FHWA Sustainable Pavements Program: Advancing LCA

Heather Dylla Sustainable Pavements Engineer

Sustainable Pavements Program

Concrete Pavement Construction

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- Technical Briefs
- Webinars

Technical Working Group

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Presentation Objectives

What is the Sustainable Pavements Program's Mission?

How does Life Cycle Thinking Fit into the Program?

What is the Future of Life Cycle Thinking in Pavement Design?

Sustainable Pavements Program Vision & Mission

Advance the Knowledge and Practice of

- Designing
- Constructing
- Maintaining

More Sustainable Pavements Through

- Stakeholder Engagement
- Education
- Development of Guidance and Tools

Sustainable Pavements Technical Working Group

Industry

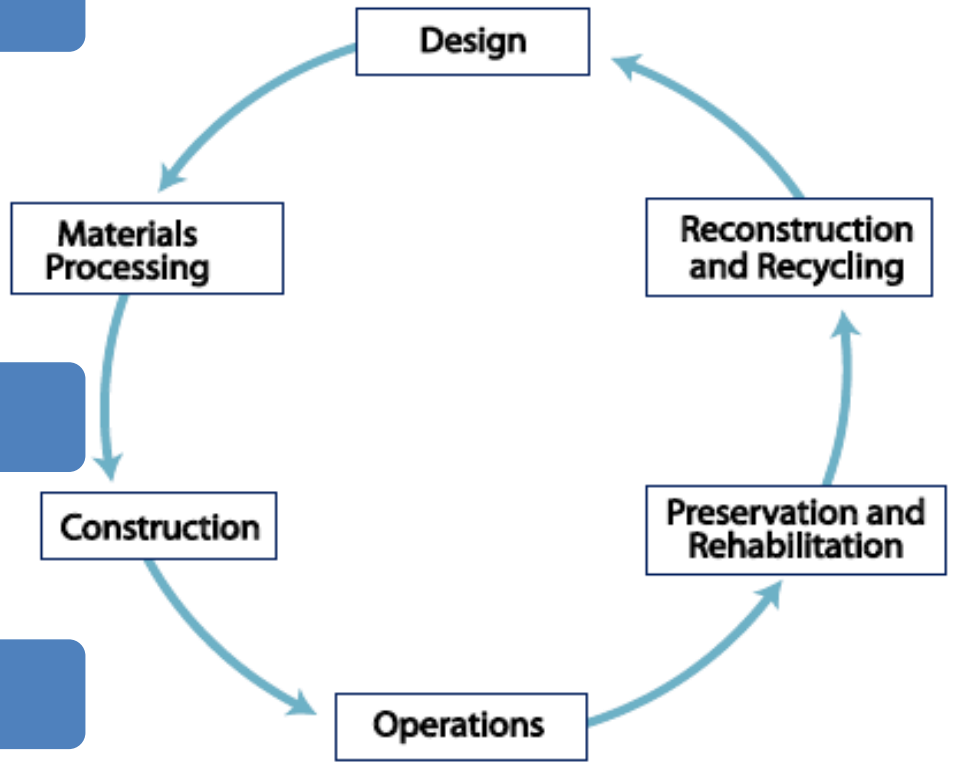
- Engineers
- LCA Professionals
- Material Manufactures
- Construction Contractors

