CASE STUDY

MASSMAN CONSTRUCTION COLD WEATHER CONCRETE INNOVATIONS

WITH POWERBLANKET

POWERBLANKET HEATED CONCRETE CURING BLANKETS OFFER A MANAGEABLE AND REALISTIC METHOD FOR CURING CONCRETE IN COLD AND ADVERSE WEATHER CONDITIONS.

> We didn't have the time to wait out the winter for the temperatures to become more moderate. The Powerblanket concrete heating blankets certainly played an important role in keeping us on schedule without having to postpone the pour on an important Kansas City bridge.
>
> DALE HELMING | PROJECT MANAGER
> MASSMAN CONSTRUCTION

EXECUTIVE SUMMARY

Massman Construction Co., also known as America's Bridge Builder, excels at complex bridgework. While constructing Kansas City's Christopher S. Bond Bridge they encountered a mid-winter dilemma. The bridge primarily utilized pre-cast concrete, but the panels left a 18-inch wide by 12-inch deep gap (46 cm x 31 cm). Unfortunately, the support beam beneath the bridge, which formed the bottom of the gap, was exposed to temperatures of -5°F (-21°C).

Water in concrete can freeze starting at 30°F (-1°C) and at around 27°F (-3°C) the hydration process can stop entirely. Since ice occupies about 9 percent more space than water, this can seriously affect the integrity of the concrete. Massman concluded that the traditional solution of erecting a structure and heating up the ambient air temperature wouldn't work in this case. They turned to Powerblanket heated curing blankets, which warmed up the surrounding concrete and support beam, and then kept a constant temperature on the concrete. This innovative solution finished the job.

BACKGROUND

In 2007 three companies - Massman Construction Co., Kiewit Construction, and Clarkson Construction Co. - formed the joint venture called Paseo Corridor Constructors, which received

POWERBLANKET PROVIDES THE MOST INNOVATIVE HEATING SOLUTIONS ON THE MARKET, DELIVERING SAFE UNIFORM HEAT.

the design-build contract for the bridge. Construction started in April 2008.

The overall project called kcICON cost $245 million and required the rehabilitation of more than four miles of Interstates 29 and 35 and a new bridge to replace the Paseo Bridge that has spanned the Missouri River since 1954. The Missouri Department of Transportation estimated the project would require 7,000 tons of steel and 50,000 cubic yards of concrete.

In late 2009 Massman Construction Co. encountered a unique challenge in completing a critical portion of the new cable-stayed river bridge.

COLD WEATHER CONCRETING

The bridge deck design called for precast concrete panels, each weighing about 60,000 pounds (27,215 kg). The panels, which were designed to have post-tensioning bars installed, were formed in a precast yard and hauled to the bridge site.

With the panels placed in proper position, Massman still confronted an 18-inch wide by 12-inch deep void (46 cm x 31 cm), or trough, that needed poured concrete in order to connect and solidify the bridge deck. In warmer weather this would not present a challenge, but low temperatures dropped to -5°F (-21°C), and they couldn't afford a delay on the project.

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"Taking into account the cold weather concreting considerations for proper curing, we had to maintain our concrete pour at a minimum of 46°F (8°C) for seven consecutive days," said Dale Helmig, project manager for Massman. "We were on a tight schedule and looking at outdoor temperatures at or below O°F (-18°C), so we had to find a way to keep the concrete warm."

EXPERTS AGREE THAT THE BEST TEMPERATURE FOR POURING CONCRETE IS BETWEEN 50-60 °F.

EXPLORING CONCRETE OPTIONS

Massman contemplated various ways to generate the necessary heat. Although they felt confident that they could use portable heaters to heat the top of the fresh concrete, the support beam below the bridge posed a real heating problem.

Massman's crew decided they had to enclose the bottom to keep the bottom warm. To do that, they would come underneath from a barge on the river and hoist up a boxed plywood structure around the beam. Once in place, they would heat the air in the enclosure. However, after some number crunching, the high cost killed this option. The plan would take a long time to execute and it wouldn't guarantee success.

