ACON PRODUCTS

Technical Memo 101-am, Alpha Mix

Setting and hardening of portland cement is the result of hydration reactions occurring between the cement compounds and mix water. However, initially, upon commencement of portland cement concrete batching, following the addition of mix water, a hydrolysis reaction occurs. Due to the hydrolysis reaction, parts of the tricalcium and dicalcium silicate molecules are split off, in effect lowering potency of the portland cement, through dilution. Alpha Mix is designed to minimize or eliminate this loss of potency in portland cement during hydrolysis. Immediately following, or maybe accompanying hydrolysis, hydration begins, resulting in the formation of gel and crystalline products that are capable of binding the inert particles of the aggregate, which include dry cement particle cores, into a coherent mass. However, all the mix water, added to portland cement concrete isn't used in cement hydration. Part of this mix water is needed to make concrete workable. Assuming no water reducers are involved, it takes 5 gallons of mix water to fully hydrate 100 lbs of cement (water-cement ratio of .042). Only approximately 2.88 gallons of this 5 gallons of mix water added to Portland cement concrete, actually chemically combines with the cement. The other 2.12 gallons of mix water is held in the pores of cement hydration products (calcium silicate hydrate). Any additional water above the 5 gallons, per 100 lbs of portland cement creates capillary voids in the concrete that decrease strength and increase permeability.

The water-filled space in fresh mixed cement and mix water is space that's available for formation of the cement hydration products. These hydration products have a volume larger than the original unhydrated cement particles, so as hydration proceeds, the volume of mix-water-filled space decreases. Remnants of the original mix water form a network of capillary voids in the hardened cement paste. These voids are initially interconnected, but if the water-cement ratio is less than 0.70, they become discontinuous during the curing process. If the water-cement ratio is low enough (around 0.42) and the cement paste cures long enough, hydration products fill all of the space, and there are no capillary voids. The only water then remaining in the concrete is combined chemically with the cement or held within the calcium silicate hydrate structure. Concrete with no capillary voids has a high strength and low permeability. Alpha Mix solution contains ingredients to create a low water-cement ratio situation, but under a totally different concept.

Mix water conditioned with Alpha Mix solution will saturate more of each cement particle, than would mix water not treated with Alpha Mix, effectively utilizing more of the cement particle, lowering cementitious material waste, generating more cement paste (C-S-H gel), while at the same time, raising the cement-water ratio without needing to increase the volume of portland cement used in the mix. This action, by itself, enhances every criteria characteristic of portland cement concrete such as added workability through lubricity, capillary void percentage decrease, smaller pore sizes, added durability, more compressive strength, a reduction in volume of surface bleed water, etc.

Initially, during hydration, hydrates are formed from the corresponding anhydrous products that passed into solution when mix water was added. Resultant hydrates have lower solubility than their corresponding anhydrous products and begin to crystallize from solution when saturated, in respect to anhydrous products. When Alpha Mix is added to the mix water, the quality of these anhydrous products (calcium silicate hydrates or C-S-H gel) will be greater.