



A Green Answer for Higher Recycling

A mill-and-overlay project in Minnesota tested a rejuvenator as a method of restoring youth to reclaimed asphalt pavement (RAP).

By *Sandy Lender*

Researchers at the National Center for Asphalt Technology (NCAT) in Auburn, Ala., the Minnesota Department of Transportation's MnROAD division, and other esteemed pavement research facilities seek ways to incorporate higher percentages of recycled content

in asphalt mixtures without compromising long-term pavement performance. That research often involves adding a rejuvenator or recycling agent to the mixture to restore youth to the reclaimed asphalt pavement (RAP) or reclaimed asphalt shingle (RAS) replacement binder. For Trudy Elsner, P.E., Road & Bridge Program Development



Crew members reported easier compaction and cleaner joints with the southbound lanes of County Route 61, which used the mixture dosed with Delta S rejuvenator.



Engineer at Hennepin County Public Works, this type of ongoing research came in handy during a pavement maintenance project in September 2017.

Paul Nolan, the Research Project Supervisor in the Office of Materials and Road Research for MnDOT, explained that he was driving a section of County Route 61 when he noticed the Hennepin County Public Works crew performing roadwork that could test a material he had on hand. He learned that the county used 35 percent RAP in the pavement mixture without any additive, so he offered to Elsner the tote of Delta S asphalt rejuvenator he had from Collaborative Aggregates LLC in Wilmington, Mass.

Nolan explained that the one-year-old NCAT and MnROAD partnership allows the entities to mirror test sections on their respective research sites. Because Collaborative Aggregates sponsored test sections to gather data on the use of its plant-based Delta S rejuvenator, Nolan had a tote of the product “left over” from the MnROAD test sections. He shared that MnDOT originally looked for

a pavement maintenance project where they could use the additive to test pavement performances with live traffic. When a candidate mill-and-overlay project in downtown Minneapolis didn’t pan out, Nolan happened upon the Hennepin County mill and overlay.

According to Elsner, the project on Northwest Boulevard (CSAH 61) from just north of Schmidt Lake Road to Bass Lake Road (CSAH 10) in Plymouth will have a side-by-side test with two lanes northbound using the typical mix and the two southbound lanes having mix treated with Delta S. The dense-graded mix will be paved at 1.5 inches compacted as a riding course. “This location was selected to also give the county a comparative test as the pavement to the south of this project was overlaid earlier in the 2017 season with the typical mix,” said Elsner.

Elsner has been with the county for two years and with MnDOT for six years prior to that, so she is well versed in Minnesota’s desire to improve conditions for motorists while improving sustainability. “The county has a goal of 67 percent or better on our ride-rating system, which we will achieve at the end of this year [2017],” Elsner said. To date, pavement maintenance has consisted mostly of mill and fill, she said. “We’ve performed thin

mills and overlays of 1.5 to 2 inches to improve rideability. We’ve been using the same mix, an MV3, with 35 percent RAP.”

For some maintenance overlay projects, the county hires a subcontractor that makes a Marshall mix that also uses 30 to 35 percent RAP; Elsner stated that cracking is the performance characteristic that has remained problematic with those mixes as well. “We’ve noticed a similar cracking pattern across the board,” she said. The 1.3-mile stretch of CSAH 61 wasn’t in poor condition, but the proactive public works team had reasons to select it for both maintenance and a rejuvenator proving ground. “This section of road was originally constructed in 1992, chip sealed in 1996, and the last treatment was a 2-inch mill and overlay in 2005,” Elsner shared. In 2016, it received a pavement condition rating (PCI) of 37 on a scale of 0 to 100, and a pavement surface rating (PSR) of 2.55 on a scale of 0 to 4.00. “Moderate transverse cracking and minor rutting were noted along with oxidation of the mat,” Elsner said.

J. Richard Willis, Ph.D., Director of Pavement Engineering & Innovation at NAPA, reminded readers why that’s a concern for agencies. “The quality of the binder in the RAP is a little less flexible



From left, Paul Nolan of MnDOT, Joe Hannan of Hennepin County, Trudy Elsner of Hennepin County, and Jerry Geib of MnDOT visited the County Route 61 project during the paving operation.

