It's a "RAP"

Los Angeles County makes the best of what it's already got

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Reclaimed asphalt pavement (RAP) has rapidly become a dependable means of resurrecting roadways in the state of California. As Greg Kelley, assistant deputy director for the Geotechnical and Materials Engineering Division of Los Angeles County, told ROADS & BRIDGES, "Every agency should consider the existing pavement materials including asphalt, base and soil as a potential resource for roadway reconstruction."

The application of this sustainable logic on a project in the Lennox community of Los Angeles County—which resulted in increased work quality, not to mention fiscal and environmental savings—has received a 2015 ROADS & BRIDGES/ARRA Recycling Award.

The County of Los Angeles Department of Public Works (DPW) maintains some 7,400 lane-miles of paved roads within 114 communities that comprise nearly 5,000 sq miles. A mixture of urban and rural roadways, this swathe of California sees all manner of geographical settings, climatic conditions and, perhaps not least importantly, traffic volumes. The Lennox community is an unincorporated residential section of Los Angeles County that skirts both Los Angeles International Airport (LAX) and the neighborhoods of Inglewood. A mapped community, it was designed with roads that were never intended to bear up under the pervasive weight of today's traffic.

The 3.5-mile project consisted of an arterial network of some 15 residential streets, and the onus on workers was to complete the job efficiently and with minimal impact on the community. "Less time to perform the road improvements means less impact to the community," Kelley stated. "And that is a huge, huge plus."

When work began, the damage was more than self-evident. The predominant distresses, James Emerson of Pavement Recycling Systems Inc., told ROADS & BRIDGES, were "substantial alligator and map cracking, with some longitudinal and transverse cracking occurring rather frequently." Kelley concurred, citing that "some streets exhibited signs of base failure and yielding subgrade. Based on lab results, field moisture was higher than optimum moisture, a condition which poses short-term constructability challenges, as well as long-term structural performance issues."

The condition of the roads in this grouping deteriorated since their last slurry seal treatment in the early 2000s to a point where the idea of preservation was quickly quashed. "This was a reconstruction project," Kelley said, "rather than a preservation project. The road conditions were simply too distressed for a preservation; [however], reconstruction by recycling the existing materials and stabilizing the existing base and subgrade was the right fit."

Making it sturdy

Over the last several years, counties throughout California have become increasingly environmentally conscious in regards to the creation, repair and maintenance of roadways. Focus on sustainable projects came quickly to the fore. In the case of the Lennox project, it was self-evident to county officials that the road distress would require complete rework—but that sustainable methods were nonetheless firmly in play.

The failing asphalt was milled off using a Roadtec RX-60B with a 7-ft-wide mill head. Milling occurred at a depth ratio of 2.5 in. to 4 in., due to an uneven pavement thickness. "We were chasing the asphalt," said Emerson, as the saying goes, in order to remove only the asphalt and not the underlying base material. "It's important to remove only the asphalt material during milling operations to ensure a homogeneous RAP pile."

"What we found," said Kelley of the removal process, "was thin layers of AC over limited inches of base. We knew we needed a structural section."

The milled-off AC was then trucked to a nearby vacant lot not even 2 miles from the work site, rather than simply consigned to a landfill as is protocol for standard mill and overlay hot-mix projects.

The project called for 4.5 in. of asphalt over 6 in. of treated base. Since the subgrade needed strengthening, the decision was made to pulverize it, the product of which was mixed with water and 7% cement for reinforcement and then compacted, producing a cement stabilized pulverized base (CSPB). "The CSPB provided a strong foundation for our road," said Kelley, who conceded that while the cement percentage was high for such an endeavor, it "provided the required strength to meet the design requirements of the project." CSPB was chosen over what would have been 8 in. of crushed miscellaneous base (CMB), which set the project on its continued road toward time and cost savings.

Once the subgrade was pre-stressed through the micro-cracking process to prevent cracking from occurring later and migrating through the pavement, the application of the base course could begin.

