

Cold Weather Concrete: Solutions, Guidelines & Tips



Cold weather can present many problems for your concrete. When the temperature drops, your concrete may freeze, or go through cycles of freezing and thawing, before acquiring adequate strength. This can cause costly issues down the road. Luckily, these problems can be avoided by taking precautionary steps to protect exposed concrete in cold weather conditions.

What really is cold weather?

ACI 306 defines cold weather when the following conditions exist for three consecutive days:

- The average daily temperature falls below 40°F
- The air temperature does not rise above 50°F for more than half a day in any 24-hour period

What is the problem?

When a combination of the above factors occurs and the weather becomes cold, concrete may encounter problems, due to water freezing. You should know that:

- Water begins to freeze in the concrete capillaries at 28°F
- Water expands by up to 9% of its volume when it freezes, causing cracks in the concrete matrix
- A strength reduction of up to 50% can occur if the concrete freezes before reaching a compressive strength of 500 psi



What is the solution?

The following facts and guidelines should be considered to minimize cold weather-related concrete quality problems:

Early Stages

Concrete should be protected from freezing at an early age (first 24–48 hours) until it achieves a compressive strength of at least 500 psi. When making and testing concrete cylinders, maintain an initial curing environment temperature of 60°–80°F.

Concrete Strength

Concrete that is saturated with water should not be exposed to cycles of freezing and thawing until it achieves a compressive strength of at least 4000 psi. Methods used to accelerate strength gain can include:

- Type III portland cement (ASTM C150)
- Additional portland cement (100–200 lb/yd³)
- Chemical admixtures (ASTM C494 Type C & E)

Set Times

For every 10°F difference in concrete temperature, set time will change by 1/3rd of its value. For example, a 6-hour set at 70°F equals an 8-hour set with the same concrete at 60°F. Using hot water is the easiest and most efficient way of raising concrete temperature to increase set times. However, avoid using water temperatures greater than 140°F. Chemical admixtures, such as the ISOXEL 5400 & 4400 accelerators are also great ways to manipulate set times in cold weather.

Admixtures

In addition to accelerators mentioned above, concrete that will be exposed to freezing and thawing, even during construction, should be air entrained. (Exceptions may be interior floors with hard-troweled finishes.) The use of admixtures once again can help. CEMEX ISOSPHERE air entrainers assist with the freeze/thaw durability, reduce bleeding, and stabilize air systems.

Placing

Surfaces in contact with the concrete should be above freezing and free from snow, ice, and frost prior to placement. Also, be sure to cover the subgrade with insulated blankets a few days prior to the concrete placement.

Important Tips to Remember

- Check the weather forecast
- Monitor the temperature of the concrete
- Have all materials available and protected before placing concrete
- Anticipate the worst-case scenario and be prepared for it
- Schedule the placement during the warmest part of the day
- If it is cold enough outside for you to wear a jacket, you probably need to put one on your concrete too!

You are now ready to take on the cold weather conditions! Still have questions about your concrete or need more technical advice? Contact us at admixtures@cemex.com to speak with an expert.



For questions about this bulletin or any other technical issues, please contact us or visit our website at cemexusa.com/admixtures.

