


SUSTAINABLE PAVEMENTS PROGRAM

An Introduction to Pavement Sustainability

— SEAUPG's Annual Meeting
Baton Rouge, LA —

Khadija Ngozi-Bullock, P.E.
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SUSTAINABLE PAVEMENTS PROGRAM 2


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

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Key Takeaways

- Definition and characteristics of pavement sustainability
- Benefits of moving toward sustainable pavement systems
- Current sustainability practices
- Emerging trends and technologies
- Tools to measure and quantify sustainability



https://www.fhwa.dot.gov/pavement/sustainability/ref_doc.cfm

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Sustainable Pavements and the Pavement Life Cycle

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Definition: Sustainable Pavements

1. Achieve the engineering goals.
2. Preserve and (ideally) restore surrounding ecosystems.
3. Use financial, human, and environmental resources wisely.
4. Meet basic human needs such as health, safety, equity, employment, comfort, and happiness.

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Opportunities for Improving Sustainability Exist Throughout the Pavement Life Cycle



Image Source: FHWA/APTech

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Why Should We Care About Pavement Sustainability?

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Benefits of Being More Sustainable

ECONOMIC

- Reduced pavement life-cycle costs

ENVIRONMENTAL

- Reduced energy
- Reduced noise
- Improved air quality

SOCIAL

- Improved safety
- Improved ride
- Conservation of resources

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How Do We Consider Sustainability in design?

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Sustainability = Good Engineering Practice

Example Sustainability Priorities/Values

Access	Finances
Healthy Life	Cost-Benefit
Safety	Clean Air
Culture/History	Clean Water
Aesthetics	Clean Land
Education	Ecological Res.
Equality	Water Res.
Fair Wages	Consumption
Governance	Renewables
Transition	Emissions
Livability	Employment

Sustainability...

- Considers **all** life cycle stages
- Looks for continuous and ongoing improvements
- Prioritizes and operationalizes values through a conscious effort
- **IS NOT** an add-on value to a system

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Trade-Off Considerations

- Improving one outcome may compromise another
- Consideration of **Opportunity Costs**
- Priorities/values of the organization/project
 - Which sustainability components are particularly valued?
 - How do we prioritize these values?
 - How do we operationalize these values?
- Risk
 - What risks do we face?
 - How much risk is acceptable?

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Sustainability is Context Sensitive

I-90 near Snoqualmie Pass, Washington
7 lanes
32,000 AADT
21% trucks
62 inches annual precipitation

Photo credit: G. March

Sustainability Is Context Sensitive

I-5 Seattle, Washington
 11 lanes
 280,000 AADT
 9% truck
 38 inches annual precipitation

Photo credit: B. March

RAP vs. Local Aggregate:
Is one more sustainable?

RAP benefits:

- Reduced raw materials use
- Reduced air emissions
- Reduced solid waste

Local materials benefits:

- Reduced fossil fuel use
- Reduced air emissions
- Improves local economies
- Reduces costs

It Depends! Context Sensitive!
Priorities, location of project site relative to material sources

- Example: nearest source of RAP is 100 miles away vs. acceptable local material only 5 miles away.
- Consider economic, environmental, and societal impacts of material hauling.

Photo credit: B. March

How Do We Measure Pavement Sustainability?

Balance of the Triple Bottom Line

Sustainability Rating Systems (e.g., INVEST)
 Performance Testing
 Life-Cycle Assessment (LCA)
 Performance Testing
 Life-Cycle Cost Analysis (LCCA)

Image Source: FHWA/APTech

Life-Cycle Cost Analysis

Title: Life-Cycle Cost Analysis in Pavement Design – Interim Technical Bulletin
Authors: Walls and Smith (for FHWA)
Published: 1998
Description: Recommends procedures for conducting LCCA of pavements. Set's standard for inclusion of user costs (WZ only) and probabilistic analysis.
Where: USDOT and various other websites
 • <http://isdct.dot.gov/OLPFiles/EHWA/013017.pdf>

Life-Cycle Assessment

https://www.fhwa.dot.gov/pavement/pubs_data/04-036-035
https://www.fhwa.dot.gov/pavement/pubs_data/04-036-038

Reasons to Measure Sustainability

- Achieving sustainability and performance goals
- Satisfying accounting mandates
- Providing decision support
- Improving agency processes
- Improving public image

Sustainability Initiatives from Transportation Agencies

- [Arizona DOT](#)
 - Sustainable Transportation Program
 - Sustainable Pavement Program
 - Resilience Program
- [Hawaii DOT](#)
 - Sustainable Transportation Forum
- [Minnesota DOT Sustainability Program](#)
 - Vision: Maximize health of people, environment, and economy

Summary

Key Takeaways


- "Sustainable" in the context of pavements refers to system characteristics that encompass a pavement's ability to:
 - Achieve engineering goals
 - Preserve ecosystems
 - Use resources judiciously
 - Meet basic human needs
- Sustainability is a continuum
- Sustainability requires innovation
- Sustainability involves trade-offs
- The FHWA's *Sustainable Pavements Program* provides many resources to help agencies

Available Resources

- Guide Documents:
 - [Towards Sustainable Pavement Systems](#)
 - [Pavement Life Cycle Assessment Framework](#)
- **Tech Briefs** on following topics:
 - *Pavement Sustainability*
 - *Life Cycle Assessment*
 - *Improving Resiliency of Pavement Systems*
 - *Strategies for Improving Sustainability of Asphalt/Concrete Pavements*
- **Webinar series** on pavement sustainability

To Learn More:

WEBINAR EVENT	WHAT WILL YOU LEARN?	DATE & TIME
1	Pavement Sustainability Basics	Sustainability concepts and assessment tools
2	Sustainable Pavement Materials	Sustainability implications of aggregate, asphalt, and concrete pavement materials
3	Sustainable Design Approaches	Design considerations related to sustainability, general and specific design strategies, emerging trends
4	Sustainable Pavement Construction	Construction considerations to improve pavement sustainability, future directions, and emerging trends
5	Maintenance and Preservation	Pavement preservation basics, impacts of preservation on sustainability, sustainable preservation techniques
6	ECOL Considerations	End-of-Life (EOL) considerations related to pavement sustainability, EOL options for asphalt and concrete pavements
7	LCCA Part I: Fundamentals	Life Cycle Cost Analysis (LCCA) concepts, steps in pavement LCCA process, tools to conduct LCCA
8	LCCA Part II: Applications	Key considerations in pavement LCCA, example LCCA applications in sustainability-related applications
9	LCA Part I: Fundamentals	Life Cycle Assessment (LCA) concepts, benefits, and uses; steps in the pavement LCA process; tools and resources on LCA
10	LCA Part II: EPDs and PCRs	Fundamentals on Environmental Product Declarations (EPDs) and Product Category Rules (PCRs)



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For More Information

- FHWA Sustainable Pavements Website
- www.fhwa.dot.gov/pavement/sustainability
- FHWA Contacts:
 - Heather Dylla (Heather.Dylla@dot.gov)
 - Khadija Ngozi-Bullock (Khadija.NgoziBullock@dot.gov)