FACT SHEET

New Concrete Mixtures Turn Waste into Quality Roads

February 2012

WHAT WAS THE 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.

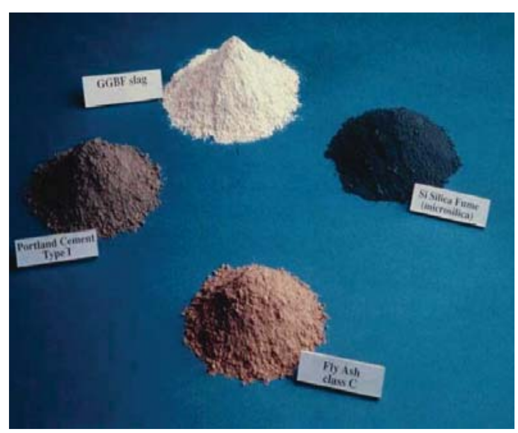
WHAT WAS DONE?

Researchers investigated the use of potential ternary mixtures incorporating various combinations and replacement levels of SCM and their respective performance. A factorial was developed consisting of 33 combinations of class C fly ash, class F fly ash, and grade 100 and grade 120 ground granulated blast furnace slag. For the concrete study, the fresh concrete tests included slump, air, unit weight, and set time. Hardened concrete tests included compressive strength at 7, 28, and 56 days; flexural strength at 7 and 28 days; and rapid chloride permeability at 56 days.

WHY SHOULD YOU DO IT?

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.

The LTRC study indicated that cement mixtures containing up to 70% fly ash and slag exhibit concrete test results that are comparable (or better) than those obtained from control mixtures containing no supplemental cementitious materials.



WHAT ARE POTENTIAL FISCAL IMPACTS?

Cost-benefit analyses indicate potential material cost savings around $25,000 per lane-mile when replacing 70% Portland cement with fly ash and slag. In bid year 2007-2008, 191 lane-miles of concrete pavement were let for construction. Replacement of 70% Portland cement with fly ash and slag on that quantity of pavement leads to a material cost savings near $4.8 million.

Another benefit of replacing Portland cement with fly ash and slag is a reduced carbon footprint during production of the cementitious material. Production for each ton of Portland cement for concrete pavement emits 0.92 tons of carbon dioxide. As byproducts of other industries, emissions due to production of fly ash and slag are negligible from the viewpoint of concrete pavement construction.

RESEARCH PROJECT TITLE
Evaluation of Ternary Cementitious Combinations

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MORE INFORMATION
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