ASPHALT: the environmentally sustainable pavement

Greening the Blacktop
ASPHALT: the environmentally sustainable pavement

- Background information
- Stormwater management / porous pavement
- UHI and reflective asphalt pavements
- USGBC LEED
- Recycled materials / RAP
- Env. Impacts and Carbon Footprints
- Warm Mix Asphalt
What is LEED?

The LEED Green Building Rating System is the national benchmark for high performance green buildings. Learn More.

What's New

Former President Bill Clinton to Keynote Opening Plenary of Greenbuild

Clinton’s keynote will kick off what is expected to be the largest Greenbuild ever. Read More...

LEED for High Performance Operations Second Public Comment Period Now Open

Please weigh in on changes made since the first public comment period. Read More...

Call for Nominations for the 2007 Chapter Awards

Awards recognize outstanding chapter achievements in Advocacy, Education, Research, LEED, USGBC as a Community, and Organizational Excellence. Read More...

USGBC featured in THE 11th HOUR
Asphalt is the sustainable material for constructing pavements.

From the production of the paving material, to the placement of the pavement on the road, to rehabilitation, through recycling, asphalt pavements minimize impact on the environment. Low consumption of energy for production and construction.

www.pavegreen.com
Energy and Recycling

Less energy consumed in building pavements
Asphalt pavements require about 20 percent less energy to produce and construct than other pavements.¹

Less energy consumed by the traveling public
Congestion leads to unnecessary consumption of fuel and production of emissions. Reducing congestion by constructing asphalt pavements just makes sense. Asphalt pavements are faster to construct and rehabilitate. And, a new or newly rehabilitated asphalt pavement can be opened to traffic as soon as it has been compacted and cooled. There is no question of waiting for days or weeks for the material to cure.

America’s leading recycler
According to an EPA/FHWA study,² the asphalt industry recycles more than 70 million tons of its own product every year, making it America’s number one recycler. Asphalt recycling saves taxpayers about $1.8 billion a year.

Other materials are routinely recycled into asphalt pavements. Some of the most common are rubber from used tires, glass, asphalt roofing shingles, and blast furnace slag.

Performance

The road doesn’t wear out
Asphalt is the Perpetual Pavement. When appropriately designed and constructed, the road itself doesn’t...
urban development
stormwater management
Stormwater management

Rainfall: 45 inches/year

Evaporative loss from impervious surfaces: 2 inches

Reduced infiltration through regraded and compacted soils in grasses.

0 inches of infiltration under impervious surfaces.

Reduction in base flow by 15 inches/year under impervious surfaces.

43 inches runoff from impervious cover.
Porous Pavement with Recharge Bed

River Jacks Open Into Recharge Bed

Pervious Asphalt

Stone Bed w/ 40% Void Space For Storage/Recharge

Stormwater management
stormwater management
Standard Pavement  Porous Pavement

Univ. NC: add’l parking lot constructed ca. 2002

stormwater management
Comparison of Detention vs. Infiltration System

- Post Development
- Post Development w/ Detention
- Post Development w/ Recharge

Decreased stormwater discharge with porous pvmr
WHAT IS A GREEN STREET?

The streets at Pringle Creek Community are part of an integrated water infiltration system that captures, absorbs and filters stormwater instead of sending it downstream in pipes. If the first one inch of every rainfall is captured and absorbed, 90% of rainwater is prevented from entering stormwater pipes.

Read More >

View Street Diagram >

Taxes on impervious residential surfaces - Iowa ... and more states to come
WHAT IS A GREEN STREET?

- Porous Streets

Porous Street Section:
- Surface Swale
  - Gravel seam next to roadway, 8 inches of crushed rock on top of 10 inches of crushed drain rock.
- Filter Fabric
  - Along perimeter between rock and subgrade.
- Eco-Grass Planting Strips
  - Native grasses, plants and trees between sidewalk and street are part of drainage and filtration system.
- Impervious Sidewalks
  - 4 inch porous concrete on top of recycled crushed concrete or native subgrade.
Benefits of Porous Pavement

**Economic**
- Reduces/Eliminates the land space consumed by conventional detention facilities
- Helps prevent excessive flooding and minimizes need for control measures

**Aesthetic**
- Eliminates the need for unsightly detention basins
- Preserves areas such as woods/open space

**Environmental**
- Limits peak stormwater discharge and improves water quality of any runoff
- Reduces amount of impervious surfaces
Dense-graded asphalt pavements were historically the standard for roadways
  - Provides structure, strength, and smoothness
  - Smoothness can cause water overspray

Open-graded Friction Courses (OGFC) developed to minimize overspray
  - Developed in the late 1940s (airports)
  - Pavement contains greater air voids
  - Thin OGFC pavement above dense-graded mat

OGFC Highly successful in minimizing accidents
  - Calif-DOT identified a 50% decrease in deaths and 20% decrease in accidents after Hwy re-paved using OGFC
  - Other state statistics similar
Spray Reduction: OGFC on Freeway

safer pavements
Vehicles on highways generate a significant amount of noise.

