ENVIRONMENTAL PRODUCT DECLARATIONS

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What is an EPD?

- Environmental Product Declaration
  - **Quantified** environmental information on the **life cycle** of a product to enable **comparisons** between products fulfilling the **same function***

- "Nutrition label" for environmental impacts

- Independently verified

EPD "Nutrition" Label

Your Building Product

Amount per Unit

LCA IMACT MEASURES	TOTAL
Primary Energy (MJ)	12.4
Global Warming Potential (kg CO^2 eq)	0.96
Ozone Depletion (kg CFC- 11 eq)	1.80E-08
Acidification Potential (mol H^+ eq)	0.93
Eutrophication Potential (kg N^- eq)	6.43E-04
Photo-Oxidant Creation Potential (kg 03 eq)	0.121

Your Product's Ingredients: Listed Here

https://westcoastclimateforum.com/cfpt/concrete/strategy1

*Source: ISO 14025:2006. **EPDs from different Product Categories should NOT be compared to each other.**

Types of EPDs

Industry-Wide

ENVIRONMENTAL PRODUCT DECLARATION

NORTH AMERICAN SOFTWOOD PLYWOOD

AMERICAN WOOD COUNCIL
CANADIAN WOOD COUNCIL

The American Wood Council (AWC) and the Canadian Wood Council (CWC) are pleased to present this Environmental Product Declaration (EPD) for North American softwood plywood. The EPD includes Life Cycle Assessment (LCA) results for all processes up to the point that plywood is packaged and ready for shipment at the manufacturing gate. The underlying LCA and the EPD were developed in compliance with ISO 14025:2006 and ISO 21930:2017 and have been verified under the UL Environment EPD program.

The AWC and CWC represent wood product manufacturers across North America. The North American forest product industry is a global leader of sustainably sourced wood products. This EPD reflects years of research and numerous sustainability initiatives on behalf of our members to continually improve the environmental footprint of North American wood products. We are pleased to present this document to show our progress.

Please follow our sustainability initiatives at www.awc.org and www.cwc.ca.

CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
UL.COM/EPD

Product-Specific

AkzoNobel

EPD®

Interpon®
POWDER COATINGS

Third party verified EPD – According to the International EPD® system

Interpon D1000
Interpon D2000
Interpon D3000

First date of publication:	06 April 2015
Valid until:	02 May 2023
PCR reference:	CPC division 3511 Paint and varnishes PCR 2012:01 CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES; ver.2.2 of 2017-05-30
Registration number:	S-P-00692
Revision date:	03 May 2018
Verified by:	NEVEN Miljökonsult
Programme operator:	The International EPD® System
Declaration owner:	AkzoNobel Powder Coatings B.V.

Plant-Specific & Product-Specific

Barilla
FUSILLI
SPAGHETTI n.5

Durum Wheat semolina pasta

in paperboard box

Environmental Product Declaration

The first EPD process certified in the Food industries

Barilla
Barilla
EPD®

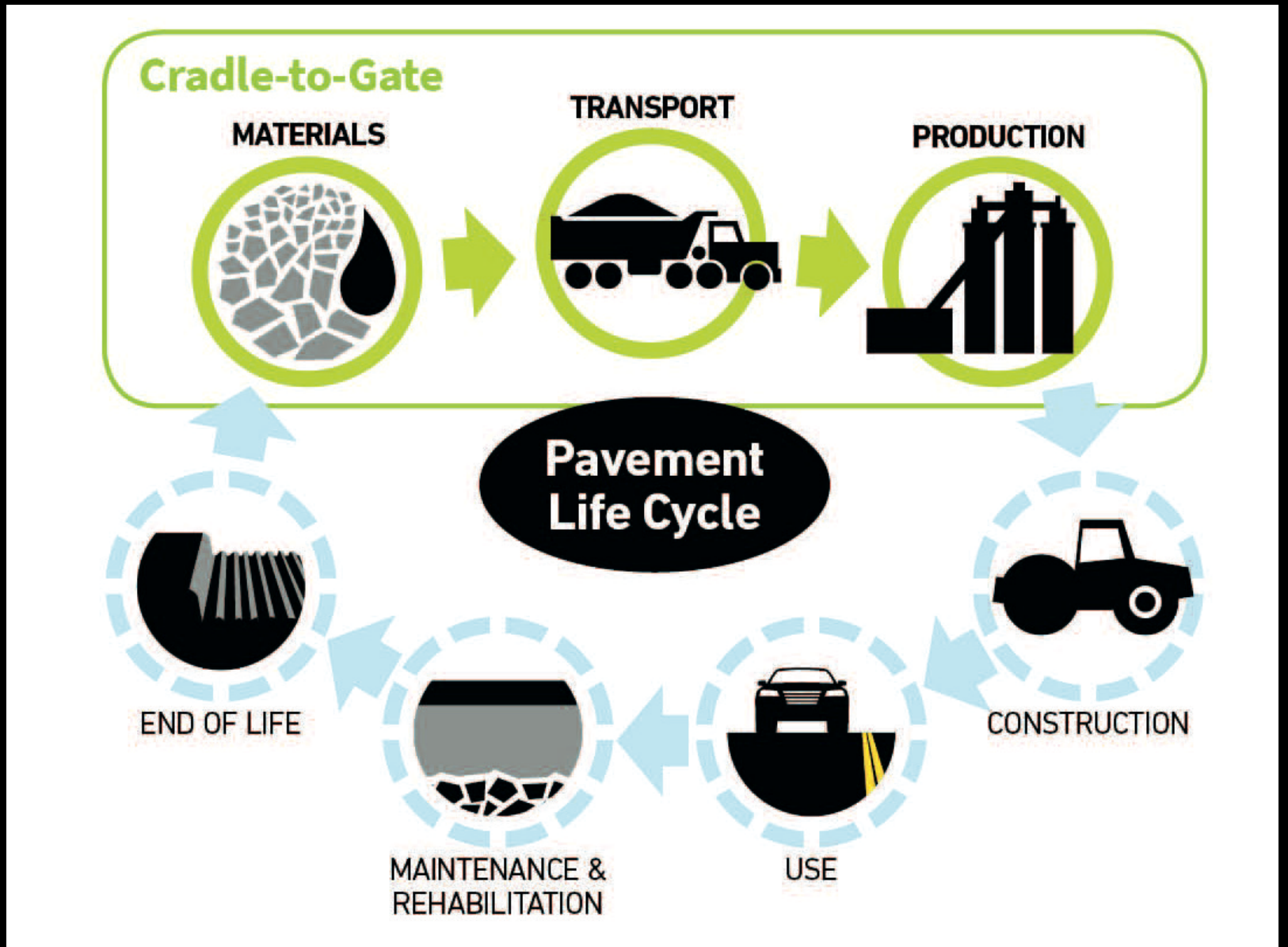
REGISTRATION NUMBER	CPC CODE	PUBLICATION DATE	REVISION	VALID UNTIL	PROGRAMME	PROGRAMME OPERATOR
S-P-00217	2731 Uncooked pasta, not stuffed or otherwise prepared PCR 2010:01 v. 3.11 06.09.2019	2011/03/10	9 of 2020/09/24	2024/11/06	The International EPD® System www.environdec.com	EPD International AB

