# PERMEABILITY OF HIGH-STRENGTH CONCRETE CONTAINING LOW CEMENT FACTOR

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ABSTRACT

Coal burning power plants generate about 80 million tons of combustion by-products per year in the United States. Each ton of by-products used in lieu of portland cement in concrete saves about 6.5 million BTU of energy, and prevents one ton of CO2 released in the air due to avoided cement manufacture. This specific project was directed toward studying the influence of ASTM Class C fly ash on concrete permeability. A plain portland cement concrete mixture was proportioned to have a 28-day compressive strength of 40 MPa. Concrete mixtures were also proportioned to have cement replacement with Class C fly ash in the range of 0-70% by weight. Each concrete mixture was tested for compressive strength, air permeability, water permeability, and chloride ion permeability. Air and water permeabilities were evaluated by using the Figg method. Chloride ion permeability was measured in accordance with ASTM C 1202. Air permeability of plain portland cement concrete was lower than that for concrete containing fly ash at the age of 14 and 28 days. At the age of 91 days, the 55% fly ash mixture exhibited the highest resistance to air permeability. All the concrete mixtures showed "fair" resistance to water permeability at ages up to about 40 days. The maximum resistance to water permeability was observed for the 35% fly ash mixture at ages of 28 and 91 days. At the two-month age, chloride ion permeability of all mixtures except the 74% fly ash mixture were rated as "moderate" to "very low" in accordance with ASTM C 1202 criteria. When duration of curing was increased to three months, the fly ash concrete mixtures with FA to cementitious materials in the range of 18 - 55% showed lower chloride ion permeability than the concrete without fly ash. The same trend was observed at the age of one year.