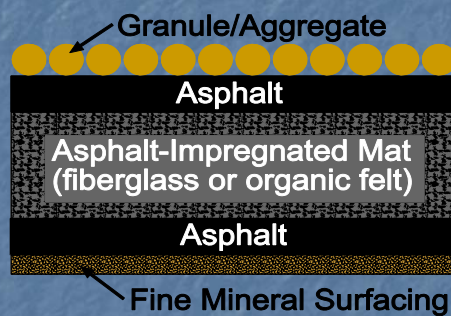


ISAP Asphalt Pavement and Environment

Gerry Huber
Heritage Research Group

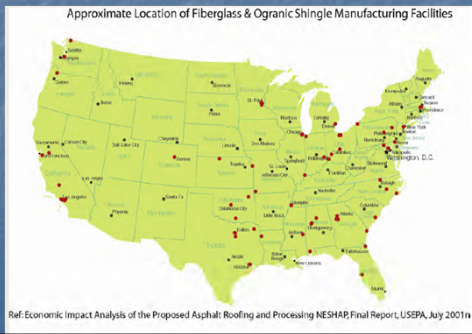
Why use asphalt shingles in asphalt pavement?



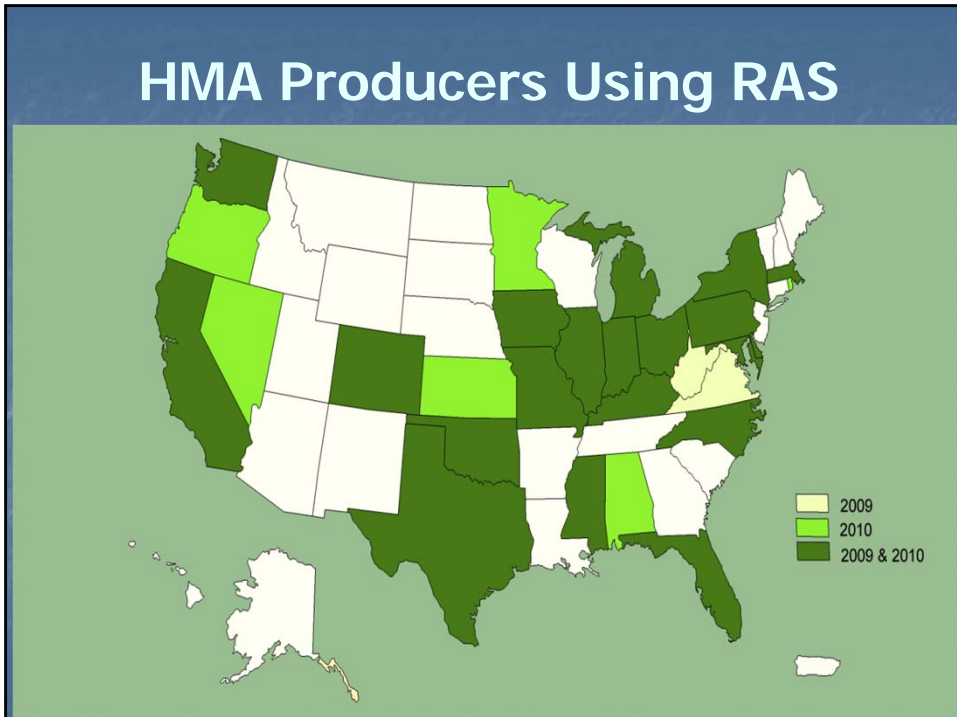
All materials commonly used in asphalt pavements

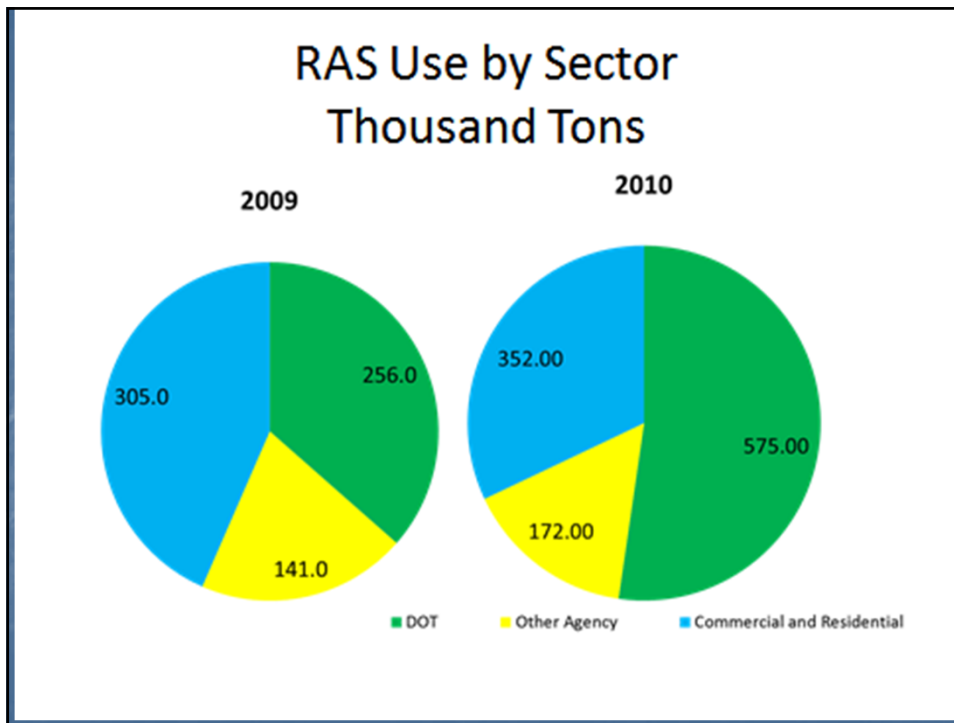
Sources of Asphalt Shingles

- Manufactures' waste ~1 MT annual
..... Not in every state
- Tear-offs ~10 MT annual
..... Everywhere