This EPD has been developed in conformity to ISO 14025. An EPD should provide current information and may be updated if conditions change. The stated validity is, therefore, subject to the continued registration and publication at www.environdec.com.

EPDs for Asphalt Mixtures are Plant-Specific & Product-Specific

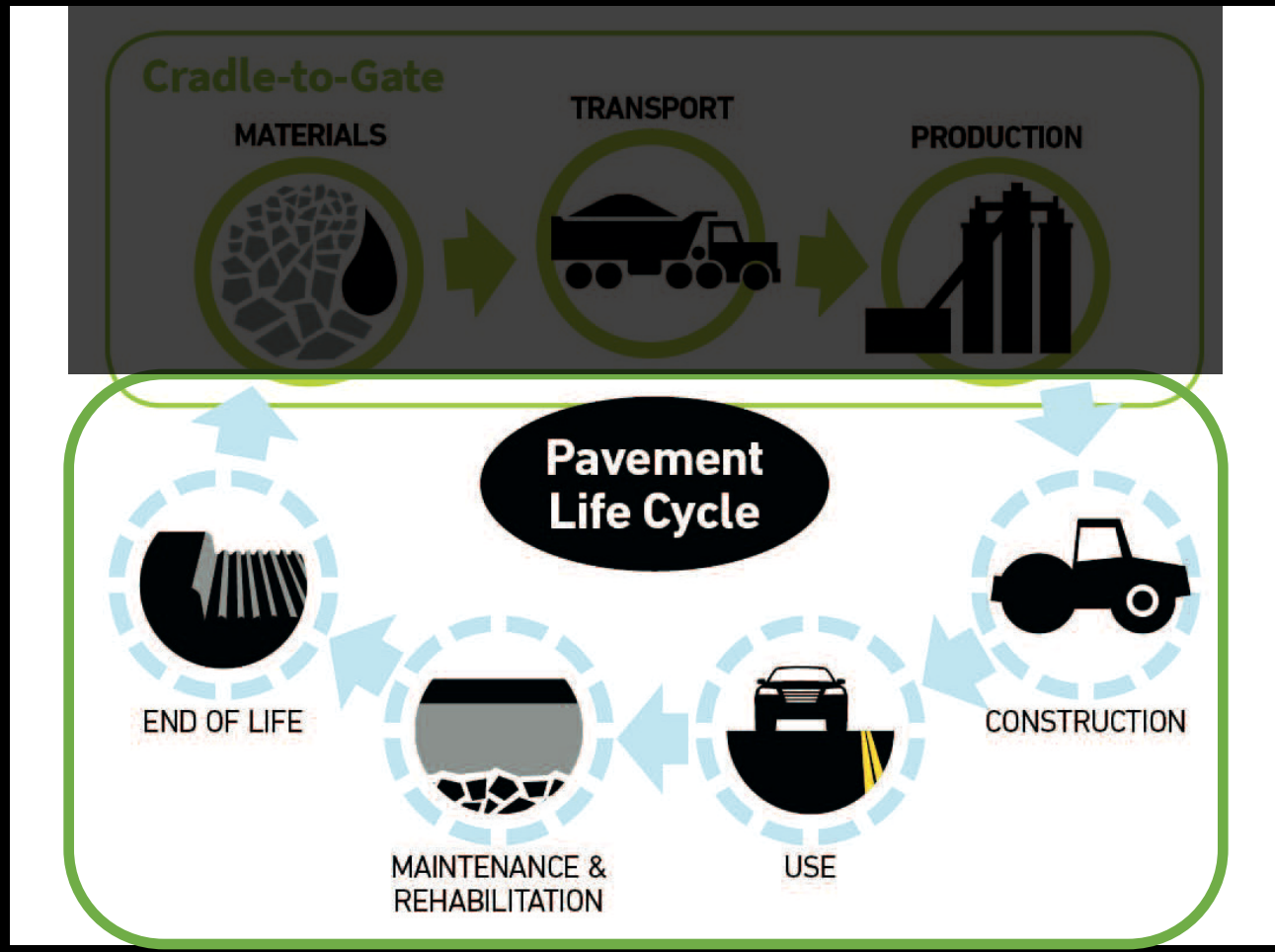
Most EPDs for construction materials have a Cradle-to-Gate scope

- Materials
  - Aggregates
  - Asphalt Binder
  - Additives
- Transport
  - Truck
  - Barge
  - Rail
- Production
  - Burner Fuel
  - Electricity
  - Equipment
  - Water



What about the other life cycle stages?

