

TECHNICAL BULLETIN



COLD WEATHER IS UPON US!

- Although it rarely reaches freezing temperatures in the Greater Austin area, it does get cold enough to slow down the reaction between cement and water resulting in set times that last longer than anticipated. This presents us the following questions: How much longer will we wait? How does this impact concrete construction? The answer to these questions can be found below.
- The reaction between water and cement occurs at a slower rate at lower temperatures. The lower the temperature, the slower the reaction. This correlation means the cooler it is, the longer it takes for concrete to reach initial set or the longer you have to wait to finish flatwork; and the longer you must wait before stripping forms or moving a precast piece. Today we will look at the data and talk about the basic issues and what we can do about it.

HOW LONG WILL IT TAKE?

When cement and water are mixed together they produce a reaction known as hydration. This reaction generates heat which in turn causes the cement paste to solidify. When we make concrete, we have to be aware of when the ready mix reaches enough integrity to support finishing the operation and when it is strong enough to stand on its own so we can strip forms. We commonly use the term "initial set" to refer to the point in time when the paste has reached a level of hardness associated with the onset of strength development. A few hours after this, concrete flatwork is normally ready to be finished. Using set time measurements we can quantify the effect of temperature and materials on the rate of hydration. Whether we are talking about set time or the time you have to wait to finish concrete, the impact of temperature is the same. A general rule to consider is: a 20 degree drop in temperature will double the set time or the time you have to wait to begin finishing operations.

Consider a house slab placed at 7:00 AM on a day with an average temperature of 93°F. Let's assume that normally you would begin finishing that slab by noon. A few months later when the average daily temperature is 73°F, you would have to wait until 5:00 PM to begin finishing. Unfortunately, most finishers will not want to wait the extra five hours so they will get on it earlier, potentially causing spalling, dusting, cracking, and other defects resulting from trapping bleed water under the surface. Now imagine this happens at 53°F, again the waiting time doubles so you end up finishing the slab late in the evening.

There are steps you can take to prevent delayed construction schedules. The most common and cost-effective remedies are:

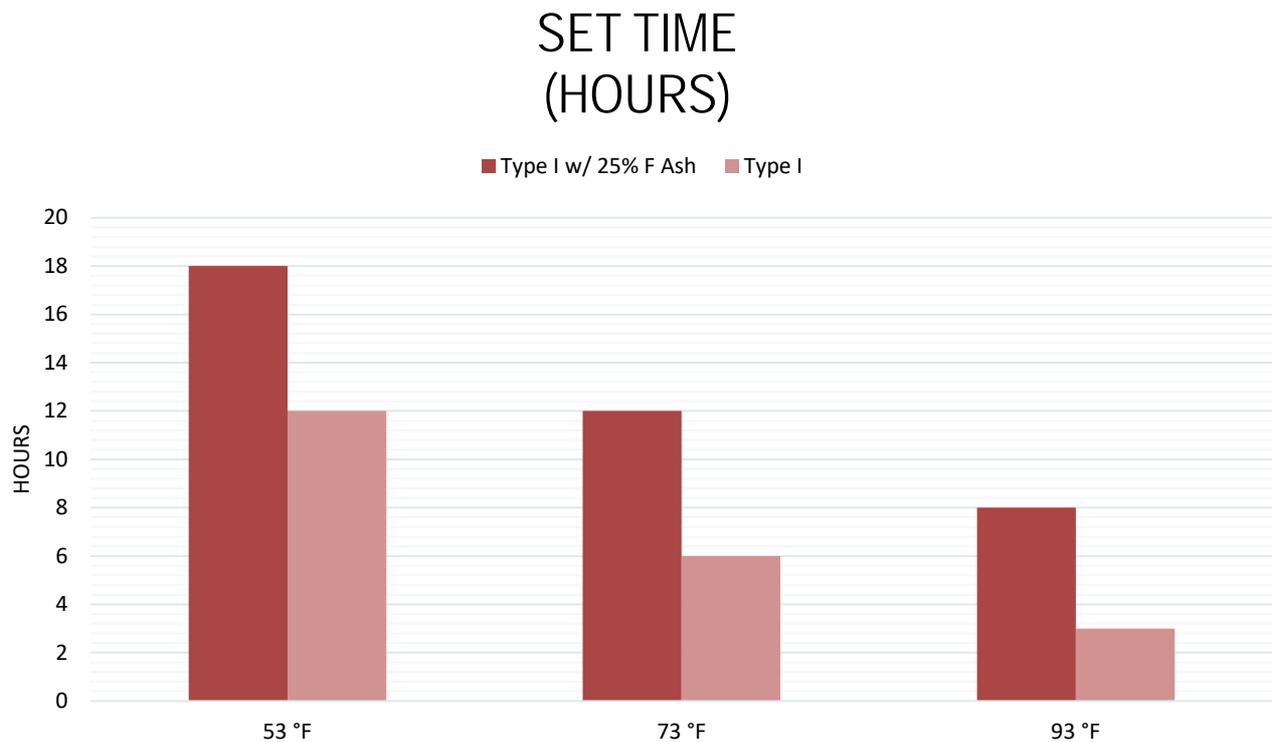
- decreasing or eliminating fly ash
- using an accelerating admixture
- increasing the cement content to compensate for the cold weather



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Centex Materials LLC

The chart below shows the relationship between straight cement and fly ash mixes at the three different temperatures presented in our house slab scenario. It also shows the relative set time at the varying temperatures. The actual time you have to wait to begin finishing will vary depending on your materials and specific mix designs (sack content, aggregates, etc).



Strength development is affected the same way in that the lower the temperature, the longer it takes to reach target strength. This is particularly important in any construction where the forms need to be stripped after a short curing period. Strength development is more complicated, but again it can take twice as long to reach a given strength during cold weather as it does in the summer months.

FIGHT THE COLD WEATHER – HOT WATER & NC

At Centex Materials we offer additional products that will accelerate your projects during cold weather.

- **Hot Water** – Available at both South Plant and Round Rock. Our temperature controlled water tank can increase your concrete temperatures up to 15 degrees Fahrenheit.
- **Non-Chloride Accelerator** – Available at all plants, our NC will reduce curing/set times as well as increase early compressive strengths without detriment to ultimate strengths.

Please contact your sales representative or dispatch for more information regarding our temperature controlled products.