Use curing blankets to offset cold weather effects on concrete

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More competition, lower profit margins, and contract incentives to complete jobs early are forcing many concrete contractors to lengthen their work year. To do this they must cope with cold weather effects on freshly placed concrete. Insulated curing blankets, used along with other cold weather procedures, can permit concrete work at temperatures as low as -25°F.

How cold weather affects concrete work

Even mildly cold weather slows concrete construction. At 70°F workers might be able to safely strip forms from a raised slab in 3 days. But when temperatures dip to 50°F the same concrete may take 7 days to reach a strength level that permits stripping. At temperatures around 32°F the needed curing time is much longer and there's the added danger of frozen concrete.

The longer curing time needed for unprotected cold weather concrete hits contractors where it hurts—their bottom line. To keep forms in place longer, they have two options: work at a slower pace and delay job completion, or buy more forms. There's a better choice—speed up concrete strength gain enough to offset low temperature effects. Then forms can be reused as quickly as during warmer weather.

Insulation supplements other...
methods

Several strategies, combined or used separately, can speed up strength gain in cold weather:

- Make mix design changes such as using more cement, high early strength cement (Type III), or accelerators.

- Heat water and/or aggregates used to make concrete.

- Keep the freshly placed concrete warm by putting a heat source either inside an enclosed work area or underneath a raised slab.

- Cover concrete with insulating material that holds heat in and keeps cold out.

At temperatures between 50°F and freezing, a mix design change may be all that’s needed to speed strength gain. Insulation, however, will improve results by holding in heat produced by cement hydration. At or below 32°F, covering the concrete with insulation retains heat and also helps to keep surface concrete from being damaged by freezing.

Choosing the insulating material

One traditional way to protect freshly placed concrete is to cover it with about 12 inches of straw or hay held down with a tarpaulin. The method isn’t suitable for columns, piers, or other vertical members. And on flatwork it’s easily undone by a strong wind. If the straw gets wet it loses its insulating value, but dry it’s a fire hazard, especially if open flame heating methods are used.

Instead of hay or straw, most contractors today use curing blankets. Fiberglass or closed-cell foam insulating material forms the blanket core. It’s covered with woven polyethylene fabric and buttoned to the fabric to keep it from bunching up or sliding.

Fiberglass-filled blankets were first on the market. They are more effective than the hay-and-tarpaulin method because they’re more fire resistant, can be easily anchored, and can be tied to vertical concrete members. However, they are easily damaged, cutting reuse. Fiberglass filling tends to mat, lowering the insulation value. And it soaks up any water that enters through a torn cover. This also lowers insulation effectiveness.

Blankets made of closed-cell foam are more effective than fiberglass blankets. The foam doesn’t absorb water or compress after repeated use.

Polypropylene foam provides excellent thermal protection because of its closed-cell structure, small cell size, and very low density. The thermal resistance (R value) for a 1-inch thickness is 3.7°F/Btu/hour/square foot. A high R value means less heat per hour passes through foam of a given area and thickness.

Polypropylene foam also remains flexible at low temperatures. Even when unrolled in cold weather, polypropylene foam blankets lie flat on a slab. They don’t get brittle in very cold weather so workers are less likely to tear them while moving them. This good resistance to damage allows the blankets to remain in service for many years. Some polypropylene blankets have been in use for more than 10 years.

Other uses for curing blankets

More than 75% of the curing blankets in service today are used to insulate elevated concrete slabs heated from below. Some are draped over walls or wrapped around columns. They have also been used on construction sites to keep the ground from freezing in late fall. Excavating frozen areas to set up concrete forms can be like digging into solid rock. Blankets put in place before the first frost can be gradually removed as the construction area expands later in the season. At some sites (see photo), workers can turn the newly uncovered ground with shovels instead of power equipment.