Academia

- Pavement Materials
- Construction

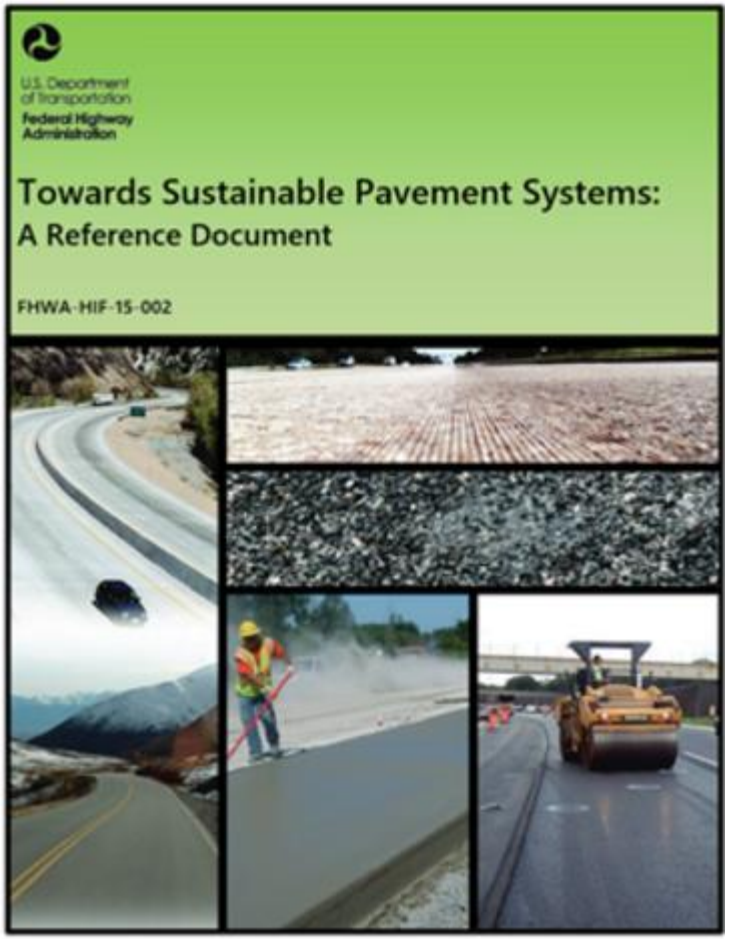
Agencies

- State Department of Transportation Agencies
- Local Agencies



Initial Focus: Develop Guidelines for Sustainable Pavements

Develop Guidelines



Purpose

- Educate Practitioners
- Encourage Adoption

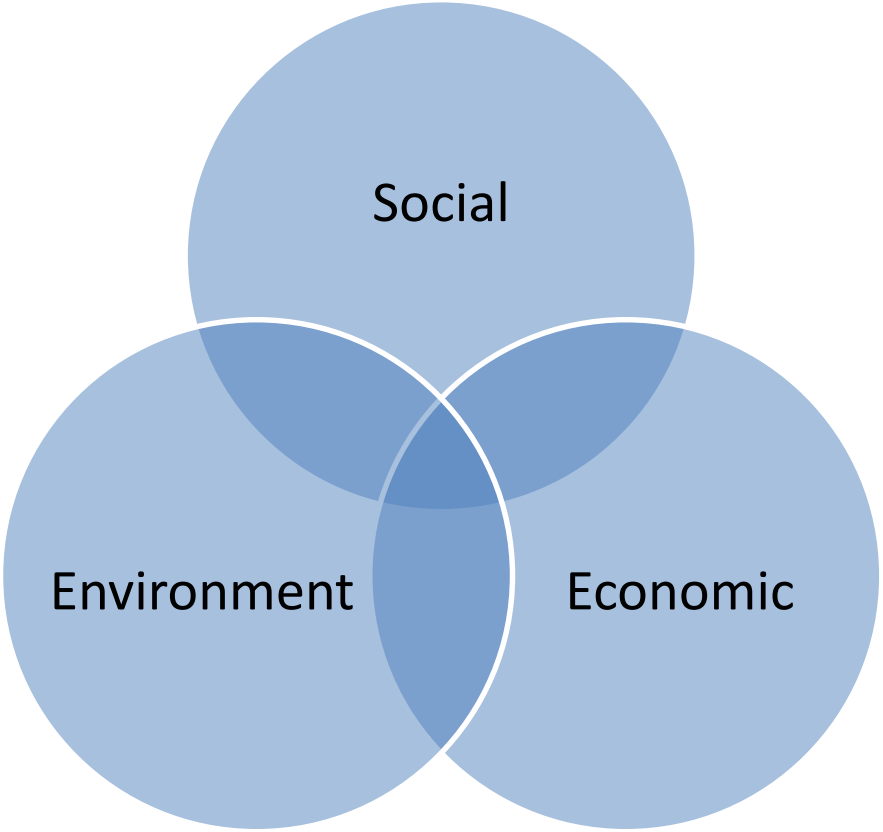
of Sustainable Practices Throughout a Pavement's Lifecycle

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

Sustainability in General

Common Definition

- Brundtland Report 1987
- “Development that meets the needs of present without compromising the ability of future generations to meet their own needs”
- Three Pillars of Sustainability



