

Use of Fly Ash to Enhance Sulfate Resistance of Concrete

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ABSTRACT

This paper presents an overview of the benefits of using fly ash to resist sulfates in soils and the water/ waste water market. It considers the usefulness of current fly ash concrete technology and prevention techniques, and advances new approaches for making concrete resist the deleterious effects of sulfates.

The cement and concrete industry is the third largest global industry in the world. The deleterious effects of sulfates have plagued the concrete industry from conception. US has recognized that its water and wastewater infrastructure is facing structural distress due to sulfates along with a lack of capacity to keep up with the growing population.

Sulfate attack in concrete is a complex science that includes both a chemical and physical process. Sulfate damage typically appears in the form of hairline cracks called “etching”, or white, powdery stains referred to as “efflorescence.” The process decreases the durability of concrete by changing the chemical and micro structural nature of the cement paste, and the mechanical properties of concrete. Depending on conditions of use, severity of sulfate exposure, and environmental factors, the defense against sulfate attack can include low-permeability concrete (primary defense), use of sulfate-resisting cementitious materials, and proper processing. Use of fly ash in concrete can be a reliable mitigation tool for sulfate attack. With the recent onset of ternary mixes, researchers are finding the durability and permeability of concrete can be enhanced far beyond current strategies.

With literally a trillion dollars being estimated to maintain and build new water/waste water plants in the next twenty years, a great deal of attention will be drawn to this market. Special consideration will go to preventing or minimizing sulfate attack on concrete and reducing any negative environmental impact. With over 76 million tons of CCPs disposed of in land fills annually and the growing issues in the water/waster water market, there appears to be a natural synergy between the industries.

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