

## C – 21: Hot Weather Concrete Placement

Placing concrete in hot weather conditions is a challenging task – but one that can be overcome if the proper procedures and precautions are followed.

### **Hot Weather Conditions:**

Hot weather concreting conditions can develop from any combination of the following situations:

1. High ambient temperature > 77° F (25° C),
2. High concrete temperature,
3. Low relative humidity,
4. High wind velocity, and
5. Solar radiation.

### **Effects on Fresh Concrete:**

Hot weather conditions can have a variety of negative effects on fresh concrete. Recognizing them early enough can give you the time to adequately respond. Some of those effects are increased water demand and an increased rate of slump loss with a dangerous corresponding tendency to add water at the jobsite to compensate for this.

It is also likely that the setting time will be faster. This can result in greater difficulties in handling, compacting, and finishing the concrete, and a greater risk of cold joints.

Additionally, there is an increased tendency for plastic shrinkage cracking and an increased difficulty in attaining the required air content.

### **Effects on Hardened Concrete:**

Hot weather conditions can have serious effects on hardened concrete – oftentimes these effects are not immediately evident and develop years later – making determination of responsibility difficult and repair expensive.

Some of the effects on hardened concrete are:

1. Decreased 28 day & later compressive strengths resulting from either higher water demand and/or higher concrete temperature levels at the time of placement or during the first few days of curing,
2. Increased tendency for drying shrinkage & differential thermal cracking from either cooling of the overall structure or from temperature differentials within the cross section of the concrete member,
3. Decreased durability resulting from cracking,
4. Greater variability of surface appearance such as: cold joints, color difference resulting from different hydration rates on different water/cement ratios,
5. Increased potential for eventual rebar corrosion that is primarily due to increased cracking allowing the ingress of corrosive solutions into the concrete,
6. Increased permeability resulting from the higher water demand.

Despite all these potentially harmful effects,

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there are numerous actions that can be taken to insure the success of the project.

### **Proactive Measures:**

There are several actions that can be done to insure that a quality, durable concrete structure can be achieved even in hot weather conditions.

Some of those actions are:

1. Recognize that more water is required to achieve the same initial slump with 80° F (27° C) concrete than with 70° F (21° C) concrete. It generally requires about 0.8 to 1.0 gallons more water per cubic yard to achieve the same initial slump for each 10° F increase in concrete temperature above 70° F. In Canadian units, it generally requires about 4.2 to 5.3 liters more water per cubic meter to achieve the same initial slump for each 5° C increase in concrete temperature above 21° C.
2. Wet down the sub-grade without leaving free standing water on the surface.
3. Take the necessary steps to cool the concrete forms and the reinforcing steel before placing the concrete.
4. Make an extra effort in scheduling concrete loads to avoid ready-mix trucks from sitting in the hot sun on the job site.
5. Avoid prolonged concrete truck mixer turns, either agitating or mixing.
6. Take the necessary steps to minimize evaporation, such as using sunshades, wind barriers or evaporation retardants (monomolecular films).
7. Consider the use of a water-reducing retarding admixture to extend the setting time, especially in a wall placement.
8. Cure the concrete as soon after placement as possible.

### **Actions to Avoid:**

Similarly, there are actions to avoid when placing concrete in hot weather conditions.

1. Don't work concrete bleed water back into the surface of the concrete.
2. Don't misuse retarding admixtures in concrete flatwork.
3. Don't retemper the concrete above the design w/c ratio. Each gallon of water per cubic yard above the designed w/c ratio causes an approximate loss of 5% of the 28 day concrete compressive strength and increases the drying shrinkage by about 10%. In Canadian units, each 6 liters of water per cubic meter above the designed w/c ratio causes an approximate loss of 5% of the 28 day concrete compressive strength and increases the drying shrinkage by about 10%.
4. Don't allow water to "pool" when wetting the sub-grade.
5. Don't over-finish the concrete surface.
6. Don't expect good curing procedures to eliminate plastic shrinkage.
7. Don't underestimate the value of a pre-placement meeting with the ready-mix supplier, the general contractor, and the sub contractors.

Placing concrete in hot weather conditions poses additional, but certainly not insurmountable, challenges. Following the aforementioned guidelines will increase the likelihood for a successful project. 