



KOOTENAI COUNTY

COMMUNITY DEVELOPMENT

BUILDING • CODE ENFORCEMENT • PLANNING

COLD WEATHER CONCRETE GUIDELINE

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

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 or freezing temperatures and develops ultimate strength 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 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 Specifications 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 or freezing weather.

COLD WEATHER DEFINED:

The provisions that follow apply to “cold weather” which is defined as when the average daily air temperature is less than 40 degrees Fahrenheit (4 degrees Celsius) during the protection period. (The average daily air temperature is the average of the highest and lowest temperatures occurring during the period from midnight to midnight.)

Protection period is defined as the time recommended to prevent concrete from being adversely affected by the exposure of cold or freezing weather during construction.

PROTECTION DURING COLD WEATHER

In “cold/freezing 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/freezing weather” conditions exist, concrete temperatures must be maintained at 50 degrees for at least two (2) days if using high-early strength or approved accelerated concrete. Three (3) days of 50 degree 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 2,500 psi minimum compressive concrete strength for footings and 3,000 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%. 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 protections of the exposed earth, steel and forms will be maintained may also be approved. This will normally require supplemental heat capability.

2. The Inspector will verify the sub-grade is NOT frozen or snow within forms and whether freeze 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 inspection.** The minimum time period for which the concrete must be protected against freezing is as follows:

- **When placing (pouring) conventional concrete during cold weather conditions, the concrete shall be protected from freezing for at least 72 hours (three [3] days).**
- **When pouring concrete utilizing approved accelerator, Type III Portland Cement or when the cement ratio is increased 100 lbs per cubic yards; the concrete shall be protected from freezing for at least 48 hours (two [2] days).**
- Depending on the performance of thermal protection provided, this protection period may need to be extended.
- **At the Inspector's discretion, complete concrete drivers batch ticket 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 additives in the concrete mix design.**

3. Footings may be permitted to be unprotected for a maximum time period of twelve (12) hours to allow foundation walls to be formed and the placement of concrete. This condition is permitted only after **a minimum of forty-eight (48) hours.** The foundation wall concrete can 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.

Methods of protection

- 1) The table below list the R-Value protection requirements based on actual temperatures (not averages) and wall thickness.

Wall Thickness	Minimum 5 Sack Mix			
	R-2	R-4	R-6	R-8
6	43	35	28	20
8	40	29	20	9
12	34	18	3	-12
18	25	2	-21	-44
24	18	-10	-38	-68
36	12	-23	-60	
48	10	-25		
60	10	-25		

Wall Thickness	Minimum 6 Sack Mix			
	R-2	R-4	R-6	R-8
6	41	32	23	14
8	37	25	13	0
12	31	12	-7	-26
18	21	-7	-35	-63
24	11	-24	-59	
36	4	-36		
48	4	-40		
60	4	-40		

- 2) Method of protection for temperatures lower than those covered by the above table

- Heated weather-resistive enclosures enveloping the footing and/or walls. The heat provided should maintain a minimum, concrete temperature of 50°F degrees until the concrete attains strengths of 500 psi (Usually two days) and double R-5.1 blankets
- The heated enclosure heating source shall be vented to the exterior. If the heater is fueled by propane, kerosene, or petroleum products, the fumes can cause damage to the fresh concrete and cause premature carbonation. The exposed area will experience a dusting of the surface which will reduce its' strength and durability.
- At the end of the protection period, concrete should be cooled gradually to reduce crack-inducing differential strains between the interior and exterior of the structure.

For further information, see Chapters 4 and 5 of ACI 318, ACI 306R-16, and referenced ASTM Standards.

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