Information Summary

Asphalt Grindings / RAP (Recycled Asphalt Pavement)

Compiled by G.Keller 6/12/2013

**WHAT IS RAP**

The definition most commonly used for asphalt millings or grindings is the fine particles (generally from dust to less than an inch or so) of bitumen and inorganic material that are produced by the mechanical grinding of bituminous concrete surfaces.

Asphalt grindings contain approximately five to seven percent asphalt, which is used as a binder for the quarry materials (stone, rock, sand, silt) that make up the load-bearing portion of a bituminous concrete surface. The asphalt millings are produced by grinding a bituminous concrete-paved surface.

Sources of asphalt millings include highway departments and local contractors hired to conduct road improvements. Quantities of asphalt millings from a particular operation can vary greatly from a few tons to hundreds of thousands of tons and quality will vary depending on the original asphalt character, age, weather and other site-specific conditions.

**COMMON AND BENEFICIAL USES OF ASPHALT MILLINGS (RAP)**

New Jersey Guidance:
Several uses of asphalt millings are fully appropriate in accordance with (MOST) regulations for recycling and beneficial use and, therefore, asphalt millings may be used as follows below. The use of loose unbound asphalt millings on land and roadway surfaces without the placement of a paved top surface is not generally appropriate, and asphalt millings are not considered clean fill. In order to prevent sediment contamination, asphalt millings should not be used where runoff to surface water features would be possible. Asphalt millings may be used, provided the appropriate conditions are followed.

-Asphalt millings may be taken directly to and used by road asphalt manufacturing plants for direct incorporation into asphalt (bituminous concrete)

-Asphalt millings may be used as sub-base material if the asphalt millings are placed directly beneath, and fully contained by a paved road surface

-Asphalt millings may be used as surfacing materials if an appropriate binder is applied to keep the asphalt millings in place. Liquid asphalt (tack) may be used to bind the asphalt millings in surficial applications.

-Asphalt millings may be used to construct or repave needed roadway or vehicle use areas, such as parking lots and pot hole filling, if such application is performed when the material is sufficiently hot to make the asphalt sufficiently pliable and adhesive to bind the asphalt millings particles on application.

More general use:
RAP is used by many road agencies and departments across the country. RAP has been shown to be an effective surfacing material for unpaved roads when blended with other aggregate. It can substantially reduce the dust coming off an unsealed road surface.

RAP has been used as a filler against an AC pavement and as a road shoulder material to help stabilize the roadway and prevent pavement damage.

RAP has been stabilized as a road surfacing material with the addition of a top dressing of oil or emulsion.

Apparently the Alpine Ski Area in Tahoe uses grindings after snow melt to stabilize roads and trails. They obtain their grindings from Placer County.

**ENVIRONMENTAL AND PUBLIC HEALTH CONCERNS REGARDING USE OF RAP:**

The bitumen binder used in asphalt paving applications contains a relatively large concentration of a family of organic compounds which can have the potential to pose human health and environmental concerns in certain circumstances especially when asphalt material is ground into very small particles that easily blow off of or wash from the surface. These compounds, known as polycyclic aromatic hydrocarbons (PAHs) are specified as targeted pollutants by the U.S. Environmental Protection Agency (USEPA), and are present in asphalt at relatively high levels for general use in a loose fashion on land.

Lead has been observed in RAP samples, with the greatest quantity in old RAP samples, likely as a result of vehicle traffic and emissions.

Asphalt millings used alone without a paved top surface have the potential to significantly migrate from the roadway through the actions of water, wind, and physical displacement and possibly contaminate surrounding soils and/or surface water sediments. Traffic traveling on the unpaved asphalt millings would generate dust containing the compounds referenced above and the dust would be a major migration route of the asphalt millings to the surrounding environment.

**While it is generally recognized that RAP does not present a great risk to human health and the environment, a better characterization of the amount and type of chemicals that leach into the environment is needed.**

Freeze thaw: Also, the natural resources specialist from the California Tahoe Conservancy has told us that grindings work great until there is a freeze-thaw cycle at which point they buckle and break up. Similar problems have been reported elsewhere with time. Poorly compacted RAP has been damaged by freeze-thaw. Good compaction is critical!

**COMMENTS ON USE OF RAP:**

From the in-place recycling perspective, we have found that the reclaimed material is essentially just aggregate, while in RAP it is a combination of binder recover and aggregate if the mix is produced at typical HMA temperatures. I don't believe it has any additional negative environmental implications above those of standard road construction/HMA production. – David Jones, Pavement Engineer, UC Davis

Use RAP blended with virgin aggregate at a roughly 50/50 ratio. When one has too much RAP, one runs the risk of the RAP setting up, forming larger chunks that cannot easily be re-worked with a motor grader to remove surface defects. Achieving good blending is critical.

The addition of RAP with a 50/50 blend with virgin material significantly reduces dust emission. Adding mag chloride brine provided only slight additional dust reduction, but it made the resulting surface very vulnerable to rutting. I would not recommend using mag chloride on a road surfaced with RAP.

Maintenance needs are substantially less for the 50/50 RAP roads than for conventional aggregate-surfaced roads.

Water Quality: Since the asphalt used is aged, the lighter volatiles are long gone by the time the asphalt millings get to the gravel road. The fines that might come off during a heavy precipitation event are not likely to come off in large enough quantities to ever concentrate any heavy metals that may be transported from a RAP blend road. The RAP blended surfaces are fairly tight, so large scale erosion should not be an issue, assuming proper maintenance practices, particularly providing adequate but not excessive crown – about 4%, are followed.

