ARTICLE REPRINT
Concrete Construction *September 29, 2011*

FACING A TIGHT SCHEDULE

Missouri's largest bridge improvement project benefitted from fast-setting grout.

The contractor sprays a curing compound on the keyway joints.

> *"The keyways were grouted with CTS Cement's Cement All fast-setting grout, because it showed high early strength and excellent bonding characteristics during mock-up testing.*

In 2009, the Missouri Department of Transportation (MoDOT) initiated the largest bridge improvement project in the state's history. The Safe & Sound Bridge Improvement Program is a two-pronged program designed to improve 802 of Missouri's worst bridges within five years—with a goal of completion by the end of 2013. The $487 million design/build project will implement a total replacement of 554 bridges in Missouri.

In the program, 248 bridges were identified for rehabilitation, and 174 of those projects were completed by the end of 2010. The bridges are put out for bid in groups according to location, type, or size to expedite the design and construction process.

The 554 bridges scheduled for full replacement were packaged in a single design/build contract with KTU Constructors. KTU Constructors is a joint venture of: Kiewit Western Co., Omaha, Neb., which specializes in construction and mining; Traylor Bros. Inc., Evansville, Ind., which is a heavy civil contractor; and United Contractors Inc., Great Falls, S.C., a heavy highway contractor. By the end of 2010, KTU had completed 156 bridges. More than 300 are scheduled for construction in 2011.

As part of this program, 90 bridges in the Mid-Missouri area were scheduled for repair or replacement, including the Highway J Bridge near Chillicothe, which was replaced in June 2010.

REHABILITATING HIGHWAY J

Replacement was necessary to ensure public safety on the Highway J Bridge because it had deteriorated beyond repair. During the construction process, workers installed seven precast, prestressed concrete slabs. To keep construction moving quickly, a fast-setting, high-strength, nonshrinking grout was used. The keyways were grouted with CTS Cement's Cement All® fast-setting grout, because it showed high early strength and excellent bonding characteristics during mock-up testing. The high strength was essential to make the individual prestressed concrete beams function as one structure.

This side profile of a panel shows a keyway joint using Rapid Set Cemet All.

ARTICLE REPRINT
Concrete Construction *September 29, 2011*

Pictured is a top view of a keyway joint.

"Bonding was a critical element of this project," says Jon Brown, product support manager for CTS Cement, Cypress, Calif. "The construction team was looking for a product that would bond the edges of these keyways."

The grout's ability to seal the bridge is a critical element checked during the MoDOT National Bridge Inventory (NBI) inspection following construction. The NBI is a database, compiled by the Federal Highway Administration, with information on all bridges and tunnels in the United States that have roads passing above or below. During the state's inspection, the bridge is flooded and observed for any leakage.

"If there's any leaking through the beam joints, it will automatically derate the bridge and subsequently has the potential to reduce the overall life of the bridge," explains Mark Thompson, Northeast regional quality control manager for KTU. "We're trying to construct the best possible bridge, and the NBI bridge rating is one of the measures of that success."

THE PROCESS

The fast-setting grout was used to fill the keyways between the cored slab and box beam girders and in the holes where dowels connect the beams to the piers and abutments. Additionally, it was used to fill the 2- to 3-inch keyways to allow the individual cored slabs to operate as one unit.

First, workers set the beams and panels to construct the keyways. Once the keyways were sealed and plugged on both ends, grouting commenced on the six keyways, with 105-foot spans each. The depth of each keyway measured approximately 6 to 7 inches.

The grouting process began with predampening of the keyways. Four bags of the grout were mixed at a time in a gas-powered mortar mixer with the allotted dose of water to produce a consistent, flowable mixture.

"A couple of things we made sure to do was have everything ready to pour and people in place, as the grout sets up very quickly," says Kelly Henderson, foreman, Cramer and Associates, Grimes, Iowa—a KTU Constructors subcontractor on the Highway J Bridge and seven other replacement projects. The fast-setting grout could set in 15 minutes, so delays were not an option.

Because construction occurred during hot weather, the crew needed more time, so CTS Cement's SET Control® setting additive was added to increase the working time an additional 5 to 10 minutes. "We also used water cooled with ice because we poured in hot weather," says Henderson.

Then they found it was necessary to alter the mixture's fluidity, so another additive, CTS Cement's FLOW Control®, was used. "We tried several different states—a plastic state, a fluid state, and a flowable state," says Thompson. "We found the flowable state produced the results we wanted, filling the keyway without voids in it."

During the process, the crew found that setting the mixer on a high rpm helped fully break up the material in the mixer. Henderson found cleaning the mixer once every three batches helped avoid buildup.

After mixing was complete, workers placed the grout in 5-gallon buckets and poured it into the keyways. Then workers knocked the grout down with trowels. After the initial set of the grout, curing started. Days later, the surface was sandblasted and then sealed.

"Cement All® takes very minimal efforts to cure compared to the other approved products," says Henderson.

SHORT TIMEFRAME

One challenge with this project was completing the work within the requirement of a tight schedule. The 58-day timeframe did not allow for rain days or delays. Henderson and his crew have completed Highway J and two other bridges using this fast-setting grout within the days allotted.

"We decided to use Cement All over the other types of grout because it enables us to get on the bridge and schedule work to be done on it the next day without worry of whether the grout will have the strength needed to do so," says Henderson.

On the Highway J Bridge project, fast-setting grout achieved the strength required within 24 hours. "We always reached between 7000 to 10,000 psi within 18 to 24 hours, well above the required 3000 psi within 24 hours," says Henderson.

The final evaluation of the bridge indicated that using a fast-setting, high-strength, nonshrink grout was a success. The bridge scored the highest possible NBI rating of 9-9-9, indicating excellent conditions in the three primary elements of the bridge—the deck, superstructure, and substructure.

By Jon Brown

CTS Cement Manufacturing Corp. is the leading manufacturer of advanced calcium sulfoaluminate (CSA) cement technology in the United States. Our Komponent® and Rapid Set® product lines are renowned for proven performance, high quality, and exceptional service life. Contact CTS Cement for support on your next project. Call 1-800-929-3030.

Original Publication: Brown, J. (2011 September 29). FACING A TIGHT SCHEDULE. Concrete Construction. *www.concreteconstruction.net/projects/repair-rehab/facing-a-tight-schedule_o.*