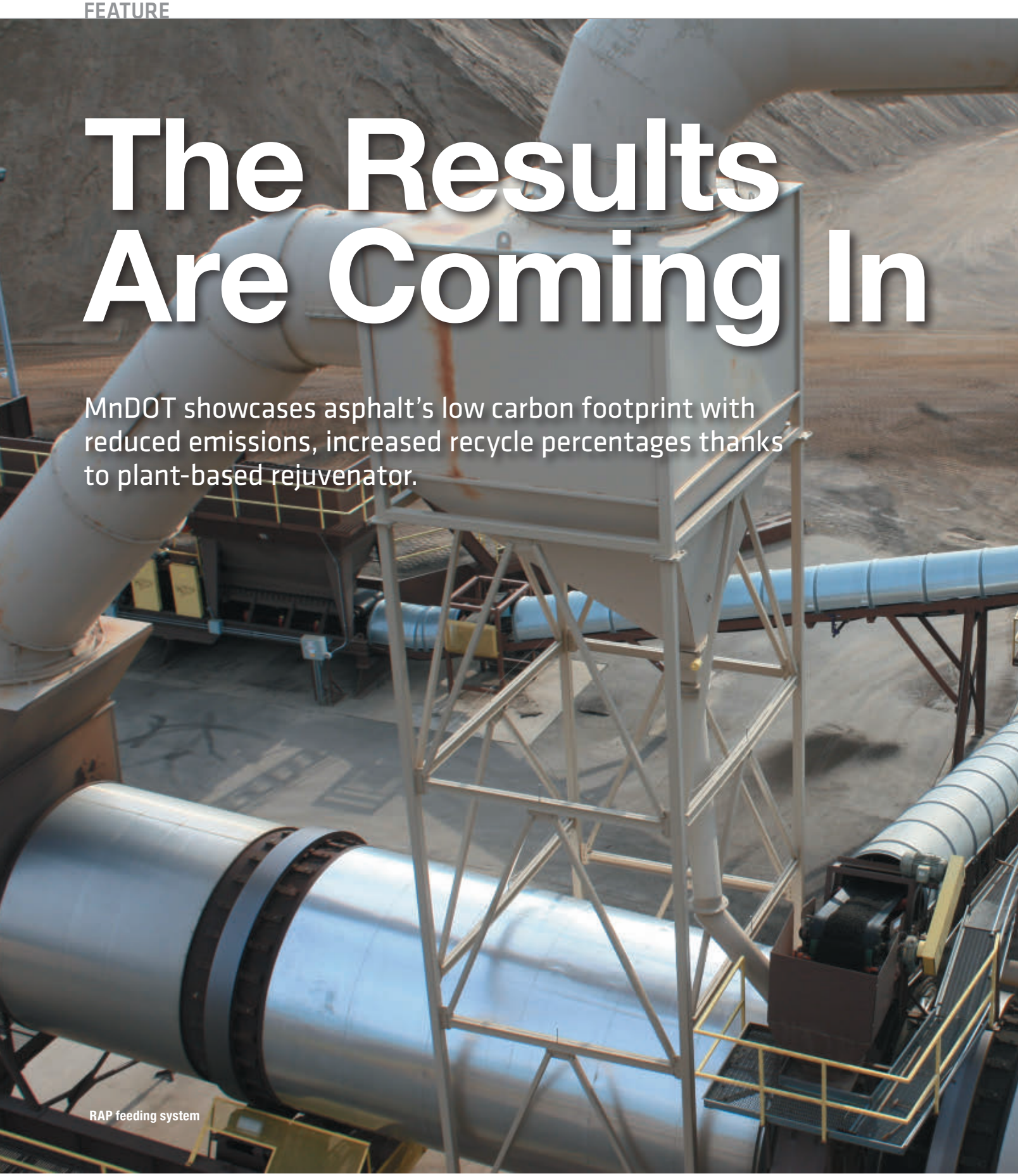
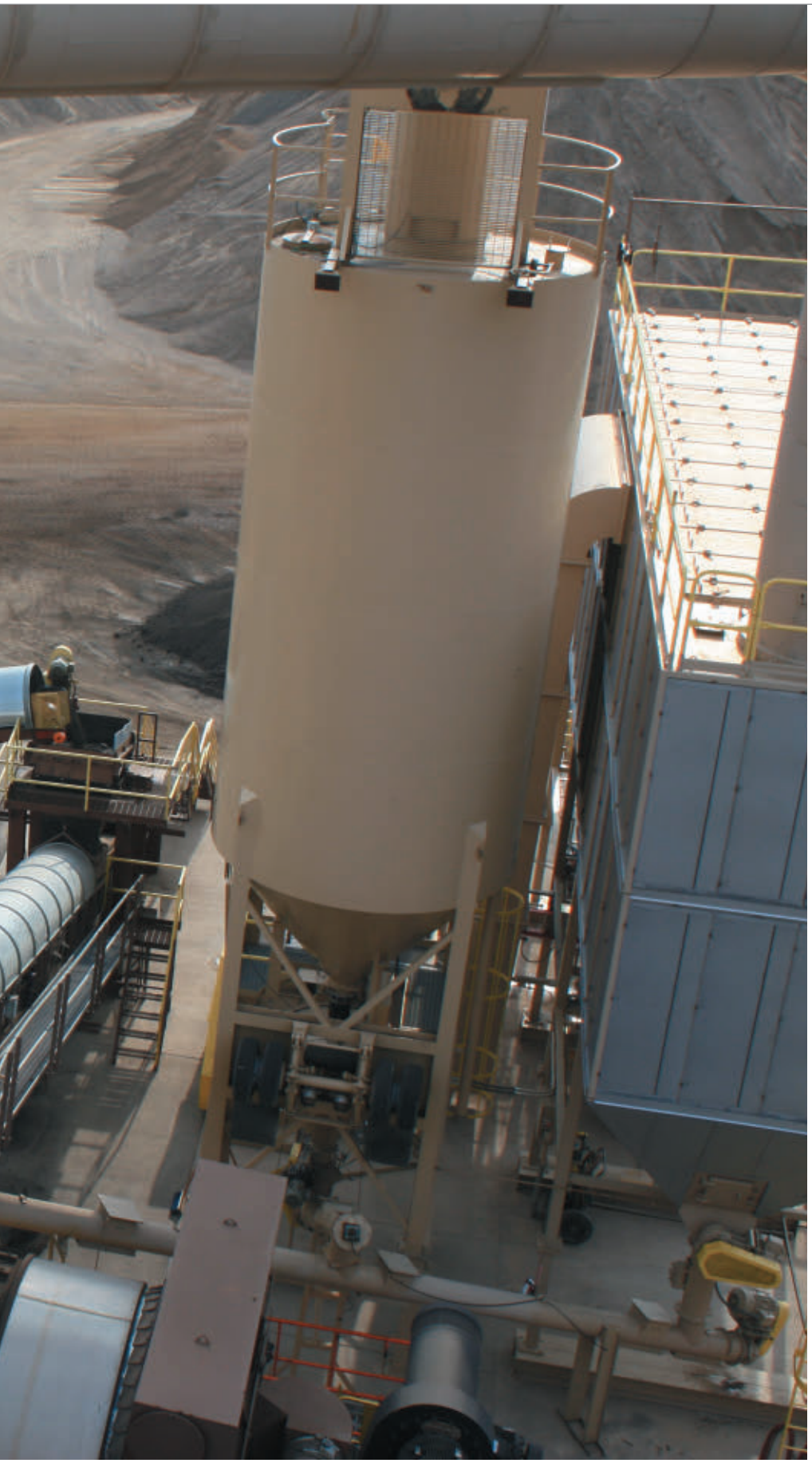
The Results Are Coming In

