Asphalt Industry EPD Program
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Presentation Takeaways

• What is an EPD?

• How is an EPD created?

• Industry Efforts
81% Executive Corporate Leaders believe they need to adopt sustainability principals

McGraw-Hill Construction 2012

>50% of State DOT's have adopted sustainability principles

NCHRP 20-83 2012
Grad students look into the future of impact issues...

93% of students say social/environmental issues are important to a business' long-term success.

60% Essential

33% Very Important

7% Somewhat Important

< 1% Not at all important

Students predict the most important issues for business to get right in the next ten years:

1. Climate & Energy [34%]
2. Sustainable Product Development & Marketing [23%]
3. Resource Conservation [17%]
4. Supply Chain Management [14%]
5. Human Rights/Fair Labor [13%]
Infrastructure Green Rating Systems

- National, State, Local
- Rating Tool
  - Best practices
  - Earn Credits
  - Indicator of sustainability

I-LAST™
New Era of Transparency

Material Credits
LEED 2009
• Recycled or Reuse Materials

LEEDv.4
• Environmental Product Declarations

- Reclaimed Asphalt Pavement (RAP)
- Ground Tire Rubber (GTR)
- Recycled Asphalt Shingles (RAS)
**Environmental Product Declarations**

**EPD** declares quantified environmental data for a defined product
- Fair
- Comparable
- Third Party Reviewed
- Credible

### Environmental Facts

Functional unit: 1 metric ton of asphalt concrete

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Energy Demand [MJ]</td>
<td>$3.9 \times 10^3$</td>
</tr>
<tr>
<td>Renewable [MJ]</td>
<td>$3.9 \times 10^3$</td>
</tr>
<tr>
<td>Non-Renewable [MJ]</td>
<td>$3.5 \times 10^2$</td>
</tr>
<tr>
<td>Global Warming Potential [kg CO₂-eq]</td>
<td>79</td>
</tr>
<tr>
<td>Acidification Potential [kg SO₂-eq]</td>
<td>0.23</td>
</tr>
<tr>
<td>Eutrophication Potential [kg N-eq]</td>
<td>0.012</td>
</tr>
<tr>
<td>Ozone Depletion Potential [kg CFC-11-eq]</td>
<td>$7.3 \times 10^{-9}$</td>
</tr>
<tr>
<td>Smog Potential [kg O₃-eq]</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Boundaries: Cradle-to-Gate
Company: XYZ Asphalt
RAP: 10%

Source: PE International, Values are for illustration purposes only.
Environmental Product Declarations (EPDs)

Standardized life cycle assessment (LCA) report defined by product category rules (PCRs)

- ISO 14040 - LCA
- ISO 14025 - EPD
Pavement Life Cycle Assessment

Inputs – Materials, Energy, Water

- Raw Material
  - Aggregates
  - Admixtures
  - Asphalt Binder
  - Transport

- Production
  - Fuel
  - Water
  - Equipment

- Construction
  - Transport
  - Paving

Use
- Vehicle Operation
  - UHI
  - Stormwater Runoff
  - Maintenance/Workzone congestion

End of Life
- Landfill
- Recycle

Outputs – Solid Wastes, Emissions to Air, Emissions to Water
Impact Assessment

<table>
<thead>
<tr>
<th>Per ton of HMA</th>
<th>Asphalt</th>
<th>Aggregates</th>
<th>Plant Oper.</th>
<th>Transport</th>
<th>Const.</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Natural</td>
<td>Manuf.</td>
<td></td>
<td></td>
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<tr>
<td>Emissions to Air (g/ton)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>SO₂</td>
<td>9.4E+01</td>
<td>1.7E+00</td>
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<td></td>
<td></td>
<td>9.5E+01</td>
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<tr>
<td>NOₓ</td>
<td>1.1E+02</td>
<td>1.3E+00</td>
<td>1.3E+01</td>
<td>4.4E+02</td>
<td>1.5E+02</td>
<td>7.1E+02</td>
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<tr>
<td>CO₂</td>
<td>1.5E+04</td>
<td>1.2E+03</td>
<td>1.7E+04</td>
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<td></td>
<td>3.2E+04</td>
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<tr>
<td>CO</td>
<td>7.3E+00</td>
<td>6.5E+01</td>
<td>1.9E+03</td>
<td>6.0E+02</td>
<td>2.6E+03</td>
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<tr>
<td>HC</td>
<td>6.8E+01</td>
<td>1.5E+02</td>
<td>5.0E+01</td>
<td>2.7E+02</td>
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<tr>
<td>Metals not specified</td>
<td>2.3E-01</td>
<td>2.3E+03</td>
<td>2.3E+01</td>
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<td></td>
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<tr>
<td>HCl</td>
<td>5.7E-02</td>
<td>5.6E-03</td>
<td></td>
<td></td>
<td></td>
<td>5.7E-03</td>
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<tr>
<td>PM2.5</td>
<td>5.6E-03</td>
<td>4.7E+01</td>
<td>1.4E+01</td>
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<td>PM10</td>
<td>4.7E+01</td>
<td>1.6E+02</td>
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<tr>
<td>Total PM</td>
<td>1.1E+01</td>
<td>8.1E+01</td>
<td>1.6E+02</td>
<td>1.4E+01</td>
<td>6.0E+02</td>
<td>3.2E+02</td>
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<tr>
<td>CH₄</td>
<td>1.4E+01</td>
<td>6.0E+02</td>
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<td></td>
<td></td>
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<tr>
<td>VOC</td>
<td>1.6E+01</td>
<td>1.6E+01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Hassan 2009

- Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI)
- Impact Assessment Tool for US
- Developed by EPA
Product Category Rules (PCRs)
Rules a product must follow to publish an EPD

- Defines Goal and Scope
- Sets LCA boundaries
- Delineates Acceptable Inventory Data
- Identifies Impact Categories

Asphalt binder manufacture
Transportation to plant
Aggregate production
Transportation to plant
Fuels
Transportation to plant

Plant Operations

Transportation to site

Construction
Chair EPD

Life Cycle Inventory Analysis
The Life Cycle Inventory Analysis covers entire life cycle stages as shown below.

