Cold Weather Concrete – Important Guidelines & Tips

Cold weather presents many problems for the concrete industry. The most common problem is with having the concrete freeze and/or go through freeze/thaw cycles before acquiring adequate strength. This and other problems can be avoided with precautionary steps. Protecting exposed concrete in these conditions can prevent costly issues down the road.

What is cold weather?

ACI 306 defines cold weather when the following conditions exist for three consecutive days:

- The average daily temperature falls below 40°F, and
- Air temperature does not rise above 50°F for more than half a day in any 24-hour period.

What’s the problem?

- Water begins to freeze in capillaries of concrete at 28°F
- Water expands up to 9% of its volume when it freezes, causing cracks in the concrete matrix
- Up to 50% strength reduction can occur if concrete freezes before reaching 500-psi.

What’s the solution?

The following facts and guidelines should be followed to assure quality of the concrete in cold weather:

- Concrete should be protected from freezing at an early age – for the first 24-48 hours- until it achieves a compressive strength of at least 500-psi
- Concrete that is saturated with water should not be exposed to cycles of freezing and thawing until it achieves a compressive strength of at least 4000-psi
- Concrete that will be exposed to freezing and thawing even during construction should be air entrained. Exceptions may be interior floors with hard-troweled finishes
- For every 10°F difference in concrete temperature, set time will increase by 1/3rd of value (example: a 6 hour set at 70°F equals an 8 hour set with the same concrete at 60°F)
- Methods used to accelerate strength gain can include:
  - Use of Type III (ASTM C 150) cement
  - Additional Portland cement, 100 – 200 lb/yd³
  - Use of Type C & E (ASTM C 494) chemical admixtures
When heating materials, using hot water is likely the easiest and most efficient way of raising concrete temperature.
Use caution if water temperature exceeds 140°F
Surfaces in contact with the concrete should be above freezing and free from snow, ice, and frost prior to placement
Cover the subgrade with insulated blankets a few days prior to concrete placement
When making and testing concrete cylinders, maintain an initial curing environment temperature of 60° - 80°F.

**Important Tips to Remember:**

- Monitor the weather forecast
- Monitor the temperature of the concrete
- Have all materials available and protected before placing concrete
- Anticipate the worst case and be prepared for it
- Schedule the placement during the warmest part of the day
- If it is cold enough outside for you to wear a jacket; you probably need to put one on your concrete too!

*References:*

ACI Committee 306, "Cold Weather Concreting" (ACI 306R-88), American Concrete Institute, Farmington Hills, MI

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