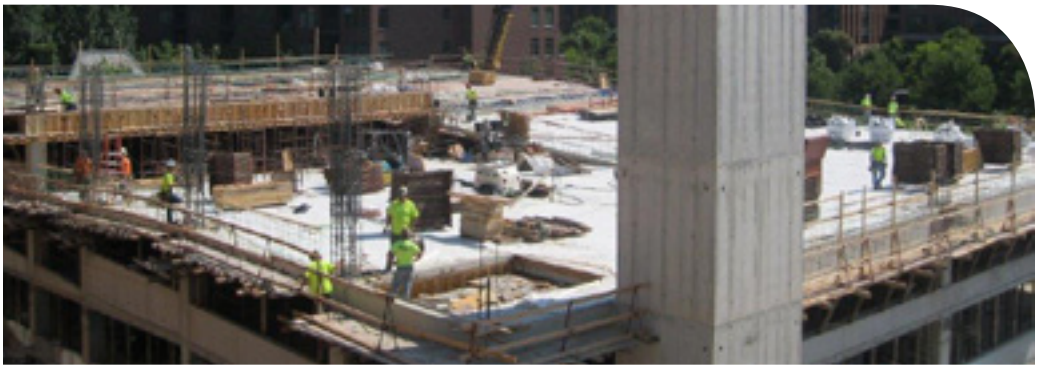

GEOTECHNICAL CONSULTANTS INC.

What You Need to Know About Hot Weather Concrete

"Damage to concrete caused by hot weather can never be fully alleviated," according to the American Concrete Institute's (ACI) 305R-10 standards for Hot Weather Concrete Placement. Potential problems in hardened concrete include decreased strength, decreased durability due to cracking, and increased variability of surface appearance.

Proper management of both construction practices and the concrete mixture are essential to minimizing the effects of hot weather.

Hot weather factors that cause concern

The ACI 305R-10 standard defines "hot weather" as any one or a combination of the following conditions that impair fresh or hardened concrete quality by accelerating the rate of moisture loss and rate of cement hydration or otherwise causing detrimental results:

- High ambient temperature
- High concrete temperature
- Low relative humidity
- High wind speed

There are no absolute threshold values for temperature, humidity or wind speed as the interaction of the elements makes it impossible to recommend specific maximums. But when ambient temperatures are greater than 90 degrees or concrete mixture temperatures exceed 85 degrees, special measures are typically needed.

Comprehensive planning helps mitigate risk

GCI's engineers and technicians will work with contractors, developers and designers to develop a comprehensive plan including contingency plans for weather conditions that may impact your project. Plans will primarily focus on:

1. Concrete mixture control
2. Concrete temperature control
3. Construction practices

Concrete mixture control

Concrete strength, durability, plastic shrinkage cracks, thermal cracking, and drying shrinkage can be favorably impacted by having appropriate concrete mixture temperatures during batching, transport and placement.

Concrete mixes will be designed for the anticipated temperatures. Mix additives or alterations may include supplementary cementitious materials (SCM) such as Class F fly ash or slag cement, retarders, or an air entraining admixture.

While the mix water amount will increase with temperature, it is critically important to not exceed the maximum water/cementitious material ratio. Increased water content results in a decrease in rate of setting, strength and durability if cementitious material is not increased proportionately.

Whether a building is being demolished or renovated for new uses, a complete inventory and mitigation plan is required for all hazardous materials such as asbestos, lead paint, mercury switches, light bulbs, lead-containing components, batteries, refrigerants, coolants and old electronic equipment.

Concrete mixture temperature control

Research shows that higher mix/place/cure temperatures give higher early strengths and reduced strength at later ages. For example, if the initial 24-hour curing period is at 100 degrees F, the 28-day comprehensive strength may be 10-15 percent lower than if cured at the standard temperature.

The mitigation of high temperature risk can include reducing the concrete mix temperature by using chilled mix water, fogging aggregate stockpiles, or replacing up to 75 percent of the mixing water with crushed, shaved or chipped ice.

Managing concrete construction practice

Curing concrete is critical during hot weather. An adequate amount of curing compound should be applied as soon as possible. Fogging can help by cooling the air and it also raises the relative humidity. Scheduling placement during the cooler part of the day may be necessary.

The sawing window may need to be adjusted since the pace of the setting, hydration and hardening stages will be different during hot weather.

Preparation and communication are key to hot weather concreting success
Concrete can be placed during extreme temperatures provided appropriate mix materials and construction practices are used. Developing a comprehensive plan with the design and construction team to define requirements and contingencies will help keep your project on schedule, within budget and with the quality you desire.

To discuss hot weather concrete strategies for your project contact:

- Bob Hiles at bhiles@gci2000.com or 614.895.1400

Strategies for Hot Weather Concrete Pours provides additional details about the measures GCI's construction inspectors and engineers may recommend or require to ensure that the hot-weather concrete pours on your project are prepared, finished and cured properly.

Special thanks to **Mark B. Snyder, Ph.D., P.E.**, *Engineering Consultant to the* **American Concrete Pavement Association** *for sharing their resources from "Achieving Quality in Hot Weather Concrete Paving, an ACPA National Webinar presented June 30, 2016" for this article.*

GCI News & Notes

20,000th milestone
GCI reached its 20,000th project in June 2016. A special thank-you to our clients for trusting us with their projects and congratulations to the GCI team!

GCI contacts now on website
To make it easier to directly reach GCI staff, team members' contact info has been added to the GCI website at www.gci2000.com. Also, past newsletter articles are archived on the site for quick reference if you need to review a previous technical topic.

GCI is pleased to announce the following promotions:

Todd R. Meek, P.E. to Manager of Engineering Operations; in his new position, Meek is responsible for overall management of engineering operations including quality control, staff, preparation and review of reports, proposal preparation, and client relations.

David S. DeLong to Staff Specialist – Field Services; in his new position, DeLong oversees Roller-Compacted Concrete (RCC) mix designs, laboratory and field testing, and also serves as a consulting field engineer to troubleshoot problematic field conditions.

David A. Kalkbrenner, P.E. to Staff Specialist – Field Services; in his new position, Kalkbrenner oversees post-tensioned (PT) structural concrete construction projects, field maturity testing services, and serves as a consulting field engineer to troubleshoot problematic or unforeseen field conditions during construction.