- Outside the scope of the Asphalt EPD
  - As defined in the Product Category Rules (PCR)
- Mix producers have little control beyond the gate of the plant
  - Owners can evaluate these stages through their own Life Cycle Assessment (LCA)



Product Category Rules (PCR)

- Defines key parameters of EPDs within a product category
  - Data inputs
  - System boundaries
  - Life cycle stages (Cradle-to-Gate)
  - Data to be reported in the EPD
- Developed by the Program Operator
- PCR must comply with ISO 14025 and other standards
- Independent review panel
- Public review process

Program Operators

SCS global SERVICES

UL Environment

ASTM INTERNATIONAL

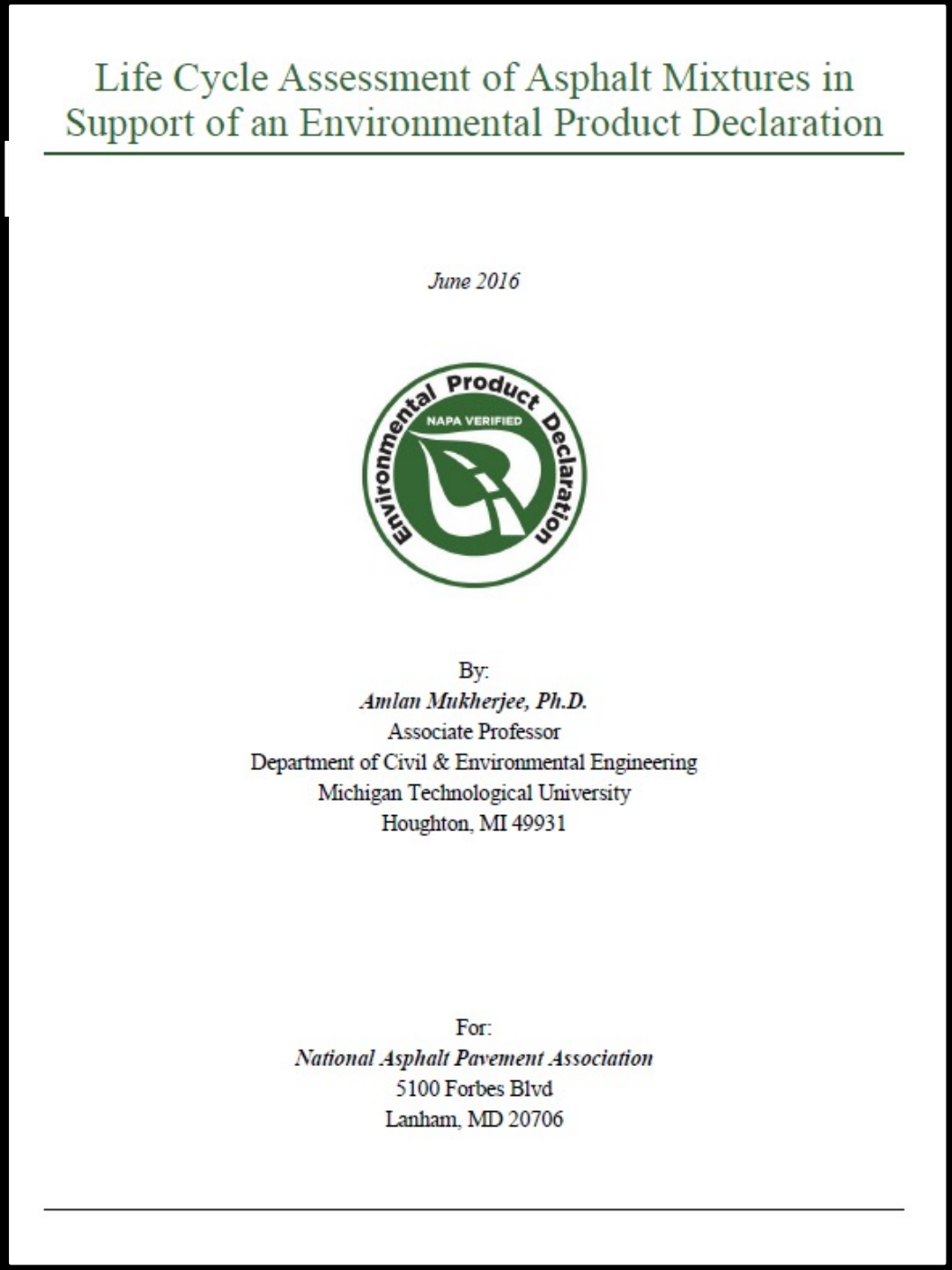
NAPA

PCR for Asphalt Mixtures

- EPDs can be comparable if asphalt mixtures meet similar performance criteria
- Declared unit is 1 short ton of asphalt mixture
- Complies with ISO 14025 and EN 15804 standards
- Specifies public databases for upstream products & processes
- Revised version expected in April 2022

Life Cycle Assessment (

- Industry-wide survey of 50 plants
  - Conducted by Dr. Amlan Mukherjee (Michigan Tech)
- Independently verified
  - Complies with ISO 14040/14044
- Underlying LCA for the PCR for Asphalt Mixtures
- Also serves as the LCA model for NAPA's Emerald Eco-Label EPD software tool
- New LCA just published



Life Cycle Assessment of Asphalt Mixtures in Support of an Environmental Product Declaration

June 2016

By:
Amlan Mukherjee, Ph.D.
Associate Professor
Department of Civil & Environmental Engineering
Michigan Technological University
Houghton, MI 49931

For:
National Asphalt Pavement Association
5100 Forbes Blvd
Lanham, MD 20706

How and Why are Customers Using EPDs?