MnDOT showcases asphalt's low carbon footprint with reduced emissions, increased recycle percentages thanks to plant-based rejuvenator.



RAP feeding system



SANDY LENDER

By Sandy Lender

Studies on the use of rejuvenators to augment recycled asphalt pavement (RAP) and recycled asphalt shingles (RAS) in pavement mixes have received much attention the last few years. That attention will only increase as industry seeks to showcase its record as an environmentally responsible recycler working with a low overall carbon footprint.

One way to keep that footprint small is to consider plant-based additives to boost recycled asphalt material (RAM) percentages. The team at Warner Babcock Institute for Green Chemistry of Lowell, Mass., developed the Delta S rejuvenator as a plant-based additive to restore the performance characteristics of the aged asphalt binder in RAM. This gives producers and contractors an environmentally sustainable option in the march toward net zero.

The Minnesota Department of Transportation (MnDOT) is a trailblazer in this realm as it reviews studies on its test sections of Truck Highway 95 (TH 95). Paul Nolan, project supervisor at MnDOT Materials and Road Research, oversaw the design and paving of these sections in 2019, which you can read about in the May/June 2020 edition of *Asphalt Pavement* magazine.

It's been a long time coming to complete these 4.5 lane miles of the study, 1.5 miles of which now contain high RAP. Nolan explained that the MnDOT Materials and Road Research flexible pavement team began working with and researching asphalt rejuvenators in 2016.

"The challenge was getting products into construction projects that could be followed for several years," he shared. "We wanted to get

SANDY LENDER

SANDY LENDER

the product in a project that would not become a safety hazard or a major inconvenience if we had a failure."

In 2017, MnDOT got the Delta S into a mill-and-overlay project on Hennepin County Road 61, paved by county crews. "The county was using a 30 percent RAP mix in their paving operation without a rejuvenator," Nolan explained. "We suggested trying a section with Delta S incorporated at the plant and we would do some testing and monitor it."

