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Acronyms in this issue

AASHTO	American Association of State Highway and Transportation Officials
APWA	American Public Works Association
CTRE	Center for Transportation Research and Education (at Iowa State University)

FHWA	Federal Highway Administration
Iowa DOT	Iowa Department of Transportation
ISU	Iowa State University
LTAP	Local Technical Assistance Program
MUTCD	Manual on Uniform Traffic Control Devices
NACE	National Association of County Engineers

Where the rubber really meets the road

A NEW technique for filling expansion joints with shaved tire particles is catching on after nearly two years of testing.

A stubborn problem

For years the Iowa DOT and its contractors used foam blocks to fill four-inch wide expansion joints where a bridge deck meets the roadway. The blocks were then sealed into the joint.

The problem came when the bridge expanded and contracted with temperature changes; the sealant deteriorated and the blocks were dislodged. Heavy rains could float them out of the joints, leaving gaps of four inches or more between the deck and roadway.

“I had been dealing with the foam plank joint problems for so long, I was getting desperate,” says Mark Carter, Iowa DOT District 6 bridge crew leader.



Exploring a possible solution

In the mid-1990s Carter encountered a magazine article about rubber tire chunks used on playgrounds. “I started to wonder if that would work better in expansion joints.”

Carter made many phone calls inquiring about different types of rubber and their suitability for his idea. In 1996–1997, his crew ran several tests on sample material and tried different topcoats.

In 1998, crew leaders from each district discussed results of test locations in District 6. They also explored possible sources for tire buffings, a byproduct of the tire retreading industry.

Testing

Mike Todsén, Iowa DOT Office of Bridges and Structures, explored the engineering aspects of using tire buffings in expansion joints. He submitted samples from four tire retreading operations to the Office of Materials for testing.

“We tested the material for density, gradation, compression and rebound qualities, foreign material content, and compatibility with several types of sealant,” says Bob Steffes, formerly with the Office of Materials and now a research engineer at CTRE.

One combination of buffings and sealant performed better than the rest and was recommended to the bridge crews.

Rubber . . . continued on next page

Old foam expansion material deteriorates or washes away, leaving gaps between the pavement and bridge deck. Photo courtesy of the Iowa DOT.

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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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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.

HPC . . . continued on next page

