

PERMEABILITY OF CONCRETE INCORPORATING LARGE QUANTITIES OF FLY ASH

By Tarun Naik, Shiw Singh and M. Hossain

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ABSTRACT

This research was undertaken to evaluate permeability of concrete made with high volumes of class C fly ash. In order to accomplish it, two series of tests were planned. For the first series of tests (Series A), concrete mixes were proportioned to have cement replacement with one source of Class C fly ash in the range of 0-70% by weight, whereas for the second series (Series B) of tests concrete mixtures were made with several fly ashes for replacing cement in the range of 35 to 55% by weight. This report includes extensive review of the previous investigations and the experimental results for the first series of tests only. Air entrained concrete mixtures were designed to have the 28-day compressive strength of 6000 psi (41 MPa). For each concrete mixture, compressive strength, water permeability, air permeability, and chloride ion permeability were determined. Air and water permeability were evaluated by using the Figg method. Chloride ion permeability was measured in accordance with ASTM C 1202.

In general, addition of Class C fly ash increased compressive strength of concrete up to a certain level of cement replacement (about 30%), beyond which strength decreased significantly. However, up to 50% cement replacement with fly ash concrete exhibited adequate strength appropriate for structural applications.

At early ages, air permeability of concrete was slightly increased with fly ash addition. At 91 days, the lowest permeability was obtained for concrete proportioned to replace 50% cement with fly ash. All concrete mixtures showed fair resistance to water permeability at ages up to 40 days. At 91 days, the best performance was obtained for the 50% fly ash concrete mixture.

In this work, all mixes except the 70% fly ash mixture attained moderate chloride permeability per ASTM C 1202 criteria. Again, the 50% fly ash mixture showed the best results with respect to chloride permeability. The 70% fly ash mixture showed higher resistance to penetration of chloride ions than the reference concrete mixture without fly ash.