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The mission of Iowa's LTAP:

To foster a safe, efficient, environmentally sound transportation system by improving skills and knowledge of local transportation providers through training, technical assistance, and technology transfer, thus improving the quality of life for Iowans.

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Rubber . . . continued from previous page

Benefits

Field testing on repairs of expansion joints demonstrated that rubber works better than foam:

- Tire buffings do not deteriorate over time.
- They are heavier than water so they won't float away in a strong rain.
- If they do become dislodged from a joint, tire buffings are not a significant hazard on the roadway.

In addition, the cost of tire buffings is less than half the cost of foam blocks specified for these joints. Because tire buffings are generally sent to a landfill, tire retread businesses around the state are willing to give the material away or charge only a minimal fee, if the Iowa DOT hauls it away.

New standard

With better performance and lower cost, the next step was to change the standard for new construction.

"The new standards for use of tire buffings in expansion joints are in the Road Design Standard update which took effect in October," says Todsen.

For more information

Standard road plans are available online, www.dot.state.ia.us/design/stdrdpln.htm. Plan RH-52 shows a tire-buffings-filled joint in detail. Note, too, new approach pavement details on RK-20(1).

See the October 2001 Final Report MLR-01-1 "Rubber Buffings for Bridge Approach Expansion Joints." To borrow a copy, contact Jim Hogan, LTAP library coordinator, 515-294-8103, hoganj@iastate.edu. Ask for publication P-1641. •

Editor's note: This article was adapted from one in the Iowa DOT's December 2003 issue of Inside, by Tracey Bramble, editor. Used with permission.



Rubber particles are spread and then sealed into the expansion joint. Photo courtesy of the Iowa DOT.

High-performing bridge decks

RECONSTRUCTED Interstate-235 through Des Moines (scheduled completion date: 2007) has been designed to perform well for decades. To help accomplish this goal, the Iowa DOT is using high-performance concrete (HPC) in I-235's 71 new bridge decks.

From standard concrete to HPC

In general, HPC begins with a standard concrete mixture that is adjusted to maximize concrete performance under anticipated operational requirements and weather conditions.

The HPC in the I-235 bridge decks, for example, is designed to have very low permeability and cracking and high durability and strength under high traffic counts, heavy loads, and Iowa's extreme seasonal weather conditions.

Adjusting and testing

To achieve these characteristics, staff in Iowa DOT's Office of Materials enhanced standard concrete mix designs. In general, they reduced the water/cement ratio, added supplementary cementitious materials, and improved aggregate gradation.

Although trial tests of a mixture containing silica fume and a high-range water-reducing admixture were favorable, the mix did not perform well in an early bridge deck experiment constructed off the I-235 corridor. So, the silica fume and high-range admixture were eliminated, ground granulated blast-furnace slag or fly ash became the primary supplementary cementing material, and a water-reducing and retarding admixture was added.

Beyond the mix

To help ensure the concrete decks perform as designed, the Iowa DOT is batching, mixing, placing, compacting, and curing the concrete to the highest industry standards.

For example, curing takes place immediately after finishing. (Longitudinal grooving is delayed until the concrete has hardened.) Curing includes placing two layers of pre-wetted burlap less than 10 minutes after final finishing, and continuous wet sprinkling for a full seven days.

These careful construction practices have resulted in almost crack-free decks.

Results

These methods can increase HPC's materials and construction-related costs. The Iowa DOT, however, anticipates that additional up-front investment in I-235 bridge decks will be more than offset by savings related to reduced maintenance and rehabilitation.

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Possible local applications

There's really nothing magical about HPC. Under current specifications, agencies can adjust standard mix designs and construction practices to enhance concrete performance.

For example, where very low permeability is desired and fly ash and slag are available, agencies can incorporate these supplementary cementitious materials into mixtures. To reduce shrinkage cracking, agencies can extend curing time.

For more information

See FHWA's high-performance concrete website, <http://knowledge.fhwa.dot.gov/cops/hpcx.nsf/home>.

The FHWA's High Performance Concrete Toolkit, which describes demonstrations of HPC on various types of bridges, is available through Iowa's LTAP library. Contact Jim Hogan, library coordinator, 515-294-8103, hoganj@iastate.edu. Ask for publication P1330. •

Editor's note: This article was adapted from "HPC for I-235 Bridge Reconstruction in Iowa," published in the September/October 2003 issue of HPC Bridge Views, by Kenneth F. Dunker. Used with permission.

Slag and fly ash in HPC

With a lower heat of hydration than portland cement, slag can help prolong the strength-gaining stage of water-cement hydration, reducing potential thermal contraction-induced tensile stresses. Slag can be an especially useful cementitious material in hot-weather concrete paving projects, but a possible disadvantage in cold-weather projects.

Fly ash can enhance concrete's resistance to attack by sulfates in water, improve mixture workability, decrease the permeability of hardened concrete, and reduce alkali-aggregate reaction in the mixture that weakens aggregate's bond to the cement paste. It, too, reduces heat of hydration.



East 9th Street, Des Moines, bridge deck pour: finishing machine and crew, October 2002. Photo courtesy of Kenneth Dunker, Iowa DOT.

LTAP Advisory Board

The people listed below help guide and direct the policies and activities of Iowa's Local Technical Assistance Program (LTAP). Contact any of the advisory board members to comment, make suggestions, or ask questions about any aspect of LTAP.

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