

PERFORMANCE OF RECYCLED ASPHALT SHINGLES IN ROAD APPLICATIONS

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INTRODUCTION

- As diversion programs for “traditional” wastes mature, Vermont continues to seek opportunities to reduce the disposal of special wastes, such as construction and demolition wastes.
- Interviews with contractors and waste managers led us to believe that asphalt shingles and drywall recycling may be feasible.

- In 1999, the VANR, thru the Vermont Agency of Transportation, was granted up to \$165,000 in Federal Highway Administration funds to research the use of post-consumer, recycled asphalt shingles (RAS) in road construction.
- The study was multi-year, multi-phase, and included:

- Phase I – Literature Search
- Phase Ia – An Estimation of Waste Shingle Generation in Vermont
- Phase II – RAS in Aggregate
- Phase III – RAS in Cold Patch
- Phase IV – RAS in Hot Mix Asphalt

Phase I – Literature Search

You all know this stuff, or will by the end of the Forum!

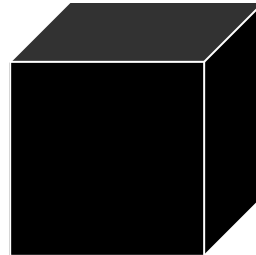
Phase Ia - Waste Shingle Generation in Vermont

Assumptions:

- Number of Vermont single family and vacation homes = 204,000
- Estimated percentage of homes with asphalt shingles = 0.90
- Average asphalt roofing density = 3.0 lbs/s.f.
- Average roof area = 1850 s.f.
- Lifespan of shingles = 20 years

$$204,000 \times 0.90 \times (3.0 \times 1850 / 2000 \text{ lb/ton}) / 20$$

Insert into black box →



and

25,704 tons of waste shingles are
generated per year in Vermont

Phase II – RAS in Aggregate

- The VANR, Chittenden Solid Waste Management District, and A. Marcelino and Company, a local contractor, developed a waste shingle collection and processing program.
- The program was advertised by press releases, signs at transfer stations, notices in waste disposal invoices, and contact with builder groups.
- The normal \$85.00/ton tipping fee was waived for segregated, uncontaminated loads of asphalt shingles.

Phase II – RAS in Aggregate (CONT.)

Asbestos Testing –

All participants were required to submit samples from each job site prior to load acceptance.

Analyses were expedited with results available within 24-48 hours and faxed to the generator and researchers.

Of 95 separate roofing projects, only one sample contained asbestos.

JOB SITE # _____

ASPHALT SHINGLE RECYCLING PILOT PROJECT
Participant and Job Site Information

NAME: _____ PHONE: _____

HOMEOWNER ROOFER BUILDER OTHER: _____

COMPANY NAME: _____

MAILING ADDRESS: _____

JOB SITE ADDRESS: _____

TYPE OF BUILDING: _____

EST. SF OF ROOF: _____

OF LAYERS OF SHINGLES: _____

EST. AGE OF SHINGLES: _____

ASBESTOS TEST RESULTS:	POS	NEG	DATE
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WEIGHTS:	TARE WT	SCALE WT	NET WT	DATE
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Load 1 _____

Load 2 _____

Load 3 _____

Load 4 _____

Load 5 _____

Load 6 _____

CSWD _____

Phase II – RAS in Aggregate (CONT.)

- From July 1999 to April 2000, 394 tons of shingles were collected for processing.
- The collected shingles were initially tub ground to $<1\text{-}1/2''$, then re-ground in a separate, low speed grinder with magnetic separation to $<7/16''$.
- Ground RAS was blended with crushed and screened recycled asphalt pavement (RAP) and gravel in a 10% RAS, 30% RAP, and 60% gravel mixture.





Phase II – RAS in Aggregate (CONT.)

- The RAS/RAP/gravel was offered to local municipalities free of charge in exchange for participating in the research and providing feedback on the material's performance.
- During the 2000 and 2001 construction seasons RAS/RAP/gravel was installed as the driving surface on seven gravel town road sections (0.13 – 0.51 miles) in six municipalities, often on difficult-to-maintain locations.

Phase II – RAS in Aggregate (CONT.)

