Recycling's day in the sun

Ariz. thoroughfare brought back to life using innovative hot in-place recycling technique

By Jeff Zagoudis
Associate Editor

Arizona would sound like the perfect place to do a hot in-place recycling project such as the one undertaken along 99th Avenue in Sun City, Ariz., last spring.

The Maricopa County Department of Transportation (MCDOT) wanted to fix up the 7-mile portion of the roadway between Olive Avenue and Beardsley Road and opted for hot in-place recycling (HIR). Cutler Repaving Inc. was tapped for the job, and their approach with an innovative, homegrown recycling method garnered a 2013 ROADS & BRIDGES/Asphalt Recycling and Reclaiming Association Recycling Award.

The selection of HIR for the road repair was a milestone for the area, explained Bob Erdman, P.E., as recycling was still a relatively untested idea in Arizona. "Maybe little test sections had been recycled in the past, but asphalt rubber has worked so well here in Arizona that not a lot of people have found a need to recycle it yet," he said. "But now, a lot of stuff's getting to be 15, 20 years old or more, and the big challenge was how well was it going to recycle."

99th Avenue definitely fell into that category, and Erdman should know—he was the one to place the existing overlay as an MCDOT employee approximately 15 years prior.

New recycling

Over its 50-plus years in operation, Cutler has developed its own brand of HIR, which it calls Single Machine Repaving (SMR), that does the work of two passes in one. For the 99th Avenue job, prime contractor Sunland Asphalt went in first and cold milled off the top inch of existing asphalt in preparation.

From that point, Cutler brought in its own paver. Going one lane at a time, the machine heated, scarified and recycled the top layer, refreshing it with new asphalt emulsion. While the recycled content is still hot (at least 200°F), an additional inch of fresh material is placed

The paver can be augmented to any width needed via a series of pre-made, 1-ft extensions for the heating head, scarifying teeth row or the recycling auger. This adaptability allowed Cutler to set a new Arizona record with one pass of 18 ft.

on top, improving the durability of the rejuvenated roadway. With the addition of the extra inch on top, the final grade of the new surface is usually an inch higher than the original pavement. Once a lane is completed, the paver backs up and moves onto the next lane.

"So it's all compacted hot to where there's no bond break layer, there's no tack coats, there's no flat snippage plane between the two mixes," Erdman said. "They're all compacted together, so it's like a monolithic, 2-in. mat that you're getting."

Making the grade

The asphalt mix—courtesy of Western Emulsions—was a ½-in., open-graded asphalt rubber mix common in Arizona, utilizing a binder of PG 64-16 asphalt cement and ground crumb rubber; the optimum binder content was 8.2% by weight of the total mix. The mineral admixture was Type N hydrated lime.

Erdman wanted to see how their mix stacked up against existing samples from the county, so he sent it to the Arizona office of AMEC Environment and Infrastructure Inc. for testing. In particular, he wanted to compare the gradation, binder content, viscosity and dynamic modulus. The results were compared with a series of curves established from new asphalt rubber samples that the Arizona DOT had been testing at Arizona State University over the previous few years. The recycled content ultimately displayed similar characteristics to the virgin asphalt mix.

"It was slightly softer, but we showed ourselves and everybody that we can essentially restore this material to—I hate to just say we can restore it to 100% new, that's almost impossible, but from the dynamic modulus and the other tests we did, it sure comes pretty close," Erdman said.

One foot at a time

One of the biggest construction challenges noted by Erdman made itself apparent right from the start: The four-lane 99th Avenue sports a wide concrete drainage channel separating the north- and southbound lanes for a long

Cutler brought in its own paver. Going one lane at a time, the machine heated, scarified and recycled the top layer, refreshing it with new asphalt emulsion. While the recycled content is still hot (at least 200°F), an additional inch of fresh material is placed on top.

portion of the roadway. As a result, lane widths vary from section to section.

"We'll make a pass run all day one width, then we'll come back and often have to do a different width on the second pass," said Erdman. "Very seldom do we get to make two equal passes on the roadway."

Luckily, Cutler's paving equipment is uniquely suited for just such a task. While the paver itself is standard width, it can be augmented to any width needed via a series of pre-made, 1-ft extensions for the heating head, scarifying teeth row or the recycling auger. Pieces are added or removed overnight to prepare for the next day's work.

This adaptability allowed Cutler to set a new Arizona record with one pass of 18 ft, breaking its own previous high mark of 17 ft set on another job for the Arizona DOT back in the mid-2000s. According to Erdman, the new record-setting pass was a large part of the reason Cutler was able to complete the job in just 16.5 days—about one-third the expected length of the project. It also helped them slightly correct the grade of the roadway.

At the outset of the project, MCDOT had implemented a smoothness specification, with a bonus available for successful compliance—and an associated penalty. Normally such specifications are made on interstates and state routes that are mostly long, straight stretches with little to no curbs and gutters. 99th Avenue, in the middle of a high-traffic residential area, was a different story.

"These roads did have curb and gutter, and they weren't really in the greatest shape," Erdman admitted, "so you didn't really have a straight line you could follow . . . It could be that the material would be below the gutter lip and then 2 in. above the gutter lip."

Cutler told the county it could aim for smoothness or follow the curb line, but it could not do both. MCDOT ultimately eliminated the smoothness specification.

Mother Nature helped the crew out as well: Temperatures during the 16.5 days in mid-April and early May nearly reached into the 100s, softening the pavement a little more. "It was like butter almost, as opposed to being sticky and rubbery," said Erdman. "It recycled very well and we were able to carry that much width without difficulty."

The SMR pavement recycling method also allowed Cutler to always keep one lane of traffic open, keeping disruptions to a minimum—an especially important consideration thanks to the large number of retirement communities in Sun City.

"To my knowledge we didn't get any complaints, but we did get some calls in for praise and gratitude," Erdman said. R&B

For more information about this topic, check out the Asphalt Channel at www.roadsbridges.com.