Kansas
LTAP Fact Sheet
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Asphalt Recycling on the Rise

By Lisa Harris & Matthew Barnett

One of the biggest investments a community makes is in the material used to build and maintain its roads. When asphalt roads need resurfacing, a way to get the most out of that investment is to mill the existing material—creating reclaimed asphalt pavement, or RAP—amend it with binder and aggregate, and re-place it back on the road. This article will describe benefits of using RAP and its use in Kansas.

When asphalt pavement is milled and reused in a new asphalt mix, the old asphalt cement is rejuvenated so that it becomes an active part of the adhesive process that holds the pavement together, just like the old aggregate becomes part of the aggregate content of the new mix. The same material can be recycled again and again. As Mike Crow, of the Kansas Asphalt Paving Association says," It's like money in the bank, sitting on your roads."

This article will discuss considerations for using RAP on local roads and will describe use of RAP by KDOT and a few locals agencies in Kansas.

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The quality of reclaimed asphalt pavement (RAP) is dependent on the age and quality of the asphalt from which it is derived. RAP can be amended to improve its performance.

Benefits of using RAP

Why use RAP? Because it can save money. Less virgin material is needed for the mix if RAP is used—less aggregate and less oil. There are environmental benefits, too. According to the National Asphalt Pavement Association (NAPA), if RAP use increases to 25 percent of the average mix in the United States, total lifecycle greenhouse gas emissions will be reduced by 10 percent, which equates to 2 million tons offset annually—equivalent to taking 350,000 cars off the road.

NAPA reports that there is ample evidence that the quality of asphalt pavements that contain RAP is equal to or better than pavements using all virgin materials. However, that assumes that RAP is tested and the mixes are designed based on the characteristics of the RAP. Unfortunately, materials testing is often beyond the financial means of local agencies, but performance can be controlled by purchasing high quality RAP or being conservative in the amount of RAP used in the mix.

KDOT's use of RAP

The Kansas Department of Transportation has been using and testing RAP in mixes for decades. Kansas was one of the lead states in the U.S. in testing a higher percentage of RAP in a pavement mix. Now KDOT uses 25-40 percent RAP in its mixes, all of which are Superpave. Greg Schieber, materials field engineer at KDOT, said that KDOT has developed a RAP blending spreadsheet that allows for RAP up to 50 percent of a mix

depending on the binder grading of the RAP. KDOT's target is -23 degrees Celsius for the blended virgin and RAP binder, so the Contractor can use any percent of RAP in the mix as long as the blended virgin and RAP binder is -23 degrees Celsius or lower.

Increased interest in RAP

The Federal Highway Administration formed a Pecycling Asphalt Pavement Expert Task Group in 2007 with stakeholders from government, industry, and academia to investigate obstacles to increasing RAP use. The Group was charged with achieving increases in RAP use through technology transfer, accelerated deployment strategies, and eliminating artificial and arbitrary barriers to increased recycling and instead using performance-based pavement criteria.

Part of the national challenge of increasing the use of RAP in pavement mixtures is related to supply. It is scarce in some rural areas. The Group encourages rural agencies to allow milling on their pavements prior to the placement of asphalt overlays to provide more material for asphalt plants in areas where RAP is scarce.

Crow said that RAP is in more demand in Kansas than it used to be. "Before it was a nuisance by-product; now it's in demand," Crow said. Cost has gone up with demand, too, Crow said, from about $6 per ton to about $20-30 per ton today.

Where to get RAP in Kansas

Asphalt contractors in Kansas each have their own piles of RAP, said Crow. RAP in those piles typically come from a variety of sources, all mixed together. However, it is possible to purchase RAP from a contractor off a specific job if you arrange for it in advance, as Butler County did (see sidebar). RAP from state and interstate highways is generally high quality, due to the standards for asphalt mixes on these highways.

Another source of RAP is your own roads. Asphalt can be removed by milling or by chunking out the

Examples of Local Agencies in Kansas using RAP

• **The City of Lawrence** uses 15 percent RAP in its asphalt mixes, and it generally performs well, says Mark Thiel, assistant public works director (phone 785-832-3134). However, Thiel said the City recently cut back to 15 percent on the allowable percentage of RAP in their Superpave mixes because they were experiencing premature cracking on some of their newer pavements. While it is difficult to know whether the cracking is due to factors such as the underlying base conditions or the amount of traffic, the suspected cause was brittle RAP.

