Tech Letter

Cold Weather Concreting

Cold weather concreting are operations concerning the placing, finishing, curing and protection of concrete during cold weather. Cold weather is defined as a period when, for more than three days, the following conditions exist:

- *The average daily temperature is less than 40°F*
- *The air temperature is not greater than 50°F for more than one half of any 24 hour period.*

How Do Cold Weather Conditions Affect Concrete?

In cold weather conditions, concrete sets and gains strength more slowly because it does not hydrate as fast (see chart on reverse side).

Fresh concrete that is frozen in the first 24 hours may lose up to 50% of its 28-day strength. Form removal time is increased which can delay construction time. Plastic shrinkage cracks can develop if cold weather conditions are right.

How Can the Effects of Cold Weather Be Lessened?

Although environmental conditions cannot be altered, measures can be taken during concrete production, placing, finishing and curing to minimize any harmful effect caused by cold weather.

1. *Materials.* Protect aggregates from freezing and pre-warm before batching – use hot water and/or Type III cement.
2. *Maximize the use of chemical admixtures.* Use ASTM Type C or E admixtures or, Type A products that are formulated for winter use. Limit the use of calcium chloride to 2% by cement weight. Calcium chloride should not be used in prestressed concrete because of its potential for accelerating the rate of stress corrosion. The presence of chlorides has been associated with galvanic corrosion between galvanized and plain steel. Calcium chloride should not be used in such construction. (Excess use of $CaCl_2$ may cause strength loss, surface dusting and discoloration of the concrete).
3. *Avoid excessive use of water.* Maintain slump of concrete below 4".
4. *Be prepared at the jobsite.* Subgrades should not be frozen. Warm surfaces that will be in contact with fresh concrete. Provide proper protection of fresh concrete from freezing until the concrete can reach a compressive strength of at least 500 psi.
5. *Ensure proper inspection and testing practices.* Test specimens should be fabricated in strict accordance with procedures outlined in ATSM C 31. Protect cylinder from temperatures below 60°F.
6. *Review ACI 306, "Cold Weather Concreting."*

The durability of concrete exposed to freeze-thaw conditions should be maintained by ensuring a minimum of 500 psi prior to freezing and should be protected until it achieves a strength of 4000 psi.

For more information on producing durable concrete in any weather conditions, consult a Boral representative. The Boral technical staff is prepared to assist you in developing the most durable concrete possible.

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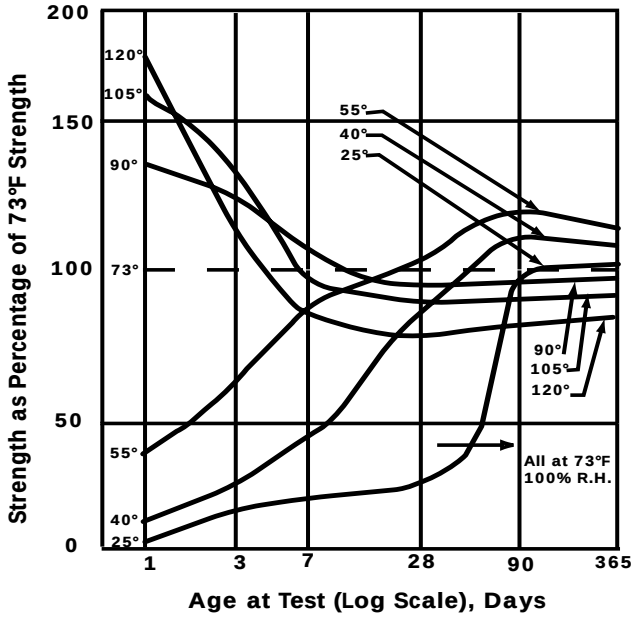
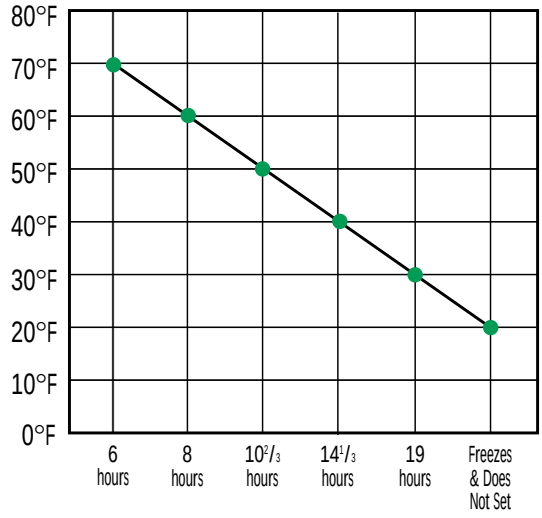
Effect of Temperature Conditions on the Strength Development of Concrete (Type 1 Cement)



Source: ACI 306R - 00

Effect of Temperature on Concrete Setting Times



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