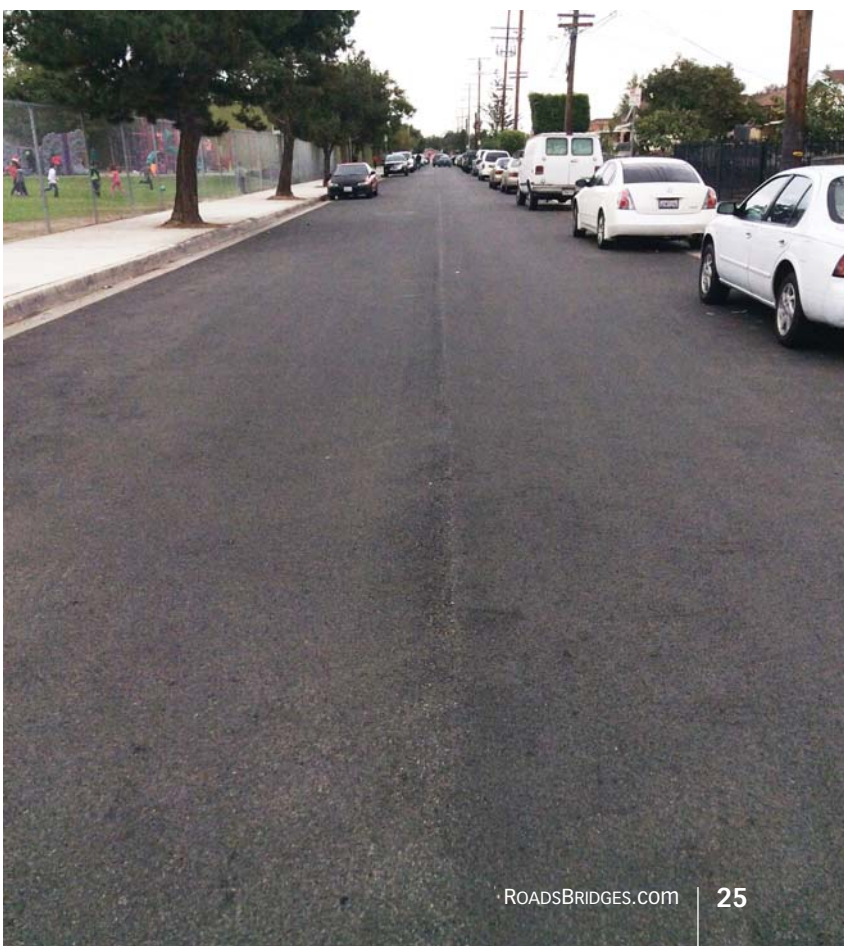
As a result of recycling the asphalt and stabilizing the subgrade, approximately 21,000 tons of material were kept out of landfills, said Emerson, "greatly reducing the costs and associated community impacts related to trucking of export and import of materials."

Giving it a good PASS

Before the wearing surface could be placed on the roads, a base course of cold central plant recycled asphalt concrete pavement (CCPRACP) was applied over the CSPB. This previously milled and stockpiled RAP was crushed and screened to produce a 1-in. minus material and subsequently processed with an engineered emulsion in a CRMX-2 self-contained, computer-automated, fully closed-loop portable asphalt plant.

Above: Significant alligator and map cracking was observed at the site prior to the project's undertaking.

Below: The asphalt rubber hot mix used as the driving surface creates a sturdy, quiet surface that looks "new" for many years following application.



More than 21,000 tons of material was kept out of landfills via the employment of recycling tactics on-site—which also produced a cost savings of $1.1 million.

In order to get the RAP to blend together and form a cohesive pavement matrix strong enough for the traffic that would be utilizing these streets, an engineered emulsion, known as PASS-R, was pug-milled into the mix design at a specified rate.