HMA Producers Using RAS





What we have seen

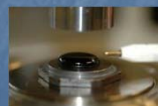
- Shingles are too valuable to throw away
- Use manufacturers' waste if available
- Tear-offs
 - Work with roofers to get clean material.
 - Work with local agencies on sampling plan
- Performance
 - Improved rutting resistance

What we have seen

- Mix AC Content
 - Will reduce the amount of new asphalt
 - Total asphalt contents often higher (0.2-0.4%)
- Plant production
 - Similar to RAP
- Mix design
 - Similar to RAP
- Construction
 - Use conventional equipment
 - Some contractors report easier density

Remaining Performance Issues

- ~ Effect on binder grade
- ~ Temperature Susceptibility
- ~ Moisture Susceptibility
- ✓ Rutting resistance



Processing

- Mixed roofing waste
 - Dump & Pick
 - Picking conveyors
 - Screens



Ref: Krivit, D. (2007). *Recycling Tear-Off Asphalt Shingles: Best Practices Guide*. The Construction Materials Recycling Association



Courtesy B. R. Amon & Sons, Inc.



Ref: Krivit, D. (2007). *Recycling Tear-Off Asphalt Shingles: Best Practices Guide*. The Construction Materials Recycling Association

Equipment

- Many suppliers
- Magnet essential in recycling tear-offs



Ref: Krivit, D. (2007). *Recycling Tear-Off Asphalt Shingles: Best Practices Guide*. The Construction Materials Recycling Association



Courtesy B. R. Amon & Sons, Inc.

Good looking grind.



Covered RAS Stockpile



Courtesy Oldcastle Materials Group

Feeding the Plant

- Same as RAP
- Scalping screen to remove oversize material and agglomerations.



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Mix Design

- Similar to RAP
- AASHTO Guidance
 - PP 53-09 Design Considerations when Using Reclaimed Asphalt Shingles in New HMA
 - MP 15-06, *Use of Reclaimed Asphalt Shingle as an Additive in Hot-Mix Asphalt*

14

Understanding VMA and RAS Specific Gravity

The 5th Asphalt Shingle Recycling Forum
Dallas, Texas
October 27, 2011

Kit Peregrine, Jason Wielinski, Gerry Huber and Bill Pine
Heritage Research Group

What is **VMA**?

- **Voids in the Mineral Aggregate**
 - "Mineral Aggregate" = **Non-Asphalt** Components
- **VMA** is the intergranular **space** occupied by asphalt and air in a compacted asphalt mixture.
- **Absorbed** asphalt is **not** part of VMA.

Why is **VMA** Important?

- It ensures a minimum **EFFECTIVE AC VOLUME**
- The **EFFECTIVE** volume drives mix **durability** – resistance to aging from the climatic and traffic conditions



Specific Gravity

$$= \frac{\text{Mass}}{\text{Volume}}$$

RAS Specific Gravity - G_{se}

- G_{sb} – Not practical for RAS
- G_{se} – Commonly used (AASHTO PP 53)



Heritage Research Group RAS Investigation

- Max specific gravity (G_{mm} includes AC)
 - Vacuum Pyc
 - CORELOK
 - Virgin AC added – Vacuum Pyc
- Extracted gradation and % AC
- G_{se} determined for each:
 - Source
 - Using each of the max specific gravity tests

Calculating G_{se} ...

$$G_{se} = \frac{(100 - P_b)}{\left(\frac{100}{G_{mm}}\right) - \left(\frac{P_b}{G_b}\right)}$$

Sampling, Blending & Splitting

- Nine Sources:
 - Ft. Wayne, IN
 - **Chicago, IL (MW)**
 - Chicago, IL (TOS)
 - Nashville, TN
 - Denver, CO
 - Cincinnati, OH
 - Kansas City, MO
 - Indianapolis, IN
 - Stockton, CA









RAS Gravity **AND** RAS Aggregate % **Matters!**

	CA1	CA2	FA1	FA2	MF	RAS			Comb G _{sb}	VMA	Pba
G _{sb}	2.63	2.64	2.65	2.67	2.70	2.00	2.30	2.60			
Blend 1	48.2	11.5	18.9	14.9	1.5	5.0	→		2.601	13.6	1.44
							5.0	→	2.623	14.3	1.10
								5.0	2.640	14.9	0.85
Blend 2	48.8	11.6	19.1	15.1	1.5	3.9	→		2.610	13.9	1.30
							3.9	→	2.627	14.5	1.04
								3.9	2.641	14.9	0.84

Take Away

- RAS Specific Gravity matters!
 - Determine G_{se} accurately
 - G_{se} rule-of-thumb value?
 - Fiberglass RAS – **2.500 to 2.600?**
 - Cellulose RAS – Lower Value?

Additional Information

FHWA Pavement & Material Web Site

<http://www.fhwa.dot.gov/pavement>

National Asphalt Pavement Association

<http://www.asphaltpavement.org>

And

<http://shinglerecycling.org/>

