

Abundance of RAP Spurs New Uses in Preservation Treatments

By Erik Updyke and Dennis Ruh

Despite recent increases in allowable reclaimed asphalt pavement (RAP) content in hot-mix asphalt concrete, both in the *Caltrans Standard Specifications* and in the *Standard Specifications for Public Works Construction* ("Greenbook"), a surplus of RAP continues to exist in most urban areas of Southern California.

New and innovative uses for RAP in slurry seals, micro surfacing, and chip seals will help consume some of this surplus, as well as

reduce the demand for virgin aggregate. These uses are becoming increasingly common among Southern California agencies.

RAP aggregate is produced by crushing and screening RAP to the gradation required for the specific seal coat application. After processing, RAP aggregate will typically have a residual asphalt content of between 5 and 8 percent, a specific gravity of approximately 2.4, and an absorption rate of approximately

1.5 percent, based on testing performed by Los Angeles County.

MAKING RAP CHIPS

The use of RAP aggregate (RAP chips) in chip seals has the longest history. Los Angeles County first used RAP chips in a scrub seal on a half-mile section of Avenue J in the unincorporated area of Lake Los Angeles area in February 2008.

Since then, RAP chips have been used in numerous chip seals. For chip seals placed under a



Los Angeles County is serious about asphalt recycling and has been honored for its efforts. At the Pavement Preservation & Recycling Alliance (PPRA) 2015 fall meeting in Niagara Falls, Ont., Greg Kelley, center, assistant deputy director, County of Los Angeles DPW, receives award from Roads & Bridges magazine for major reconstruction project involving recycling of milled RAP into a cement-stabilized base, placement of a rejuvenated cold central-plant recycled layer, and overlay with an asphalt rubber-modified hot mix asphalt. Flanking him are James Emerson, Pavement Recycling Systems Inc., and Brian Budzynski, Roads & Bridges

contract, RAP chips are a contractor option. The Avenue J scrub seal, and subsequent chip and scrub seals – placed using polymer-modified rejuvenating emulsions and RAP chips – continue to perform well.

RUBBER-MODIFIED BINDER

In April 2013, a state of California Department of Resources Recycling and Recovery (CalRecycle)-funded chip seal composed of hot-applied PG 76-22 tire rubber modified paving asphalt and RAP chips was placed in the Lake Los Angeles area.

The intent of this project was to determine if non-preheated (ambient temperature) RAP chips would adhere to a hot-applied binder. Three-eighths-in. RAP chips were placed on a two-mile segment of Avenue K, and 5/16-in. RAP chips were placed on a two-mile segment of Avenue M.

A problem was encountered during the first day of placement on Avenue M that was traced to moisture content



Crushing and screening of RAP into usable fractions creates an engineered product from one-time waste material, permitting blended stockpiles with consistent residual asphalt content which can be figured into mix designs

and cleanliness. RAP chips used with hot-applied binders must be dry and clean, as hot-applied binders do not have the forgiveness of emulsions. Despite adverse weather conditions, there were no subsequent placement problems. To date, this project continues to perform well.

RAP IN SLURRY SEALS

The use of RAP aggregate in slurry seal (RAP slurry) is a more recent development and becoming more common.

RAP slurry is similar in specification requirements to other polymer-modified slurry seals,

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Use of RAP 'chip' has long history in Los Angeles County

with minor exceptions. The residual asphalt on the RAP aggregate contributes to the asphalt content, thus the virgin residual asphalt content requirement is lower.

Also, rolling of the RAP slurry with a pneumatic-tired roller after placement is required. Rolling helps to seat and knead the RAP aggregate. Testing and observation by Los Angeles County indicates the lower absorption rate of RAP aggregate may result in more of an encapsulation of the aggregate in the emulsion and less of a mechanical bond, versus polymer-modified slurry produced with virgin aggregate.

Wet track abrasion test results were similar if the patties for RAP slurry were rolled to simulate the seating of the upper layer of aggregate by the field rolling (not a part of the ASTM D3910 test procedure). Testing also indicated that the use of aluminum sulfate in the RAP slurry mixture resulted in much higher loss of aggregate versus the use of only a portland cement additive.


RAP IN MICRO SURFACING

RAP aggregate use in micro surfacing has been less common. Los Angeles

County had positive results on a project constructed in 2010 on Soledad Canyon Road and Escondido Canyon Road in the Antelope Valley area. The county allows RAP aggregate as a contractor option.

The economics of RAP aggregate usage is affected by the typical market factors of availability and transportation costs. Some agencies in rural locations have chosen to stockpile RAP from nearby projects, then process it on-site into RAP aggregate at a later date. This reduces the haul-off costs of cold millings for current projects, and it eliminates the cost of virgin aggregates for future seal coat projects.

RAP aggregate usage in various seal coats is becoming more common, and specifications will continue to be refined as lessons are learned and the performance of completed projects reviewed.

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