

Optimization of Fly Ash in Concrete: High Lime Fly Ash as a Replacement for Cement and Filler Material

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This research paper describes preliminary results from work that seeks to optimize the benefits of using high-lime fly ash in concrete as a replacement for large proportions of cement and fine aggregates.

High-lime fly ash is a type of sub-bituminous fly ash that is self-cementing as well as pozzolanic in nature. Many high-lime fly ashes would be categorized as ASTM Class C; the ash considered in this work has a sulfur content of approximately 6% which just exceeds the limit on sulfur set by ASTM for ash used in concrete. One goal of this project is to verify that ashes with slightly elevated sulfur levels can still produce strong, durable concretes. The physical and chemical properties of high-lime fly ash, namely the coarser particles and low carbon content, will affect both the air content and water demand of the concrete; parameters that greatly affect the durability and strength of concrete. Determining proper mix proportions could eliminate or minimize the need for an activator and/ or air entraining agents.

High-lime fly ash obtained from Colorado's coal industries will be used in the concrete tests. Varying amounts of fly ash will be used in given mixes of concrete as a partial replacement of the cement (binder) and fine aggregate (filler). Several design mixes will be prepared, cured and tested. This paper presents results for compressive strength. Future work will consider bond strengths and durability (freeze thaw) properties. Each sample will be tested at 3, 7, 14, 28 and 56 days. The results will be analyzed and compared with standard concrete and conclusions made on how best the fly ash can be utilized to give optimum results.

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