Perfecting the cold pour

Cold-weather concrete could save Alaska builders, and their clients, time and money

By Melissa Campbell
Alaska Journal of Commerce

Builders — and especially the building owners — cringe a little when they realize they'll have to pour concrete in the winter.

Winter concrete pours add to the cost and efforts of construction. Thick plastic has to be put up to surround the work area. Then it has to be heated, and kept to a temperature above freezing.

But consider a patch of sidewalk in New Hampshire. The concrete was poured when the air temperature was at 20 degrees. Later, temperatures plummeted to minus 20 degrees. The still-curing concrete didn't freeze, it set up textbook perfectly. Years later, it is still intact.

With a variation of chemicals already used in the industry, concrete could be poured in temperatures as frigid as minus 5, and soon, maybe even to minus 10.

Nicole Lupro, a technician for Alaska Concrete Casting, tests for slump and air content during a cold-weather concrete demonstration held in Juneau in early February. *PHOTO Courtesy of SpringBoard*

"This has tremendous application opportunities for Alaska construction," said Adam Fisher, technical manager for SpringBoard.

SpringBoard, a program of the Juneau Economic Development Council, has a partnership with the U.S. Department of Defense to transfer technology between the federal government and private businesses, educational institutions and state government.

The formula to make a cold-weather concrete additive came from the U.S. Army Corps of Engineers' Army Cold Regions Research and Engineering Laboratory. Charles Korhonen, now a consultant at SpringBoard, recently retired from the lab but continues his work on the additive.

"Nobody is using this," Korhonen said. Not even the Corps of Engineers.

But why not? The construction industry spends more than $1 billion a year to heat jobsites enough to pour concrete. This admixture could save up to a third of the cost of winter pours in the long run, Korhonen. Chemicals do cost more, but savings can be found in eliminating heating and labor time to put up the tent.

Concrete is made of a mixture of cement, an aggregate — the size of the rock depends on the job — and water. After it is mixed and poured, it solidifies and hardens in a chemical process referred to as hydration. The water reacts with the cement, which hardens, bonding the other components together and eventually forming into the stone-like material.

Build codes say concrete can't be poured unless temperatures are at 40 degrees or warmer.

If the concrete is poured in temperatures colder than 32 degrees, the water in the concrete freezes, but the concrete will still harden. Once the water thaws, the concrete has more and larger holes, which weakens the end product.

“You lose half the strength,” Korhonen said. “Basically the concrete is destroyed and you have to start over. It's less durable.”

The formula depresses the freezing point of water, similar to an antifreeze. It also speeds up the rate that the concrete hardens.

The process has been around for more than a decade. In 1993 the Corps did a test pour in northern Michigan, laying a cold-weather concrete section next to a regular concrete section that was poured under tented and heated conditions.

The cold-weather concrete has performed as well as the rest, Korhonen said.

There are two main barriers to widespread use. Companies that make the chemicals will have to make adjustments to add this to their list of products. “It's one of those, ÔIf they make it, will people buy it?'” Korhonen said.

But most importantly, there are no building standards for the use — yet.

The American Society of Testing and Materials has recently provided the foundation for manufacturing the mixture, offering better ideas for performance.

But building codes are slower to change, Korhonen said. The American Concrete Institute is going through the process of laying out guidelines for the use in its annual report. That's the first step to industry acceptance.

“They used to say cold-weather concrete was impossible,” Korhonen said. “About 10 years ago, I started to challenge that, and they couldn't back it up. Now we have the evidence that it does work.”

A demonstration pour was conducted in Juneau earlier this month, and a second is scheduled for Fairbanks in early March. The materials will be tested for strength and durability over the coming weeks.

Korhonen is scheduled to give a presentation on the cold-weather method to a Society of American Military Engineers conference in Anchorage March 1.

Melissa Campbell can be reached at melissa.campbell@alaska journal.com.