Industry Perspectives: Sustainable Asphalt Technologies
• What does it mean to be “Sustainable”?  
• What asphalt technologies are considered “Sustainable” and why?  
• Why do we need to quantify our impact?  
• What tools are available for quantification?
What does it mean to be “Sustainable”?

Sustainable

“Meets the needs of the present without compromising the ability of future generations to meet their own”¹

Sustainable Pavements?

No universal definition

“Triple Bottom Line”

¹ UN World Commission on Environment and Development
Sustainable Asphalt Pavements

Societal
- Safe
- Quiet
- Smooth Ride Quality
- Minimizes User Delay
- Natural Resource Conservation

Economic
- Virgin Material Reuse/Replacement
- Reduced Fuel
- Improved Durability

Environmental
- Storm Water Runoff
- Water Treatment
- Reduce Emissions
- Reduce Landfill
How Sustainable are Asphalt Pavements?

- 1960-1999, 250% increase in Asphalt Tonnage and 97% reduction in Emissions
- Porous Pavement
- Warm Mix Asphalt
- Recycled/Reused Asphalt Pavement
  - Recycled Asphalt Shingles
  - Ground Tire Asphalt
  - Reclaimed Asphalt Pavement
Porous pavements manage stormwater

Not just for parking lots
Porous Asphalt Pavements

Societal
- Cool Pavement
- Reduced Noise
- Improved Safety

Economic
- Cost Effective

Environmental
- Storm Water Runoff
- Water Treatment
- Ground Water Recharge
Warm Mix Asphalt

Warm Mix Asphalt Use

- 2009: 5%
- 2010: 11%
- 2011: 19%

DOT  Other Agency  Commercial & Residential
Warm Mix Asphalt

Societal
- Worker Comfort
- Extension of Paving Season
- Improved Ride Quality
- Lower User Delay

Economic
- Reduced Fuel
- Allows higher percent RAP

Environmental
- Reduced Emissions
Recycled Asphalt Shingles (RAS)

- 11 Million tons asphalt roofing waste generated
- Asphalt shingles take 300 years to decompose

Image Source: fhwa.dot.gov
How Many Tons of RAS is Used in Asphalt Mixes?

~ 1.2 million tons RAS recycled into pavement
Recycled Asphalt Shingles (RAS)

Societal
• Natural Resource Conservation

Economic
• Material Replacement

Environmental
• Reduced landfill space
Millions of new tires produced annually

> 60 million are stockpiled

Asphalt-Rubber uses over 2,000 TIRES per lane-mile on a typical 2” overlay.

Source: Rubber Manufacturers Association, 2003
In total 220 million pounds, or approximately 12 million tires are used in asphalt rubber.
Ground Tire Rubber

- **Societal**
  - Reduction Traffic noise

- **Economic**
  - Improved Durability

- **Environmental**
  - Reduced landfill space
  - Substitute for TDF (tire derived fuel)
Reclaimed Asphalt Pavement (RAP)

Reused not just recycled
Reclaimed Asphalt Pavement (RAP)

How much RAP is Being Used?

- Used in HMA/WMA
- Used in Aggregate
- Used in Cold Mix
- Used in Other
- Landfilled

<1% RAP is landfilled
Reclaimed Asphalt Pavement (RAP)

Average Percent RAP in All Mixes

2009 2010 2011
Reclaimed Asphalt Pavement (RAP)

Societal
- Natural Resource Conservation

Economic
- Reuse Aggregate and Asphalt Binder

Environmental
- Reduced Emissions
- Reduced landfill space
- Closes Life Cycle Circle
Need to Quantify Green Pavement Benefits

- Increased awareness of Environmental Impacts
  - Growing Interest in Sustainability Principles
  - >1/2 of DOTs have adopted Sustainability Principles
- Environmental and Social Benefits could be part of pavement selection process
- Increasing bottom line through green practices
- Helps with Environmental Benchmarking
Measuring Sustainability – Life Cycle Analysis

Must look at Life-Cycle of the Pavement
Measuring Sustainability – Life Cycle Analysis

www.asphaltpavement.org/GHGC
Measuring Sustainability – Life Cycle Analysis

NAPA’s GHG Calc.

MIT
Measuring Sustainability – Life Cycle Analysis

NAPA's GHG Calc.

**Environmental Product Declarations**

**Environmental Facts**

Functional unit: 1 metric ton of asphalt concrete

<table>
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<tr>
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<th>Value</th>
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<tr>
<td>Primary Energy Demand [MJ]</td>
<td>3.9x10³</td>
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<tr>
<td>Renewable [MJ]</td>
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<tr>
<td>Non-Renewable [MJ]</td>
<td>3.5x10²</td>
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<td>Global Warming Potential [kg CO₂-eq]</td>
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<td>Acidification Potential [kg SO₂-eq]</td>
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<td>Eutrophication Potential [kg N-eq]</td>
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<td>Ozone Depletion Potential [kg CFC-11-eq]</td>
<td>7.3x10⁻⁹</td>
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<tr>
<td>Smog Potential [kg O₃-eq]</td>
<td>4.4</td>
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</tbody>
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Boundaries: Cradle-to-Gate
Company: XYZ Asphalt
RAP: 10%

Source: PE International

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**Environmental Product Declarations (EPDs)**

Standardized Life Cycle Assessment defined by the Product Category Rules

**Product Category Rules (PCRs)**

Defines LCA
- Goal and Scope
- Acceptable Inventory Data
- Impact Categories

**Life Cycle Inventory (LCIs)**

- Energy Use
- Raw Material Use
- Emissions/Waste
• **Rating Tools**
  - Best practices
  - Earn Credits
  - Indicator of sustainability

• **Move Towards Transparency**
Conclusion

• Asphalt Industry has well established sustainable paving technologies
  – Use increased over time
  – Ways to increase efforts

• Quantify environmental and social impacts
NAPA Annual Meeting

- February 2-5, 2014
- Boca Raton, Florida