Concrete Atlantic béton Atlantique

Concrete Tech-Tip #14

Hot Weather Concreting

What is Hot Weather Concreting?

As per CSA A23.1:24 Clause 7.2.1, hot weather concreting is when "the ambient air temperature is at or above 27°C, or when there is a probability of the temperature rising above 27°C during the placing period (as forecast by the nearest official meteorological office), facilities shall be provided for protection of the concrete in place from the effects of hot and/or drying weather conditions".

Hot weather, is any combination of the following conditions that tends to impair the quality of freshly mixed or hardened concrete 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, and
- Solar radiation

Hot weather problems are most frequently encountered in the summer, but the associated climatic factors of high winds, low relative humidity and solar radiation can occur at any time, especially in arid and tropical climates. Hot weather conditions can produce a rapid rate of evaporation of moisture from the surface of the concrete, and accelerated setting time, among other problems. Generally high relative humidity tends to reduce the effects of high temperature.

Why Consider Hot Weather?

Hot weather should be taken into consideration when planning concrete projects because of the potential effects on fresh and newly placed concrete. High concrete temperatures cause increased water demand, which in turn will increase the water-cementitious ratio and result in lower strength and reduced durability. Higher temperatures tend to accelerate the rate of slump loss and can cause loss of entrained air. Temperature also has a major effect on the setting time of concrete. At higher temperatures, concrete will set quicker and finishing operations will need to occur at a faster rate. Concrete that is cured at high temperatures at an early age will not be as strong at 28 days as the same concrete cured at more moderate (21°C) temperatures.

What Precautions Should You Take?

The key to successful hot weather concreting is:

1. Recognition of the factors that affect concrete.

2. Planning to minimize their effects.

Use proven, local recommendations for adjusting concrete proportions, such as use of water reducing, set retarding admixtures. The use of pozzolanic admixture (fly ash) can reduce the heat generated by cement hydration. Advance timing and scheduling to avoid delays in delivery, placing and finishing is a must; trucks should be able to discharge immediately and adequate personnel should be available to place and handle the concrete. When possible, deliveries should be scheduled to avoid the hottest part of the day. Consider pouring concrete at night when ambient temperatures and wind speeds tend to be lower. In the case of extreme temperature conditions or with mass concrete, the concrete temperature can be lowered by using chilled water or ice as part of the mixing water.

Recommendations for Pouring in Hot Weather

a. Concrete mixture designs may incorporate set retarders or hydration stabilizers, water reducers. Use the lowest practical cement factor by replacing a portion of it with pozzolanic admixtures or other proven local solutions.

b. Have adequate manpower to quickly place, finish and cure the concrete. Schedule the rate of concrete delivery that can be managed by the available placing crew and equipment.

c. Limit the addition of water at the job site.

Hot Weather Concreting

d. Slabs on grade placed directly on vapour retarders will require special precautions when finishing and curing to avoid cracking and other surface defects.

e. Finish as soon as the sheen has left the surface; start curing as soon as finishing is completed. Cover to prevent evaporation or use a liquid membrane curing compound, or cure slabs with water. Using white pigmented membrane curing compounds will help to ensure proper coverage and will reflect heat from the concrete surface.

f. On dry and/or hot days, moisten the subgrade, forms and reinforcement prior to concrete placement. Avoid ponding of excess water

g. Ensure laboratory cylinders are maintained between15 - 25°C. This may require a temperature controlled cooler or site trailer on site.

Three Rules to Consider:

1. Schedule pours wisely, use chilled water or ice if needed.
2. Use admixtures and pozzolans to slow setting and reduce heat.
3. Finish as soon as possible, limit extra water, and cure immediately.

References

1. CSA A23.1 A23.2 2024. Concrete materials and methods of concrete construction Test methods and standard practices for concrete. CSA Group
2. Design and Control of Concrete Mixtures. 9th Edition. Cement Association of Canada
3. Effect of Temperature and Delivery Time on Concrete Proportions, R.D. Gaynor, R.C. Meininger, T.S. Khan, NRMCA Publication 171, NRMCA, Silver Spring, MD.

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