Beverly Municipal Inspections

BN01

Building Notes

A series of notes to assist the homeowner/contractor through the permitting and construction process

July 6, 2004

COLD WEATHER CONCRETE

This procedure may be used as the basis for the acceptance or rejection of any concrete foundation for one or two-family dwellings. The State Building Code (SBC) references American Concrete Institute (ACI) 318 as the standard to follow for concrete. It is the intent of this procedure to closely follow the ACI 318, *Standard Specification for Cold Weather Concreting* and ACI Report 306R, *Cold Weather Concreting.*

Code Requirements
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%.

Cold Weather Defined
The provisions that follow apply to "cold weather," which is defined as a period of three consecutive days when the average temperature is below 40° F, and not above 50° F for more than half of any one of those three days. A "cold weather" situation is solely based upon previous temperature, and not upon forecasted temperatures.

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.

Concrete that does not attain acceptable strength must be removed. It has been shown through data analysis that if concrete freezes it does not continue to gain strength in a manner consistent with normal concrete performance.
Following is a summary of cold weather concrete construction practices. This summary is not necessarily all-inclusive:

- ❑ The minimum temperature of the concrete that is being placed must be 50° F as measured by the use of an appropriate thermometer.
- ❑ Aggregate and water should be heated sufficiently and uniformly to eliminate snow and ice lumps.
- ❑ The temperature of any concrete forms, steel and subgrade must be a minimum of 35° F.
- ❑ The subgrade may be thawed by the use of a thermal blanket or an external heat source. The subgrade may have to be recompacted.
- ❑ All snow and ice must be removed so that it does not occupy space intended to be filled with concrete. Hot air may be used for this purpose.

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- Concrete placements must be protected with insulating materials immediately and surface temperature of concrete must be maintained at a minimum of 55° F for a minimum of **3 days (72 hours)** during cold weather. Commonly used insulating materials include: polystyrene foam sheets, urethane foam, foamed vinyl blankets, mineral wool or cellulose fibers, straw, and blanket or batt insulation.

- When placing 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 **2 days** (**48 hours).** Note: When placing conventional concrete during "non-cold weather" conditions, protection from freezing shall be maintained for at least **24 hours**.

- If footings were required to be protected from freezing, foundation walls will not be allowed to be placed for at least 48 hours. **Exception:** If protection from freezing can be maintained for the period specified above the wall may be placed after 24 hours has elapsed from the time of the original footing pour.

- If accelerants are used to decrease setting time of concrete, these chemical additives may equal no greater the 2% of the total cement weight of the approved concrete mix design, as indicated on the concrete ticket.

- To lower the likelihood of cracking due to thermal stresses, precautions should be taken to assure gradual cooling of concrete surfaces at the termination of the protection period. If an extreme weather change in imminent, protection of the placement should continue until a less rapid cooling will occur.

Inspection Practices

- Inspectors shall approve only the foundation elements that are going to be poured that same day.

- The inspectors will be checking to ensure that the subgrade is not frozen and whether the proper protection components are on site at the time of inspection when daily temperatures are below 32° F or forecasted to drop below 32° F within the next 24 to 48 hours.

- 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 additive that may have been added to the concrete.

- When this procedure mandates protection of footings and walls, the inspector shall give only a partial approval on the initial inspection. Final approval will be given only when it can be established that proper procedures have been taken to protect the concrete from freezing.

- If the inspector believes that the concrete has not been properly protected as described above or per another approved method, the inspector may require that the concrete be tested in order to ensure that proper strength of the concrete has been developed.

Credits: Portions of this report were reprinted from the October 2002 edition of Codeword, the official newsletter of the Massachusetts Board of Building Regulations and Standards.

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