



Cold Weather Concrete

Issues with Cold Weather Concreting

What is the definition of cold weather?

When the ambient temperature is continuously below 32°F the weather is without a doubt cold. But, there are conditions when above 32°F when special precautions should be taken during concrete construction.

When the following two conditions exist, cold weather concreting practices should be strictly adhered to:

Condition 1) When the average of the maximum and minimum air temperatures recorded on 3 consecutive days is less than 40°F, and

Condition 2) when the air temperature during the last 12 hours in any 24 hour period is 50°F or lower.

Concrete is a mixture of coarse stone or gravel, sand, cement and water. In the winter, there is a real risk of the water in the concrete freezing. Water within the pores or capillaries in concrete can freeze resulting in irreparable damage within the concrete due to expansive forces within the concrete matrix as the volume of water increases upon freezing. Frozen water takes up about 9% more volume than liquid water. This is similar to why special precautions are taken during winter months to prevent water pipes in a home from freezing causing a catastrophic rupture. Concrete at 28°F or lower is susceptible to freeze-thaw damage if saturated to greater than 91% of the pore volume filled with water. It is known that if concrete attains a compressive strength of 500 psi before being allowed to endure a single freeze-thaw cycle then no damage will occur.

Concrete at lower temperatures (<50°F) can set slower and gain strength at a much slower pace. Frozen subgrade can cause the concrete to set slower at the interface of soil-to-concrete and the top crusting over with the bottom still soft. If the concrete temperature is maintained at least 55°F during the first 24 hours, the required 500 psi can be attained before first freeze. Subsequent freeze-thaw cycles are not permitted until the specified design strength is obtained. The design strength should be 4500 psi if it is known that deicers will be applied to the surface. No deicers should be used until the concrete is at least 1 year of age. Well proportioned air entrained concrete can prevent damage during repeated cycles of freezing-thawing. Air entrained concrete can provide an air void system with enough space for water to occupy during expansion of freezing water preventing damage to the concrete matrix.

Concreting Practices to Consider are as follows:

- Use the lowest slump possible to reduce bleed water.
- Never place concrete on frozen ground or on ice or snow.
- Warm the ground the day before using tarps and blankets to hold the heat absorbed by the soil from the sun during the previous day.
- Have all curing, coverings and insulating materials on site to hold heat within the concrete.
- Use thermometer or maturity readings of concrete to monitor if concrete protection is sufficient.
- Use calcium chloride set accelerators cautiously due to mottling of finished concrete surfaces especially in colored concrete and risk of corrosion of metallic reinforcement or metallic embedment. Non-chloride accelerators are available which prevent mottling of the surface but may be expensive.

Additional Questions?

Contact:

Nick Gallagher

South Ready Mix Sales

641-522-9206