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“Best Practices” for the Use of Recycled Asphalt Shingles



The Asphalt RAP

PAVE GREEN - Pave with Asphalt
America's Most Recycled Product

“The Asphalt RAP” is a publication of the Colorado Asphalt Pavement Association



Stockpiled “Tear Off” Shingles



The use of recycled asphalt shingles (RAS) from both manufacturers’ waste and tear-offs in asphalt mix is a win-win situation for owners, contractors and the environment, provided best practices for quality control and all other specifications are being followed by the producer. The high asphalt binder content of shingles allows only small percentages of RAS to replace significant quantities of new asphalt binder, saving materials and reducing costs. This can also remove a significant amount of waste materials from landfills.

Research and experience has shown that RAS can work in all asphalt mixes provided all specifications are being followed. When used at percentages where the amount of virgin binder in the mix at least 70 percent, no change in binder grade is normally required. At lower percentages of virgin binder, specifications may require using a softer binder. The effect of the stiff asphalt binder in RAS improves rutting resistance, but does not appreciably

affect the low temperature properties of the mix.

With proper screening and testing of tear-off materials the potential risk of asbestos containing materials is extremely low. Persons recycling tear-off shingles will need to work with roofing companies, and federal, state and local agencies to develop a monitoring plan to make sure the process is safe for workers and the environment.

Why recycle shingles?

Recent price fluctuations in asphalt binders have encouraged asphalt mix producers in the U.S. to seek ways of reducing or extending the virgin asphalt binder they use in their products with continued industry emphasis on quality and environmental assurances.

The most practical approach in the short term is to use the binder available in reclaimed asphalt pavement (RAP) and reclaimed asphalt shingles (RAS). The industry has long realized the value of RAP for saving money and conserving resources. More recently the industry has also come to realize the value of asphalt shingles since they contain anywhere from 19 to 36 percent of liquid asphalt binder (Townsend, Powell, & Xu, 2007). Therefore, even a small percentage of shingles can have a significant effect on the amount

of new asphalt binder added to the mix, asphalt shingles contain other materials, including fibers, fine aggregate and mineral filler which are also commonly Used in asphalt mixtures.

Will it work?

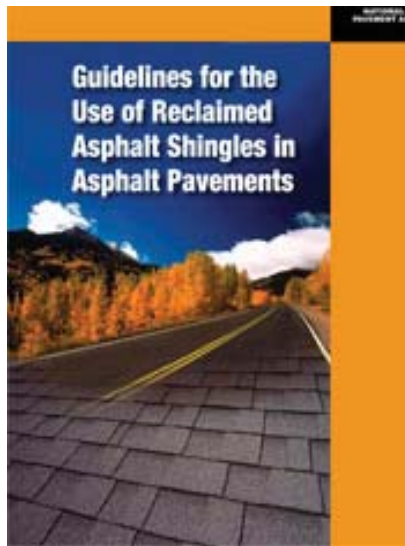
provided best practices for quality control and all other specifications are being followed by the producer .

“Best Practices” for the use of Recycled Asphalt Shingles

What are the benefits of using RAS?

There is a substantial environmental benefit to the use of waste roofing shingles. A Wisconsin study of municipal solid waste (MSW) reported that asphalt shingles represent the third largest source of land filled material each year. Only untreated wood and food waste were higher (Cascadia Consulting Group, 2003). Thus, shrinking landfill space can be saved by using waste shingles in asphalt mixtures.

Asphalt roofing shingles constitute nearly two-thirds of the roofing market for both new homes and roof replacements. Roof installation generates an estimated 7 to 10 million tons of shingle tear-off waste and installation scrap annually. U.S. manufacturing plants generate another 750,000 to 1 million tons of manufacturing shingle scrap (NAHB Research Center, 1998). This represents over 2 million tons of liquid asphalt binder available for use in asphalt paving mixtures, or a replacement of almost 9 percent of the current national need for liquid asphalt binder in pavement construction.



What are the potential savings?

