

LOW-COST, HIGH-PERFORMANCE MATERIALS USING ILLINOIS COAL COMBUSTION BY-PRODUCTS

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ABSTRACT

This project was proposed to provide a practical solution to disposal problems for Illinois coal combustion products. The entire project work was organized in three phases, each phase lasting one year. Phase I work was directed toward optimizing mixture proportions for ready-mixed concrete and masonry products containing Illinois coal ash through lab investigation during the year 1994-1995. In Phase I, a number of candidate mixtures for concrete, bricks, blocks, and paving stones were established based on strength and durability performance data. In Phase II (1996-1997), mixtures selected from Phase I were field manufactured and evaluated to establish optimum concrete mixture proportions containing Class F fly ash. This Phase III, 1999-2000, emphasizes the utilization of clean coal ash and blends of clean coal ash materials with Class F fly ash from Illinois in production of concrete and cast-concrete products.

A total of three non-air entrained, three non-air entrained with a high-range water reducing admixture, and three air entrained concrete mixtures were manufactured at the facilities of the United Ready-Mix, Inc., Peoria, IL. One mixture of each type of concrete was a control mixture without fly ash and the remaining mixtures contained fly ash up to a maximum of 35% of clean coal ash based upon total cementitious materials and 5% by weight Class F fly ash as a partial replacement of fine and coarse aggregates. Concrete mixtures are being evaluated for strength and durability related properties. Additional tests are in progress for compressive strength, splitting tensile strength, flexural strength, and drying shrinkage. A total of 10 cast-concrete product mixtures consisting of five 8-in. hollow-core block mixtures, and five 2-in. solid paving stone mixtures were manufactured at the facilities of Crumb-Colton Block Company, Rockford, IL. Block mixtures contained up to a maximum of 45% clean coal fly ash based upon total cementitious materials, and 8% by weight of Class F fly ash as a partial replacement of fine and coarse aggregates. Paving stone mixtures contained up to a maximum of 44% clean coal fly ash based upon total cementitious materials, and 7% by weight Class F fly ash of fine and coarse aggregates. The block and paving stone mixtures are being tested and evaluated for compressive strength, absorption, and density.