PCI Plant Quality Talk
Quality Enhancement Committee

NPCA National Precast Concrete Association

PCI Precast/Prestressed Concrete Institute

SERIES 2, ISSUE 3 – HOT WEATHER CONCRETING

Hot weather problems are mostly encountered in the summer months, but need to be considered whenever fresh concrete is exposed to any of the following: high temperatures, high winds, low humidity, and direct sunshine.

The Effects of Hot Weather on Concrete

High concrete temperature causes a higher water demand, which can prompt the addition of water, resulting in lower strength and reduced durability. Higher temperatures accelerate the rate of slump loss and can cause loss of entrained air. Generally, concrete that is cured at high temperatures at an early age will not be as strong at later ages (28 days) as the same concrete cured at lower temperatures.

High temperatures, high wind velocity, and low relative humidity can each cause a high rate of evaporation, which can promote plastic shrinkage cracking before the concrete sets, and encourage early-age drying shrinkage. Thermal cracking may result from rapid variations in temperature, such as when concrete members are cast on a hot day followed by a cool night. High temperatures also accelerate cement hydration and contribute to the likelihood of thermal cracking in thicker concrete segments.

Hot weather conditions can result in a rapid rate of evaporation of moisture from the surface of the fresh concrete that makes a “spongy, rubber-like” surface that’s difficult to finish. It will also accelerate the set time of concrete, and therefore the finishing processes will need to occur at a faster rate. Typically, high relative humidity lessens the effects of high temperature with regard to rapid moisture loss.

Best Practice Options

- Follow supplier recommendations for adjusting concrete with the use of water-reducing and set-retarding admixtures.
- Use hydration control admixtures to extend workability times in high temperatures.
- Change the concrete mixture constituents or proportions to reduce the heat generated by cement hydration, such as by using a Type II moderate heat cement. Also, the use of fly ash, slag cement, or calcium carbonate can reduce potential problems with high concrete temperatures.
- Schedule concrete placement to avoid interruptions and delays in placing and finishing. Concrete should be placed immediately, and sufficient personnel should be available to place and handle the concrete.
- When possible, avoid the hottest part of the day when placing concrete.
- Do not sprinkle water on the surface of concrete members to facilitate finishing; this can result in a higher water-cement ratio at the surface, resulting in surface scaling.
- Lower concrete temperature by using chilled water or ice as part of the mixing water. Chilled water can reduce concrete temperature by up to 10°F; ice can reduce temperature by up to 20°F. The overall water content will need to be reduced based on the volume of the ice added to the mixture.
- Concrete temperature at the mixer shall be maintained below a maximum of 95° F, unless otherwise specified and managed.
- Sprinkling and shading the aggregate helps lower the temperature of the concrete.
- Use windbreaks, sunscreens, mist fogging, or evaporation retardants to slow evaporation and reduce the risk of plastic shrinkage cracking.
- Micro fiber may be used to reduce the risk of plastic shrinkage cracking.
- Do not exceed the maximum allowable mixing water content established for the concrete mixture proportions.
- During dry and hot days, when the temperature of the steel forms exceed 120°F, wet the formwork before placing concrete. Do not allow excessive water to pond, and make sure the casting surface is free of excess water before placing concrete.
- Start curing as soon as possible after finishing is completed. Cover to retain moisture in the enclosure, thus increasing humidity at the concrete surface.
- Ensure that test cylinders maintain their temperature and moisture for the initial curing, matching the members in the casting bed.
- Accelerators may be used in hot weather to expedite finishing operations and to avoid plastic shrinkage cracking.

References

ACI 305R-10 Guide to Hot Weather Concreting

PCI TM-103, *Quality Control Technician/Inspector Level III Training Manual*, provides a method for determining the potential for plastic shrinkage cracking based on weather conditions and concrete temperature.

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Note: Please complete this form and return to the Quality Control Manager. All crew members should be observant and report to their foreman anything out of the ordinary on a project. *See something, say something.*

NOTES	ATTENDEE SIGNATURES
_____ DATE _____ PRESENTER	_____ _____ _____ _____ _____ _____