- Standard placement practice:
 1. Grade existing surface, correct drainage as needed;
 2. Spread and grade RAS/RAP/gravel to 3" lift thickness;
 3. Compact the material with a vibratory roller; and
 4. Apply ~600 gallons/mile of liquid CaCl_2 .

Repeat steps 1-4 to obtain a 5-6" thickness.













Phase II – RAS in Aggregate (CONT.)

- In all, about 4000 tons of RAS/RAP/gravel was manufactured and installed.
- Feedback from town officials has been very positive. The driving surface is hard and durable. Potholes and washboarding are less evident, grading is less frequent, and the material is not as dusty as natural aggregate.
- One test section was plagued by nails for some unknown reason – bad publicity is tough to overcome!
- For a time, our contractor continued to collect shingles at \$40/ton, but has not processed any due to permitting issues. Estimated for-profit price of RAS/RAP/gravel will be \$5.50/ton – comparable to virgin gravel.

Phase III – RAS in Cold Patch

- 55 tons of <math><1/4\text{''}</math> RAS from tear offs were imported from out-of-state. (Well, 54 tons of RAS and 1 ton of nails.)
- Based on earlier testing of RAS samples, modifications to the typical “high performance” cold patch mix design were made. Liquid binder was increased from 5% to 6%, virgin aggregate was decreased from 95% to 80%, and the remainder, 14%, was RAS. The mix was processed at 180°F.

Phase III – RAS in Cold Patch (CONT.)

- 275 tons of RAS cold patch was produced in November 1999, and was made available to area municipalities and VTrans Maintenance Districts.
- Seven towns and cities, and two highway districts performed pilot studies of the cold patch.

VERMONT AGENCY OF NATURAL RESOURCES

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FOR ROAD APPLICATIONS"

ASPHALT SHINGLE CONTAINING COLD PATCH
USAGE LOG

Town: _____

Town or State Highway (name or number): _____

Location (from where to where, including any locations that convention cold patch was used):

Condition of Road (pavement integrity, drainage, subbase, distresses, frequency and depth of potholes, etc.):

Road Design (if known): _____

Year of Most Recent Paving: _____ Year of Next Anticipated Paving: _____

Patching Methods (throw-and-go?, thrown-and-roll?, remove water?, brush or cut back edges?, etc.):

Comments on Asphalt Shingle-Containing Cold Patch Placement (as compared to conventional cold patch):

Other Comments: _____

Form Completed by: _____ Date: _____

Please return to:

James Surwilo
Vermont Agency of Natural Resources
1 South
Waterbury, VT 05671-0407

Phone: (802) 241-3481
Fax: (802) 244-5141









“It’s drier than
a popcorn fart!”

Phase III – RAS in Cold Patch (CONT.)

- Results were mixed. The material was stiff and difficult to apply, conditions which worsened over time. Users with “hotboxes” praised the cold patch as more durable than even high performance mixes.
- We theorize that the temperature during manufacture was not high enough to melt the asphalt in the RAS. Thus, rather than supplementing the liquid asphalt in the mix, the shingles acted as aggregate, adsorbing additional liquid binder.

Phase IV – RAS in Hot Mix Asphalt

Uncertainties with funding, liability and Vtrans commitment to the project forced the decision to abandon this last Phase....

Conclusions

- Post-consumer recycled asphalt shingles have a future in road construction projects...or else you wouldn't be here!
- With a financial incentive, contractors and homeowners will separate and recycle waste shingles.
- Asbestos content is not an issue, but the logistics and cost of mandatory testing is.
- With additional research and mix design testing, it is likely that quality RAS cold patch can be developed.
- HMA using RAS? To be determined...

Conclusions (CONT.)

- For a rural state with a relatively limited source of RAS, using the material as a gravel road driving surface blend is very practicable.
 - Production is simple. Cold mixed, not relying on a asphalt plant. No imported feedstock.
 - Can utilize recycled asphalt pavement, also.
 - Mix design is flexible. Likely that RAS content from 5-15% would give satisfactory results.
 - The material is cost competitive with natural aggregate, but with superior performance.
 - Quality control is crucial. Get the nails out!



*THE
END*