The potential savings of using waste shingles in Asphalt materials may include

- % shingles in mix = 5%
- Total Binder content of shingles = 25%
- Assume effective Binder content 80 percent of total AC = 20%
- New Binder = \$400, \$500 and \$600/ton
- % fine Aggregate in Shingles = 30%
- Tipping fees at local landfill = \$25-\$50 per ton
- Acquisition cost = \$0.00 per ton (assumes generator of waste pays this cost)
- Additional processing costs = \$12/ ton

Assuming the cost shown above we can make some assumptions on savings

| Binder Costs per ton | \$400 | \$500 | \$600 |
|---|--------|--------|--------|
| Potential Net Savings per ton of Asphalt Material | \$4.80 | \$5.80 | \$6.80 |



Are all shingles the same?

Obtaining a reliable supply of tear-off shingles free of hazardous or harmful materials is very important as it affects the economics and sustainability of the operation. Since tear-off shingles will typically come from roofing

companies who will have other options for disposing of their waste shingles, it is necessary to make the recycling process attractive through reduced tipping fees, convenient location(s), less stringent requirements on non-hazardous contaminants, or other economic incentives.

Tear-off shingles will always have some minor contaminants and it is up to the shingle recycling operation to define what is acceptable, taking into account state and federal requirements. However, in no case should this include contaminants that are harmful to the health and safety of workers or the environment. Asbestos containing material (ACM), as defined by NESHAP, should be prohibited (e.g., cementitious shingles, transite siding, etc.) (Krivit, 2007).

After the sources of waste shingles are identified, the necessary permits and licenses from local, state and federal agencies must be obtained. The permits and licenses vary from state to state and may include:

- Zoning, construction, and operation permits.
- Solid waste and/or recycling facility licenses and permits.

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“Best Practices” for the use of Recycled Asphalt Shingles (RAS)

This document is intended as a “Best Practices” guideline for specifiers or end users who are considering or allowing the use of RAS in an asphalt paving mixture. This document is a synopsis of practices and guidelines and should not be considered inclusive.

- Processing of Waste Shingles
 - Manufactures waste
 - Grinding to an acceptable size, the generally acceptable size is 100% passing the ½ inch sieve
 - Tears Off shingles
 - Separation of materials
 - ☒ Shingle residual from other roofing materials
 - Relatively free of debris and contaminates, no more than 1.5% deleterious materials
 - ☒ Paper, plastic, ferrous materials, roofing felt or other materials
 - Mixture design
 - Asphalt mixture which have RAS added should meet all agency/end user guidelines and properties for asphalt mixtures
 - Binder Grading
 - The use of RAS may affect the recommended binder grade. Grade bumping of the binder should be considered.

(An example of Grade bumping may have an original Binder specified of PG 64-22, with 30 recycled product, the grade may need to be adjusted to PG58-28 or different depending on the new grade of binder from the recycled product to meet the original specified binder)
- Production and Construction
 - The producer and laydown contractor should maintain all requirements, practices and tolerances currently in use by agencies for asphalt mixtures
 - If RAS is proposed or approved for use, the producer and laydown contractor should supply a quality control (QC) plan addressing the introduction, use and testing of the RAS for review by the approving agency
 - If tear off shingles are used the supplier should have documentation that asbestos testing has been completed on the shingle materials

Regulations that may apply in addition to these permits and licenses are:

- State and federal worker health and safety regulations.
- State and federal water quality protection.
- State and federal air emissions regulations.

A quality control plan should be in place before considering the use of RAS.

Initial quality control of the recycled asphalt shingle (RAS) material is performed prior to and during grinding. Material for reclamation is separated by quality and source before being accepted for processing. Shingles must be free of wood, metal, and other debris, and must be proved by testing to be free of asbestos. Stockpiles should be built throughout the winter months so as to have the most material on hand with appropriate testing during production. These stockpiles are built from the ground up, completely mixing all loads as they come in.