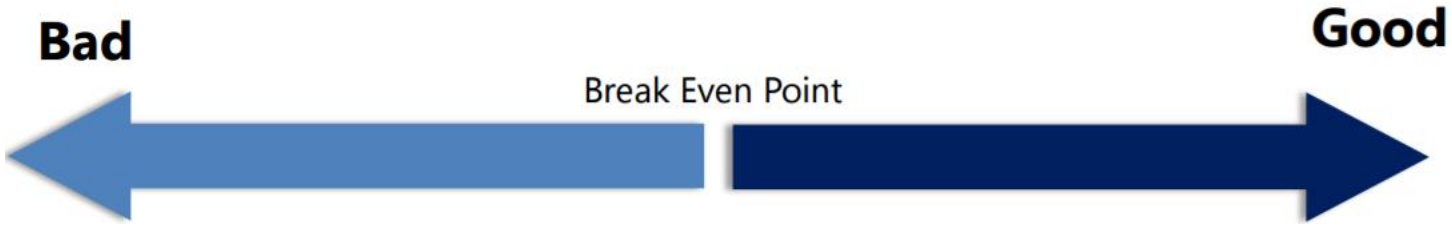
Sustainable Pavements

Definition

- No Universal Definition
- Challenge: Transportation System

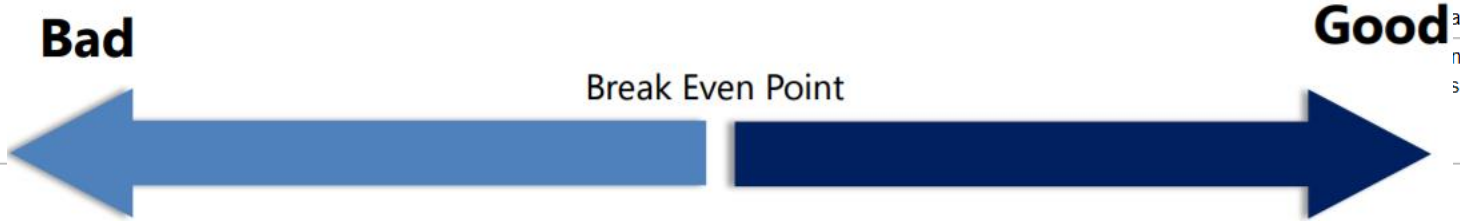
Concepts

- achieve engineering goals
- preserve and restore surrounding ecosystems
- use financial, human, and environmental resources economically
- meet basic human needs such as health, safety, equity, employment, comfort, and happiness



Approaches for Improving Aggregate Production for Pavement Sustainability

Aggregate Materials Objective	Sustainability Improving Approach	Economic Impact	Environmental Impact	Societal Impact
Reduce the Amount of Virgin Aggregate Used	Use more aggregates derived from Recycled, Co-Products and Waste Materials (RCWM) sources.	Can potentially reduce cost, and preserve scarce or difficult to permit virgin sources. May increase cost depending upon availability, transportation, or processing required; reduce ability to recycle in the future; durability; special pollution problems (pH, toxicity, contaminants).	Dependent on characteristics of RCWM, considering transportation, processing, ability to recycle multiple times, special pollution problems.	Preserves virgin sources. Can reduce need for new sources and associated impacts. Reduces space in landfills. Potential for negative impacts depending upon transportation, processing requirements.
	Use more durable aggregate, maximizing pavement life.	May increase initial cost, decrease life cycle cost.	Dependent upon transportation distance if not locally available.	Primarily dependent upon transportation.
Reduce the Impact of Virgin Aggregate Acquisition and Processing	Review environmental impact and remediation plans of different aggregate sources when permitting (handled via the National Environmental Policy Act [NEPA] guidelines or equivalent environmental impact review [EIR] and permit process in many states).	Dependent upon requirements imposed by permit. Most permit processes do not consider impacts of locating quarries outside of the jurisdictional area and importing the aggregate (transfer of impacts).	More sustainable features for quarry may come from permitting process.	More sustainable features for quarry may come from permitting process.
	Implement processing and mining operations using less or lower impact energy sources and less water.	Will often result in initial cost increase due to changeover and life cycle cost decrease due to greater energy efficiency.	Will generally reduce environmental impact.	Will often reduce societal impact.
Reduce the Impact of Aggregate Transportation	Use locally available materials or those using a low impact mode for transportation (next item).	Will often reduce initial cost, may increase life cycle cost if there are significant differences in durability.	Will often reduce environmental impact.	May increase impact for those near local source production and transportation locations.
	Minimize transportation impact by maximizing use of marine/barge and rail transport and minimizing truck transport.	Will often reduce cost.	Will usually reduce environmental impact.	Will usually reduce societal impact, focusing it on marine and rail routes reducing noise, safety issues



Managing change

Second Focus: Guidance for Sustainability Assessment

"What you can't measure, you cannot manage. What you can't manage, you cannot change."

