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Hot Weather Concrete - Tips & Reminders

Every summer, the concrete industry faces a long list of many challenges. At or near the top of this list, hot weather concrete issues will be found. The problem is not new, and in fact has been around as long as concrete has been made. We should be better educated today than we were 50 years ago, however we see the same problems summer after summer. Are we then really better educated or are we taking short cuts and trying to save a few dollars? By following some simple steps, hot weather issues can be prevented.

Coordination between the designer, ready-mix supplier, testing laboratory, and contractor are critical for successful hot weather concreting. ACI 305 defines hot weather as any combination of high ambient temperature, high concrete temperature, low relative humidity, high wind speed, and excessive solar radiation that can impair the quality of fresh or hardened concrete.

Hot weather issues encountered in plastic concrete include: increased water demand, increased rate of slump loss, increased concrete temperature, shortened setting time, and possible increased plastic shrinkage and craze cracking. Issues encountered in hardened concrete: lower strengths, increased potential for uncontrolled cracking, and decreased durability.

Preventing issues from occurring in plastic concrete by a ready-mix producer can be as simple as using a mix that has performed properly in hot weather, using chilled water, shading and wetting aggregate stockpiles, supplementary cementitious materials, and using a retarding admixture. Often this is performed when the ready-mix producer has control in place to implement hot weather precautions or when requested by the contractor.

The use of presoaked aggregates, admixtures and/or supplementary cementitious materials are common practices

For the contractor dealing with plastic issues, the solution could be as simple as having the forms set and ready for placement, shade or wind breaks in place, a dampened sub-grade, the correct number of concrete finishers present to handle the amount of concrete, and materials ready in case of sudden work stoppages. These materials may include plastic sheeting, surface evaporation reducers, extra form materials for repair or construction joints, and fog sprays.

The use of plastic, fog sprayers, and/or evaporation reducers along with proper curing (shown above) are essential

Be sure to monitor the addition of water added at the job site. Added water often can decrease strength, durability, and abrasion resistance while increasing shrinkage and permeability. ACI 305 has a chart available for evaporation rates and when plastic shrinkage cracking is most common.

Managing the effects of hot weather concreting issues in hardened concrete in many cases tends to fall on the designer/engineer and contractor/builder. The designer/engineer often includes references in the specifications to following ACI or other types of hot weather concreting guidelines. How often though does someone check to see if the guidelines are followed and enforced? How many designers/engineers specify the use of a preconstruction checklist, which often covers issues related to hot weather concreting? From a contractor/builder responsibility it could be as simple as having a surface evaporation retarder available if necessary, a curing compound ready to apply when finishing is completed, a joint layout prepared prior to construction, and proper length of curing.

Control joints should be cut as soon as possible to control crack potential

Strength issues can be seen throughout the entire year. Quality Control testing procedures of concrete in hot weather is performed no differently than any other time of the year. Temperature is usually of primary influence. ASTM provides very specific procedures for the making and curing of concrete test cylinders. ACI puts this responsibility on the shoulders of the contractor to ensure that proper testing and curing of cylinders is performed. Often a contractor will hire a testing laboratory for testing only the plastic properties of the concrete. It is important for contractors to follow ASTM which states it is the responsibility of the contractor to cure the cylinders in the proper environment. It is the testing laboratories responsibility to monitor and record the initial curing temperatures. When all of the testing is performed properly, ASTM C 94 states that the ready-mix supplier will be furnished with test reports in a timely manner. Quite often, the ready-mix suppliers never receive any results.

When dealing with hot weather concreting, advance planning and communication by the engineer, contractor, testing laboratory, and ready-mix producer can prevent hot weather concrete issues. It may be as simple as requesting or using a retarding admixture, wind breaks, fog sprays, reviewing the weather forecast, or having a plan for all scenarios. Preventing issues before they occur can result in concrete that is of greater durability and higher quality to the owner.

References:

ACI Committee 305, "Hot-Weather Concreting" (ACI 305R-99), American Concrete Institute, Farmington Hills, MI

PCA – Design and Control 14th Edition, Chapter 13 (2002), Portland Cement Association, Skokie, IL

NRMCA Publication #12, "CIP #12 Hot Weather Concreting" (2000), National Ready Mixed Concrete Association, Silver Spring, MD

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