LEED projects and other green rating systems

- EPD credits included in LEED v4
- Disclosure credit
  - Projects collect EPDs from 20 different products
- Optimization credit
  - Projects collect EPDs for at least 20 products that are “optimized”
  - Reduced impact relative to industry benchmark or previous version
- Pilot credit for “low carbon” materials
- 1,000+ LEED v4 projects certified in 2020

https://www.buildings.com/articles/27844/what-leed-gold-school-future-looks

Understanding Carbon

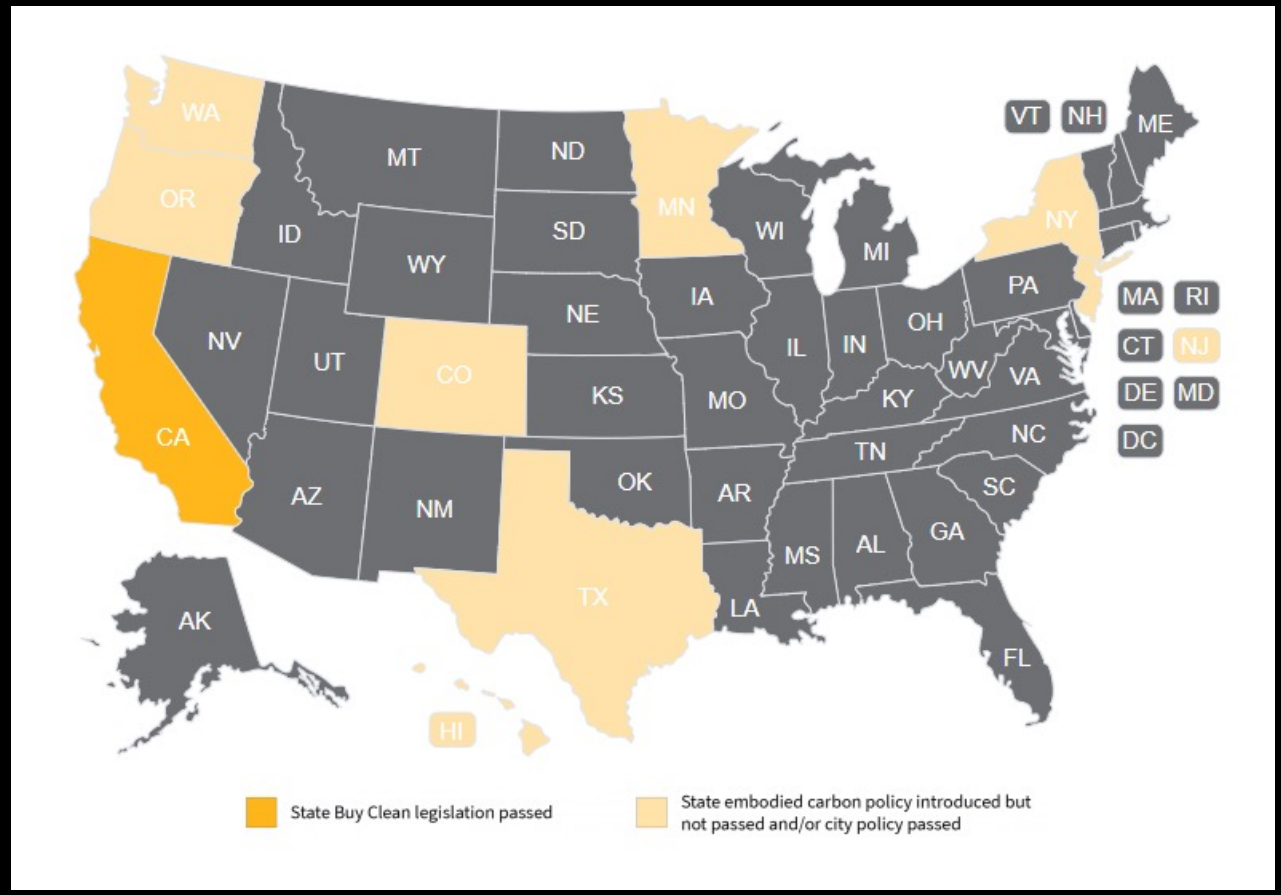
- Often measured using the Global Warming Potential (GWP) indicator in **EPDs**

https://www.architects.org/news/building-a-low-carbon-future-reducing-embodied-carbon-in-the-built-environment

“Buy Clean” Legislation

- Process:
  1. Agencies collect EPDs for eligible materials for 1-2 yrs.
  2. Agencies determine **embodied carbon** (GWP in units of CO_2e) limit for each material type
  3. Incorporate GWP limits into procurement (prequalification)