Peter Drucker

Writer, professor and management consultant

Global Reporting Initiative

Adapted from GRI

Sustainability Assessment

Economic Efficiency

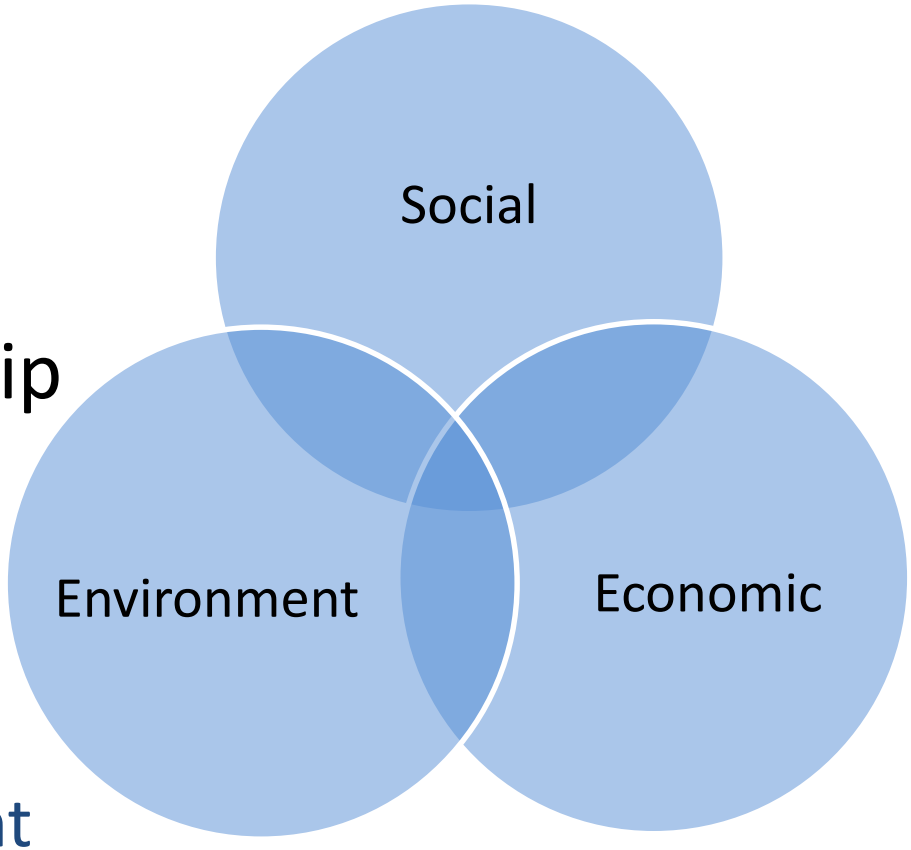
- Life Cycle Cost Analysis
- Network and Project Level

