HAHN READY MIX

Cold Weather Concreting

Technical Bulletin #2

BRRR...

It's cold outside, but more and more commonly, project owners and general contractors are pushing for concrete work to continue through the cold winter months. While it is difficult to reproduce the quality of exterior concrete made in more moderate temperatures, there are steps that can be taken to give our concrete a fighting chance. So, how

do we do it? What do we need to do with the concrete mix and the concrete pour, and what kind of protections do we need afterwards?

Facts about concrete in cold weather. As you might know, concrete set time and strength development depends greatly on the initial concrete temperature and the ambient temperatures the concrete is exposed to during curing. A rule of thumb for set times is that every 20° drop or gain in concrete temperature doubles or halves the set time, depending on which direction you are moving. For example, If a concrete mix achieves initial set in two hours at 90°, it will achieve initial set in four hours at 70° and eight hours at 50°. In regards to strength development, when concrete falls below 40°, little to no hydration happens and the concrete kind of goes to sleep. Below 29°, concrete freezes and can be permanently damaged if it has not achieved strengths necessary to withstand that freezing action.

What can we do with the concrete mix?
The following mix design options are smart choices in cold weather:

- - Reduce or eliminate supplementary cementitious materials like Fly Ash and Slag. These products set slower than cement, which is undesirable in winter conditions.
- - Use heated water and/or aggregates to achieve a concrete temperature of 60-65° in cold temps for all non-mass concrete pours.
- - Use accelerators to speed up the cement hydration process. This causes the strength gain of the in-place concrete to begin earlier and develop more rapidly. Remember, calcium chloride is a very effective accelerator, but is not to be used with rebar or wire mesh, as it will corrode the steel. A non-chloride accelerator is preferable when steel is present.
- - Use water reducers or superplasticizers to lower the in-place water/cement ratio. This results in quicker sets and greater strengths that give more resistance to freezing action.
- - All concrete, save interior hard-troweled floors, should be air entrained if it will be subject to freezing and thawing. Even if the freezing and thawing will only happen during construction.

What should we do to prepare for our concrete pour?

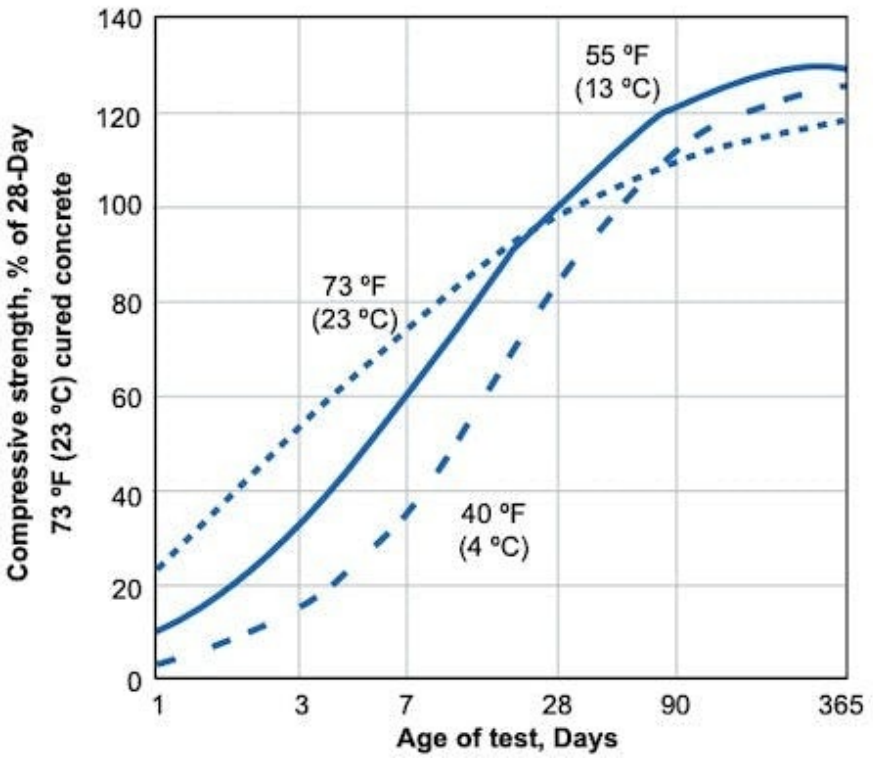
- - Make sure there is no frost in the ground below the concrete pour.
- - Make sure the pour area is clear of ice and snow.
- - Make sure any rebar is not frozen. Frozen rebar can freeze the concrete immediately surrounding the bar and result in a poor bond with the bar.
- - If we are pouring outside, have blankets and other curing materials ready before pouring.
- - Extreme conditions may require windbreaks, insulated forms, or heated enclosures to properly protect the concrete.
- - Remember to vent any enclosures heated with fuel based heaters to prevent carbon monoxide poisoning and carbonation of the concrete surfaces that will lead to dusting.
- - Pour the concrete as quickly as is practical to reduce the time the concrete is exposed to the elements.

How do we protect the concrete after it has been poured?

- - The goal is to keep the concrete above 50° for the curing process.
- - We can achieve this by using insulating materials to cover the concrete. These materials may include polystyrene, straw, thermal

blankets, and plywood. Multiple layers or materials may be necessary.

- - Concrete needs to be protected from ANY freezing until it reaches 500psi (~24hrs)
- - Concrete expected to survive multiple freeze thaw cycles should be protected until it reaches 3500psi. See the chart below for strength gain of concrete at different curing temperatures.
- - In absence of any specific job requirements, ACI 301 recommends at least 3 days of protection or until the concrete has reached 85% of it's designed strength, whichever is longer.
- - When it is time to remove protection, it is wise to do it in layers to allow the concrete to drop temperature gradually. Removing three layers of insulating blankets at once, for example, could cause thermal shock for the concrete.
- - Never use water curing or curing compounds on any concrete that may be exposed to freezing over the following 28 days.
- - Make sure any cylinders that have been made are also adequately protected.
- - Do not allow any flatwork to be salted in the first year, if salt must be added for safety reasons, use rock salt and NEVER Magnesium Chloride or any fertilizer based de-icers.
- - Make sure to clear ice and snow off slab for the remainder of the winter.



In the figure above, see that curing temperature of concrete significantly affects concrete strength development.

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Tech Bulletin #1 - Portland Limestone Cement

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