CONCRETE ONTARIO
Ready Mixed Concrete Association of Ontario

CONCRETE ZERO

TECHNICAL SPECIFICATION
Hot Weather Concreting

Environmental factors like high ambient temperature, low humidity, high wind, or a combination of low humidity and high wind which are typically observed during hot weather, significantly impact concrete properties and the processes of mixing, transporting, and placing concrete.

As per CSA A23.1, hot weather is defined as 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).

During this period the following adverse impacts must be considered:

- Increased water demand
- Accelerated rate of slump loss, often leading to the addition of water at the job site
- Faster setting rate, causing more difficulty in handling, consolidating, and finishing, and increasing the risk of cold joints
- Higher likelihood of plastic shrinkage and thermal cracking
- More challenging control of entrained air content

Potential deficiencies in the hardened state of concrete due to inadequate care during hot weather can include:

- Reduced strength due to additional water being added on site
- Increased drying shrinkage
- Thermal cracking
- Lowered durability
- Greater variability in surface appearance

Preparation

- A pre-concrete placement meeting should be held at least 30 days before the start of hot weather concrete construction. This meeting is necessary to review the proposed concrete mix designs and discuss the methods and procedures required to meet the project's specifications. Additionally, here are things to consider before placing any concrete:

- Ensure preparations for the rapid transport, placement, consolidation, and finishing of concrete
- Verify that placing and consolidating equipment is in excellent working condition to prevent any placement delays
- Moisten the subgrade or subbase, forms, and reinforcement
- Have curing materials readily available

Temperature Control

Hot weather concreting emphasizes the importance of performance specifications and the flexibility to adjust mix designs to meet performance and durability criteria. This includes utilizing hot-weather solutions like higher slag replacement levels, admixtures, liquid nitrogen and ice in concrete. Figure 1 depicts ice being added at the batch plant.

Figure 1: Ice addition to a ready-mix truck

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The concrete producer is responsible for delivering concrete in accordance with CSA A23.1 Table 14:

Table 14
Permissible concrete temperatures at placing
See Clauses 5.2.5.4.1, 7.2.2.1, 7.5.1.3, 8.2.2.3 and 8.5.3

	Temperatures, °C	
Thickness of section, m	**Minimum**	**Maximum**
< 0.3	10	32
≥ 0.3 - < 1	10	30
≥ 1 - < 2	5	25
≥ 2	5	20

Slump

A concrete consistency (slump) that enables rapid placement and consolidation should be considered. Chemical admixtures, such as superplasticizers, can significantly enhance the concrete slump and reduce placement and consolidation times. Additionally, retarders can extend the time available for placing the concrete, benefiting the contractor overall.

Placing & Finishing

After the concrete is properly mixed, ensure it is discharged promptly without delay. Consider using larger crews to speed up the placement and finishing process. In cases where protection against rapid evaporation of water from the concrete surface is a concern consider the use of one or more of the following actions:

- Erect sunshades and windbreaks
- Use evaporation reducers
- Apply fog spray after finishing operations

Curing

Curing shall begin immediately following the placing and finishing operations and the concrete shall be cured for the duration outlined in CSA A23.1:19 Tables 2 and 19 for the identified class of exposure.

Testing

To ensure accurate strength test results, it is crucial to protect and properly cure the strength test specimens used for concrete acceptance. Due to their small size, test specimens are highly susceptible to ambient temperature changes. Initially, these test specimens should be stored in a controlled environment with a temperature range of 15-25°C (Figure 2). Concrete cylinders that exceed this temperature range generally show significantly lower 28-day strengths.

Figure 2: In-spec initial curing of concrete cylinders

Table 19
Allowable curing regimes
See Clauses 4.1.1.1.1, 7.2.2.2, 7.8.1 and 7.9.9 and Table 2

Curing type	Name	Description
1	Basic curing	3 d at ≥ 10 °C or for the time necessary to attain 40% of the specified strength.
2	Additional curing*	7 d total at ≥ 10 °C and for the time necessary to attain 70% of the specified strength.
3	Extended wet curing	A wet-curing period of 7 d at ≥ 10 °C and for the time necessary to attain 70% of the specified strength. The curing types allowed are ponding, continuous sprinkling, absorptive mat, or fabric kept continuously wet.

Source:
1. Table 14 & 19, CSA A23.1:19/CSA A23.2:19 Concrete materials and methods of concrete construction/Test methods and standard practices for concrete. © 2024 Canadian Standards Association
2. ACI 305R-20 Guide to Hot Weather Concreting