Environmental Stewardship

- Life Cycle Assessment

Social Progress

- Social Life Cycle Assessment



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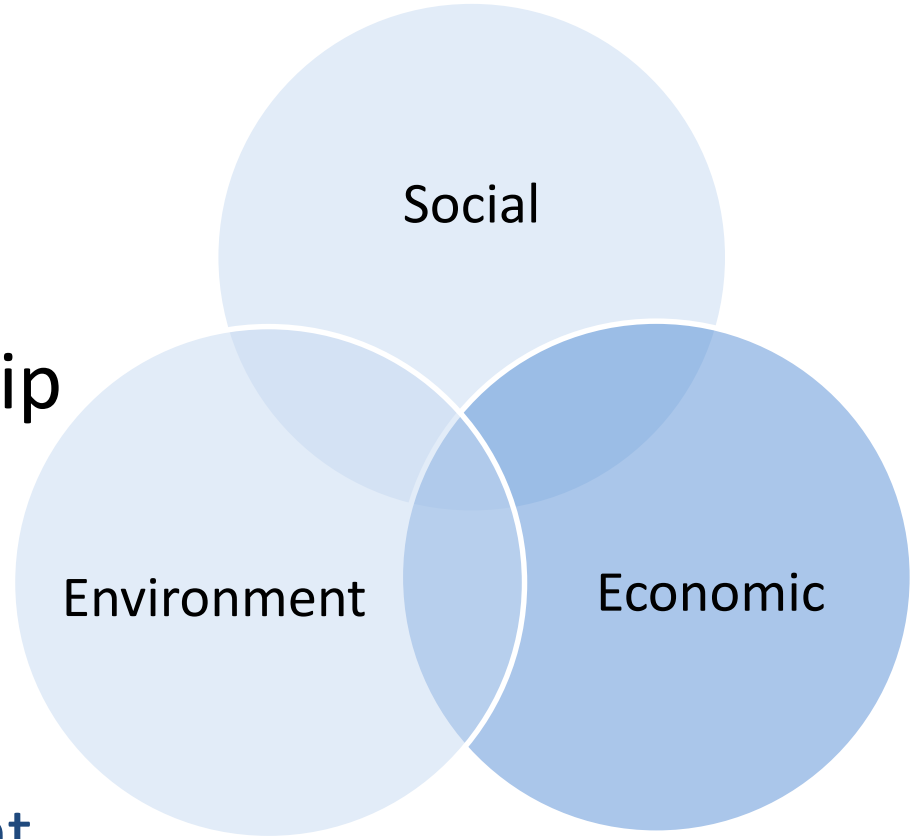

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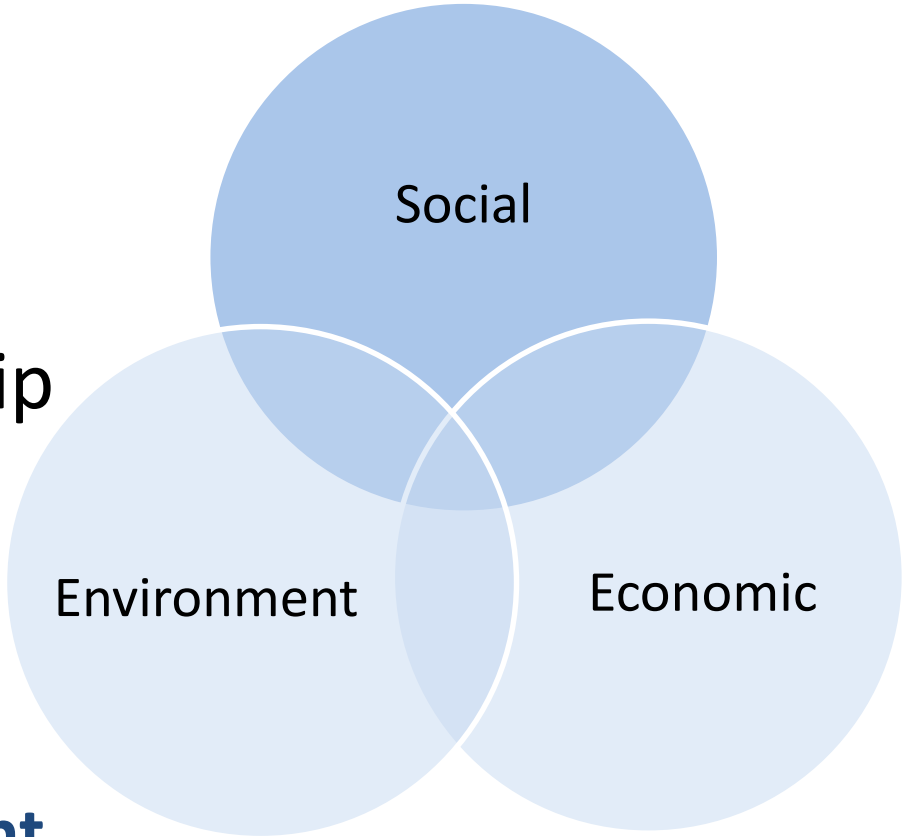

