

USE OF FGD MATERIAL AND PONDED CLASS F CCPS IN READY-MIXED CONCRETE

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ABSTRACT

This paper presents the results of experimental investigations carried out to study the effects of FGD material and ponded Class F CCPs (coarse Class F ash) on the properties of non-air-entrained and air-entrained concrete. A FGD material is defined as the ash derived from thermal power plants using clean-coal technologies such as SO₂ Control Systems, NO_x Control Technology, Fluidized Bed Combustion, and Gasification Combined Cycle for reducing SO_x and NO_x. FGD material is generally obtained by combustion of high-sulfur coal. Ponded ash is usually a mixture of fly ash and bottom ash or boiler slag. Concrete was made and tested in laboratory as well as at a ready-mixed concrete plant. A total of nine concrete mixtures were produced: three non-air-entrained concrete mixtures, three non-air-entrained concrete mixtures with HRWRA, and three air-entrained concrete mixtures. Percentage of FGD material varied from 22 to 45 % of the total cementitious (cement and FGD material) materials in non-air-entrained concrete and 17 to 27 % in the air-entrained concrete. All concrete mixtures also contained ponded, coarse Class F ash, as a replacement of up to 6 % of aggregates. Control mixture of non-air-entrained concrete and non-air-entrained concrete with HRWRA were proportioned to attain 28-day compressive strength of 35 MPa. Control mixture of air-entrained concrete was proportioned to achieve compressive strength of 28 MPa at 28 days. Tests were performed for fresh concrete properties, and also for compressive strength, splitting tensile strength, flexural strength, and abrasion resistance. For air-entrained concrete mixtures, salt-scaling test was also conducted.

Based on the tests results it was concluded that: (1) non-air-entrained concrete mixtures can successfully incorporate up to 22 % FGD material and a blend of 34 % FGD material and 6 % coarse Class F ash; (2) FGD material up to 45 % and 6 % of coarse Class F ash can also be used in non-air-entrained concrete mixtures using HRWRA for general concrete construction; and, (3) air-entrained concrete mixtures incorporating up to 17 % FGD material and blends of 27 % FGD material and 5% coarse Class F ash can also be used for general concrete construction.