CEMSTONE
ENGINEERING SERVICES

October 2017

ACI 306R - 16

COLD WEATHER CONCRETING

Cold weather exists when the air temperature has fallen to, or is expected to fall below 40 °F (4 °C) during the protection period. The protection period is defined as the time required to prevent concrete from being affected by exposure to cold weather. Concrete placed during cold weather will develop sufficient strength and durability to satisfy the intended service requirements when it is properly proportioned, produced, placed and protected. The necessary degree of protection increases as the ambient temperature decreases.

TOP 10 COLD WEATHER TIPS YOU NEED TO KNOW FOR STRUCTURAL CONCRETE

** ***Please note that ACI 306 addressed structural concrete. ACI 318 address durability such as surface defects which requires 4,500 psi for exterior concrete in a severe climate such as Iowa, Minnesota and Wisconsin.***

1) To prevent damage to the concrete due to early age freezing in a dry condition, concrete should be protected until it obtains a minimum **COMPRESSIVE STRENGTH OF 500 psi.** For well-proportioned concrete mixtures, this is typically within 48 hours of placement when the concrete temperature is maintained at 50 °F.

2) Properly air-entrained exterior concrete should not be subjected to freezing and thawing in a saturated condition before developing a **COMPRESSIVE STRENGTH OF 3,500 psi.**

3) **FROZEN SUBGRADE** can cause the concrete to freeze as well as cause finishing and durability issues. The subgrade should be (a) free of snow and ice and (b) have a temperature no greater than 20 °F cooler than the concrete being placed.

4) **MINIMIZE RAPID TEMPERATURE CHANGES**, particularly before the concrete has developed sufficient strength to withstand thermal stresses which can cause cracking. Gradually remove insulation and other protection methods so that the surface of the concrete temperature decreases slowly over a 24 hour period.

5) The use of **HIGH EARLY STRENGTH MIX DESIGNS OR ACCELERATING CHEMICAL ADMIXTURES** is recommended during cooler temperatures to increase the speed of hydration and mitigate free water from freezing. Avoid calcium chloride if the concrete contains steel reinforcement. Accelerating admixtures must not be used as a substitute for proper curing and frost protection.

6) **TEST CYLINDERS** must be cured according to ASTM C 31 which specifies an initial temperature curing of 60 to 80 °F (cure boxes, blankets or other curing methods must be used in order to comply with ASTM specifications). ASTM C 31 also requires that cylinders must be initially cured in an environment free of evaporation and stored for not longer than 48 hours prior to being taken to the laboratory for final curing and testing.

7) **DO NOT USE UNVENTED HEATERS: CARBON DIOXIDE** from unvented heaters can cause carbonation of the concrete. Carbonation can result in craze cracking and a soft, chalky surface that will dust under traffic.

8) Allow ample time for **BLEED WATER** to dissipate before final finishing. Trapping or finishing bleed water into the concrete can cause higher water/cementitious materials ratios at the surface and may lead to scaling and/or blistering.

9) **PROPER CURING** procedures must be followed immediately after finishing is completed. Please see Cemstone's Concrete Flatwork Guidelines for more information.

10) **MONITOR CONCRETE TEMPERATURES**. Monitor temperatures at concrete corners and edges as they are vulnerable to freezing as temperatures are usually more difficult to maintain in these locations.