Engineering More Sustainable Pavements

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Key Takeaways

Definition

Approaches

Resources

Tools
Sustainable Pavements

Should:

• achieve the engineering goals for which it was constructed,

• preserve and (ideally) restore surrounding ecosystems,

• use financial, human, and environmental resources wisely, and

• meet basic human needs such as health, safety, equity, employment, comfort, and happiness.

Parallels VDOT’s Core Values
Advance the knowledge and practice of:

• Designing
• Constructing
• Maintaining

More sustainable pavements through:

• Stakeholder engagement
• Education
• Development of guidance and tools
Triple Bottom Line

Source: FHWA
Pavement Life Cycle

Source: FHWA
Concrete Sustainable Approaches

Materials
- RCA
- Blended Cements

Design
- Pervious
- Two-Lift
- Long Life

Construction
- Roller Compacted Concrete

End of Life
- On-Site Recycling
- RCA (unstabilized bases)

Maintenance
- Bonded Concrete Overlays
- Diamond Grinding

Use
- Maintain Smoothness
- Longitudinal textures
## Sustainability Approach Potential Impacts

### Roller Compacted Concrete

<table>
<thead>
<tr>
<th>Social</th>
<th>Environment</th>
<th>Economic</th>
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<tbody>
<tr>
<td>• Reduced fuel used during construction</td>
<td>• Reduced material &amp; construction environmental impacts</td>
<td>• Significant construction cost savings</td>
</tr>
<tr>
<td>• Reduced construction duration</td>
<td>• Cement</td>
<td>• Material</td>
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<tr>
<td>• Lower ride quality</td>
<td>• Admixtures</td>
<td>• Labor</td>
</tr>
<tr>
<td></td>
<td>• Fuel</td>
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Source: FHWA
Sustainability Performance Measures for Project-Level Analysis

Sustainability Rating Systems
- INVEST
- ENVISION

Performance Testing
Life-Cycle Cost Analysis (LCCA)

Life-Cycle Assessment (LCA)

Note: This does not pertain to Life Cycle Planning requirements for Asset Management.

Source: FHWA
LCA for Pavement Design

Evaluates potential environmental impacts
- Eutrophication
- Acidification
- Smog
- Ozone depletion and others

Inputs for all stages
- Material
- Fuel

Outputs for all stages
- Pollution to water
- Pollution to soil
- Pollution to air

Source: FHWA
Pavement LCA Implementation Elements

End Goal

Biggest Barrier: Data Availability

Current

Source: FHWA

Source: Pixabay
Environmental Product Declarations

Like nutrition label but with environmental impacts

- Eutrophication
- Acidification
- Smog
- Ozone depletion and others

An LCA that follows industry product specific rules (Product Category Rules)

- Functional unit
- System boundaries

Allows for some sort of comparison

Source: FDA
LCA/EPD Implementation

**Policy**
- Caltrans
- California High Speed Rail Authority

**Pilots**
- Minnesota DOT
- Arizona DOT

**Benchmarking**
- Texas DOT
- Illinois DOT

**Tools**
- Louisiana DOT
- Illinois Tollway
EPD Challenges and Barriers

Barriers
• Education
• Top-down support
• Public data sets

Challenges
• Incentives
• Harmonization
Advance the knowledge and practice of:

• Designing
• Constructing
• Maintaining

More sustainable pavements through:

• Stakeholder engagement
• Education
• Development of guidance and tools
Current Program Resources

Sustainable Pavement Technical Working Group

- Public bi-Annual meeting

References

- Reference Manual

Technical Guidance

- LCA Framework

Technology Transfer

- Webinars
- Tech Briefs

https://www.fhwa.dot.gov/pavement/sustainability/
Sustainable Pavements Reference Document

Education
• Shows how to incorporate sustainability concepts into pavement design, construction and maintenance

Technical Guidance
• Incorporates life cycle thinking
• Identifies more sustainable approaches
• Benchmarks current understanding

Deployment
• Encourages adoption of more sustainable practices

LCA Framework

**Education**
- Informs agencies on pavement LCA methodology and application
- Shares LCA principles with practitioners

**Technical Guidance**
- Shares guidance on implementation of pavement LCA within the U.S.
- Documents current practices and gaps

**Deployment**
- Encourages progress in pavement LCA

### Sustainable Pavement Technical Working Group

- **May 8-9, 2018 – Seattle, WA**

**Source: FHWA**

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<thead>
<tr>
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<td>• LCA Benchmarking Tool</td>
<td>• LCA Pilot Study</td>
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Conclusion

• Sustainable Pavements is good engineering

• Current practices include many sustainable approaches

• Now we need to begin measuring and communicating our progress
  • LCA, LCCA, and green rating systems
Want More?

- Visit Website
  www.fhwa.dot.gov/pavement/sustainability
  - Review available resources
  - Join the Sustainable Pavements Program Friends List
- Attend a Sustainable Pavement TWG meeting
- Contact me with questions, comments, or suggestions
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