Hot Weather Concrete

RMCAO

Weather conditions can have a dramatic effect on both the setting time and concrete placing, finishing and protection systems that must be followed for proper concrete placement. Hot weather concreting conditions typically include:

- High ambient air temperatures (≥ 28°C)
- Low relative humidity conditions
- High wind speeds
- Solar radiation or heat gain

These conditions can result in the following challenges for the concrete contractor:

- Increased concrete water demand
- Accelerated concrete slump loss
- Increased rate of setting leading to placing and finishing difficulties
- Increased tendency for plastic shrinkage cracking
- Increased concrete temperature resulting in lower ultimate strength
- Increased potential for thermal cracking

The first step that must be taken is to identify when hot weather concreting conditions may apply and modify the normal concrete placing and finishing procedures accordingly. Possible steps that may be taken include:

Preparation

ACI recommendations regarding the prewetting of the subgrade have recently changed so that this procedure is not typically recommended. The only exception is during hot weather conditions where plastic shrinkage cracking may be an issue. The subgrade should be prewetted and forms and reinforcing steel should be dampened prior to concrete placing (there should be no standing water). The purpose of these actions is to prevent the absorption of water from the concrete into the subgrade.

Ordering

Inform the ready mixed concrete producer of your placing schedule and whether a chemical retarder will be required. For exposed flatwork the use of retarding admixtures or supplementary cementing materials should be discussed with the concrete producer. In extreme cases the concrete temperature may also be lowered by using chilled water, ice or liquid nitrogen.

Slump

A concrete consistency (slump) which allows for rapid placement and consolidation should be considered. Chemical admixtures such as super-plasticizers can dramatically improve the concrete slump and reduce placement times.

Placing

After the concrete is properly mixed ensure that it is discharged as soon as possible. Consider the use of large crews to accelerate placement rates.

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Finishing

In cases where protection against rapid evaporation of water from the concrete surface is a concern, (Figure 1) consider the use of one or more of the following actions:

- Erect sunshades and wind breaks
- Cover the surface with white polyethylene sheets
- Apply fog spray
- Place and finish at night or early morning
- Apply temporary evaporation retarder after the screeding operation

Curing

Curing should be started as soon as the concrete has set enough to avoid any surface damage. Concrete should be cured for at least 7 consecutive days after placing. Ensure that the concrete is kept moist throughout the curing process (see technical bulletin on curing options).

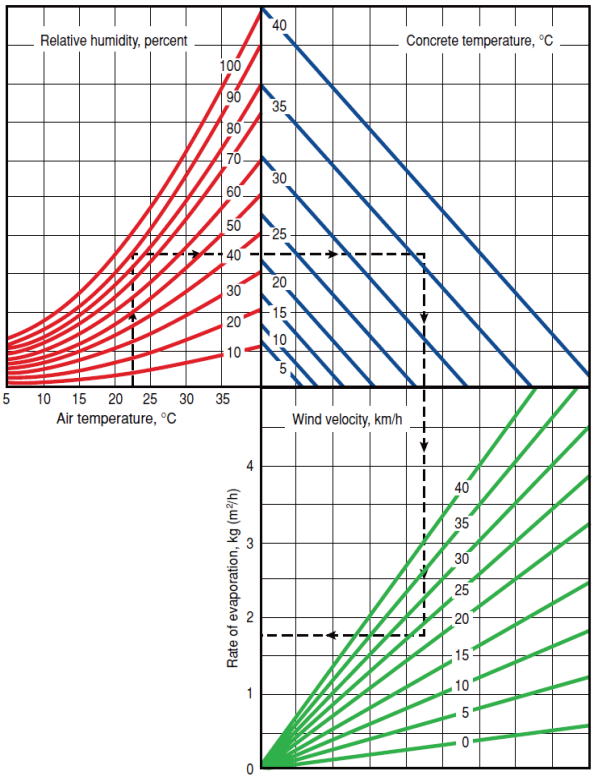
Testing

To avoid inaccurate strength test results, the initial test specimens shall be stored in a controlled environment that maintains the temperature at 20 ± 5°C as per CSA A23.1/.2 requirements. Concrete test cylinders that exceed these temperature requirements typically exhibit much lower 28 day strengths.

FIGURE 1

Estimation of rate of evaporation of moisture from a concrete surface

(See Clause 7.4.2.2.)



To use this chart:

1. Enter with air temperature, move *up* to relative humidity.
2. Move *right* to concrete temperature.
3. Move *down* to wind velocity.
4. Move *left*; read approximate rate of evaporation.

Note: Adapted (with metric values) from PCA EB101.05T. Additional information can be obtained from Berhane, 1984, and discussions of this article in ACI Materials Journal 82 (1985). Further information and background can be obtained from Uno, 1998.

References:

1 CSA A23.1-09 – Concrete Materials and Methods of Concrete Construction, Canadian Standards Association International

2 RMCAO Concrete Digest, Second Edition

3 Concrete in Practice #12 – Hot Weather Concreting, National Ready Mixed Concrete Association

Technical information prepared by:

Ready Mixed Concrete Association of Ontario

#3 - 365 Brunel Road
Mississauga, ON L4Z 1Z5

T: 905.507.1122
F: 905.890.8122

info@rmcao.org

RMCAO.org