"RAP in the stockpiles [of our asphalt suppliers] is inconsistent in quality—it could come from a road that is 15 years old or a parking lot that is 40 years old," Thiel said. The City does not have the resources or the money to do the testing necessary to determine the characteristics of the RAP they are getting and what they might need to do to improve its performance. Thiel said the City was asked by a supplier to try a paving project where one lane would have a higher percentage of RAP than the other lane, to see if the additional RAP affected performance under similar conditions. The City is interested, but that project is not yet planned.

• **McPherson County** plans to overlay 15-20 miles of roadway with asphalt containing RAP in the next year. Justin Mader, project engineer, (phone 620-241-0466) said the county has acquired about 10,000 tons of millings and about 30,000 tons of chunked asphalt from a nearby KDOT project on K-61, so they have material to work with for many years. The County will be adding a RAP addition onto their asphalt plant this winter, so they can start using RAP. They are in the process of determining the design of their mixes. Mader hopes for some help from KDOT with that. He expects the County will use a higher percentage of RAP in the base layers and a lower percentage in the surface layers.

Mader says that adding RAP to an asphalt mix will make the pavement more stiff and more susceptible to cracking. Therefore, a softer asphalt oil is recommended with a RAP mix. McPherson already uses a soft oil (PG64 22) in virgin mixes, so they will not have to change oil type.

McPherson County is also experimenting with warm mix asphalt. They have been told that using warm mix asphalt will allow for a higher percentage of RAP in those mixes.

• **Butler County** uses a high percentage of RAP in its mixes (50 percent in both hot and cold mixes) and reports good success. Darryl Lutz, public works director (phone 316-322-4101), said they address quality control on the front end. The County purchases high quality RAP from projects from KDOT or the Kansas Turnpike. To obtain RAP, Lutz finds out where KDOT and the Turnpike will be doing mill and overlay projects in his area and gets the word out to prospective bidders that he is interested in buying RAP, followed by a proposal.

The County proceeses millings for use in cold mix asphalts to pass a 7/8" sieve opening. Lutz said they do not process the RAP they run through a hot mix plant, but they do pass the millings over a 2" bar screen to remove large chunks.

Lutz said mixes with 50 percent RAP are a little stiffer than those with virgin materials, and more open at the top. He said they typically seal pavements with RAP sooner to account for that.

Lutz is pleased with the performance of their RAP mixes based on visual inspection. His agency has significantly reduced the amount of oil they use, and he thinks the pavements with RAP are good for the County in many ways.

pavement (if from a full reconstruction project). Over time, a stockpile of millings will begin to harden and will need to be crushed again before adding it to virgin material. If your recycled asphalt comes from a full roadway reconstruction, a more economical approach may be to have the asphalt chunked out and stockpiled. Then every year you could crush only the amount of material you need for that year, eliminating the possibility of having to process the RAP twice.

What percentage is best?

Schieber said that 15 percent RAP, regardless of its quality, should not have an effect on the thermal cracking performance of the virgin material in the mix. KDOT allows 15 percent of RAP in a mix to come from an off-site source. If above 15 percent, the RAP on a KDOT project must be from millings created onsite. This policy gives KDOT some measure of quality control because KDOT knows the quality of their own pavements.

Crow said local agencies typically use a 15 percent mix, although there is a range. Three local agencies using RAP are profiled in the sidebar at right.

In sum

Using RAP in an asphalt mix can save your agency money and provide environmental benefits. It may take some trial and error to get the right mix of RAP and virgin material for your conditions.

For more information, read NAPA's brochure titled *How to Increase RAP Usage and Ensure Pavement Performance*. It provides answers to common questions associated with RAP performance. See the sources for this article for a link to this brochure and to other resources about RAP.

You can also request help from KDOT. For assistance with mix design, contact Greg Schieber at (785) 296-1198 or gregs@ksdot.org. For assistance with testing, contact your nearest KDOT area office. ■

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Sources:

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- NAPA. Black and Green: Sustainable asphalt now and tomorrow. http://asphaltroads.org/images/documents/Sustainability%20Report%202009.pdf
- Recycling Asphalt Expert Task Group home page. http://www.morerap.us/
- Phone interviews with Mike Crow, Mark Thiel, Justin Mader, Darryl Lutz, and Greg Schieber, KDOT, October 2011.