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Good charging of the hopper shows off the fine mix.

than virgin asphalt cement,” he said. As agencies add more than the national average of 20.5 percent RAP to mixtures, they’re adding more of the stiffer, oxidized material.

At this time, Willis said, even the National Cooperative Highway Research Program (NCHRP) is looking at recycling agents, such as rejuvenators, for mixes, to restore softness and flexibility to the recovered binder from RAP. “The rejuvenator or recycling agent does not ‘unage’ the binder, but softens it, similar to what an anti-aging skin cream does. The sun takes the oil away from skin; the cream adds it back. With RAP, the sun takes away the elements that keep it young; these chemicals restore the youth.” Readers can check out NCHRP 9:58 for updates.

Agencies are catching on. Willis pointed to the NAPA/FHWA 2016 Construction Season Survey on Recycled Materials and WMA. Producers from 11 states reported using recycling agents in RAP mixtures, and eight states reported using recycling agents in RAS mixtures. Nationally, tons produced using recycling agents is estimated at 7 percent.

Project Lessons

The pavement maintenance project took place Sept. 11-15, 2017, with milling performed by a subcontractor and paving performed by Hennepin County Public Works. “The in-house county forces work with a milling



The roller operator on the County Route 61 project has 35 years of experience and reported an easier time of rolling out marks from cross-traffic when working with the Delta S-dosed mat versus the control mat.

contractor, Bituminous Roadways,” Elsner explained. “The county does the hauling with the contractor providing the full-width mill and an operator.”

After the milling and sweeping operation, a Hennepin County asphalt distributor on a truck sprayed a tack coat. Commercial Asphalt Company of Maple Grove, Minn., manufactured both asphalt mixtures for the Route 61 job at its 700 TPH Gencor drum mix plant, which was about 15 minutes from the project site. The plant was installed in 1999 and averages

800,000 tons per season operating April through November. For this project, the plant operated at 450 TPH to inline blend the Delta S rejuvenator. Trucks loaded out of the Commercial Asphalt Company silos with an asphalt mix temperature goal of 290 to 300 degrees Fahrenheit.

Hennepin County’s 10-wheel trucks delivered the mix to an asphalt paving machine equipped with sonic controls. They used a 10-ton steel roller in vibratory mode for initial compaction, which the roller operator found “easier” on



Commercial Asphalt Company loaded the material at temperatures between 290 and 300 degrees Fahrenheit.

the southbound lanes treated with Delta S, according to a survey of the crew. Elsner said they gave a survey to the crew members after project completion and learned that the team found the southbound lanes “stickier, but a lot more forgiving when locking joints or fixing spots.”

The survey responses also showed both mixtures posed the same difficulty to clean from tools and equipment after cooling, but the mixture treated with Delta S was easier to clean up when still warm. The crew discovered the need to spray release agent in truck bodies before every load to facilitate smooth movement of material dosed with Delta S, and found that the Delta S-treated mixture reacted to the release agent better than the control mixture. To the naked eye, the crew members saw no difference between the northbound and southbound mats, but did say the seams (joints) looked better in the southbound section.

While the crew member survey represents subjective information, it gives Hennepin County and MnDOT a starting point for in-field research. Elsner said they’ll review



The Delta S rejuvenator is blended inline at a rate of about 1.5 pounds per finished ton, which Nolan described as “an exceptionally small amount.”

the pavement at six months and again at one year for cracking and oxidation. She said they specifically want to learn if it will take longer for the cracking to come back and what difference they can get out of the age of the lanes. She hopes to be able to use an even higher percentage of RAP in future mixtures.

“The fact that Delta S is a green, sustainable product is a factor; however, the primary concern is to extend the life of the overlay by

delaying the reflective cracking,” Elsner said. “That’s the primary benefit we hope to see. With the side-by-side comparison, we will be observing if there is a difference in the oxidation rate with the Delta S.” **AP**

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