

Retarded Setting

ASCC Position Statement #28

ACI 318-08, “Building Code Requirements for Structural Concrete,” does not limit the amount of fly ash or other pozzolans that can be used in concrete not exposed to deicing chemicals. The recent emphasis on reducing cement contents to reduce greenhouse gas emissions has resulted in project specifications that require replacing up to 50% of the portland cement with fly ash or other pozzolans. Concrete with 50% fly ash normally sets more slowly than concrete containing lower amounts.

A concurrent trend also affects setting. Concrete containing large amounts of fly ash may also contain up to three different admixtures that retard setting to varying degrees: ASTM Type A water-reducing admixtures, ASTM Type F high-range water-reducing admixtures, and hydration stabilizers. These admixture combinations are often used in concretes with water to cementitious materials ratios at or below 0.45, and magnify the effects of the fly ash on setting time. The effect on setting time can be extreme if the admixtures are dosed on the basis of total cementitious material in the concrete instead of basing the dosage only on the amount of portland cement used.

When used in concretes with as-delivered temperatures of 60F or less, and at jobsite ambient temperatures of 50F or less, effects of the fly ash and admixtures are greatly magnified. The undesirable effects include:

- Increased probability of surface crusting, blistering, and delamination in floors and other flatwork.
- Increased probability of settlement cracking in deep members such as pile caps.
- Need for longer curing and protection periods for concrete placed in cold weather, thus delaying both the time at which a structure can be subjected to construction loads and work of other trades as well as the time at which the structure can be put into service.

When specifications require up to a 50% substitution rate of fly ash for portland cement, ASCC

members recommend regarding this as an average value for concrete used in the entire project. This allows the engineer to specify lower amounts of fly ash for floors, and higher amounts for foundations or other structural members for which setting time and early strength gain are less critical. For very thick foundations and other members, some settlement cracking over reinforcing steel should be anticipated, with the contract including details on the widths of cracks requiring repair and acceptable methods for such repairs.

Contractor compliance with the plans and specifications will produce a structure with a potential for surface defects that is determined by the designer’s and specifier’s decisions regarding concrete properties. Prudent contractors need to know the batch quantities for all ingredients, including admixtures, to anticipate the undesirable effects noted and use the best methods to minimize these effects. ASCC contractors will assume responsibility for defects or delays that are a direct result of noncompliance with project plans and specifications, but not for defects resulting from delayed setting or strength gain.

If you have any questions, contact your ASCC concrete contractor or the ASCC Technical Hotline at (800) 331-0668.



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