



King County LinkUp Shingles Panel Presentation

These notes summarize the panel presentation and discussion of the King County LinkUp Shingles in Paving Demonstration Project held on Wednesday, February 24, 2009 at the Tukwila Community Center in Tukwila, Washington.

Panel Discussion

Kris Beatty

Kris Beatty, King County LinkUp project manager, welcomed the stakeholders, introduced the panel, and provided an overview of the project.

In 2006-2007, King County identified shingles as a priority, conducted background research, and began engaging stakeholders. Stakeholder engagement was a key to the project's success: from the first stakeholder meeting in August 2007 to an 18-member advisory group to engagement with transportation agencies, regulators, and pavers in designing the project specifications.

Since the project began in 2006, the number of states allowing the use of RAS in HMA has more than tripled to 10 states. The local market has developed significantly with more local processors recycling shingles and more pavers experimenting with and using shingles on private roads. Regionally, Vancouver, British Columbia, and the State of Oregon are exploring shingles paving projects.

LinkUp conducted the paving demonstration in partnership with King County Road Services Division (KCRSD) and the Washington State Department of Transportation (WSDOT). The demonstration involved designing a project that would minimize risk to KCRSD and developing a specification for recycled asphalt shingles (RAS) and hot mix asphalt (HMA) to include RAS. In designing the RAS specification, the team used guidance from national research and collaborated with transportation and regulatory agencies and with private industry. To address environmental, health, and safety standards, the project worked with a variety of key agencies, including the Department of Ecology, Department of Labor and Industries, Puget Sound Clean Air Agency, and local health departments. The project team took the issue of asbestos contamination seriously by restricting the RAS supply to shingles only, requiring inspections of incoming loads, and employing rigorous sampling and testing for asbestos-containing material (ACM). Testing confirmed no ACM in shingles but detected low levels of ACM in several other roofing materials such as roof patching and aluminum coating; these items were sorted out of the source material.

The next steps are to share the paving demonstration report, continue conducting research and pavement testing, and implement another demonstration. Further information is available on the project Web site at <http://your.kingcounty.gov/solidwaste/linkup/shingles>.

Frank Overton

Frank Overton, supervising engineer at KCRSD, described KCRSD's interest in sponsoring the demonstration, the study goals, and the demonstration's technical objectives. He noted that this effort

confirmed that it takes a good project team to make a successful demonstration. KCRSD is committed to learning about green products it can use, and RAS is a green product that can reduce waste and perhaps provide a cost benefit. At the same time, KCRSD must ensure that roads are safe and meet stringent performance criteria over the long term. To that end, the objectives of this demonstration were to reflect stakeholder issues, evaluate the performance of RAS in HMA with a high degree of certainty, and capture objective engineering data.

Kevin Kelsey

Kevin Kelsey, geotechnical engineer at KCRSD, provided additional details on the study design, the mix and road testing, and the findings and conclusions. To test the long-term performance of HMA with RAS, the project team sought a roadway in which as many other variables as possible were controlled. In addition, the road needed to be scheduled for repaving in 2009, at least two miles long, and in good enough condition for rehabilitation rather than complete replacement. The project team used several tools to identify the pre-construction conditions of the roadway including the WSDOT Distress Data Collection Van, a falling weight deflectometer, and roadway coring. To accommodate variability between the eastern and western side of the roadway, the two-mile test section was divided into four smaller sections so that HMA with RAS could be placed on both sides of the road. During the mixing and paving, the project team adjusted the mix twice. The first change resulted in a mix higher in oil content and fines than the specification called for, but the resulting road looked like a traditional HMA paving job. The second change resulted in a mix that largely met specifications.

Initial results are that HMA has had no negative impacts on pavement performance. The roadway was in near-perfect visual condition after paving. Future work will consist of monitoring and testing the roadway over three years, followed by a construction report. A testing report is available in the paving demonstration report appendices. The King County Road Services Materials Lab Web site can be found at <http://www.kingcounty.gov/transportation/kcdot/Roads/EngineeringServices/GeotechnicalMaterialsTesting/MaterialsLabServices.aspx>.

Joe DeVol

Joe DeVol, bituminous materials engineer at WSDOT, discussed the key factors in mix design, the development of the preliminary HMA mix design, testing results, and the final mix design. He noted the importance of being conservative when designing pavement specifications because of the tax dollars at stake. Although WSDOT looked to other states, limited guidance was available. In designing specifications for HMA with RAS, WSDOT considered the amount of RAS to include, the estimated binder replacement from RAS, and the use of reclaimed asphalt pavement (RAP) in conjunction with RAS. WSDOT extensively tested the RAS and RAP both alone and in combination, using samples from three RAS suppliers.

