Sustainability

Louisiana Transportation Conference
Baton Rouge
2013
ASPHALT SUSTAINABILITY

- Porous pavements manage stormwater
- OGFCs mitigate UHI
- Asphalt accepts recycled goods / are recycled
  - Lower energy to construct, low carbon footprint
- WMA lowers energy consumption & emissions
- RAP can offset the annual HMA plant GHG emissions
- Perpetual Pavements use fewer resources and cost less
- Carbon in asphalt is sequestered, NOT burned.
The Bad News

Texas Gulf Coast Asphalt Prices

Date
12/6/99, 4/19/01, 9/1/02, 1/14/04, 5/28/05, 10/10/06, 2/22/08, 7/6/09, 11/18/10, 4/1/12, 8/14/13

Price (cents/gal)
0.0, 100.0, 200.0, 300.0, 400.0

Graph showing the price of Texas Gulf Coast Asphalt from 12/6/99 to 8/14/13.
Cement
- China consumes over half (1.8 out of 3.3 billion tons)
- India in second (212 million tons)

Asphalt
- Demand to increase at 4.1% per year from 2010 to 2015
- Largest increase in demand in North America
- China accounts for 20% of consumption

Fuel
- U.S. continues to consume the most
- Other countries competing
- Geopolitical forces
- Natural disasters
- Refinery accidents
Recycling

- Oil Embargo - 1974
  - Gas prices skyrocket to
  - Gas lines

- Industry
  - Look to Recycling
    - Minnesota Heat Transfer
    - Mix Design Changes
    - Milling Machines
  - Today
    - Fractionate RAP
    - Greater RAP Content
RAP is Worth the Virgin Material it Replaces

Using 20% RAP in HMA reduces carbon emissions by about 8.5%
Virgin mix requires 5.5% AC
RAP has 4.0% AC
Use 30% RAP – Reduce virgin AC 1.2%
RAP Processing - $6.00/ton
AC price $650/ton – Aggr. price $10/ton
On 1 ton HMA reduce AC by 0.012 tons
Reduce aggregate by 0.28 tons
SAVE $8.80/ton!
The savings will show up in bids!
Roofing shingles comprised of:

- Polymer modified asphalt
- Fiberglass or felt fibers
- Grit – angular fine aggregate
- Mineral filler
10,000 tons of ground shingles replaces:

- 468,000 gallons of asphalt
- 8,000 tons of aggregate

Using 5% RAS in HMA reduces carbon emissions by approx. 7.0%
Roofing shingles contain ~ 20% asphalt
Use 5% shingles in HMA, reduce 1% asphalt
Reduce 0.01 ton AC/ton HMA
Reduce cost by $6.50/ton HMA
Savings will show up in bids!
Not What We’re Looking For!
Warm Mix Asphalt

Hot Mix (155 °C) 311 °F

WAM (110 °C) 230 °F
Control
Temp = 320°F

WMA
Temp = 245°F
Benefits of WMA

• Reduced odors
• Reduced Fuel
• Reduced Emissions
• Higher RAP
• Improved Working Conditions
• Cold Weather Paving
• Longer Haul Distances
WMA Goals

• Use existing Hot Mix Asphalt plants

• To meet existing standards for Hot Mix Asphalt specifications

• Must work with Superpave, SMA

• **WMA quality** = Hot Mix Asphalt quality
Technology Providers

Foaming Methods
- Advera – PQ
- Astec Double-Barrel Green
- Gencor Green Machine
- Low Energy Asphalt - McConnaughay
- Terex
- Maxam – Aquafoam
- Meeker – Aquablack
- Aesco-Madsen – Static Inline Vortex Mixer

Chemical Modifiers
- Evotherm - MeadWestvaco
- Rediset – Akzo-Nobel
- Revix – Mathy-Ergon
- Sasobit – Sasol
- Trinidad Lake
- AdRAP
Warm-Mix Asphalt: Best Practices
GHG Emissions

<table>
<thead>
<tr>
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<th>CO2eq (lbs CO2 eq/ton of mix)</th>
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<tbody>
<tr>
<td>HMA</td>
<td>108.6</td>
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<tr>
<td>HMA 5% RAS</td>
<td>100.8</td>
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<tr>
<td>HMA 20% RAP</td>
<td>99.4</td>
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<tr>
<td>HMA 40% RAP</td>
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<tr>
<td>WMA</td>
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<tr>
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<td>87.4</td>
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<td>WMA 40% RAP</td>
<td>79.4</td>
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</table>
GHG Emissions Reductions

- HMA
- HMA 5% RAS
- HMA 20% RAP
- HMA 40% RAP
- WMA 5% RAS
- WMA 20% RAP
- WMA 40% RAP

Emissions Reduction over HMA (%)
WMA with 15% RAP and 5% RAS

- 83 lbs. of carbon emissions per ton of mix as compared to 109 lbs. with HMA and no recycled materials

That’s over a 23% reduction in emissions
At 9 million tons of mix produced annually, the amount of CO2eq reduced would be 115,000 tons:

That’s the equivalent of taking 19,982 cars off the road for one year.

Or consuming 11,755,644 gallons of gasoline

Or producing electricity for 13,572 homes for one year.

Or the GHG emissions avoided by recycling 35,188 tons of waste instead of sending it to the landfill.
POROUS ASPHALT PAVEMENTS

Photo courtesy Cahill Associates
Courtesy Cahill Associates
Roads

- Challenges
  - Cuts and fills
  - Slope
  - Variable soil conditions
  - Utilities
- Limited use
Oregon Pringle Creek Subdivision

Courtesy Jim Huddleston
Porous pavements offer good alternative to conventional stormwater mitigation

Site Conditions must be right

Need to protect pavement from contamination during and after construction

Properly designed and constructed will last more than 20 years
Save asphalt and aggregate over the long term. It’s sustainable.

- Lower Life Cycle Cost
- Lower User Cost
Max Tensile Strain

Pavement Foundation

40-75 mm SMA, OGFC or Superpave

Zone Of High Compression

High Modulus Rut Resistant Material (Varies As Needed)

Max Tensile Strain

Flexible Fatigue Resistant Material 75 - 100 mm
## Comparison of Structures

<table>
<thead>
<tr>
<th>Year</th>
<th>Activity</th>
<th>Year</th>
<th>Activity</th>
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<tbody>
<tr>
<td>0</td>
<td>6” HMA/10” Base</td>
<td>0</td>
<td>11” HMA/6” Base</td>
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<tr>
<td>15</td>
<td>Mill 2”/Overlay 3”</td>
<td>18</td>
<td>Mill 2”/Overlay 2”</td>
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<tr>
<td>25</td>
<td>10% Patching + Mill 2”/Overlay 3”</td>
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<td>Reconstruct with 8” HMA</td>
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<td>50</td>
<td>Mill 2”/Overlay 3”</td>
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<tr>
<td>Year</td>
<td>Conventional (tons/lane-mile)</td>
<td>Perpetual Pavement (tons/lane-mile)</td>
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<tr>
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<td>HMA*</td>
<td>Gravel Base*</td>
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<td>Total</td>
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<td>RAP</td>
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<td>Aggregate</td>
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<tr>
<td>Asphalt Binder**</td>
<td>350</td>
<td>252</td>
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Material Usage

- HMA, tons: Save 31%
- RAP, tons: Save 28%
- Aggregate, tons: Save 32%
- Binder, tons: Save 28%
Costs

Save 44%
Environmental Landscape

- Climate Change
- Tougher Ozone Standards
- Increased Activism
- Energy Concerns
- Political Change
- International Developments