Noise from the tire/pavement interface accounts for over 75% of the vehicle noise.

Sound-walls are expensive and are only somewhat effective if placed in the line-of-sight:
- They reduce noise minimally and only over certain distances from the roadway.
- Sound-walls can increase UHI effects because they decrease air movement across pavement surface.

Traffic Noise can be significantly reduced using Open-Graded Friction Courses (OGFC).
Noise Reduction: AR-OGFC on Highway

SR 202W
11/7/03 106 dB(A)

quieter pavements
Little vegetation or evaporation causes cities to remain warmer than the surrounding countryside.
Urban Heat Islands
pavement type & temperatures
Pavement Temperatures vs. Albedos

- San Ramon, 8/7/98
- Berkeley, 9/13/96

Myth or reality?
Location: University Dr., Tempe, AZ  
Time: 2:30pm, May 15, 2007

**Albedo**: .192  
**Surf. Temp**: 131, 131.5, 130 (°F)  
**Age**: >5 years  
**Traffic**: light foot, cart and bicycle traffic

---

**Albedo**: .090  
**Surf. Temp**: 129.9, 130.2, 128.4 (°F)  
**Age**: >5 years  
**Traffic**: constant traffic

---

**Albedo**: .036  
**Surf. Temp**: 146.8, 143.3, 147.4 (°F)  
**Age**: 3 days  
**Traffic**: no traffic
Location: University Dr., Tempe, AZ
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reflectivity & temperatures
Cooler Pavements → Cooler Air

Los Angeles: Simulate change of all pavement albedos (in < 20 years of normal maintenance)

* Input:

- Albedo change = 0.25
- Pavement area = 1,250 km²
- Urban area = 10,000 km²
- Normal LA weather

* Result:

- Decrease in air temperature ≈ 0.6°C (1°F)

why is this important?
cooler pavements
cooler pavements
Interstate w/ PCC
Highway w/ PCC

cooler pavements

mountain range
Below grade w/ sound walls

¾ inch asphalt-based OGFC over dense pvmt

Above grade w/ landscape

Below grade w/ sound walls

Airport: 23-inch thick pvmt

cooler pavements

Interstate w/ PCC

Highway w/ PCC

mountain range
Cool Pavements

- Denotes link to glossary definition

There is no official standard or labeling program to clearly stage.

While studies show that pavements can affect the several factors. These include the impact of shade time; and the absorption by buildings of solar radiations.

There are situations, however, where communities that lower surface temperature and achieve related roadways with large expanses of paved surface are used.

Investigations of cool paving materials have focused. Pavements with higher solar reflectance are cool pavements benefit from the cooling effect of evaporative construction are essential in applying either cool pavements.

Other factors affecting performance, cost, and be the best solutions may occur where multiple benefits help with storm water runoff as well as provide a
It's NOT a black and white issue?

Cool Pavements

There is no official standard or labeling program to early stage.

While studies show that pavements can affect the several factors. These include the improvement for time; and the absorption by buildings and radiating

There are situations, especially in communities that lower surface temperature and achieve relate roadways with large expanses of paved surface a

Investigations of cool paving materials have focused. Pavements with higher solar reflectance® are cool pavements benefit from the cooling effect of evaporation. Porous pavements are essential in applying either cool p

Other factors affecting performance, cost, and be the best solutions may occur where multiple benefit help with storm water runoff as well as provide a

? cooler reflective pavements ?
Little vegetation or evaporation causes cities to remain warmer than the surrounding countryside.

a heat “bubble” ??
not quite . . .
What happens after solar radiation strikes a pavement surface

- **Dark pavements** absorb / re-radiate as heat (night)
- **Light pavements** reflect as UV radiation (day)

  - Heats up near-surface air / Heats up buildings
  - Provides catalyst for increasing ground-level ozone
  - Increases potential personal UV radiation exposure

- Pavement thickness and material capacities
  - Thicker pavements retain more heat (Phoenix)
  - (near) surface temperature vs air temperature

- Pavement design has “net zero” balance on UHI temperatures
- Concrete pavement is NOT necessarily cooler than asphalt
- Porous (OGFC) asphalt pavements are COOLer
- UHI does NOT cause Global Warming . . . Sci. Am.
- Specialized binders are expensive but . . .

