

Suggested : Cold Weather Concreting

Producing and placing ready mixed concrete is a year-round operation in Ohio. Although there are a few days each winter that are considered too cold to pour concrete, the general rule is that concrete construction is only slightly reduced during the winter months. Concrete placed during cold weather runs the risk of freezing during the critical early stages of cement hydration which will usually result in concrete of low strength, poor durability, and surface defects such as scaling and dusting. During cold weather, special precautions are required to insure that adequate strength is attained before the concrete is exposed to sub-freezing temperatures. These precautions fall into two categories: (1) Furnishing concrete that is suitable for cold-weather use and (2) Proper placing and protection of the concrete after it has been delivered.

Furnishing Suitable Concrete

This area of responsibility falls directly in the hands of the ready mix producer. However, good communication between the concrete producer, the architect, and the general contractor is a necessary ingredient to success. Proper specifications and good job site preparation are two things that help make everyone's job much easier. The producer's main objective is to provide his customer with

concrete that is designed for cold weather placement. If this concrete is properly handled and protected after delivery, the quality of the finished product should meet or exceed the specifications.

The producer can make adjustments in his mixes to achieve his objective, and these adjustments fall into three areas:

I. Raise Concrete Temperatures

The ASTM Specifications for Ready Mixed Concrete (C94M-98) require that the concrete as delivered must conform to the following temperature limitations:

Minimum Concrete Temperature as Placed

Section Size in. [mm]	Temperature, min °F [°C]
<12 [<300]	55 [13]
12-36 [300-900]	50 [10]
36-72 [900-1800]	45 [7]
>72 [>1800]	40 [5]

The most common method of raising the concrete temperature in order to meet the above requirements is to heat the mixing water. This procedure works well in moderately cold climates and is adequate for temperatures below freezing if the aggregates are free of ice. Heated mixing water should be available

The contractor would be well advised to post the following check list and make sure that all supervising personnel are aware of it:

- 1) Concrete should not be placed on frozen subgrades.
- 2) Concrete should not be placed on or against forms covered with snow or ice.
- 3) Forms should be warmer than 32° F. but not higher than the minimum temperature of the concrete to be placed.
- 4) Insulating materials such as polystyrene foam sheets, foamed vinyl blankets, heating blankets, or dark colored plastic film and straw should be easily accessible.
- 5) Avoid direct contact of fresh concrete with carbon dioxide which is emitted from open fires or poorly ventilated space heaters. This carbon dioxide will combine with the calcium hydroxide in the fresh concrete to form a layer of calcium carbonate and dusting will occur.
- 6) Always use ASTM approved curing compounds to insure proper curing and to prevent rapid drying and loss of moisture.

It is important to remember that proper planning and site preparation may seem to be expensive and time consuming, but the cost of being prepared for cold weather is small compared to the cost of replacing large sections of concrete. Job conditions, severity of weather, and size of concrete pours will greatly determine the initial cost of being prepared for cold weather concreting.

Some of the above information was taken from the ACI Recommended Practice for Cold Weather Concreting (ACI 306R-88) and from a publication of the National Ready Mixed Concrete Association (NRMCA Publication #130).