



By Jeff Zagoudis
Associate Editor

Natural preservation

Los Angeles County uses cold in-place recycling to repair national forest highway

All roads lead to somewhere—even if they appear to be in the middle of nowhere.

Such is the case with the Angeles Forest Highway, which winds 25 miles through the Angeles National Forest north of Los Angeles. Mountainous and forested, the region is a popular spot for motorcycles, sports cars and other sports enthusiasts.

The road exhibited significant pavement distress. With an average pavement condition index (PCI) of 47, the road seriously needed to be rehabilitated, according to Imelda Diaz, P.E., with the Los Angeles County Department of Public Works and head of the county's pavement-management unit. In an effort to

improve its performance, in the summer of 2011, the county debuted its first-ever cold in-place recycling (CIR) project, which earned a ROADS & BRIDGES/Asphalt Recycling and Reclaiming Association Recycling Award.

Location, location, location

Ultimately, location proved to be the biggest factor that pushed the county toward CIR recycling, on two levels. First and foremost was the forest itself, which is protected as a national forest by the National Forest Service as well as local authorities. So environmental friendliness was definitely at the top of the list of necessary criteria.

With a project site in the middle of a forest, resources were hard to come by too—particularly asphalt plants. "It was important to

consider in our pavement-treatment strategy the overall impacts of distance and cost to haul road materials from existing asphalt plants," said Diaz. That meant either a lot of trucks coming and going from the site—which could not be called "environmentally friendly"—or finding another way to do things. This was how the decision for CIR was ultimately made.

"We were looking at different alternatives, but after evaluating all of the data, it met all of our needs — engineering, environmental and financial," Diaz told *ROADS & BRIDGES*. "It really gave us a better value for our money." She also cited the ability to open the road to traffic again more quickly as another benefit of the process.

Paving the way

While Granite Construction was the general contractor, Pavement Recycling Systems (PRS)—out of nearby Jurupa Valley, Calif.—handled the actual CIR process. The multiunit train employed by PRS for the project, with just three machines, is one of the shortest CIR trains in the world, according to James Emerson, APM, project manager for PRS. (Most older-model CIR trains are four or five units long.)

The lead unit was the milling machine, a Caterpillar PR-1000 with a 12.5-ft-wide, down-cut milling head. Unlike most of today's milling machines, the PR-1000 is rear loading, "which is pretty unique because they don't make rear-loading machines anymore," Emerson told *ROADS & BRIDGES*. (PRS owns six rear-loading milling machines.) Three inches of existing pavement were taken off the top, intended for recycling as the new base course for the roadway since the subgrade was still strong.

As the milling and cutting were done, a conveyor belt carried the raw recycled material to the second unit, a self-contained portable asphalt recycling plant, for screening, crushing and weighing. After weighing, the material was deposited directly into the dual-shaft, variable-speed pug mill, where the emulsion was added; for this project, PASS-R engineered emulsion supplied by Western Emulsions, Irwindale, Calif., was used. An onboard computer monitors the continuous weighing

process, using that data to calculate the proper, precise emulsion content per the engineer's mix design. The emulsion is stored in the third unit, an insulated tanker trailer with a 5,500-gal capacity.

As the plant finishes blending and mixing, the rejuvenated asphalt is deposited in a windrow and quickly picked up and put back into the paving equipment for placement back onto the roadway. Emerson said that project specifications require the recycled asphalt to be placed by a track paver with a minimum of 170 hp. The use of a track paver has historically provided a smoother paving operation with this CIR process.

"Really it's a moving process with no trucks coming in and out of the work zone. You can usually do 2-3 lane-miles a day," said Emerson. "It's a continuous moving process that allows you to move the closures and/or traffic control. So if you start in the morning, by mid-afternoon you can be moving the closures and signs down the road."

The final step—and one of the most important, according to Emerson—was compaction, which was accomplished with a 10- to 12-ton double steel drum roller and a minimum 25-ton Caterpillar PS-360B pneumatic roller. The steel drum roller went in first, making a few passes before the pneumatic roller made another three to five passes to achieve maximum density.

"There are constant quality control and quality assurance requirements per

specifications conducted daily as well as a rolling pattern established during the test strip on day one, but I would say that's a really important piece of equipment on the job," Emerson told *ROADS & BRIDGES*.

Upon completion of the CIR process, the old asphalt has become new asphalt.

Once the 3-in. recycled base course was put down, crews went back and put down a 1.5-in. asphalt rubber hot-mix overlay, which incorporates recycled automobile tires, according to Diaz. "For every lane-mile that we paved with rubberized asphalt, we diverted approximately 2,000 tires from the landfill," she said. "Our goal was to be green the whole way, from the bottom of the structural section to the top."

Beating the heat

Somewhat fittingly, Mother Nature proved to be a formidable opponent in the remote setting. Since this was a summer project in California, conditions could dry up quickly, making the threat of forest fires an ever-present possibility. Right as work was set to begin on the project, a change in conditions prompted the local forest service to up the threat level. This meant a restriction in working hours for PRS, from 9 a.m. to 2 p.m.

These time constraints were less than ideal, as Emerson explained. "Eight-hour days are very important because it's such a high-production system. That's what allows you to get in and get out quicker



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and keep your unit prices down because it's a very fast system," he said. "But if you're restricted to four hours a day of production, it kind of cuts into the economy of the project."

The team ultimately pushed the start of the project back three weeks; by that time, humidity levels had gone back up, making it safe to work again.

Reaping the benefits

In the end, the savings—both financially and environmentally—were easily apparent: 850 three-axle truckloads eliminated; 34,000 truck miles saved; 10,000 tons of virgin aggregates not used; 2,500 barrels of oil not needed; and a 75% reduction in greenhouse-gas emissions. Going with a CIR solution saved the county more than 40% compared to the cost of the alternative mill-and-fill method.

"When you consider a sustainable pavement development...you could actually recycle this material, then 20 years later recycle it again and



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continually use the asphalt assets in a renewable fashion. So I'm really excited to be able to share that with agencies," said Emerson. "That's a win-win."

"This is kind of a paradigm shift for us," Diaz admitted. "In the past, we were a 'worst-first' organization—we fixed the worst roads first. Based on the success of this project, cold in-place recycling has

definitely changed the way we will fix our roads from now on"

The L.A. County Department of Public Works has done a number of additional CIR projects since then, with equally satisfying results. **R&B**

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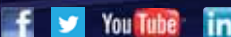


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