results show that SLAs will have advantages (e.g., lightweight, stiffening with age) and disadvantages (e.g., large elastic deformation) over the use of traditional granular materials.

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