The recycled asphalt shingle material is sampled during the grinding operations according to CP 30 at frequencies not greater than 1/1000 tons and tested for gradation and asphalt content in accordance with CP-31A, B, and CP-L 5120. Testing is done randomly on a daily basis to ensure conformance to specifications. Extractions for asphalt cement content should be performed to correlate results obtained using CP-L5120

The recycled asphalt shingle material at the asphalt plant is again sampled and tested according to CDOT procedures to ensure that the asphalt content and gradation meet CDOT specifications and represent initial quality control data. Once data is collected a statistical analysis is performed to determine the blend for the asphalt mixture design. This analysis is provided with the Asphalt Mixture Design submittal.

Detecting Recycled Asphalt Shingles (RAS) in Asphalt Mixtures:

Questions have been raised on how an owner/agency or private property owner can test to determine the presence of recycled asphalt shingles in Asphalt Mixtures. The simplest thing to do is A) conduct an AC Content Determination Test using an ignition oven test and look for fibers (should be able to see the fiberglass ones) or B) do a solvent based extraction test and look for fibers (fiberglass and organic ones).

Either of these approaches should give a yes or no indication of the presence of shingles. An estimated range of shingle content used can be estimated based on the fiber content.

Are there published "Best Practices"?

CAPA and our membership have created documents for the "Best Practices" for the use of RAS as well as a RAS Quality Control Plan. Both of these documents as well as the CDOT specification for the use of RAS are available from the CAPA web site http://www.co-asphalt.com/documents/Resources_Files/RAS.doc

RECYCLED ASPHALT SHINGLES QUALITY CONTROL PLAN

1. Initial quality control of the recycled asphalt shingles (RAS) material is performed prior to and during grinding. Material for reclamation is separated by quality and source before being accepted for processing. Shingles must be free of wood, metal, and other debris, and must be proved by testing to be free of asbestos. Stockpiles should be built throughout the winter months so as to have the most material on hand with appropriate testing during production. These stockpiles are built from the ground up, completely mixing all loads as they come in.
2. The processed material is stockpiled at the grinding facility and kept in separate piles and separate from other products to prevent intermingling, as well as at the feed bins.
3. The recycled asphalt shingles material is sampled during the grinding operations according to CP 30 at frequencies not greater than 1/1000 tons and tested for gradation and asphalt content in accordance with CP-31A, B, and CP-L 5120. Testing is done randomly on a daily basis to ensure conformance to specifications. Extractions for asphalt cement content should be performed to correlate results obtained using CP-L5120.
4. The recycled asphalt shingles material at the asphalt plant is again sampled and tested according to CDOT procedures to ensure that the asphalt content and gradation meet CDOT specifications and represent initial quality control data. Once data is collected a statistical analysis is performed to determine the blend for the asphalt mixture design. This analysis is provided with the Asphalt Mixture Design submittal.
5. The RAS system at the asphalt plant consists of a feed bin with a variable speed motor controlled by the plant computer, which ensures the proper quantity of RAS material called for by the mix design. Material is delivered to the asphalt mixing chamber of the asphalt plant by means of conveyor belts. The RAS material falls from one conveyor to another through a shaker screen that serves to break up any RAS material that has recompacted. Any oversize material is rejected at the shaker screen. While in production, the front-end loader works the full face of the stockpile, to ensure a representative batch is being produced.
6. Prior to starting a project and at any other time necessary, the RAS feed system is calibrated by placing an amount of RAS measured by certified external scales into the feed bin. That measured material is fed from the RAS bin across the belt scales. The weights are compared and, if outside of accepted tolerances for the blending system, adjustments are made by the plant blending computer. This process is the same as for all other components of the mix design.

Resources/References

- Guidelines for the use of Recycled Asphalt Shingles in Asphalt Pavements, NAPA publication IS 136, Kent R. Hansen, PE, www.hotmix.org
- CDOT Specification for the use of Recycled Asphalt Shingles, Revision of Section 401
- Best Practices for the use of RAS, CAPA 2010
- Recycled Asphalt Shingles, A Quality Control Plan. CAPA 2010

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