CONMIX

CONCRETING IN HOT WEATHER CONDITIONS

What, Why & How?

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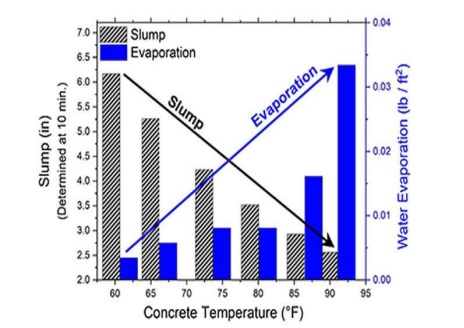
INTRODUCTION

Hot weather concreting presents unique challenges due to the accelerated setting time and increased water demand as experienced in Gulf Countries (i.e. UAE). Understanding the effects of hot weather and implementing proper techniques are crucial for ensuring the workability, quality and durability of concrete structures.

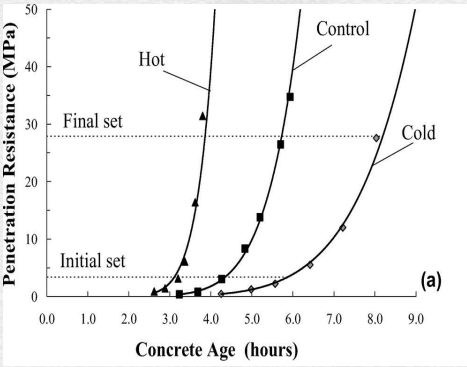


Effect of Temperature on Slump and Evaporation (Fig. 01)

WHAT is Hot Weather?

Hot weather in concrete construction is generally defined as any combination of high ambient temperature, high concrete temperature, low relative humidity, and high wind speed that tends to impair the quality of freshly mixed or hardened concrete.

According to ACI 305R-20, hot weather conditions typically include temperatures exceeding 77°F (25°C) and/or wind speed above 5mph.



Effect of Temperature on Concrete Setting Time (Fig. 02)

WHY consider Hot Weather?

1. Increased Water Demand: Elevated temperatures can lead to increased evaporation rates, requiring more water to maintain proper hydration and workability, which can be expected to have high effect on concrete slump retention.

2. Reduced Setting Time: High temperatures can significantly shorten the setting time of concrete, affecting workability and placing operations.

3. Surface imperfection and Cracks: Hot weather can lead to potential plastic cracks on concrete surfaces.

4. Risk of Thermal Cracking: Rapid drying and hydration in hot weather can increase the risk of thermal cracking, compromising the structural integrity of the concrete.

HOW to Concrete in Hot Weather?

1. Temperature Control: Keep concrete temperatures as low as reasonably possible by using chilled mixing water, **flaked ice**, shading aggregates, and using sunshades orwindbreaks.

Use of Flaked Ice— for hot weather concreting (Fig. 03)

2. Reduced Transportation Time: Minimize Transportation time to reduce the heat generated by the mixing process lead to high losses of concrete workability.

3. Use of Retarders: Employ retarding admixtures to delay setting time and improve workability in hot weather conditions.

4. Proper Curing: Immediately after finishing, cover the concrete with plastic sand, or other materials to retain moisture and regulate temperature.

5. Early Finishing: Begin finishing operations as soon as possible to reduce the effects of rapid setting, that lead to surface plastic cracks.

6. Controlled Evaporation: Use evaporation retardants or windbreaks to minimize surface moisture loss.

Proper Curing—immediate covering of Polythene Sheet , wet burlap (hessian cloth) and watering. (Fig. 05 &04)

Rules to Follow for Hot Weather Concrete

1. Pre-Construction Planning:

A. Develop a hot weather concreting plan that includes temperature monitoring, equipment availability, and personnel training.

B. Slabs on grade should not be placed directly on polyethylene sheeting or other vapor retarders. Cover the vapor retarder with a minimum 4-inch (100 mm) layer of compactible, easy-to-trim, granular fill material.

C. Begin final finishing operations as soon as the water sheen has left the surface; start curing as soon as finishing is completed. Continue curing for at least 3 days; cover the concrete with wet burlap and plastic sheeting to prevent evaporation or use a liquid membrane curing compound, or cure slabs with water. Using white pigmented membrane curing compounds will help by indicating proper coverage and reflecting heat away from the concrete surface.

D. Have adequate manpower to quickly place, finish and cure the concrete.

2. Material Selection: Use low-heat cement – cementitious supplementary materials such as GGBS, Fly Ash and Pozzolanic materials, low-conductivity aggregates (i.e. lime stones), and avoiding high-early-strength concrete mixtures to mitigate the effects of hot weather.
for High strength concrete and high-early-strength in hot weather / special prequtions shall be taken such as usag of ice in concrete to avoid high generation of heat induced that lead to very high slump retintion.

3. Testing and Monitoring: Regularly test fresh and hardened concrete properties to ensure compliance with specifications and adjust mix designs as necessary.

4. Safety Measures: Provide adequate hydration and shade for workers, and use appropriate personal protective equipment (PPE) for hot weather conditions.

CONCLUSION

Hot weather concreting requires careful planning and adherence to specific guidelines to ensure the quality and durability of concrete structures. By understanding the effects of hot weather and implementing proper techniques, especially the usage of flaked ice, construction professionals can mitigate risks and achieve successful outcomes in hot weather conditions.

References

ACI Committee 305, "Hot Weather Concreting," ACI 305R- 20, American Concrete Institute, Farmington Hills, MI, 2020, www.concrete.org

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By

Abdalmenem M.A. Al Namoora

Civil Engineer, NRMCA—CCPf / PMP