Air Quality: Clearly any of the possible hazards associated with hot mix asphalt placement and the associated fumes are not an issue with RAP since the asphalt is cool and has aged for years. The dust reduction achieved should help reduce particulate emissions, thereby improving air quality. Our studies have documented this reduction in dust emissions using the CSU dustometer. – George Huntington, Wyoming LTAP

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In Oregon no one has a problem with asphalt grindings as long as the source of the grindings has been on roadway, not parking lot, surfaces. From parking lots one could argue that the grindings might have some drippings from leaking crankcases and oil pans.

Remember when using the asphalt grindings one would very likely be using a mix of asphalt grindings and native aggregate since just the asphalt grindings themselves will set up in the summer heat and turn into a weak asphalt concrete surface, we have had that happen a number of times. The above statement is only true if one is aiming for an aggregate surface. If one wants a semi asphalt concrete surface then they would be using the straight grindings.

In terms of the impact of any leaching from the grindings I would agree (and not including grindings from parking lots) that the material would not cause any environmental impacts, any volatiles or any product that would have leached out would have leached out in the first few years after placement. - Pete Bolander, USFS

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Grindings are a viable and low cost option for surfacing and are typically installed with an oil treatment that makes them act like a chip seal surface. I have observed them in place for 10 years with remarkable wear on roads with limited winter hauling with heavy loads. As a precaution we did not use them in the stream crossing area. -Mark Lancaster

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One good example is that the County has used asphalt concrete grindings to stabilize road shoulders and as a treatment for unimproved dirt roads. I contend this type of practice is a solid BMP. I would suggest that local government and Basin regulators come together in an

attempt to agree on road management policy (regarding RAP) -Peter Kraatz - Deputy Director, Placer County Public Works Dept.

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As far as Caltrans, we are currently in the middle of a study with the North Coast Regional Water Board on this topic. I spoke with headquarters over the phone this morning and they told me that we will have some information on the outcome of the study in a year. We don't expect to come up with the final results from the study until we monitor for several years. All of the details, monitoring requirements and which pollutants will be looked at, are still being negotiated up with the North Coast Regional Water Board as we speak.
The summary of studies (above) states that as long as the pollutants don't reach any water body there will be no threat to the environment.

I am going to let our construction and maintenance personnel know to continue our usual practices on AC Grindings/Miling within the Tahoe Basin.

This is a message we received from Bud Amorfini, Lahontan Regional Water Quality Control Board, in 2011 about the AC grindings:
"Our overall position is the same as described in the 9/27/2001 letter from Lauri Kemper of Lahontan to Tahoe Asphalt. The use of AC grindings is regulated the same throughout our region, whether in the Tahoe Basin or outside of the Basin. AC grindings are allowable providing they are not placed in surface waters, flood plains, or conveyances that would connect to surface waters, and they are stabilized where they are placed. For practical applications, AC grindings should not be placed on shoulders that are adjacent to roadside ditches, concentrated flow lines, or similar conveyances. It is appropriate to place grindings on shoulders and pullouts where storm water runoff is allowed to sheet flow off the right-of-way such that it does not enter natural or man-made conveyances. -Santiago Cruz-Roveda, Caltrans

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Yes, we could approve the use of the material if your environmental documents and permit application attachments clearly show that there will be no negative impact on the environment. We would like to see some independent review of the material which proves that it is safe to use in the environment. Lacking scientific evidence, we would prefer not to use the material in Tahoe. If you know of any such research findings regarding AC Grindings, please let me know as I am very curious about this topic.

Please note that TRPA has never approved the use of AC grindings as a surface treatment for shoulder backing or dirt road surfacing. For future reference, all AC grindings need to be removed from the basin to an approved disposal location. I have also verified this requirement with members of the Lahontan RWQCB.

If you believe that AC Grindings should be allowed, and you can locate some strong scientific evidence indicating there is no negative environmental impact or threat to water quality, please let me know. With the proper documentation, TRPA may be able to permit the use of AC grindings along with some ongoing monitoring and evaluation. For now, it is very important that your maintenance crews and Contractors know that AC Grindings need to be removed from the Basin and not used for surface treatments or sold/donated to any local projects. -Ethan Casaday, TRPA

**SUMMARY OF ISSUES AND RECOMMENDED USE:**

Asphalt grindings (RAP) clearly have a very desirable, beneficial, and popular use when used as a surfacing material on low-volume roads. It has generally performed very well when mixed with aggregate and well compacted. Also the material has been shown to have toxic leachates or components including polycyclic hydrocarbons and lead. Concentrations are typically low, but can exceed health standards and can be a source of water quality contamination. Therefore use of this material is encouraged in applications where the pollutants do not have a direct source of conveyance to water courses. Application on upland area roads with sheet flow into the forest or on roads with ditch systems that are "disconnected" from water sources and drainages seems reasonable and overall desirable. Use at the approach to stream crossings should be limited or prohibited, at least until there are further studies on the issue. …G. Keller

**COMMENTS RECEIVED FROM THE FOLLOWING AGENCIES/INDIVIDUALS:**

David Jones, PhD, Project Scientist, UC Davis Pavement Research Center

George Huntington, Civil Engineer, Wyoming LTAP Center

Pete Bolander, Pavement Engineer, Region 6 RO, US Forest Service

Peter Kraatz, Deputy Director, Placer County Public Works Department

Mark Lancaster, 5 Counties Salmonid Conservation Program

Santiago Cruz-Roveda, Caltrans District 3 Office, Marysville

Ethan Casaday, Environmental Specialist, Tahoe Regional Planning Agency

**KEY REFERENCES:**

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