In designing specifications, Washington uses the Superpave system, created by the Strategic Highway Research Program. Two of the key design specifications are that HMA mixes should have 4 percent air voids (Va) and an appropriate level of voids in mineral aggregate (VMA). As Kevin described, the first test section with RAS had higher asphalt content, more fines, and fewer air voids than targeted. This mix was subsequently modified and improved for the second test section with RAS. The project team was surprised by how much the RAS contributed asphalt binder to the HMA.

From WSDOT's perspective, Washington is not yet ready to roll out a permissive specification for using RAS in HMA, but WSDOT will continue following the development of the project. Unlike some other materials that people have tried to place into asphalt pavement, RAS is compatible with asphalt may even offer a benefit.

John Grisham

John Grisham, project manager at Woodworth and Company, presented the contractor's perspective on the demonstration, discussing the lessons learned and whether participation was beneficial to the company. According to Woodworth, the involvement of WSDOT was very important from a paver's perspective. Woodworth will use WSDOT's review on paper as an indication that RAS can work on public roads.

Woodworth learned several lessons from the demonstration. For example, Woodworth will consider improvements and efficiencies in inspecting incoming loads of shingles and sorting out suspect materials. Woodworth also found that shingles needed to be ground twice to meet the paving demonstration specifications. Although Woodworth initially thought the asphalt contribution from RAS would be small, double-grinding shingles may have provided more asphalt benefit from RAS to the HMA than expected. Blending RAS with RAP and introducing the mixture using the RAP feeder worked well. The roadway with RAS looks like a traditional HMA roadway. Even the section with higher asphalt content shows no streaking or flushing.

In Woodworth's opinion, using RAS in paving truly has merit. Woodworth wants to be a good environmental steward and keep shingles out of landfills. Woodworth has been mixing RAS into HMA for a while on private roads. The fibers in the shingles seem to give the HMA more strength. Woodworth does not think that HMA with RAS will cost more than traditional HMA. As the use of RAS evolves, the industry may see savings, depending on what processing and equipment are required.

Many businesses are becoming involved and making investments in RAS. Woodworth, in particular, will use this paving demonstration to promote RAS to private industry and public agencies.

Question and Answer Session

After the panel discussion, participating stakeholders asked the panelists the following questions about the project.

What will WSDOT recommend to other agencies about using shingles in HMA?

- Joe responded that WSDOT would tell agencies that shingles have possibilities. Joe's opinion is that that industry, rather than agencies, should advance the use of shingles. If using shingles does not benefit the paving industry, then an agency will end up paying more by requiring their use.

What interest have you had from other public agencies about RAS? How do we promote the use of RAS in paving?

- Kris responded the many public agencies have expressed interest. Seattle Public Utilities and the Seattle Department of Transportation were on the demonstration's advisory committee, and several counties and other cities along the I-5 corridor in Washington have also expressed interest. The next immediate steps of the project are to share findings from the demonstration and testing to generate additional interest in using RAS in HMA.

Are all public roads in Washington built using the state specifications?

- Most municipalities use the state specifications when commissioning roads. King County's goal is for WSDOT to create a permissive specification that allows but does not require pavers to use

RAS. WSDOT's involvement is critical: from a contractor's perspective, WSDOT's name on a process or specification makes it the standard.

Can you elaborate on the cost savings? I've heard that using RAS can create significant savings.

- John responded that savings depend on the required investment, which can add costs. Using RAS also increases costs for sorting and handling materials to meet specifications. However, the demonstration indicates that RAS may provide a higher asphalt benefit than expected, creating savings by reducing the need for virgin asphalt. It will take a few years to establish the real cost or savings—accounting for investment, handling costs, and asphalt benefit.

Can you talk about the collection process for shingles? How many collectors brought shingles for the project?

- John explained that Woodworth has been collecting shingles for 15 years, so the company has an existing set of customers who deliver shingles year round. Customers pay a fee for tipping shingles. Woodworth has a separate, covered area to store the shingles; all runoff water is treated before it leaves the site. Customers range from "ma and pa" to professional roofing contractors. Customers are allowed to dump only shingles. Some customers try to hide contamination in the piles, but Woodworth stops accepting materials from such customers.

When contractors bring shingles to the site, do they test first?

- At Woodworth, customers must provide test documentation. John added that some people may pay more for recycling (to cover the costs of testing) if they knew the shingles were being recycled instead of landfilled.

Who besides Woodworth is collecting shingles for recycling? Do roofers save money by recycling instead of landfilling? What happens to shingles that are delivered to landfills?

