



It's a RAP

Recycled material saves money, helps create safer road

By Todd Loesch
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Using recycled material is obviously good for the environment and saves money.

But in the case of Illinois Highway 1, in Christian County, it also helped create a cleaner and safer road. For its extensive use of recycled material, the project won one of the 2010 ROADS & BRIDGES/ARRA recycling awards.

The rural highway had the highest average daily traffic (ADT) in the county, at around 3,500 vehicles per day. And much of that traffic consisted of heavy trucks traveling to and from a nearby limestone quarry.

As a result, the highway was heavily worn. Although the road was paved, the 5.5-ft shoulders were not. The trucks frequently kicked up the aggregate along the shoulder, creating a 2- to 4-in. drop-off on each side. Not only did road crews often have to pull the aggregate back to the shoulder, Christian County Engineer Cliff Frye said the drop-off led to several rollover accidents.

So in the summer of 2010, the county decided to repair more than 6 miles of pavement and add a paved shoulder. But rather than simply adding hot-mix asphalt to either side, the county opted to recycle the entire roadway.

The paving train

Dunn Co., which served as one of the contractors on the job, used a Wirtgen W 1900 mill to dig a widening trench that was 8 in. deep and 3 ft wide. Immediately behind it was a Wirtgen W 2200, which milled approximately 2 in. off the top and threw it into the widening trench.

"We recycled a total of 10 in. but we actually spread material out wider than the existing pavement," Nat Bowe, a professional engineer and director of sales development at Dunn, told ROADS & BRIDGES.

Next, Dunn used a Caterpillar 140H motor grader to make sure the milled material was in the widening trench. It was then compacted with a smooth-drum roller.

After milling the entire 6.6 miles in both directions, they used a Wirtgen CR3800 cold-recycling mill to pulverize 7.5 in. deep. Once again, the material was graded and smoothed out. Then Dunn came through with a Wirtgen W 2500S and W 2400 and injected emulsion 8 in. deep.

Two Caterpillar CP563E pad-foot rollers compacted the material, which was once again graded with a motor grader. Dunn did intermediate compaction with a Hamm HD 140 VV steel-drum vibratory roller and followed that with a Caterpillar PS 360B rubber-tire roller. Finally, a smooth-drum roller compacted all the material.

The entire project cost \$3.9 million, but using RAP saved the contractors \$750,000. But not only did it save a significant amount of money, using so much recycled material created very little waste.

"Everything that was taken out for that job was put back on that job," Bowe said.

The contractors used an HMA BC IL-19.0 N70 engineer emulsion binder that was supplied by Road Science. Although the design called for a 2.6% mixture, Bowe said they ended up using about 2.1%. The density of the final product ended up being around 95%.

Bowe said the crews didn't have any subgrade or sub-base issues to deal with during the process. There was still granular material underneath the recycled mixture, and the combination of the RAP base and hot-mix overlay was thick enough to bear the structural capacity that the county needed.

Prior to laydown, they also performed several tests on the mix at Road Science's asphalt-testing lab.

The actual mix-design process was designed around several criteria, the first one being a short-term strength test. They also conducted an indirect tensile strength test to judge how quickly the mix built strength.

Additionally, they took long-term samples to see how the mix built strength over time, and they measured the strength at specific points in time. Another sample was vacuum-saturated with water and then tested to see how it retained its strength. Finally, they used a resilient modulus to determine the mix's structural-bearing capacity.

No easy task

However, the job was not without its challenges. In fact, Bowe said just getting everything to the site was difficult, since all the heavy equipment had to cross one of the county's older bridges. Bowe also said it was difficult keeping everyone together—an essential part of a paving project—under live traffic.

Frye said the traffic alone made repairing the road more difficult than similar recycling projects. To begin with, most other full-depth work closed the

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"We didn't want to use the standard mill and fill that state DOTs had used for years," Frye told ROADS & BRIDGES. "You always get a longitudinal crack where the existing pavement and widening meet."

Such cracks let water seep in, which quickly causes breakdowns and failures.

All told, the base was made up of 100% reclaimed asphalt pavement (RAP), while the hot-mix asphalt overlay, which was around 290°F at laydown, was made up of 15% RAP. Bowe said that percentage is fairly standard for surface mixes in Illinois.

road. This time, the crews didn't have that luxury.

"Unfortunately we didn't have any good detours to send that traffic around without sending them an exorbitant number of miles," Frye said.

As a result, the crews had to operate under live traffic.

Jerry Parsons, a field engineer on the project, also said they had to work around the timing of the traffic. Crews didn't want to start the project before the local school buses were done for the year. But by the time the work began, the quarry nearby was going through a surge of activity, meaning a heavier volume of semi trucks.

"Then of course we were also shooting to get it done before harvest season," Parsons told ROADS & BRIDGES, "because that's also a heavily traveled route for the farmers."

The traffic also presented another challenge, since the mix needed time to cure. Crews needed to give the mix

breaking time for the emulsion to come out of the suspension and curing time to let any water evaporate. Bowe said this meant crews had to wait about two hours before they could let any traffic drive across the fresh mix.

However, the heavy quarry trucks posed another problem. If they had stopped on the mix before it was sufficiently cured, they would have caused permanent damage to the pavement. Typically, recycled material needs to set between four and eight hours before it can handle the heavy load of a stopped quarry truck.

To get around this issue, workers staged traffic-control points to make sure traffic never came to a standstill on the fresh material.

A safer road

Work on the Christian County highway wrapped up mid-September. And while it is too early for any hard data regarding the road's

performance, everyone agrees that it is a huge improvement.

Although the actual lanes are the same width, Phil Koeberlein, the project's designer, said the paved shoulder has made a huge difference.

"People feel a lot safer because they don't see that edge," he told ROADS & BRIDGES.

Frye added that the road just looks better.

"Right now, it looks as good as the day it was put down," he said.

If past projects are any guide, though, this section of Highway 1 should hold up just fine. Koeberlein said the county did a similar recycling project in 2006, and so far, no transverse cracks have appeared.

But despite the challenges that the project presented, the county is pleased with the final product.

"We were fortunate to have had a good designer and a good contractor," Frye said. "And we got a road we're pretty happy with." **R&B**



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