Materials
This stage includes raw materials extraction and transformation, as well as purchased parts, until delivery to the manufacturing site in Grand Rapids.

Production
This stage comprises all production and assembly processes. Data was obtained from the management system of the production site in Grand Rapids.

Transport
Transport from suppliers to Grand Rapids and transport from Grand Rapids to major North American markets is considered.

Use
No relevant environmental exchanges occur during the use of the product.

End of life
A product can be disposed of in different ways, or become a resource itself. Based on current North American averages, it was assumed that about 99% of the products are landfilled, 0% incinerated and 1% recycled at the end of their useful life.

Distribution of the environmental impacts for the relevant life cycle stages

<table>
<thead>
<tr>
<th>Category</th>
<th>Unit</th>
<th>Total</th>
<th>Materials</th>
<th>Production</th>
<th>Transport</th>
<th>End of Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global warming</td>
<td>[g CO₂-eq.</td>
<td>102 610.0</td>
<td>67 800.0</td>
<td>27 700.0</td>
<td>3 720.0</td>
<td>3 390.0</td>
</tr>
<tr>
<td>Acidification</td>
<td>[g SO₂-eq.</td>
<td>836.6</td>
<td>535.0</td>
<td>266.0</td>
<td>35.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>[g NO₂-eq.</td>
<td>712.2</td>
<td>471.0</td>
<td>179.0</td>
<td>59.2</td>
<td>3.0</td>
</tr>
<tr>
<td>Photochemical smog</td>
<td>[g C₂H₄-eq.]</td>
<td>24.2</td>
<td>18.0</td>
<td>0.8</td>
<td>4.6</td>
<td>0.7</td>
</tr>
</tbody>
</table>

No relevant environmental exchanges occur during the use stage of the product.
How to get an EPD

1. Identify Program Operator
2. Identify or Develop a PCR – Program Operator
3. Conduct LCA study – LCA Consultant
4. Development of EPD – LCA Consultant
5. Verification of EPD and LCA study – Third Party Reviewers
6. Publish EPD – Program Operator
EPD Project

- Initial Goal: Develop Industry Average EPD
- Determine Program Operator
  - Affordability
  - Credibility
  - Facilitates Innovation
- Conduct Underlying LCA – Amlan Mukherjee
Who are Program Operators?

LCA/EPD Consultants
- NSF
- UL
- FP Innovations

Standard Developers
- CSA Group
- ASTM

Non-Profit Associations
- IERE
- NRMCA
- NAPA
NAPA EPD Program

- Program Overseen by the Sustainability Committee
  - Created in Sept. 2014
  - International Standards
- PCR for Asphalt Mixtures for use in North America
  - PCR Guidance Development Initiative
  - Starting Point – Norwegian PCR

www.asphaltpavement.org/epd
<table>
<thead>
<tr>
<th>Customers</th>
<th>Industry</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Local</td>
<td>Asphalt Producers</td>
<td>Academic</td>
</tr>
<tr>
<td>• State</td>
<td>Asphalt Binder</td>
<td>LCA Expert</td>
</tr>
<tr>
<td>• Federal</td>
<td>Suppliers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asphalt Contractors</td>
<td></td>
</tr>
</tbody>
</table>

PCR Development Working Group
Source Materials

Asphalt Mixture Production

Transportation

Construction

Use Phase

Maintenance

End of Service Life

Reuse

Disposal

<0.1%

Asphalt 100% Recyclable

NAPA

NATIONAL ASPHALT PAVEMENT ASSOCIATION
Underlying LCA – Data Collection

- Led by Dr. Amlan Mukherjee
- Surveyed nearly 40 plants
- Primary Data
  - Natural gas (in cu-ft) – annual
  - Electricity (kWh) – annual
  - Diesel oil used in boiler and equipment (gallons) – annual
  - Mix design data and percentage production
  - Transportation distances: raw materials to plant
  - Emissions: stack test in the last 5 years
  - Plant and region specific insights
EPD Tool

- Aid Contractors to Create EPD
- Online Tool
- Real-Time EPDs
EPDs in Practice

Economic
- Meeting Green Rating System Credits
- Optimizing Plant Operations
EPDs in Practice

Social
- Communicates Commitment to Environment
- Corporate Sustainability Reports
EPDs in Practice

Environment
- Optimizing Mix Design
- Optimizing Plant Operations
Design Curves

- 5% Binder Mix
- 8% Binder Mix

Graph showing the relationship between % reduction in GWP (kg of CO2 Eq) and % asphalt binder replacement.

- 5% Initial Virgin Mix
- 8% Initial Virgin Mix
Project Schedule

- **PCRs**
  - Published – Spring 2016

- **EPD Tool**
  - Beta Version – Spring 2016
  - Final Version – End 2016
Thank You

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