During the testing, they identified that the asphalt mix had low DCT fracture energy numbers. With the Delta S added, they achieved better fracture energy numbers, but were still not where they wanted to be. Hennepin County determined that moving to a Superpave mix would get them better long-term performance.

The MnDOT TH 95 project began in 2018 and spanned over eight miles and three years. The project consisted of moving utilities, correcting cross slopes, improving safety features, replacing culverts, and adding shoulders. "The asphalt pavement was to have a 3-inch mill and two 2-inch overlays. Originally, we were working on placing a test deck with Delta S in 2018 on Phase One of the project," said Nolan. "Again, after a lot of work getting the Delta S into a project, it found its way to the cutting room floor right before it was going to be paved. It was recommended to be put into the upcoming year's continuation of the same project."

In 2019, three-quarters of a mile was paved with the Delta S-dosed, 48-percent-RAP Superpave mix in one direction and a control standard Superpave mix with 20 percent RAP in the opposite direction. In 2020, Nolan's team completed the project, paving another 1.25 miles of Superpave with 48 percent RAP and the control section of Superpave with 20 percent RAP. The balance of the project – 2.36 miles – was paved with a standard Superpave mix with the same 20 percent RAP dosed with Delta S and a Superpave with 30 percent RAP dosed with Delta S in the opposite direction.

Though the rejuvenator was included in the 2019 and 2020 test and control sections, there were a few differences between the 2019 and 2020 paving projects. For example, the contractor paved with end dumps into the paver in 2019 and used a rubber-tire roller in the breakdown position to achieve initial density. In 2020, the contractor used windrow paving with a pickup conveyor system and a steel vibratory roller in the breakdown position.

The 2020 project included an intelligent compaction component to help the paving crew get final densities. Thermal profiling helped show the crew where the most effort was needed during rolling. Following the first winter on the 2019 section, both sections were performing well. Upon closer examination the control section had lost more surface fines than that of the high-RAP dosed section.

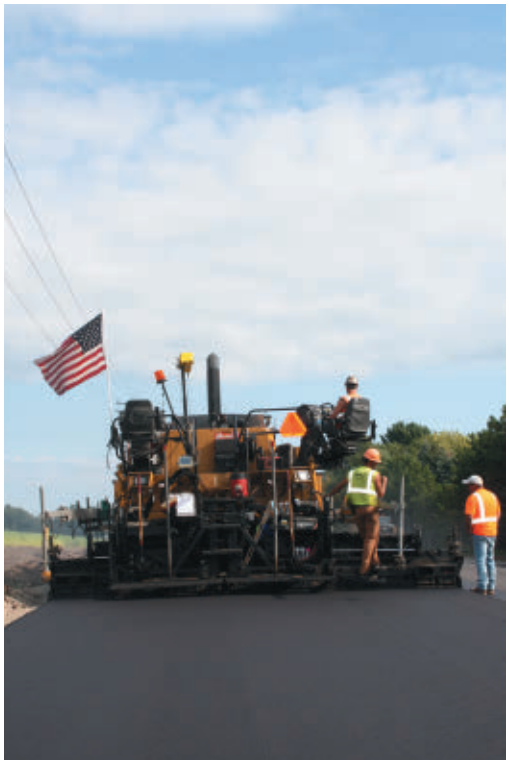
"We have no cracks in either side yet," Nolan said. "In the beginning of the control section, there's a reflective crack from something below. It is located within the first 500 feet. We removed the first and last 500 feet of a test section to eliminate cross-contamination." In the dosed sections, Nolan observed fewer cracks. He is seeing that you can use higher RAP content without sacrificing quality.

Nolan discussed performance results that will influence an aging pavement and what MnDOT is looking

forward to. "We are starting to see some positive initial results with fine retainment. What other benefits will we see as the products age? How long will the performance continue to last? Will it continue to retard cracking?"

"When you are doing real life research with a 1:1 time frame, you must wait a year to see one year's deterioration. When you are working to extend the pavement life, you may have to wait 10 to 15 years to see meaningful results," he said. "The proof is usually seen in the back end of the research."

Research such as that ongoing in Minnesota with rejuvenators offers our industry a real-world opportunity to test products that can increase our use of recycled materials while maintaining or increasing quality pavements.



SANDY LENDER

The asphalt pavement research community has made great strides over the past 30 years, crafting a product that can withstand rutting while also maintaining flexibility and cracking resistance. This is all balanced in a world of changing crude sources and increasing refinement, which leaves less quality material for paving.

"Asphalt researchers spend millions of dollars annually trying to figure out ways to make asphalt pavements perform better, last longer, and cost less," Nolan said. "So, when people ask me why it's so hard to make a road last, I have to chuckle. It's a moving target. Processes change, materials change, equipment changes. The journey will never have a final destination – it will just keep on keeping on." AP

Sandy Lender is the award-winning editor of AsphaltPro *magazine, the "how-to" publication for the asphalt industry.*