



Cold Weather Concrete

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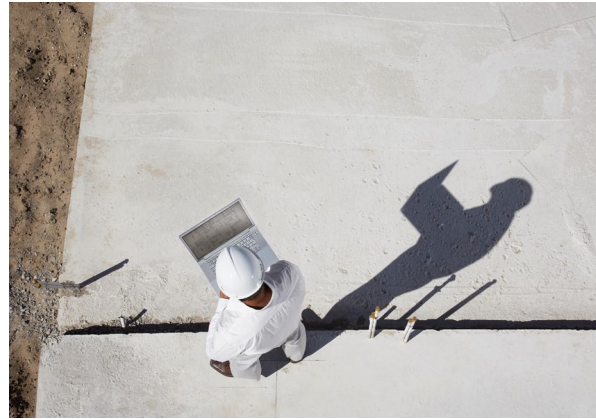
Both the International Building Code (IBC) and the International Residential Code (IRC) define cold weather and require concrete to be protected in cold weather. The following information is intended to provide guidance for working with concrete in cold weather.

Cold Weather Defined

A period of time when, for more than 3 consecutive days, the following conditions exist:

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

Refer to the IBC or IRC for complete details



Building Inspector approval to place concrete during cold weather conditions does not relieve the contractor/builder of responsibility to protect uncured concrete in accordance with recognized standards.

If the inspector determines that the concrete has not been adequately protected as evidenced by ice crystals in the concrete and/or crystal patterns on the concrete surface, the inspector shall require that the concrete be tested to ensure that required strength has been developed.

For more details, review our Cold Weather Concrete Policy and for further information, Chapters 4 and 5 of ACI 318, ACI 306R and ASTM Standards.

COLD WEATHER CONCRETE POLICY

Effective Date: Immediately

Purpose: To provide requirements for the placement of concrete during cold weather conditions.

Procedure:

This procedure may be used as the basis for the acceptance or rejection of any concrete foundation placed during periods of cold weather. **Building Inspector approval to place concrete during cold weather conditions does not relieve the contractor/builder of responsibility to protect uncured concrete in accordance with recognized standards.** Any approval to place concrete during periods of cold weather as defined below should be considered as "at risk".

Low temperatures during the placement and curing of concrete and masonry work can affect the ultimate strength and durability of concrete both temporarily and permanently. Concrete cures slower in cold temperatures and develops ultimate strengths over longer periods of time. Exposure of fresh concrete to temperatures significantly below freezing may actually stop the curing (hydration) process. Both the International Residential Code (IRC) and the International Building Code (IBC) reference

American Concrete Institute (ACI) 318 as the standard to follow for cold weather concreting. It is the intent of this guideline to closely follow specific Code requirements and the ACI Committee 306, Standard Specification for Cold Weather Concreting.

(It is required that the Responsible Design Professional specifies the method(s) of concrete placement and protection to be utilized on any site during cold weather.)

Cold weather defined

The provisions that follow apply to "cold weather," which is defined as a period of time when, for more than 3 consecutive days, the following conditions exist: 1) the average daily air temperature is less than 40°F and; 2) the air temperature is not greater than 50°F for more than one-half of any 24-hr period. (The average daily air temperature is the average of the highest and the lowest temperatures occurring during the period from midnight to midnight.) The average daily temperature will be taken from the three days prior to the date of the scheduled pour.

Protection during cold weather

In "cold weather" conditions it is important to protect the concrete from freezing and to maintain curing conditions to ensure sufficient strength and durability to satisfy intended service requirements. When "cold weather" conditions exist, concrete temperatures must be maintained at 50°F for at least two days if using high-early-strength or approved accelerated concrete. Three days of 50° concrete temperature is required if regular concrete is used. Depending on the adequacy of thermal protection provided, this protection period may need to be extended. The building code requires a 2500 psi minimum compressive concrete strength for footings and 3000 psi minimum for foundation walls. The code also requires the concrete to be air-entrained during cold weather concreting. The total air content (percent by volume of concrete) shall not be less than 5% or greater than 7%, Type III cement, and hot water. Non-chloride admixtures are strongly recommended. The maximum slump without Superplasticizer is 5.0" and with Superplasticizer is 8.0".

Inspection practices

1. Inspectors shall approve only the foundation elements that are proposing to place concrete that same day. Projects which are demonstrated that protection of all exposed earth, steel, and forms will be maintained may also be approved. This will normally require supplemental heat capability.
2. The inspectors will verify the sub-grade is not frozen and whether freeze protection components are on site at the time of inspection. The minimum time period for which the concrete must be protected against freezing is as follows:
3. Footings may be permitted to be unprotected for a maximum time period of twelve hours to allow foundation walls to be formed and the placement of concrete. This condition is permitted only after the footing concrete has reached a minimum of 500 psi compressive strength (usually about two days after placement for most concrete maintained at 50°F). The foundation wall concrete be placed using one of the approved mixes with the footings and wall totally covered again and cured as discussed.

If the inspector determines that the concrete has not been adequately protected as evidenced by ice crystals in the concrete and/or crystal patterns on the concrete surface, the inspector shall require that the concrete be tested in order to ensure that required strength has been developed.

FOOTINGS & WALLS (non-engineered)

<u>Air Temp</u>	<u>Protection</u>
32° to 25° F	Maintain above 50° Provide weather resistive membrane for a minimum of 72 hours
24° to 20° F	Provide 6" minimum depth and weather resistive membrane for a minimum of 72 hrs
20° F & Below	Provide an enclosure and auxiliary heat for A minimum of 72 hours

CONCRETE FLATWORK

<u>Air Temp</u>	<u>Protection</u>
40° to 30°	Maintain above 50° Provide a wind break for A minimum of 24 hours
30° to 20°	Provide insulation and weather resistive concrete blanket for a minimum of 72 hours
20° and Below	Provide enclosure and auxiliary heat for a Minimum of 72 hours

MASONRY & PLASTER

<u>Air Temp</u>	<u>Construct Requirement</u>	<u>Protection Requirement</u>
40° to 32°	Heat mixing water to produce mortar temps between 40° and 120° F	Provide a weather resistive concrete blanket
30° to 20°	Heat mixing water to produce mortar temps between 40° and 20° F	Maintain masonry above 32° for <u>16 hours</u> with auxiliary heat or insulation. With wind velocity over 15 mph, provide a wind break during the day.
25° to 20°	Mortar on boards to be maintained above 40° F. Heat mixing water & sand.	Maintain masonry above 32° for <u>16 hours</u> with auxiliary heat or insulation. With wind over 15 mph, provide wind break during the day.
20° & Below	Mortar on boards to be maintained above 40° F. Heat mixing water and sand.	Provide an enclosure and heat to maintain masonry above 32° for 24 hours.

NOTE:

1. The protection for the first 24 hours is the most important.
2. Wind protection is vital below 35°.
3. Air temperature 30° to 20°, morning placement is a must.
4. Soils below a footing must be protected prior to concrete placement.
5. Insulation can be:
 - equivalent to r-6
 - minimum 6” of straw
6. Weather resistive membrane examples:
 - plastic
 - canvas
 - wood (forms)
 - builders felt
7. The insulation must be between the concrete/masonry/plaster and the membrane.
8. No products of combustion may be blown over or against the concrete/plaster surface.

For further information, Chapters 4 and 5 of ACI 318, ACI 306R and ASTM Standards.