As the leaves start to change, and the temperature starts to drop, construction companies and ready-to-mix producers are gearing up for the colder weather. To avoid lag time or facing issues such as freezing of concrete at an early age, lack of required strength, improper curing, rapid temperature changes, and improper protection of the structure, contractors must plan, plan, plan. This entails using the right protection methods and tools to aid in creating durable, sustainable concrete during cold weather concreting.

## Before concreting in Cold Weather

When faced with temperature fluctuations concrete is subject to different curing conditions. Contractors must prepare long before the weather changes to adequately protect fresh concrete. Having the right equipment ready to use at the job site such as tarps and blankets can help avoid extraneous delays and unsafe concrete development.
ACI 360 defines “cold weather” as three or more consecutive days of low temperatures, specifically outdoor temperatures below 40 degrees F (4 degrees C) and air temperature below 50 degrees F (10 degrees C) for more than any 12-hour period.

Methods to ensure proper curing of concrete during cold weather include:

1. Installing internal electric heating which requires using embedded coils and insulated electrical resistors.
2. Covering with an insulated material after pouring concrete in cold weather conditions. Layering helps maintain the heat that is generated.
3. Using insulated forms along side enclosures to increase effectiveness. This method needs to be closely monitored as to not heat curing concrete beyond its recommended temperature.

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A few of things to consider

- When working with early aged concrete, temperatures should be above freezing or within 10 degrees F (-12 degrees C) of the minimum required placement temperature, according to NPCA.
- The required temperature of concrete is >5°C (40°F) for 48hrs (sourced from, ACI 306)
- The desired strength of concrete before freezing is 3.5 MPa/500 psi (ACI 306), concrete

that is below 3.5 MPa/500 psi can lead to cracking because it does not have the strength to resist the expansion of water due to ice formation.
- A proper curing process results in obtaining the desired strength for your concrete, if that is not established, the newly placed concrete is subject to drying.
- To protect concrete from freeze damage all concrete surfaces need to be protected within the first 24 hours of being placed.
- When removing ice, the volume of ice should not be more than 75 percent of the batch water NPCA.


## SmartRock

With the advancement of technology, easier methods have been developed to aid the construction industry when it comes to monitoring concrete temperature. SmartRock is a waterproof wireless sensor that monitors temperature and maturity of concrete in real-time. The unique features of the wireless senor, which is embedded in the concrete framework, make it easier to check the data as well as share data all in one app. SmartRock can provide an accurate estimate of the strength of concrete over time, uses non-destructive methods to test strength of concrete, and allows for of-site monitoring via the smartphone application. The application works on both iOS and Android devices and is accessible from a tablet or smartphone.

Related articles: Why Concrete Temperature Testing Is Important, Especially During Temperature Extremes

**Learn More About SmartRock**