*think about it . . .*
Surface Chip Seals and Coatings: using reflective / light-colored chip / paints
“Gritting”: reflective chips and aggregate
Shot-Blasting: abrading surface binder
Synthetic and Colored Binders: using reflective aggregates
Synthetic / Colored Binders: using reflective / colored aggregates

reflective pavements
20,000 sq. ft. parking lot

- Conventional HMA @ ~ $1.35 sq ft.
  - $400/ton binder, 3” thick, $75/ton HMA, ~ 400 tons HMA total

- PCConcrete pavement @ ~ $5.75 sq ft.
  - standard depth of ~ 6-8” w/ wire mesh etc; range $4 - $8

- Colored HMA pavement @ ~ $2.50 sq ft.
  - $2,000/ton binder, 3”, = ~ $140/ton HMA; material costs / placed
  - more labor involved re cleaning plant equip etc

- Densiphalt (cement grout over OGFC) @ ~ $4 sq ft
  - includes placement of 2” OGFC only + std labor;
  - range $3.50 - $5; process needs an existing (HMA) pavement base

Other technologies . . .

specialized binders are expensive but . . .
$2,000 / ton binder only doubles the sq. ft price

Triple current HMA price is still competitive

Densiphalt is current “alternative” to PCC for LEED credit – customers are purchasing

Small volumes, specialized market, but GROWING

Other technologies are much less $$

HOW and WHY does this fit into LEED ???

specialized binders are expensive but . . .
Using Asphalt Pavement to Reduce UHI

- Albedo doesn’t appear to be the entire story
- The role of thickness, density, and porosity are being evaluated to understand pavement’s heat sink capacity
- Other “BMPs” have been identified to help mitigate pavement surface temperature (trees, topography)
- OGFC / porous pavements have been shown to be highly effective in reducing pavement surface temps
- Reflective HMA pavements can be produced $$
- But . . . IMHO . . .
- Pavement design has “net zero” balance on UHI temps
- USGBC needs to understand this . . .
specialized binders are expensive but . . .

HOW and WHY does this fit into LEED ???

cooler pavements
Leadership in Energy and Environmental Design

What is LEED®?

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ is the nationally accepted benchmark for the design, construction, and operation of high performance green buildings. LEED gives building owners and operators the tools they need to have an immediate and measurable impact on their buildings’ performance. LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.

LEED provides a roadmap for measuring and documenting success for every building type and phase of a building lifecycle. Specific LEED programs include:

- New Commercial Construction and Major Renovation projects
- Existing Building Operations and Maintenance
- Commercial Interiors projects
- Core and Shell Development projects
- Homes
- Neighborhood Development
- Guidelines for Multiple Buildings and On-Campus Building Projects
- LEED for Schools
- LEED for Retail
LEED: Leadership in Energy and Environmental Design

- Developed by USGBC
- National benchmark for design, construction, and operation of “green” buildings
- 5 key areas:
  - Sustainable site development
  - Water savings
  - Energy efficiency
  - Materials selection
  - Indoor environmental quality

Earning LEED certification
- Must meet certain criteria → credits / certification process
- Levels based on total credits

How asphalt pavements contribute to LEED credits

Retail Certification Levels
- Certified: 26-32 points
- Silver: 33-38 points
- Gold: 39-51 points
- Platinum: 52-70 points
### LEED for Retail - New Construction and Major Renovations

<table>
<thead>
<tr>
<th>Category</th>
<th>Possible Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable Sites:</td>
<td>16</td>
</tr>
<tr>
<td>Water Efficiency:</td>
<td>5</td>
</tr>
<tr>
<td>Materials &amp; Resources:</td>
<td>13</td>
</tr>
<tr>
<td>Energy &amp; Atmosphere:</td>
<td>17</td>
</tr>
<tr>
<td>Indoor Environ. Quality:</td>
<td>14</td>
</tr>
<tr>
<td>Innovation &amp; Design:</td>
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</tbody>
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### Retail Certification Levels
- Certified: 26-32 points
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### Sustainable Sites

