

Suitability of conventional ballast mixed with concrete debris and bottom ash waste

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ABSTRACT

The use of waste materials as a substitute for natural aggregate has been widely tested in all areas of the construction industry. Yet, there is a lack of study on the suitability of the physical properties of waste material when used as one of the components in track ballast. This study evaluates the suitability of conventional ballast (CB) incorporated with concrete debris (CD) and bottom ash (BA) as track ballast material. To achieve the objective, sieve analysis, shape analysis, specific gravity test, water absorption test, and permeability test were carried out. Furthermore, microscopic analysis was used to validate the presence of voids. The result shows that the waste mixed ballast has a coefficient of uniformity (C_u) in the range of 1.92 to 12, a coefficient of curvature (C_c) in the range of 0.8 to 1.18, fines less than 14 mm account for 0.1 % to 28 %, and the mean size is in the range of 22.5 mm to 27.5 mm. Furthermore, the flakiness ranged from 7.56% to 22.5%, the void ratio was 0.43 to 0.55, and water absorption was 2.86% to 4%. The specific gravity was found to range from 2.30 to 2.77 when the permeability measurement was in between 30 cm/sec to 61 cm/sec. All these promising values of engineering properties exhibit the confidence of a suitable alternative to track ballast materials. Hence, CD and BA waste materials incorporated into conventional ballast have a high potential to exhibit better performance and reduce the dependency on natural aggregate.

KEYWORDS

Alternative materials; Bottom Ash; Concrete Debris; Conventional Ballast; Flakiness; Gradation; Permeability; Void Ratio

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