

Potential use of Fly Ash as Partial Replacement of Cement in Concrete

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Abstract - The aim of this research is to investigate the effect of fly ash, used as partial replacement to cement CEM I 42.5N, on the properties of fresh and hardened concrete. Fly ash, acquired from a local Thermal Energy Operations industry, based on the island of Mauritius is used to prepare various trial mixes namely FA5, FA10, FA15, FA20, FA25, FA30, FA40 and FA50 with partial replacement of cement by 5%, 10%, 15%, 20%, 25%, 30%, 40% and 50% of fly ash respectively. The behaviour and strength properties of the samples have been compared to an equivalent mix of plain cement concrete – FA0. At first the tests have been performed on mortar specimens to establish the optimum amount of fly ash which yields maximum compressive strength. As such, samples are prepared from 9 different mixes by substituting only cement by Fly Ash, keeping the total amount of binder constant. The cement, fly Ash, sand and water are mixed together in compliance with prevailing standards - EN 196-1. Mortar samples are cured and matured at 20°C. Results show that 15% fly ash replacement of cement yields a maximum compressive strength of 42.5 MPa equating to CEM II 42.5 equivalent strength. Fly Ash with LOI 5% is then used to prepare concrete samples. Concrete of grade 25 has been selected for testing activities to comply with its high demand in Mauritius, i.e. 60% of the local market. Tests are performed on cubes for each trial mix to determine the compressive and flexural strengths respectively after 2, 7 and 28 days. Compressive and Flexural strengths are found to vary in the range of 10.3 – 33.1 MPa and 0 – 9 MPa respectively for the said grade 25 concrete containing 263.5 Kg of cement and 46.5 Kg of fly ash per m³ of concrete.

Keywords: Fly Ash, Carbon Burn Out, Mortar, LOI, Cogeneration, Compressive and Flexural Strengths.