"[PASS-R] contains a polymer and a rejuvenator," Kevin Donnelly, director of pavement production for Western Emulsions, told Roads & Bridges. "The polymer provides strength, while the rejuvenator softens the asphalt in the recycling process, binding the system together, giving a better coating."

This mix took place at a temperature of 100°F, some 200° lower than standard hot mix. "This saved enormously on greenhouse-gas emissions," said Kelley. This mix was placed at a 3 in. thickness and allowed to set for one week, after which 1.5 in. of asphalt rubber hot mix (ARHM) was put down as the driving surface. "L.A. County's been a longtime user of ARHM," said Kelley. "By utilizing discarded tires into our hot-mix pavement we have reduced the number of tires that go into landfills, and we've found that it mitigates reflective cracking that helps the performance of our roads immeasurably. Plus, the ride is a lot quieter, and the roads look new for many, many years."

A working philosophy

Legislation to reduce greenhouse-gas emissions in California was a key element in L.A. County's development of a three-pronged approach to sustainable road infrastructure, to wit:

1. First, take care of the roads that are in good condition;
2. Include recycled materials in as many treatment selections as possible; and
3. Reuse or modify existing in-place materials by recycling the pavement and/or strengthening the subgrade beneath it.

According to Kelley, nearly one-third of all countywide road projects over the last five years have engaged a sustainable treatment, and that is only the beginning, the proverbial tip of the "green" iceberg.

"Five or six years ago, we were in a state where we would wait for distresses to show up before making recommendations for

repair or restoration," said Kelley. "A worst-first approach."

And while there are many roads for which county operators are still playing catch-up, the hope is that they will be able to get ahead of the problem sooner rather than later.

"We will be [recycling] on any reconstruct we do," assured Kelley. "The question is can we use asphalt, can we use the subgrade material? We think in most cases, it is yes. Our five-year goal as of now is to use sustainable treatments in 80% of all projects."

Keeping it close

Projects and figures are one thing, but plain, measurable facts are something else entirely. In any recycling project, proximity can be as important as process, and this was clearly the case on the Lennox job.

"[With] the choice to reuse the existing material as part of the pavement design and our ability to recycle the material on-site we were able to substantially reduce both the hauling tasks and the amount of material going to landfills all at once," said Kelley. "We did realize 21,000 tons of landfill reduction on this project and we saved $1.1 million by recycling the materials on-site."

According to Emerson, traditional removal and replacement methods—1.5-in. ARHM, 2.5-in. HMA over 8 in. of CMB—would have drawn a price tag of $2.242 million, whereas the sustainable methods that were actually used—1.5-in. ARHM, 3-in. CCPRACP atop 6-in. CSPB—came in at only $1.192 million, resulting in a cost savings of $1.050 million.

Commensurate to that cost savings was a reduction in the environmental impact of the project as a whole.

"By recycling the AC and stabilizing the subgrade/base in place, the county was able to reduce the energy consumption [of the project] by 69% and the greenhouse-gas emissions [of a larger standard hot-mix operation] by 61%," said Kelley. "And what's more, construction time was cut by 25%. The project, including setting times, took less than three months."

The impact of such reductions on the community in which this work took place cannot be underestimated, particularly in California, a state that had in times past registered some of the worst air-quality ratings in the U.S., a fact that is one propeller of the aforementioned legislation to reduce greenhouse emissions. "The community was very supportive of the operations," said Kelley. "Very few complaints were received."

Where to next?

In a state very conscious of day-to-day environmental impacts, it stands to reason that sustainable objectives have quickly moved from case-based applications to overarching operational concepts. With 7,400 lane-miles to keep watch over, L.A. County operators look to have no shortage of places to apply their sustainable methods, both in the immediate future and, perhaps, indefinitely.

Kelley, for his part, is anything but dubious. "Los Angeles County plans on implementing this strategy of reutilizing existing materials at the given project site on all residential reconstruction projects. And we are planning similar treatment approaches to major roads in the very near future." R&B

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