

Permeability and mechanical properties of binary and ternary cementitious mixtures

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Abstract. Today, pozzolans are widely used in construction for various reasons such as technical and economic efficiency. In this research, in order to evaluate some of important properties of concrete, silica fume and fly ash have been used as a replacement for cement in different mass percentages. Concrete mixtures were made from a water-cement ratio of (0.45) and cured under similar conditions. The main focus of this study was to evaluate the permeability and mechanical properties of concrete made from binary and ternary cementitious mixtures of fly ash and silica fume. In this study permeability of concrete was studied by evaluating the sorptivity, water absorption, water penetration depth, electrical resistivity and rapid chloride permeability (RCP) tests. Mechanical properties of concrete were evaluated with compressive strength, splitting tensile strength and modulus of elasticity. Scanning electronic microscopy (SEM) was used to characterize the effects of silica fume and fly ash on the pore structure and morphology of concrete with cement based matrix. The results indicated that the incorporation of silica fume and fly ash increased the mechanical strength and improved the permeability of concrete.

Keywords: silica fume; fly ash; permeability; mechanical strength; SEM

1. Introduction

Concrete is a construction composite consisting of aggregate and cementitious binder which is widely used in variety of constructions. Strength and durability are the most important criteria in concrete. Nowadays using additives (mainly pozzolans) as replacement for a part of cement in production of concrete, to enhance its technical and economic efficiency, has become inevitable. Since permeability and shrinkage are key features of concrete in evaluating its long-term behavior and have a close correlation with its durability, use of mineral additives and pozzolanic industrial wastes in order to improve the long-term performance and increase the strength of concrete, has been a subject for experts in this field of research which has led to the wide application of some of

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