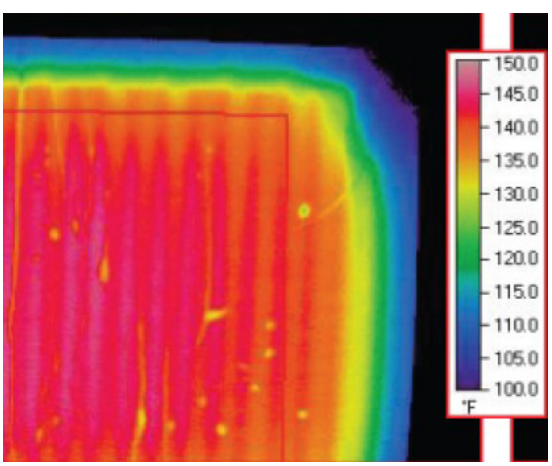
THE NEW SOLUTION

Fortunately, the company connected with a local equipment dealer who had an alternative solution in the form of electric-powered concrete curing blankets from Powerblanket. Powerblanket products deliver contact heat. Helping to seal in the hydration and providing additional heat to keep the concrete within a desired temperature range, the blankets cured the concrete without cracking it.

"We gave the engineers at Powerblanket the boundary conditions — at least 46°F (8°C) at the bottom but no warmer than 82°F (28°C) at the top," said Helmig. "They performed the calculations and determined the appropriate blankets needed to get the job done." Standard curing blankets could help heat the top surface of the poured concrete, but they could not adequately heat the entire 12-inch depth due to the extreme cold affecting the bottom portion of the slab resting on the steel support beam beneath the bridge deck.

Powerblanket standard concrete blanket on the top of the project.

Massman used 34 Powerblanket Extra Hot Series blankets. Each came equipped with a digital thermostat to ensure that the blankets did not overheat the concrete. The thermostat allowed constant temperature monitoring. Because of the technology used by Powerblanket products, the heat spreads evenly, and even the corners and edges of the concrete receive protection



The thermal image above records how evenly the product spreads heat. In fact, 98% of the temperature data points measured within a

POWERBLANKET CONCRETE BLANKETS ARE AN IDEAL SOLUTION FOR MAINTAINING OPTIMUM CONCRETE CURE TIME DURING COLD WINTER CONDITIONS.

range of 137°F to 147°F - only 10 degree difference (58.3°C to 63.8°C).

THE DETAILS

The Powerblanket heated blankets used were 6 feet by 12 feet (1.8m x 3.7m), easily exceeding the 18-inch (46 cm) width of the trough. The additional blanket width was utilized to preheat the precast concrete panels that formed the sides of the trough prior to the pour. The preheating process helped minimize each panel's ability to absorb heat from the freshly poured concrete.

Using portable generators and junction boxes to supply power to the 120volt electric blankets, Massman initiated the weeklong concrete cure. In addition to relying on the blankets' external thermostats, crew members used probes to take temperature readings several times daily to ensure that the engineering specifications were being properly met and maintained for the full seven-day period – during wihich the outdoor air temperature hit a low of -5°F (-21°C).

"It was awfully cold, but the blankets did their job keeping the concrete temperatures within spec," said Helmig. "We achieved the PSI (Pounds per Square Inch] levels we had targeted, and it turned out to be a successful operation. We didn't have the time to wait out the winter for the temperatures to become more moderate. The Powerblanket products certainly played an important role in keeping us on schedule and not having to postpone the pour."

TEST RESULTS

POWERBLANKET

2.8X FASTER

That's how much a recent test found that Powerblanket concrete blankets outperformed standard curing blankets. That means doing jobs quicker in the winter.

3,925 PSI STRENGTH

3,925 psi (276 kgf/cm2)—the strength of the concrete cured under the Powerblanket curing blanket during the three-day test, which took place in temperatures ranging from 22°F/-5°C to 38°F/3.6°C.

THE OTHER GUY

2,162 PSI STRENGTH

2,162 psi (152 kgf/cm2)—the strength of the concrete cured under a standard curing blanket in the same test.

NEED A COLD WEATHER CONCRETE SOLUTION?

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