Cold Weather Concreting – It's Time

By John Albinger

It's time to start thinking about the impending cooler temperatures. Although the following is nothing new you may want to consider talking with your customers before problems arise. It's also a good practice to make sure you review jobs specifications for minimum temperature requirements and review ACI 306 Guide to Cold Weather Concreting. It is not the concrete producer's responsibility to protect the concrete once it is placed on the project but it often is in the best interest of the concrete producer to have some conversation with the contractor regarding ACI 306 to make sure the contractor understands what their responsibility is in regards to protecting the concrete during cold weather.

STRENGTH AND RATE OF STRENGTH GAIN

All of the mixes you supply will achieve their design strength when produced, placed, cured, and tested according to ASTM and ACI standards, though the reality is that all of these things don't always happen, especially in cold weather. Mixes containing supplementary cementitious material (SCM), such as fly ash or slag, may not achieve the desired strengths in the field when exposed to cooler temperatures. Remember that for exterior concrete to be freeze/thaw-resistant it must achieve 4000 PSI before it is exposed to any f/t cycles. When problems arise, how the concrete was cured or not cured may not be the only reason for failure. Evaluate your mixes and make sure the percent of cement replacement isn't too high so the concrete you provide has a chance of being as durable as your customer expects.

SETTING TIME

Setting time is about cement, slump (water content), accelerators, and temperature. Theoretically, the higher the cement content and accelerator dosage and temperature, and the lower the water content, the faster the setting time.

TEMPERATURE

Concrete temperatures as produced and as cured are equally important. Usually we begin heating our concrete with heated water. This is normally a temporary measure because the temperature of the concrete is a reflection of the temperature of the aggregates. As aggregate temperatures become lower, hot water becomes less effective and more temperature is lost during delivery. At that time heating aggregate becomes necessary. It is important to have the capacity to heat aggregates so that your concrete temperatures remain consistent throughout the day. You should also need to be aware of the water heater recovery time so that you can maintain consistent temperatures throughout the day.

ACCELERATORS

The effectiveness of calcium chloride is dependent on the temperature of the concrete as produced as well as the temperature of the environment in which the concrete is placed. The lower either temperature is, the less acceleration occurs. Bagged calcium chloride added on the job should be dissolved in water before it is added to the concrete.

Non-chloride accelerators are less, or not at all, reliant on temperature and generally produce more consistent setting times. No accelerators should be relied upon to contribute to the rate of strength gain or 28 day strengths.

CURING AND SEALING

Neither curing nor cure and seal compounds should be used in cold weather. The concrete must be allowed to dry, at least 28 days for sealers. In cooler or cold environments curing is all about heat retention. This is the contractor's responsibility. Depending on the environment in which the concrete is placed, plastic or tar paper, plastic and straw, blankets, enclosures, or heaters may be necessary to insure the proper strength at the proper age.

Concrete Temperatures

Concrete producers should check and record concrete temperatures in the morning, mid-day, and afternoon using a calibrated thermometer. It is the contractor's responsibility to maintain concrete temperatures on the job. Setting time and rate of strength gain are primarily temperature dependent. It is also a good practice to periodically check in place concrete temperatures on some of you projects you are supplying concrete to.