ABSTRACT

Hydraulic cement concrete slabs were cast and stored outdoors in Charlottesville, Virginia, to study the impact of wet curing duration on durability parameters. Concrete mixtures were produced using portland cement, portland cement with slag cement, and portland cement with Class F fly ash concretes with water–cementitious materials ratios (w/cm) of 0.45 and 0.35. These concretes were subjected to immediate liquid membrane-forming curing or 1, 3, 7, or 14 days wet curing. Two slabs were cast for each of the wet curing durations. Following the curing period, one slab was allowed to dry naturally, and liquid membrane-forming curing compound was applied to the other. Three additional concretes containing saturated lightweight fine aggregate were produced to study the potential impact of internal curing on the durability parameters. These concretes contained portland cement with fly ash, silica fume, and both, at 0.35 w/cm. Three slabs were cast from each mixture and subjected to liquid membrane-forming curing, 1 or 3 days wet curing. The slabs were instrumented with humidity probes at two depths below the surface. Specimens were removed from two depths and tested for tensile strength, electrical conductivity, and sorptivity at 3 and 12 months of age.

The success rate of the humidity measurements within the slabs was low because of water condensation. However, water condensation qualitatively indicates that the slabs did not dry out to an extent that would adversely impact concrete property development. Neither the strength, electrical conductivity, nor sorptivity results were impacted appreciably by the duration of moist curing. At most, 1 to 3 days wet curing was sufficient.

Reducing w/cm had a positive impact on reducing permeability parameters, and previous work by others has shown the duration of curing needed to achieve discontinuity in the capillary pore system decreases with decreasing w/cm. No added benefit was observed by application of liquid membrane-forming curing following the wet curing. The prevailing weather conditions in the months during and following placement were humid, which would obviate any benefit from post wet-curing applications of liquid membrane-forming curing compound to slow drying. Prevailing weather conditions and the w/cm of the concrete mixture are important factors in determining adequate curing procedures and duration and should be considered by the project management team at the time of construction to establish appropriate procedures.

A direct cost savings could be realized by removing the requirement for wet curing and using LMFC only in situations where it is likely to benefit the curing process. Alternatively, there may be long-term benefits that could be realized by applying these cost savings to the application of penetrating sealers, particularly for concretes that will be subjected early in their life to aggressive anti-icing and deicing programs.