<table>
<thead>
<tr>
<th>Prereq 1</th>
<th>Construction Activity Pollution Prevention</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit 1</td>
<td>Site Selection</td>
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<tr>
<td>Credit 2</td>
<td>Development Density &amp; Community Connectivity</td>
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<tr>
<td>Credit 3</td>
<td>Brownfield Redevelopment</td>
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</tr>
<tr>
<td>Credit 4</td>
<td>Alternative Transportation</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>A. Public Transportation Access (1 point)</td>
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</tr>
<tr>
<td></td>
<td>B. Bicycle Storage &amp; Commuting (1 Point)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. Low Emitting &amp; Fuel Efficient Vehicles (1 Point)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D. Parking Capacity (1 Point)</td>
<td></td>
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<tr>
<td></td>
<td>E. Delivery Service (1 Point)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F. Incentives (1 Point)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G. Car-Share Membership (1 Point)</td>
<td></td>
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<tr>
<td></td>
<td>H. Alternative Transportation Education (1 Point)</td>
<td></td>
</tr>
<tr>
<td>Credit 5.1</td>
<td>Site Development, Protect or Restore Habitat</td>
<td>1</td>
</tr>
<tr>
<td>Credit 5.2</td>
<td>Site Development, Maximize Open Space</td>
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</tr>
<tr>
<td>Credit 6.1</td>
<td>Stormwater Design, Quantity Control</td>
<td>1</td>
</tr>
<tr>
<td>Credit 6.2</td>
<td>Stormwater Design, Quality Control</td>
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<tr>
<td>Credit 7.1</td>
<td>Heat Island Effect, Non-Roof</td>
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<tr>
<td>Credit 7.2</td>
<td>Heat Island Effect, Non-Roof</td>
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<tr>
<td>Credit 7.3</td>
<td>Heat Island Effect, Non-Roof</td>
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<td>Credit 7.4</td>
<td>Heat Island Effect, Roof</td>
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<tr>
<td>Credit 8</td>
<td>Light Pollution Reduction</td>
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</tbody>
</table>

**LEED credit for asphalt**

Total credits: 5 credits
# Materials & Resources

<table>
<thead>
<tr>
<th>Prereq 1</th>
<th>Storage &amp; Collection of Recyclables</th>
<th>Required</th>
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</thead>
<tbody>
<tr>
<td>Credit 1.1</td>
<td><strong>Building Reuse</strong>, Maintain 75% of Existing Walls, Floors &amp; Roof</td>
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<td>Credit 1.2</td>
<td><strong>Building Reuse</strong>, Maintain 95% of Existing Walls, Floors &amp; Roof</td>
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<tr>
<td>Credit 1.3</td>
<td><strong>Building Reuse</strong>, Maintain 50% of Interior Non-Structural Elements</td>
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</tr>
<tr>
<td>Credit 2.1</td>
<td><strong>Construction Waste Management</strong>, Divert 50% from Disposal</td>
<td>1</td>
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<tr>
<td>Credit 2.2</td>
<td><strong>Construction Waste Management</strong>, Divert 75% from Disposal</td>
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</tr>
<tr>
<td>Credit 3.1</td>
<td><strong>Materials Reuse</strong>, 5%</td>
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</tr>
<tr>
<td>Credit 3.2</td>
<td><strong>Materials Reuse</strong>, 10%</td>
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<tr>
<td>Credit 4.1</td>
<td><strong>Recycled Content</strong>, 10% (post-consumer + 1/2 pre-consumer)</td>
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</tr>
<tr>
<td>Credit 4.2</td>
<td><strong>Recycled Content</strong>, 20% (post-consumer + 1/2 pre-consumer)</td>
<td>1</td>
</tr>
<tr>
<td>Credit 5.1</td>
<td><strong>Regional Materials</strong>, 10% Extracted, Processed &amp; Manufactured Regionally</td>
<td>1</td>
</tr>
<tr>
<td>Credit 5.2</td>
<td><strong>Regional Materials</strong>, 20% Extracted, Processed &amp; Manufactured Regionally</td>
<td>1</td>
</tr>
<tr>
<td>Credit 6</td>
<td><strong>Rapidly Renewable Materials</strong></td>
<td>1</td>
</tr>
<tr>
<td>Credit 7</td>
<td><strong>Certified Wood</strong></td>
<td>1</td>
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**LEED credit for asphalt**

- Reuse up to 10%
- Recycled up to 20%

8 credits
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**Retail Certification Levels**