More Research Needed; Long Term Need

Sustainability Assessment

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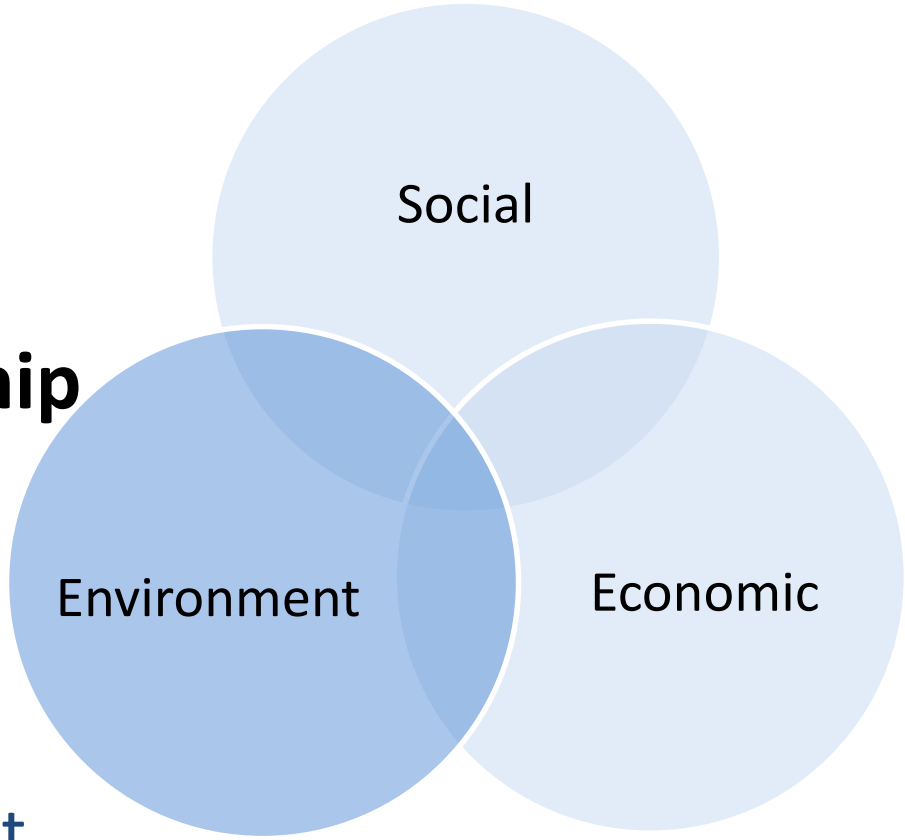
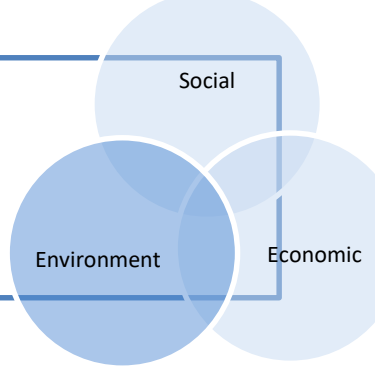


