

CONCRETE ADMIXTURES

Definition: An admixture is any substance, other than cement, aggregate and water, added to the concrete mix for the purpose of altering any of the properties of the concrete.

Air Entraining Agents: resinous or fatty materials either interground with concrete during manufacture or added to concrete mixes to produce air bubbles throughout the mix. Air entrainment minimizes the effects of freezing and thawing and protects the concrete from deterioration caused by road salts. This admixture also improves the workability and cohesiveness of the concrete; when concrete is placed in forms, the entrained air helps to keep the ingredients from separating resulting in a lesser tendency for water to rise to the top of fresh concrete. With a coarse aggregate size of 3/4" maximum, air entrainment is usually 6%, \pm 1%. The percentage of entrainment decreases as the coarse aggregate size increases. In light weight concrete, air entraining agents are used to maintain the unit weight of the concrete.

Water Reducing Agents: Plasticizers used to lower the water-cement ratio and to lubricate the particles in the mix. They are generally compounded from carbohydrate materials and sulfonated organic compounds. Workability and plasticity are increased but hydration may be delayed and early strength decreased.

Retarders: slow the chemical process of hydration allowing the concrete to remain plastic and workable for an extended period of time. Usually consist of boron compounds, sodium carbonate or certain sulfates. Many chemicals impart a retarding action on Portland cement but some are extremely erratic and unreliable. Sugar is a powerful retarder; very small quantities could completely prevent hydration. There is some loss of early strength but strength gain returns to the normal rate once the cement starts to set. Retarders are effective for hot weather placement and massive or complicated pours.

Accelerators: The most common accelerator, calcium chloride, has become universally connected with cold weather concrete placement to such an extent that it is erroneously considered by some, to be an anti-freeze solution which will protect concrete from freezing and thereby eliminate the need for heat, insulation and other forms of cold weather protection. As the name implies, accelerators hasten the hydration process, decreasing the length of time required to achieve high early strength thereby helping to guard against concrete freezing before proper strength is gained. All of the normal protections and precautions for cold weather concrete are still required. Calcium chloride used at manufacturers' recommended rate of 2 pounds per bag of cement, lowers the freezing point of water by only 3°F. Calcium chloride increases expansion and contractions, reduces resistance to sulfate attack, increases efflorescence and promotes corrosion of reinforcing steel. Some manufacturers introduce other chemicals into the calcium chloride mixture intended to neutralize the deleterious effects. Other chemicals are used to accelerate the hydration of cement but because of cost, difficulty in handling or erratic results, they are not used extensively.

Color Pigments: Oxides of iron, chromium or cobalt blue added either integrally to concrete mix or as a topping to provide colored concrete floor surfaces. Color pigments reduce the strength of the concrete in proportion to the quantity of color and increases water requirements resulting in increased drying shrinkage.

Pozzolan: Volcanic ashes, fly ash, calcined shale and clay, siliceous materials, natural cements and some slags added to the concrete mix to control alkali-aggregate reaction, improve workability, increase strength after 28 days and increase resistance to sulfate attack. Pozzolanic finely divided powders may cause excessive drying shrinkage, reduce durability and reduce early strength.

Hardeners, color pigments, special aggregates, sealers and abrasive materials are admixtures only in the broadest sense of the word in that they are surface treatments added to concrete work already installed.

Hardeners: Usually zinc or magnesium fluosilicates mixed integrally with concrete or surface applied after the concrete floor is cured to harden the surface and to prevent dusting. Available in colors or natural (clear). Metallic aggregates, usually iron particles, may be mixed and added to freshly floated floors to produce a hard, durable and wear resistant heavy duty surface. Metallic aggregates may be electrically grounded for floor surfaces where static electricity is hazard, such as where highly explosive or flammable materials are used or stored.

Anti-spalling Compound: An equal mixture, by volume, of boiled linseed oil and mineral spirits is used to provide a protective barrier against destructive salt solutions. The coating may be applied on new concrete after only 7 days of curing but it is most effective if applied after 28 days. It should be applied in 2 coats at the rate of .025 gallon per square yard for the first coat and .015 gallon per square yard for the second coat. A two coat system will be effective for 50 freeze-thaw cycles. Additional coats every 2-4 years is recommended.