

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

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## ABSTRACT

The major objective of this investigation was to develop technology for high-volume applications of Illinois coal combustion by-products generated by using both conventional and clean coal technologies. This project was primarily directed toward developing concrete and masonry products incorporating large amounts of coal ashes generated from combustion of Illinois coals.

Fifteen coal ash samples were obtained from eight different sources burning Illinois coals to represent a spectrum of Illinois coal ashes. These ashes were tested and evaluated for their physical, chemical, mineralogical, and microstructural properties. A clean coal ash is defined as the ash derived from SO<sub>2</sub> control technologies. Based on these properties, two sources of both conventional and clean coal ashes were selected for further investigation. Two additional ash samples were prepared by blending these selected conventional and clean coal ashes. Using these six different ash samples, nineteen concrete mixtures and eleven masonry mixtures were proportioned for initial testing and evaluation. These concrete mixtures were tested for compressive and splitting tensile strengths at various ages from 3 to 28 days, and the masonry mixtures were tested for compressive strength at 7 and 28 days using applicable ASTM standards. The results showed that concrete and masonry products can be manufactured using large amounts of conventional and clean coal ashes, as well as blended ashes.

Based on the results obtained from the initial testing, twenty-seven additional concrete mixtures and twenty-one additional masonry mixtures were proportioned. Strength and durability testing of the final mixtures for concrete and masonry products revealed that these products can be manufactured having cement replacement with Illinois coal ashes and their blends in the range of 0 to 60 percent. Long-term strength and durability data are being collected. Based on results obtained in this investigation, several mixtures for manufacture of concrete and masonry products are recommended. These new Illinois coal ash-based concrete products need further field-testing and evaluations before their commercialization can start.