Pavement LCA History



2010

Pavement LCA Workshop
Davis, CA

2013

Concrete PCR

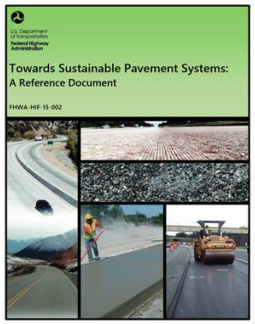
NRMCA CERTIFIED EPD

Asphalt PCR

Environmental Product Declaration
NAPA VERIFIED

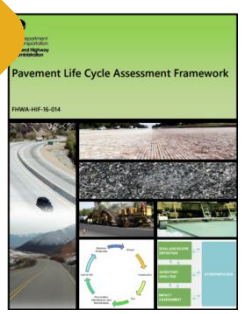
2015

Sustainable Pavements Program
FHWA Reference Document



2016

Pavement LCA Framework



2017

Based on Amlan Mukherjee, SPTWG Gainesville FL

FHWA Pavement LCA Framework

Educate

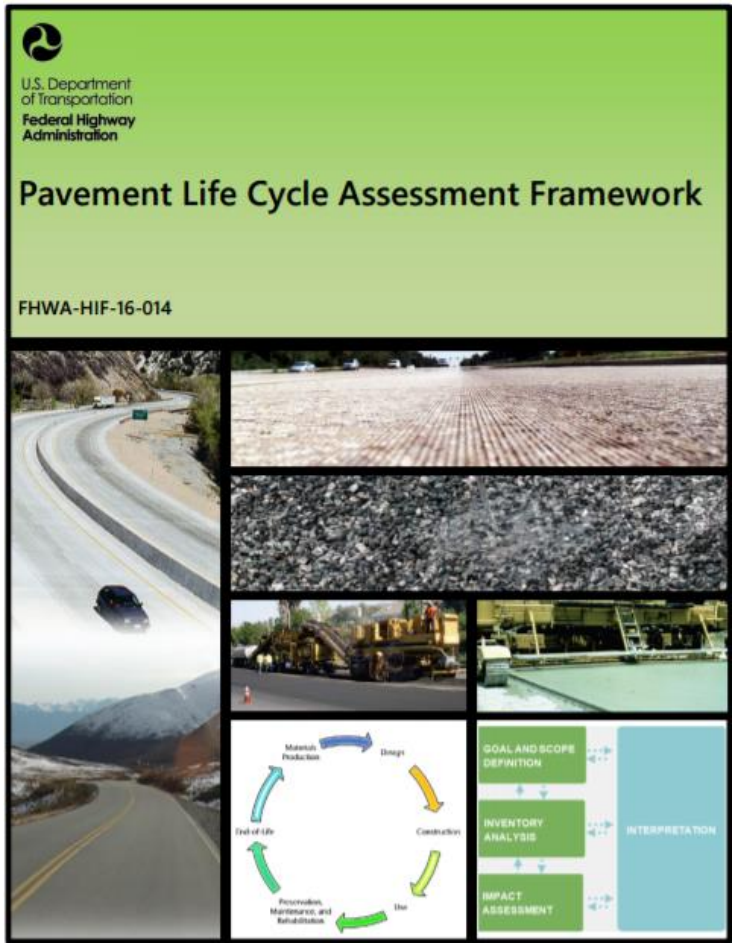
- Agencies on LCA methodology and application to pavements
- Practitioners on LCA principles as applied to pavements
- Documents current practices and gaps

Technical Guidance

- Implementation of pavement LCA within the U.S
- Description of viable alternatives with pros and cons

