

## **Cold Weather Concrete**

Concrete can successfully be placed, finished, and cured in cold weather or during the winter, but it requires an understanding of the impact of cold weather on the process of creating long-lasting concrete. \*\* Low temperatures slow down curing time which results in lower compressive strength early in the curing process. \*\* The colder it gets the longer it takes to cure. By definition (ACI 306), cold weather conditions exist when "...for more than 3 consecutive days, the average daily temperature is less than 40 degrees Fahrenheit AND the air temperature is not greater than 50 degrees Fahrenheit for more than one-half of any 24 hr. period." So, if the air temperature is below or expected to go below 40 degrees Fahrenheit, then "cold weather" techniques shall be employed. In this case, it is our policy that the contractor provides us with a "Plan of Action" based on ACI 306.

The procedure outlined here may be used as the basis for the acceptance or rejection of any concrete footing/foundation respective to concrete placement during cold weather conditions. It is the intent of this procedure to closely follow ACI 306, Standard Specification for Cold Weather Concreting.

### **Code Requirements IRC**

The building code requires that the minimum compressive strength of concrete for footings be 2500 psi, for foundation walls, 3000 psi. The code also specifies that the concrete be air entrained. The total air content (percent by volume of concrete) shall not be less than 5% or greater than 7%.

### **Effects of early freezing in a concrete pour**

The ultimate strength of concrete can be reduced by up to 50 percent of its potential 28 day strength if it freezes soon after placement, usually before 24 hours and before reaching strength of 500 psi. \*\* Avoid adding water to concrete on the job to create "better flow". The use of more water increases the likelihood of freezing. For each gallon of water added to the mixture on site, at least 200psi of strength is lost.

### **Inspection Practices**

1. The enforcement of cold weather concrete protection requirements will occur when the ambient air temperature is at or below 40 degrees Fahrenheit, or a temperature is forecasted within 48 hours of below 40 degrees Fahrenheit. Footings, walls, structural slabs, sidewalks and driveway approaches shall be protected.
2. Inspectors will verify the sub-grade is not frozen prior to concrete placement and that adequate protection components are on site at the time of inspection. They will also be checking the maintenance of the protection for two days following the inspections.
3. If footings were required to be protected from freezing, foundation walls will not be allowed to be poured for at least 48 hours.

4. At the inspector's discretion, concrete drivers batch tickets may be reviewed for the purpose of determining the time the concrete truck left the plant, strength of the concrete, percent of air entrainment or any special additives in the concrete mix.

### **Protection during cold weather**

In cold weather conditions it is important to protect the concrete from freezing and to maintain curing conditions to ensure adequate strength development. When cold weather conditions exist, surface concrete temperatures must be maintained at 55° F for three days. Curing time may be reduced to two days if the cement content is increased by 100 lbs. per cubic yard or Type III Portland Cement is used, or if an approved accelerator is employed.

### **Methods of protection**

- For footings, an acceptable method of protection from freezing during the curing process is to cover footings with 12 inches of straw. The straw shall be held in place with tarps or polyethylene sheeting.
- For foundation walls, insulated blankets may be used.
- After the initial curing period, it is recommended that the concrete be kept dry (protected from the elements) for at least two or three additional days before it is exposed to freezing conditions.
- Remove the heat protection in a manner that ensures the temperature of the concrete will not drop faster than more than 40 degrees Fahrenheit in 24 hours.
- After the initial curing period, it is recommended that the concrete be kept dry (protected from the elements) for at least two or three additional days before it is exposed to freezing conditions.
- When pouring conventional concrete during cold weather conditions, the concrete shall be protected from freezing for at least 72 hours (three days).
- When pouring concrete utilizing approved accelerators, Type III Portland Cement, or where the cement ratio is increased 100 lbs. per cubic yard; the concrete shall be protected from freezing for at least 48 hours (two days).
- If footings were required to be protected from freezing, foundation walls will not be allowed to be poured for at least 48 hours.



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### **Surfaces in contact with concrete**

Obviously, all surfaces in contact with concrete should be protected from freezing for at least 24 hours before placement, including embedded items. Embedded items, especially reinforcement, at temperatures below freezing can cause localized freezing of concrete. Embedded items should be kept indoors for as long as possible. It all begins with being well prepared – monitor weather conditions and know when cold weather will strike. If the inspector believes that the concrete has not been protected as described above or per another approved method, the inspector will require that the concrete be tested in order to ensure that proper strength of the concrete has been developed.