Concrete Temperature Monitoring in Cold Weather

Optimizing Jobsite Workflow in Cold Temperatures

For many construction companies and ready-mix producers around the world, it is approaching the time of the year when dropping temperatures play a massive role in procedures and requirements that comprise concrete production and placement. Because concrete gains strength more slowly in colder temperatures, concrete temperature needs to be monitored, and certain precautions and measures need to be taken to ensure concrete quality remains optimal and structural failure is avoided.

What is Cold-Weather Concreting?

“Cold-weather concreting” is defined by ACI 306 as the procedures relating to the placing, finishing, curing, and protection of concrete during cold weather. Monitoring temperature and meeting cold-weather specifications is especially important during the winter months as well as early spring when warm days alternate with cold nights below freezing temperatures. ACI 306 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.

Why is it Important?

Temperature monitoring and cold-weather concreting practices are imperative to ensure manufacturers produce high-quality products that meet specifications and avoid potential problems. Among these problems are the freezing of concrete in early stages, lack of required strength, rapid temperature changes, inadequate protection of the structure and its serviceability, and improper curing procedures. These problems can be avoided by taking special precautions to ensure optimal temperature of concrete is maintained during the curing stages and observing a few principles such as protecting concrete from freezing and ensuring little or no external moisture is added unless located in a heated enclosure. It is up to the manager’s discretion to decide whether operating during cold weather will be possible without any issues or if it is wiser to wait for warmer temperatures, and to guarantee the quality of the work being produced.
Concrete Strength and Temperature Control

ACI 306R, “Guide to Cold Weather Concreting,” instructs managers to “[t]ake advantage of the opportunity provided by cold weather to place low-temperature concrete. Concrete placed at lower temperatures [40 to 55 °F (5 to 13 °C)], protected against freezing, and properly cured for a sufficient length of time, has the potential to develop higher ultimate strength and greater durability than concrete placed at higher temperatures. It is subject to less thermal cracking than similar concrete placed at higher temperatures.”

In order to ensure optimal strength gain during colder temperatures, certain measures need to be taken. In mass concrete elements, protective blankets are used as covers to retain the heat generated by the concrete itself and decrease the temperature difference between the surface and inner parts of the concrete element.

Monitoring Temperature in Cold-Weather Concreting
Although there are different devices for monitoring concrete temperature, certain devices and sensors have proven to be more beneficial than others, especially in cold-weather concreting. Wireless temperature sensors, such as SmartRock are designed to address these challenges and more. One of the benefits of fully-embedded sensors during cold weather concrete temperature monitoring is the elimination of a physical connection to the loggers, which could be difficult to set up in cold weather. This allows sensors to remain protected in the concrete and eliminates the hassle of having to find the sensors beneath protective blankets. It also eliminates potential malfunctioning from cold temperatures and exposed wires.

SmartRock allows contractors to navigate the jobsite with their wireless-enabled smartphone or tablet to collect data wirelessly without disrupting blanket placement and heat retention. It improves speed and efficiency on the jobsite by enabling contractors to gather real-time temperature, strength, and maturity results. Having this data easily accessible allows contractors to optimize the heating process, decrease energy costs, minimize the risk of concrete cracking, and optimize subsequent construction operations.

Learn More About SmartRock

Sources: Guide to Cold Weather Concreting by ACI
National Precast Concrete Association