Deployment

- Encourage Progress in Pavement LCA



https://www.fhwa.dot.gov/pavement/pub_details.cfm?id=998

LCA in Policy

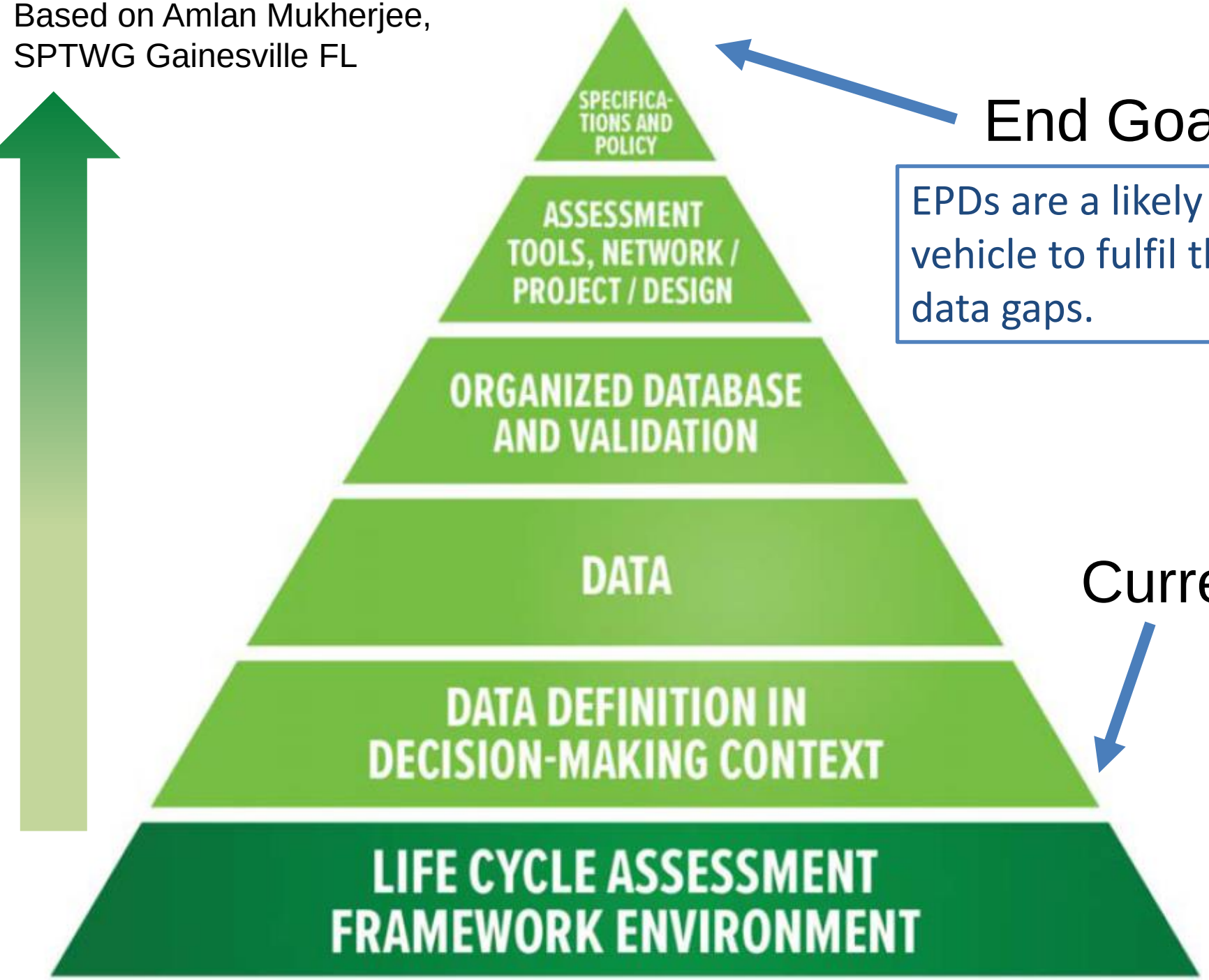
Oregon No. 3021

- DEQ is sponsoring EPDs for concrete
- Proposed Bill
  - DOT Create Pilot Program to assess how products procured affect CO_2 emissions
  - Environmental Cost
  - EPDs

California No. 262

- CO_2 reporting for Bidding and Awarding of Public Contract
- EPDs

Based on Amlan Mukherjee, SPTWG Gainesville FL



End Goal

EPDs are a likely vehicle to fulfil the data gaps.

Currently

LCA Needs

Includes SPTWG Feedback

- Education on LCA, EPDs, PCRs
  - Webinars, web-based videos, tech briefs, quick simple talking points
- Examples
- Technical Guidance and Tools

Sustainable Pavements Program: Immediate and Future Needs

Case Studies

- Highlighting Technologies Identified in the Reference Manual
- Document Environmental, Social, Economic Benefits

EPD Tech Brief

- Educate Agencies and Policy Makers
- What is EPD?
- How can EPDs be used?

LCA Tool

- Help Agencies Benchmark Impacts

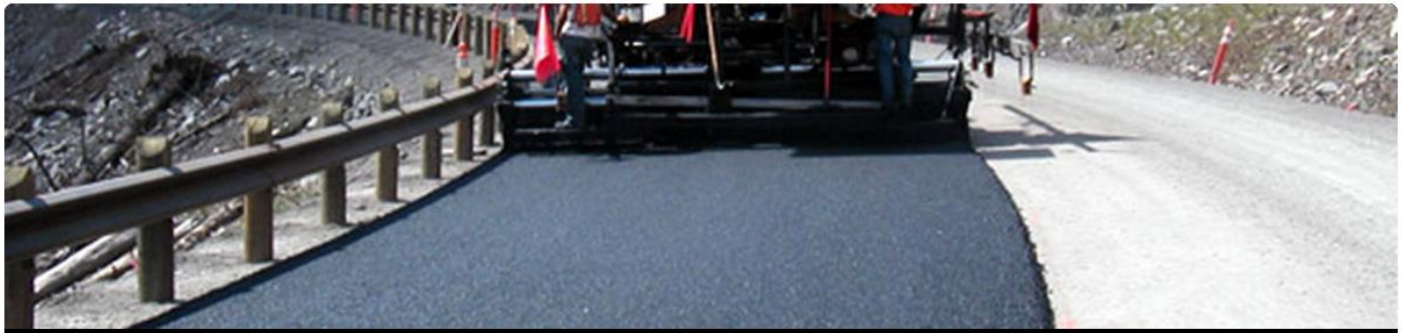
Future Needs:

- Pilot study using FHWA Pavement LCA Framework
- Develop Technical Guidance on How to Incorporate EPD's
- Develop Pavement LCA Tool

Questions

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

Sustainable Pavements Program



Warm Mix Asphalt Pavement Construction

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