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**LEED process**

- Reuse up to 10% from asphalt  
- Recycled up to 20%
Asphalt pavement is positioned nicely

- Recycled (re-used) and recyclable
  - Innovation credit every 5% more than 10% / 20% reused / recycled – petition USGBC LEED

- Local materials

- Stormwater management

- UHI: need to work through the “process”
  - Comfort issue under limited circumstances
  - Overall environmental impact might be less, e.g., UV radiation
  - Porous pvmts / OGFC might mitigate – petition

- By Show of Hands . . . Lost jobs to reflectivity?
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UHI: think about it . . .
UHI: think about it...
www.PaveGreen.com

ASPHALT

The Nation’s #1 Recycled Material

recycled pavement
Common Recycled Materials in Asphalt Pavements

- Shingles
- Crumb / Tire Rubber
- Glass
- Slag
- Foundry sand

All are in different stages of utilization / evaluation
reclaimed asphalt pavement “RAP”
Reclaimed Asphalt Pavement “RAP”

- Removed and/or reprocessed pavement materials containing asphalt and aggregates
- Over 80 percent of the asphalt pavement, removed each year for widening and resurfacing, is re-used
- Represents close to 100 million tons / year
- RAP is the Nation’s No. 1 recycled material in both total amount and percentage recycled
Glass bottles  20  40  60  80  100

Paper  20  40  60  80  100

Newsprint  20  40  60  80  100

Aluminum cans  20  40  60  80  100

Scrap Steel  20  40  60  80  100

Asphalt Pavement  20  40  60  80  100

Percent Recycled

recycled pavement

FHWA / USEPA Report to Congress, EPA/600/R-93/095.
30,000 Tons of RAP = 70 - 6,000 Gallon Transport Trailers and 28,200 Tons of Clean Aggregate
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- LEED for Retail
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<tr>
<th>What is Green Roads?</th>
<th>Why? Assessment &amp; Information</th>
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<tbody>
<tr>
<td><strong>Green Roads</strong>, is a rating system that distinguishes high-performance sustainable new, reconstructed or rehabilitated roads. It awards credits for approved sustainable or environmentally friendly choices/practices and can be used to certify projects based on total point value. <a href="#">more...</a></td>
<td><strong>Green Roads</strong> provides (1) a quantitative means to assess the sustainability and environmental stewardship of roads, and (2) a tool for decision-makers that allows them to make informed design and construction decisions regarding sustainability and environmental stewardship of a road.</td>
</tr>
</tbody>
</table>
The Partnership

The Green Highways Partnership (GHP) is a voluntary, public/private initiative that is revolutionizing our nation’s transportation infrastructure. Through concepts such as integrated planning, regulatory flexibility, and market-based rewards, GHP seeks to incorporate environmental streamlining and stewardship into all aspects of the highway lifecycle.

With an extensive network of environmental, industrial and governmental collaborators, GHP believes active cooperation and regulatory progressiveness are critical in moving beyond the current paradigm. The combined resources of our partner base allow Green Highways to ensure that sustainability becomes the driving force behind infrastructure development. By harnessing the power of the

other green metric programs

GHP Reuse/Recycle Workshop
The GHP Aug. 2 recycling workshop goes off without a hitch.

Strategic Conservation Planning Course
The Conservation Planning course in Shepherdstown, from October 18

ACPA Award
EPA’s Dominique Lueckenhoff, first recipient of Outstanding Health, Safety & Environmental Stewardship Award.
The BEES (Building for Environmental and Economic Sustainability) software brings to your fingertips a powerful technique for selecting cost-effective, environmentally-preferable building products. Developed by the NIST (National Institute of Standards and Technology) Building and Fire Research Laboratory, the tool is based on consensus standards and designed to be practical, flexible, and transparent. Version 4.0 of the Windows-based decision support software, aimed at designers, builders, and product manufacturers, includes actual environmental and economic performance data for 230 building products.

In support of the 2002 Farm Security and Rural Investment Act (P.L. 107-171), BEES has been adapted for application to biobased products. For more information about this program, go to BEES for USDA.