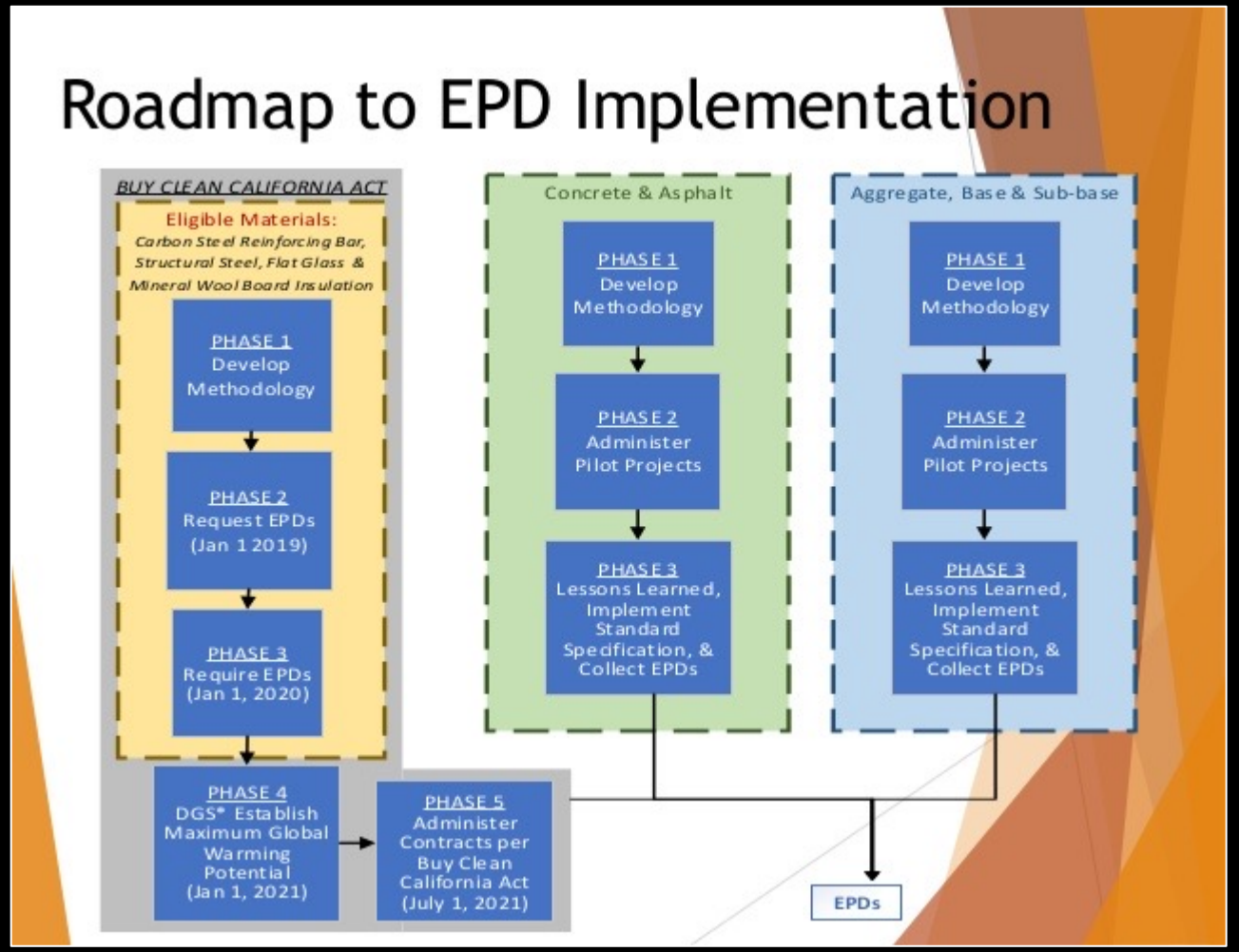
- Most Buy Clean policies target these materials:
  - Steel, Glass, Insulation, Concrete
  - Asphalt has been proposed in several jurisdictions



https://carbonleadershipforum.org/clf-policy-toolkit/#map

Caltrans EPD Policy

- Policy decision by Caltrans to get ahead of legislation
- Contractors must submit EPDs for Concrete, Asphalt, and Aggregates
- Started with 20 projects in 2019
- Now targeting 100 projects

