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HOT WEATHER CONCRETE

ACI 305.1-14 (Specification for Hot Weather Concreting) provides recommendations and best practices for concrete placement when environmental conditions can have detrimental impacts on concrete quality. High temperature placement of concrete can sometimes cause challenging and difficult conditions to ensure that concrete quality and desired properties are maintained. However, it is not just the temperature of the concrete that must be controlled during placement as other factors such as ambient temperature, humidity, wind speed and exposure to sunlight can also play a significant role in the hydration process of cement and ultimately alter the physical setting characteristics of the concrete mixture.

"Hot weather" conditions can create difficulties in placing & finishing fresh concrete such as:

- Increased water demand and accelerated slump loss
- Increased rate of setting times resulting in finishing difficulties
- Increased tendency for plastic and drying shrinkage cracking to occur
- Potential difficulties in controlling entrained air characteristics
- Inability to reach desired strength requirements

When to take precautions:

Although many local and national requirements vary, it is generally recommended to consider taking precautions for placing concrete in "hot weather conditions" when the concrete temperatures are in the range of 77-95ºF (25-35ºC). ACI 305.1-14, sections 3.2 and 3.3, recommends a maximum temperature of fresh concrete at time of discharge to not exceed 95ºF (35ºC), unless supporting field experience or pre-construction testing is available.

The following recommendations may also reduce potential problems associated with hot weather concreting:

- Schedule concrete placement to limit exposure and place during 'cooler' periods of the day, ie: at night.
- Use a concrete consistency that will allow for rapid placement and consolidation.
- Reduce the time of transport, placing and finishing.
- Consider the use of retarding or hydration stabilizing chemical admixtures and supplemental cementitious materials, such as fly ash and silica fume, to reduce the heat of hydration.
- Employ the use of temporary moisture retaining films immediately after placement.
- Use methods to limit the exposure of the concrete such as wind screens and sun shades.
- When possible, schedule slab placement after roof structures and walls are in place.
- Provide curing methods to maintain adequate moisture and favorable concrete temperature.
- Cool the concrete itself by using chilled water during production and aggregates that have been 'watered' down.

Source: Portland Cement Association Design and Control of Concrete Mixtures

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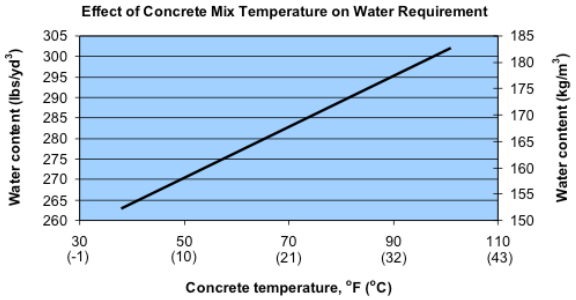
Impact of hot temperatures on concrete:

For a typical 4000 psi (28 MPa) mixture, concrete temperature can be reduced by 2oF (1oC) during the batching process by any of the following means:

- Reduce the cement temperature by 14oF (8ºC)
- Reduce the water temperature by 9oF (5ºC)
- Cool the aggregates by 3oF (1.5ºC**)**



High temperatures of freshly mixed concrete can increase the rate of setting time by as much as 2 hours for an 18ºF (10ºC) increase in concrete temperature. This can result in additional problems such as the scheduling of saw-cutting and additional placements. In hot weather, there is an increased tendency for cracks to form both before and after concrete hardens. The addition of water to either cool the concrete or add more workability should never be permitted as this can have detrimental effects on the required strength of the concrete as well as overall long-term durability.

Hot Weather Product Solutions and Recommendations

Appropriate Additives and Admixtures can help protect concrete during hot weather conditions through the use of set-retarding admixtures, fibers, hydration stabilizers, evaporation retarders and curing compounds.

- Set-retarding and hydration stabilizing admixtures can lower water demand, extend working time, and maintain strength.
- Fibers can be utilized to minimize cracking and reduce crack widths.
- Evaporation retarders can be used to maintain moisture during placement.
- Membrane forming curing options can protect concrete from moisture loss.
- White-Pigmented curing compound can also reflects sunlight to help keep concrete cool.