- A stakeholder in the audience who is a RAS dealer said, generally, recycling costs less than disposal at a landfill. King County has an online searchable database to help people find recyclers (<http://your.kingcounty.gov/solidwaste/wdidw/category.asp?CatID=17>). Shingles that are delivered to a landfill are usually dumped in the landfill rather than separated for recycling. The stakeholder is trying to convince landfill operators to create a separate dump area for loads of source-separated shingles so they can be recycled.

Did the RAS include shingles only or shingles and tar paper?

- The demonstration used shingles only and excluded tar paper. On private projects, Woodworth does not usually process source materials as extensively as on this project.

In Vancouver, pavers are concerned that they would need a separate feeder line for adding RAS into the HMA. Is this the case?

- Woodworth did not need a separate feeder because it mixed the RAS with the RAP during the final grinding process. Both materials were introduced into the HMA through the same recycled material feeder.

In processing the shingles, did you separate the aggregate from the base material? Were the shingles cellulose or glass-fiber based?

- The cellulose-based shingles were ground whole, not separated into components.

My company is proposing to separate the fiber from the body of the shingles to create two products: asphalt and cellulose fiber, which composes 60 percent of shingles by volume. What do you think of that alternative?

- John responded that increasing the sophistication of processing shingles increases costs, so the end-product must be correspondingly more valuable. From Woodworth's standpoint, the company would not invest in this type of process because, first and foremost, Woodworth is a paving company, and it can readily use the entire shingle in its mixes.

How do you test for the asphalt content in RAS? Pavers in Vancouver are concerned about fulfilling their pavement warranty requirements if they use new or inconsistent materials.

- Woodworth does not currently test RAS for asphalt content because the company no longer uses trichloroethylene. Another consideration in understanding the effective asphalt binder contribution from RAS is the growing interest in warm mix asphalt. The lower temperatures needed for these mixes could make it more challenging to extract asphalt from the RAS for HMA.

Other states are testing the use of RAS. What test data from other states is WSDOT able to use? And what is different about Washington that WSDOT needs to test for independently?

- Joe explained that WSDOT examines what other states are doing and tests their processes with materials available in Washington to adjust the specifications as necessary. Washington adopted the national standards but makes adjustments to account for local differences in climate, applications, and material sources such as aggregates. Washington has very good aggregate sources. WSDOT also needs to consider whether states with test data are using the Superpave system or another standard. The biggest challenge when testing the use of RAS is to predict what roadways will look like at the end-of-life. Washington adopted the use of RAP with a similar process of looking at other states and starting slowly in the 1970s. In the 1980s began allowing up to 10 percent RAP, which later increased to 20 percent.

In the HMA mix, the demonstration used 15 percent RAP and 3 percent RAS, but the state's specification allows up to 20 percent RAP. Could you use RAS to replace the rest of the RAP up to 20 percent (15 percent RAP and 5 percent RAS) or use 20 percent RAP plus 3 percent RAS?

- Preliminary testing with RAS samples and RAP indicated that 15 percent RAP and 3 percent RAS was the best combination for the paving demonstration. Joe explained that the specification balanced performance and volumetric properties, aimed at keeping the amount of reclaimed asphalt pavement under 20 percent (WSDOT specification) and the total quantity of recycled asphalt binder under 30 percent, which would require adjustments to the grade of asphalt per AASHTO guidelines. Preliminary testing with 5 percent RAS increased the air voids of the mixture and exceeded the 30 percent limit of recycled binder. There was also a comment that if pavers used 3 percent RAS on all the public paving jobs, there would be a supply issue for tear-off shingles.

How does using RAS with RAP affect roadway noise level?

- John reported that the sections of the demonstration road paved with RAS plus RAP looked and acted just like a traditional HMA road, although the grains were a bit finer. He does not anticipate a difference in roadway noise level.

On test patches with RAS, did pavers find any difference in odors or smoke?

- John said that neither he nor his crewmembers noticed any differences from traditional HMA.

Suppose in the future a city wants to grind and resurface a road paved with HMA containing RAS. Can the ground pavement be used in the resurfacing mix? Is reclaiming that asphalt going to be difficult?

- John responded that reclaiming the asphalt will require more testing to establish how much asphalt will come from the RAP that contains RAS.
- Joe added that WSDOT's practice has been to allow up to 20 percent RAP in new pavements because laboratory testing indicated that it did not adversely affect the HMA up to that percentage. At this point, until WSDOT starts seeing a problem, it will probably not do much testing on RAP containing RAS. An HMA producer may need to consider adjusting the virgin binder to account for the stiffer reclaimed binder. Another thing to consider is that WSDOT has modified their specifications to allow the use warm mix asphalt on all paving projects and how this will impact the use of RAS is undetermined.

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