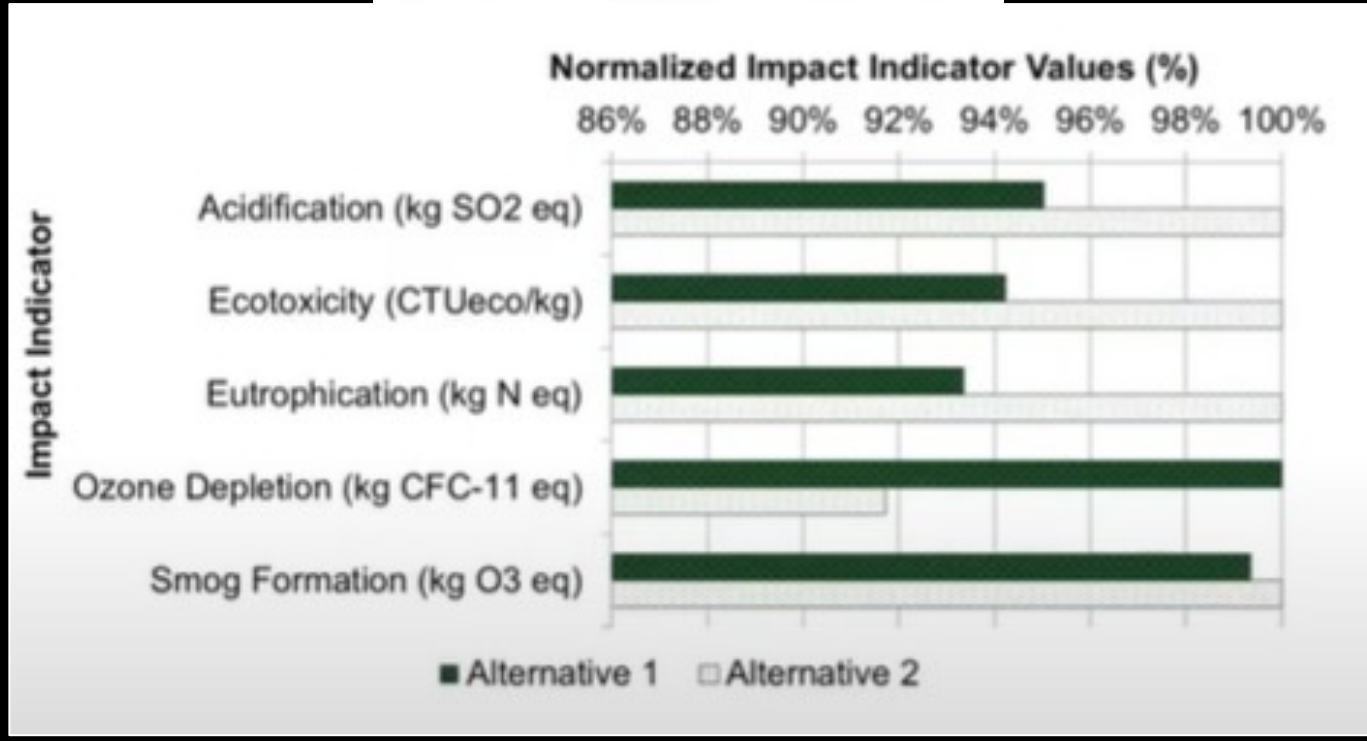


https://www.slideshare.net/CaliforniaAsphalt/epd-implementation-on-caltrans-projects-137910238

FHWA Initiatives

- Roadmap for upstream datasets
  - For fuels, electricity, & common materials
- PCR Guidance
  - Goal is to align PCRs for different pavement materials
- Pavement LCA Framework in OpenLCA
  - LCA software used by consultants
- LCA-Pave Software Tool
  - Excel-based LCA software designed for agencies
  - Can use EPDs as a data input

LCA PAVE



https://www.youtube.com/watch?v=uqpKLwy2N1U

FHWA Initiatives (continued)

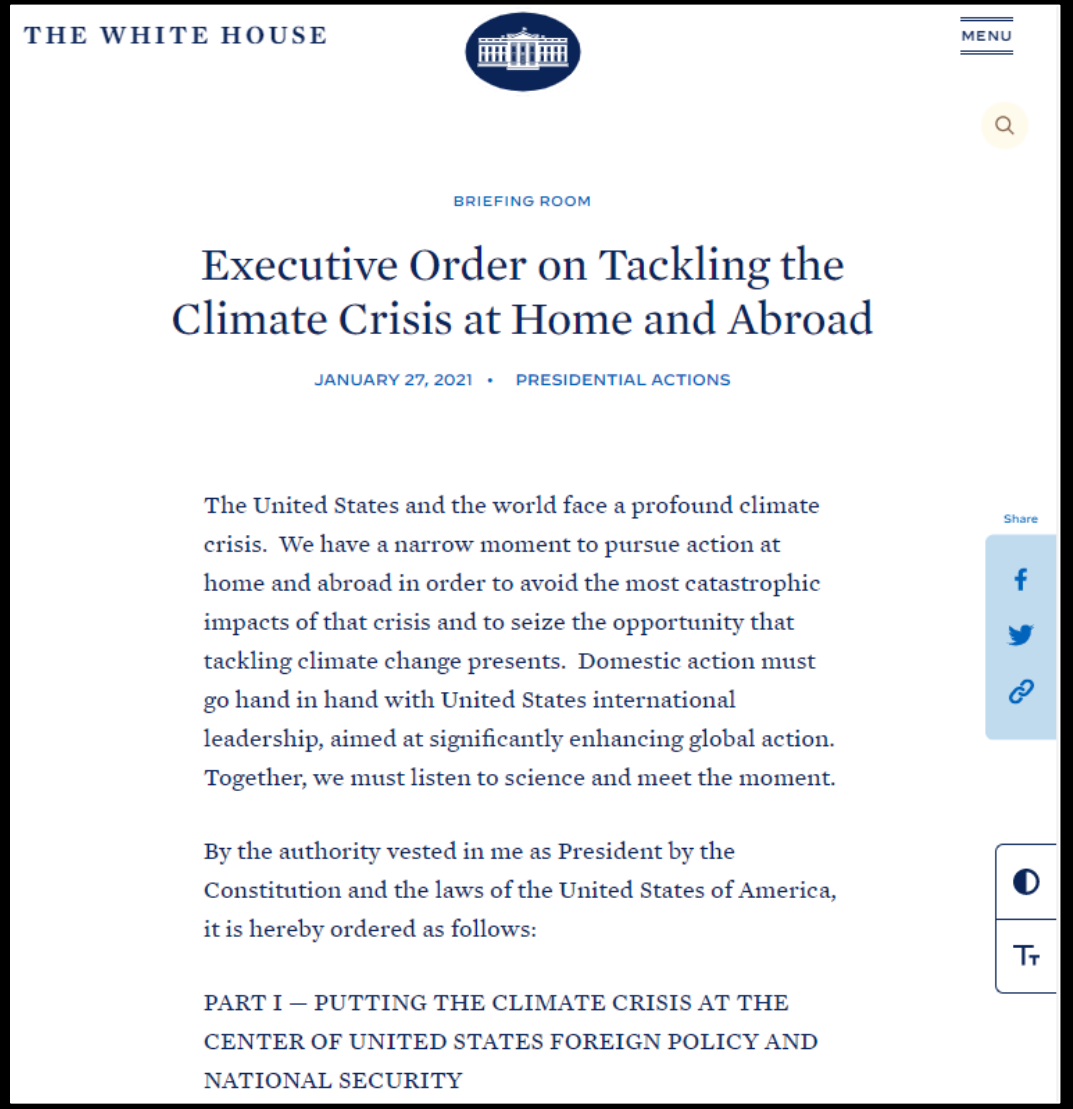
FHWA's Proposed* EPD Implementation Process:

- Step 1: Use EPDs as a communication tool
  - No decisions made based on content
  - Agencies can use EPDs to inform development of benchmarks
- Step 2: Use EPDs as a material procurement aid
  - Requires development of relevant benchmarks
- Step 3: Use EPDs as a data source for LCA
  - Requires harmonization of PCRs for different materials
- Step 4: Use multiple LCAs to inform policy

*References:
Rangelov et al. (2020). Integration of life cycle assessment into planning and project delivery for pavements in the USA. Roadways and Infrastructure.
Rangelov et al. (2021). Use of EPDs of pavement materials in the U.S.A. to ensure environmental impact reductions. Journal of Cleaner Production.

Biden Administration

- Climate change is a top priority for Biden and Congress
- Direct Federal procurement?
  - National parks, military bases, other federal projects?
- Other Federal Legislation
  - Highway funding could be tied to greenhouse gas emissions and “low carbon” materials
- Federal policy expected to clarify in 2022



THE WHITE HOUSE

MENU

BRIEFING ROOM

Executive Order on Tackling the Climate Crisis at Home and Abroad

JANUARY 27, 2021 • PRESIDENTIAL ACTIONS

The United States and the world face a profound climate crisis. We have a narrow moment to pursue action at home and abroad in order to avoid the most catastrophic impacts of that crisis and to seize the opportunity that tackling climate change presents. Domestic action must go hand in hand with United States international leadership, aimed at significantly enhancing global action. Together, we must listen to science and meet the moment.

By the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

PART I — PUTTING THE CLIMATE CRISIS AT THE CENTER OF UNITED STATES FOREIGN POLICY AND NATIONAL SECURITY

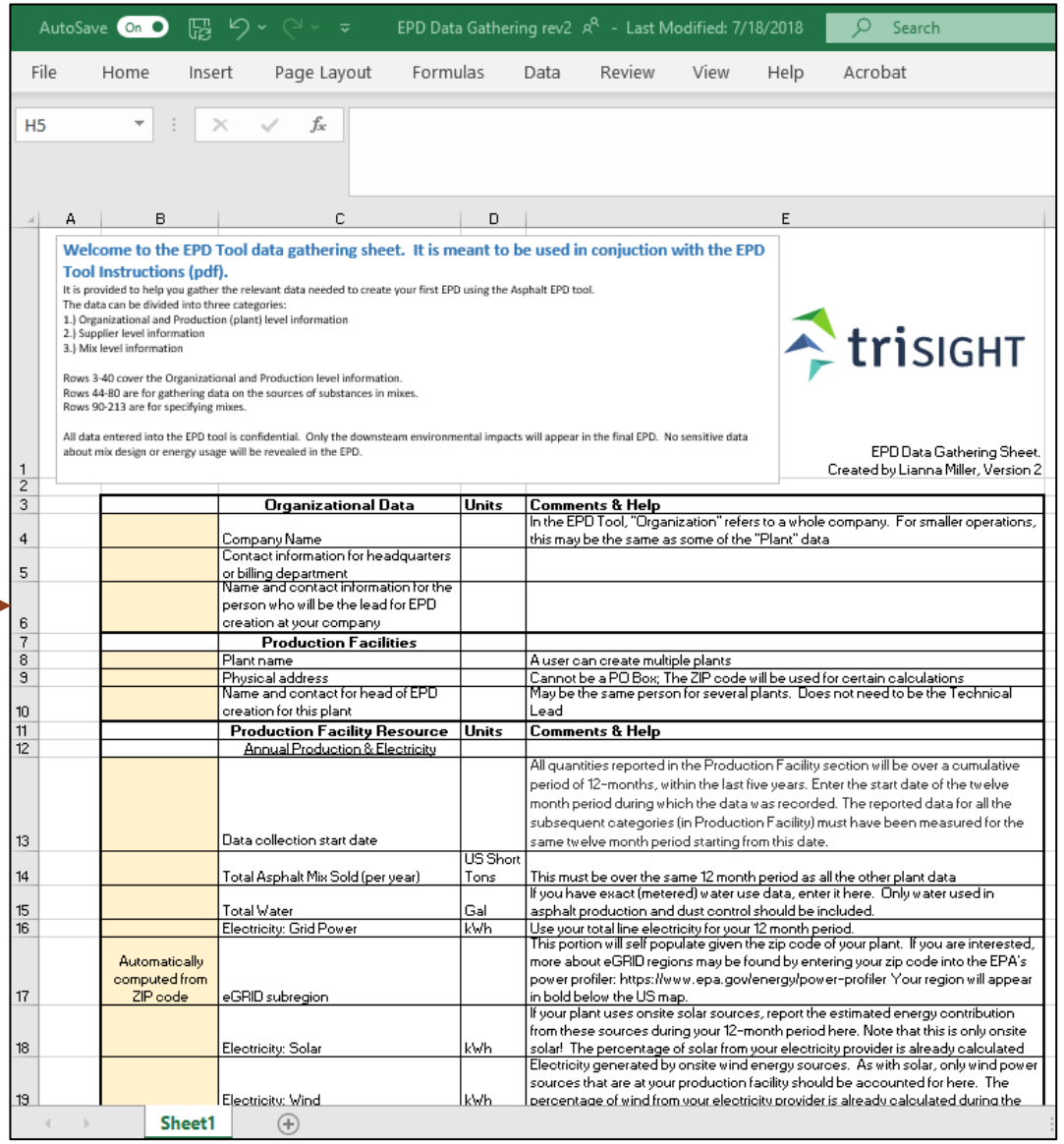
https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/

