

JUST THE FACTS

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SPR

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Evaluation of Ternary Cementitious Combinations**PROBLEM**

Many entities currently use fly ash, slag, and other supplementary cementitious materials (SCMs) in Portland cement concrete (PCC) pavement and structures. Although the body of knowledge is limited, several states are currently using ternary cementitious combinations for structures and pavements. Increased use of SCMs will not only reduce the cost of PCC pavement and structures, it will also reduce the carbon footprint by utilizing byproducts of other industries. This project will investigate the use of potential ternary mixtures incorporating various combinations and replacement levels of SCM and their respective performance.

From information cited by the American Concrete Institute (ACI) and others, there is general agreement that the use of SCMs is associated with these effects on concrete: improved workability and finish ability, strength gain, decreased temperature rise in mass concrete, reduced permeability in mature concrete, improved resistance to sulfate and chloride attack, increased freeze thaw resistance, increased modulus of elasticity, resistance to de-icing salts, resistance to corrosion of reinforcing steel, increased time of setting, and unpredictable change in time between initial and final set.

OBJECTIVES

The objectives of this research are to characterize the fresh and hardened concrete characteristics of possible ternary combinations. From these results, ternary combinations can be specified and applications can be developed.

METHODOLOGY

The supplementary cementitious materials to be used are one source of class C fly ash, class F fly ash, and grade 100 and grade 120 ground granulated blast furnace slag. Each material will be tested according to their respective American Society for Testing and Materials (ASTM) standards.

For the concrete study, the fresh concrete tests will include slump, air, unit weight, and set time. Hardened concrete tests will include compressive strength at 7, 28, and 56 days; flexural strength at 7 and 28 days; and rapid chloride permeability at 56 days. Each mixture will be produced and cured at 70°F.

**SPECIAL POINTS
OF INTEREST:**

- Problem Addressed
- Objectives of Research
- Methodology Used
- Implementation Potential



Figure 1

Portland cement, grade 120 slag, silica fume, and class C fly ash

IMPLEMENTATION POTENTIAL

It is foreseen that the results of this study will greatly assist in determining whether or not to allow the use of ternary cementitious combinations. The results of this research are anticipated to be applied to all classes of concrete including pavement, structural, and concrete for other applications such as precast concrete and drilled shafts. It is envisioned that incorporating ternary cementitious combinations will benefit the state economically by having an equal or superior concrete product that is less expensive to produce.