BEES measures the environmental performance of building products by using the life-cycle assessment approach specified in the ISO 14040 series of standards. All stages in the life of a product are analyzed: raw material acquisition, manufacture, transportation, installation, use, and recycling and waste management. Economic performance is measured using the ASTM standard life-cycle cost method, which covers the costs of initial investment, replacement, operation, maintenance and repair, and disposal. Environmental and economic performance are combined into an overall performance measure using the ASTM standard for Multi-Attribute Decision Analysis. For the entire BEES analysis, building products are defined and classified according to the ASTM standard classification for building materials.
Overall Performance

Note: Lower values are better
Note: Lower values are better
Human Health Cancer by Sorted Flows

**Note:** Lower values are better

<table>
<thead>
<tr>
<th>Category</th>
<th>100% OPC</th>
<th>20% FlyAsh</th>
<th>Asph/Trad</th>
<th>Lafarge Alpena I</th>
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<tr>
<td>Cancer--(a) Dioxins (unspecific)</td>
<td>2,087.00</td>
<td>1,660.52</td>
<td>0.41</td>
<td>0.49</td>
</tr>
</tbody>
</table>
proof of global warming
Global Warming by Life-Cycle Stage

Note: Lower values are better
Production of HMA pavement requires ~ 20% less ENERGY than vs construction of PCC pavement – but difficult to quantify

UHI may be “real” but is only local; NOT a contributor to Global Warming – Scientific American

Avg. automobile emits ~ 6 tons CO2 annually
Avg. HMA plant emits ~ 2,500 tons CO2 = ~ 0.0023 Tg
Cement industry emits ~ 45 Tg CO2

HMA pavement unit @ ~ 30% vs. PCConcrete (BEES)

Very few existing published info. but general support

So, where is HMA industry vs. all GHG emissions . . .
Figure ES-5: 2005 Sources of CO₂
Figure ES-5: 2005 Sources of CO₂

- Fossil Fuel Combustion: 5,751.2 Tg CO₂ Eq
- Non-Energy Use of Fuels
- Cement Manufacture
- Iron and Steel Production
- Natural Gas Systems
- Waste Combustion
- Ammonia Production and Urea Application
- Lime Manufacture
- Limestone and Dolomite Use
- Soda Ash Manufacture and Consumption
- Aluminum Production
- Petrochemical Production
- Titanium Dioxide Production
- Ferroalloy Production
- Phosphoric Acid Production
- Carbon Dioxide Consumption
- Zinc Production: <0.5
- Lead Production: <0.5
- Silicon Carbide Production and Consumption: <0.5

CO₂ as a Portion of all Emissions: 83.9%
Figure ES-6: 2005 CO₂ Emissions from Fossil Fuel Combustion by Sector and Fuel Type
The entire annual CO2 / greenhouse gas emissions / carbon footprint from a typical hot-mix plant (~ 2,500 tons) could be totally offset by using 20 - 25% RAP in pavement mix designs -- accomplished by minimizing acquisition of energy intensive (natural) raw materials such as aggregate and petroleum asphalt.
continually changing technology...
to drive efficiency = $$ / env comp
This Street Paved With Environmentally Friendly Warm Mix Asphalt

York County South Carolina

Boggs PAVING, INC. GREEN

Warm Mix Asphalt (“WMA”)
Many different technologies
- Additives such as waxes and zeolites
- Emulsions and water foaming processes
- Costs differ; some higher, some lower

End-result: to lower mix temperatures from 300 oF → ~ 250 oF (or lower)
- Less energy demand / fuel consumption
- Less emissions: plant and field

Quantifying energy and emissions
- ~ 15% less fuel consumption
- ~ 20% less CO2 emissions
- Lower NOx, particulate, other emissions

States, Producers, Contractors, FHWA all interested
- TRB funding @ ~ $2MM; performance/ emissions
ASPHALT: the environmentally sustainable pavement

- Porous pavements manage stormwater
- OGFCs are safe and quiet
- Reflective / OGFC / Porous can mitigate UHI
  - Remember: UHI doesn’t cause Global Warming
- Great pavement to help with LEED certification
  - Additional credits are possible
- Asphalt pavements accept recycled goods / are recycled (RAP)
- HMA pavements are environmentally preferred
  - Less energy to construct, low carbon footprint, speed of construction, no emissions like dioxins
- Warm Mix lowers energy consumption & emissions
- RAP can offset the entire annual HMA GHG emissions
Questions ??

“it ain’t easy being green!”
Questions ??

Getting “credit” for energy / GHG reductions: LEED / cap-and-trade

“it ain’t easy being green!”
Asphalt is the sustainable material for constructing pavements. From the production of the paving material, to the placement of the pavement on the road, to rehabilitation, through recycling, asphalt pavements minimize impact on the environment. Low consumption of energy for production and construction.