National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

Importance of Considering Performance from an Environmental Perspective

SEAUPG

Suri Gatiganti

SEAUPG Annual Meeting

11/20/2024

What is LCA, EPD, PCR?

The Communication:
"providing environmental information of a product"

EPD

The Analysis:
"Evaluation of environmental impacts of a product"

LCA

The Guidelines:
"Set of specific rules, required for developing EPDs of a product"

PCR

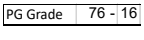
4

Acknowledgments

- Lorena Garcia, Kraton Inc.
- Bob Kluttz, Kraton Inc.
- David Timm, Auburn University
- Nam Tran, NCAT
- Samina Samrose, Auburn University

2

What is LCA, EPD, PCR?



The Communication:
"providing environmental information of a product"

EPD

The Analysis:
"Evaluation of environmental impacts of a product"

LCA

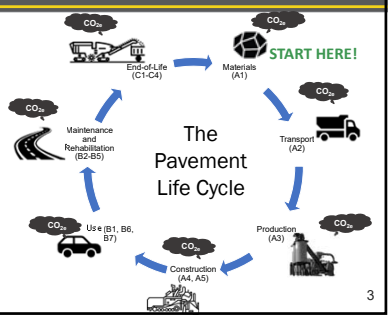
The Guidelines:
"Set of specific rules, required for developing EPDs of a product"

PCR

5

Life Cycle Assessment

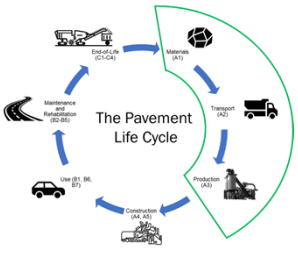
- A systematic analysis of the potential environmental impacts of products during their entire life cycle.
- LCCA is a financial accounting, LCA is eco-accounting



3

Asphalt Mixture EPD's

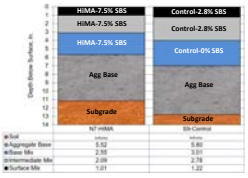
- The current NAPA EPD system cover only "Cradle-to-gate" system boundary
- Is it fair to compare environmental impacts of two mixtures just based on "Cradle-to-gate"?
- How critical is to consider life-extension benefits into LCA consideration?

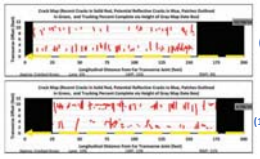


6

2009 – HiMA Section from NCAT TT

- HiMA section was 1.36" thinner
- Still outperformed the control section after 20 million ESALs
  - Cracking
  - Rutting



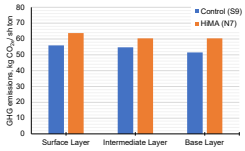


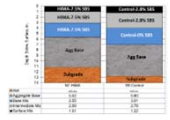
7

Cradle-to-Gate LCA Results

Declared Unit: one short ton

- Just from Cradle-to-Gate perspective HiMA mixtures had higher GHG emissions
  - 14% (surface)
  - 10% (Intermediate)
  - 17% (Base)
- However, the cradle-to-gate analysis is blind to
  - Reduced thickness of HiMA section
  - Better performance





10

LCA Case Study

- Goal is to perform a Cradle-to-grave comparative LCA between control and HiMA sections

Production Stage			Construction Stage		Use stage							End-of-life			
Raw Materials	Transport	Manufacturing	Transport	Construction	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Demolition	Transport	Waste processing	Disposal
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
✓	✓	✓	✓	✓	x	✓	✓	✓	✓	x	x	x	x	x	x

✓: Life cycle stage included in the LCA
x: Life cycle stage excluded from the LCA

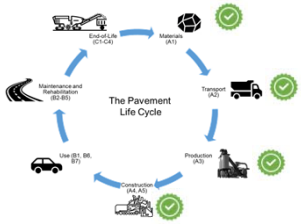
HiMA mixtures had 7.5% SBS

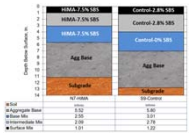
HiMA section is 1.36" thinner

8

Cradle-to-Constructed LCA

- Functional Unit: Test section
  - 200 ft long, 12 ft wide

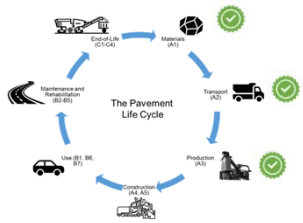


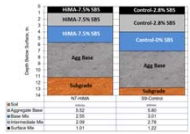


11

Cradle-to-Gate LCA

- Declared Unit: One Short ton



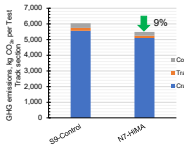


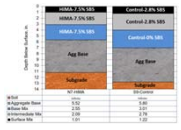
9

Cradle-to-Constructed Results

Functional Unit: test track section

- From Cradle-to-Constructed perspective HiMA section had 9% lower GHG emissions
- However, this analysis is blind to
  - Better performance of HiMA
  - Life extension benefits

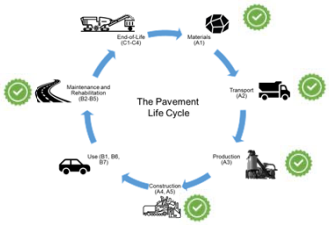


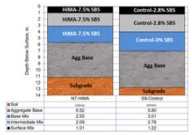


12

Cradle-to-Grave LCA

- Functional Unit: One lane-mile
  - 12 ft wide



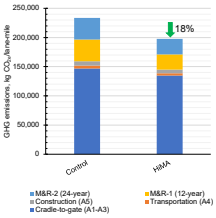


13

Cradle-to-Grave Results

Functional Unit: One lane-mile

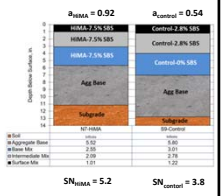
- From Cradle-to-Grave perspective HiMA section had 18% lower GHG emissions



16

Future M&R Scheduling

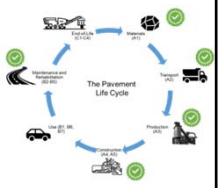
- The structural layer coefficients for HiMA mixtures are 0.92
  - Compared to 0.54 (ALDOT) for conventional asphalt mixtures.



14

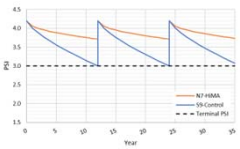
Summary

- Cradle-to-Gate LCA results
  - HiMA mixture had higher GHG emissions compared to control
- Cradle-to-Constructed LCA results
  - HiMA mixture showed 9% lower GHG emissions compared to control
- Cradle-to-Grave LCA results
  - HiMA mixture showed 18% lower GHG emissions compared to control
- For specialty mixtures it is important to consider life-extension benefits into LCA

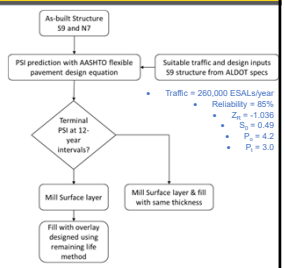


17

Future M&R Scheduling



Year	Activity	
	Control	HiMA
0	Initial construction	Initial construction
12	1.2" mill and 1.6" fill	1.0" mill and 1.0" fill
24	1.6" mill and 2.0" fill	1.0" mill and 1.0" fill
35	end-of-analysis period	end-of-analysis period



15

Thank You

Questions?

Suri Gatiganti
Assistant Research Professor
National Center for Asphalt Technology
szg0094@auburn.edu
334-498-0365