SUSTAINABLE PAVEMENTS PROGRAM UPDATE

NRRA Research Pays Off Webinar Series
Heather Dylla, FHWA
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Acronyms

• BIM Building Information Models
• EPD Environmental Product Declaration
• FLCAC Federal LCA Commons
• LCA Life Cycle Assessment
• LCI Life Cycle Inventory
• M&R Maintenance and Rehabilitation
• PCR Product Category Rules
• SPP Sustainable Pavements Program
Plastic vs. Paper
Takeaways

• Transportation Sector
• Methodologies
• Tools and Resources
TRANSPORTATION SECTOR
Challenge: 2050 – Net Zero

2019 U.S. GHG Emissions by Sector

Transportation: 29%
Electricity: 25%
Industry: 23%
Commercial: 10%
Agriculture: 7%
Residential: 6%

Source: EPA

*GHG: Greenhouse Gas
What does the 29% include?
Embodied Carbon

2019 U.S. GHG Emissions by Sector Source: EPA
Strategies

• Incorporate Waste Materials
  – Plastic
  – Ground Tire Rubber

• Recycle

• Increase Durability

• Use of Local Materials

“Feel goods”  You can’t improve what you don’t measure
METHODOLOGIES
Approach – Life Cycle Assessment

A Primer on LCA for Pavements
LCA ≠ LCCA

- Life-cycle cost analysis (LCCA) evaluates life-cycle economic impacts

- Life-cycle assessment (LCA) quantifies life-cycle potential environmental impacts
Balance of the Triple Bottom Line

Sustainability Rating Systems (e.g., INVEST)

Performance Testing

Life-Cycle Cost Analysis (LCCA)

Life-Cycle Assessment (LCA)
LCA Fit in Planning and Project Delivery

What is Life Cycle Assessment (LCA)?

Quantifies Potential Environmental Impacts: Acidification, Eutrophication, Climate Change, Ozone Depletion, Smog Creation
Pavement LCA Data Needs

Data collection point: as-built
EPDs and construction equipment

Material manufacturers

Transportation agencies & contractors

Asphalt mixture EPD

Wastes, emissions

Asphalt mixture

Energy

Pavement construction

Wastes, emissions

Maintenance

Wastes, emissions

End of life

Recycled materials

Legend
A1- materials extraction and upstream production
A2- transport to production facility
A3- manufacturing
A4- transport to the site
A5- construction
B- Use
C- End of life
Transportation

A1
A2
A3
A4
A5
B
C

LCA Data Needs Tech Brief
CLOSER LOOK AT EPDs
What Are EPDs?

- Communicate Environmental Impacts
- Created with Stakeholders
- LCA following PCR
- EPDs & PCRs one-pagers

Image source: FHWA
What are EPD Types?

EPD type | Potential use
---|---
Industry-wide EPD | Design, benchmarks
Regional EPD | Design, benchmarks
Product-specific EPD | Business benchmarks
PFS EPD | Bidding

Note: PFS- Product- and facility-specific EPD
e.g. a specific concrete mixture from a specific plant
What are Product Category Rules (PCRs)?

- Industry-consensus standards
- Used to develop EPD for:
  - Consistency
  - Transparency
- Tech Brief and Webinar

Note: PCRs and EPDs are not required by law or federal regulations
# Example Pavement Materials PCRs

<table>
<thead>
<tr>
<th>Material</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blended Cement</td>
<td>ASTM Slag Cement Association</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>Portland Cement Association / ASTM</td>
</tr>
<tr>
<td>Steel</td>
<td>Concrete Reinforcing Steel Institute</td>
</tr>
<tr>
<td>Hot Mix Asphalt</td>
<td>National Asphalt Pavement Association</td>
</tr>
<tr>
<td>Concrete</td>
<td>National Ready Mixed Concrete Association</td>
</tr>
<tr>
<td>Aggregates</td>
<td>ASTM</td>
</tr>
</tbody>
</table>
How can agencies use EPDs?

Key considerations
- EPD comparability
- PCR harmonization

EPD uses
- EPDs as communication tools
- EPDs as procurement aid
- EPDs as data source

Ultimate goal
- Ensure environmental improvements
  - Materials
  - Pavement

Current status
- Path forward

For more information: Rangelov et al. (2020) Use of environmental product declarations (EPDs) of pavement materials in the United States of America (USA) to ensure environmental impact reductions. Journal of Cleaner Production, p.124619.
Agencies’ Interest in EPDs

• Material manufacturers use EPDs for Marketing
• State and local interest to use EPDs for public purchasing
  – Oregon
  – City of Portland, OR
  – California
  – Washington State
  – Minnesota
• Green Rating Systems reward EPDs with credits
Current Status of PCRs and EPDs

• No overarching agency harmonizing PCRs
• Limited collaboration between some program operators
• FHWA is documenting best practices for pavement materials’ PCRs and EPDs
• PCRs and EPDs are not required by Federal statute or regulation
Agencies’ Possible Involvement with EPDs

- Establish an EPDs database
- Encourage development and use of EPDs
- Compile EPDs to track and communicate progress toward agency goals
- Use EPDs as input in LCA
- Conduct pilot program to introduce industry to EPDs and their applications
- Consider EPDs for material procurement
- Participate as a stakeholder for creating PCRs
What Are Current Deployment Efforts?

• LCA Benchmarking Tool
  – Created with stakeholders’ input
  – Uses public background datasets
  – Incorporates material EPDs
  – Educational

• Workshops/Pilots/Case studies with Tool

• Support using EPDs in procurement

• Quantitative metrics of sustainability
TOOLS & RESOURCES

FHWA Efforts
FHWA Pavements & Materials Program Areas
Vision and Mission

To advance the knowledge and practice of designing, constructing, and maintaining more sustainable pavement through:

− Stakeholder engagement
− Education
− Development of guidance and tools

Unless noted otherwise, FHWA is the source for all images in this presentation.
Stakeholder Engagement

Industry
- Engineers
- LCA Professionals
- Material Manufactures
- Construction Contractors

Academia
- Pavement Materials
- Construction

Agencies
- State Departments of Transportation
- Local Agencies
Elements of Pavement LCA

End goal

SPP phase 2

Ensure environmental improvements

SPP phase 1
FHWA Activities

LCA Benchmarking Tool

- Created with stakeholder input
- Use the identified background datasets
- Incorporate material EPDs
Tool Uses

• Quantify environmental impacts of pavement:
  - Materials
  - Structures
  - Treatments

• Comparisons of:
  - Material sources
  - Hauling alternatives
  - Maintenance, preservation and end-of-life strategies
Data Features

• Publicly available data:
  – EPDs as data sources
  – National average data from industry
  – Background data from FLCAC

• Customizable tool’s library:
  – Add
  – Store
  – Update
  – Use existing data

• Metadata
• Data quality indicators

https://www.lcacommons.gov/
FHWA Future Activities

Pooled Fund- Demo Projects

Accelerated Implementation and Deployment of Technologies Pavement Technologies Program (AIDPT)

https://www.pooledfund.org/Details/Solicitation/1542

Integration of sustainability and resiliency into:

- Decision-making process
- Technical frameworks
- Education efforts
- Stakeholder engagement
Takeaways

• Need to consider the life cycle of decisions

• LCA is the tool for environmental impact quantification

• FHWA Sustainable Pavements Program is a Resource
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http://www.fhwa.dot.gov/pavement/sustainability