2017 – Launched the Emerald Eco-Label Environmental Product Declaration (EPD) Program

- NAPA is the EPD program operator
- Developed all materials:
  - Product Category Rules
  - Life Cycle Assessment
  - EPD Software
- Inexpensive and easy to develop verified EPDs

How to use Emerald Eco-Label

- **Visit** https://asphaltepd.org/ and login
- **Watch two webinars** and pass the quizzes
- **Compile data** for plant and mixes
  - Use EPD Data Gathering spreadsheet
- **Purchase access** for your plant(s)
- **Enter data** for plant and mixes to produce EPDs



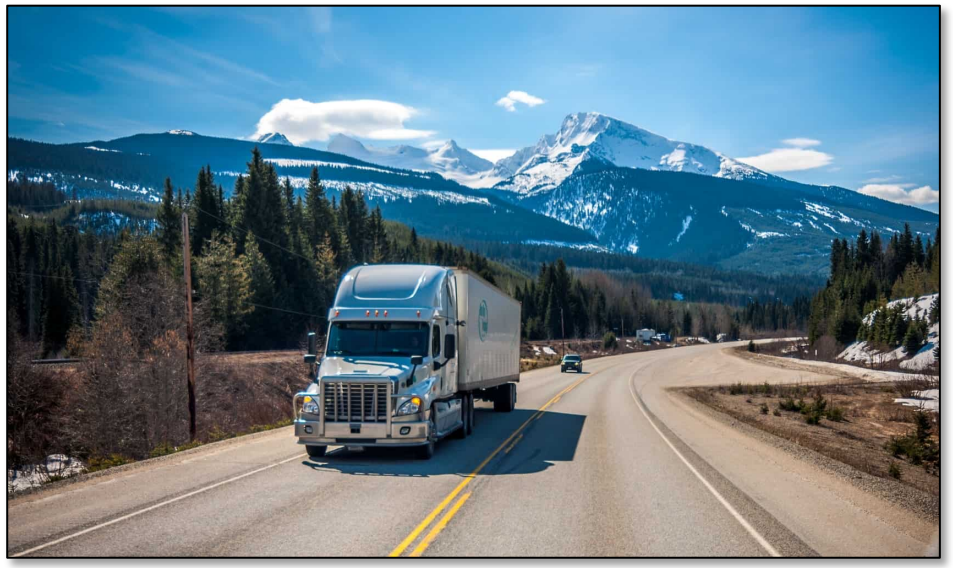
www.AsphaltPavement.org/EPD

Can EPDs for Asphalt Mixtures be Compared to Each Other?

Emerald ECO LABEL

EPDs for different asphalt mixtures are comparable if:

- They perform a similar function and have similar performance characteristics



Examples of mixes that should not be compared to each other:

- Porous vs. dense-graded
- Binder mix vs. surface mix

Beware of data gaps!

EPD Optimizer Tool

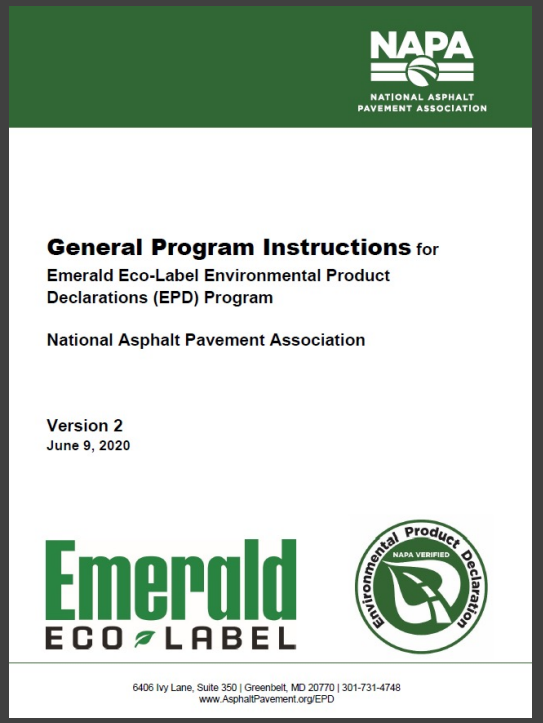
- Easily **compare** two of your own mixes to each other
- More **granular analysis** of data
- Create **plant variants** to see how changes to plant operations affect EPDs
- Evaluate **economic** and **environmental** impacts of certain changes
  - Switching fuel types
  - Aggregate moisture reduction

Emerald ECO LABEL OPTIMIZER BETA

Overview of Using Emerald Eco-Label to Develop an EPD for Asphalt Mixtures

Key Components of NAPA's EPD Program

General Program Instructions


NATIONAL ASPHALT PAVEMENT ASSOCIATION

General Program Instructions for
Emerald Eco-Label Environmental Product Declarations (EPD) Program

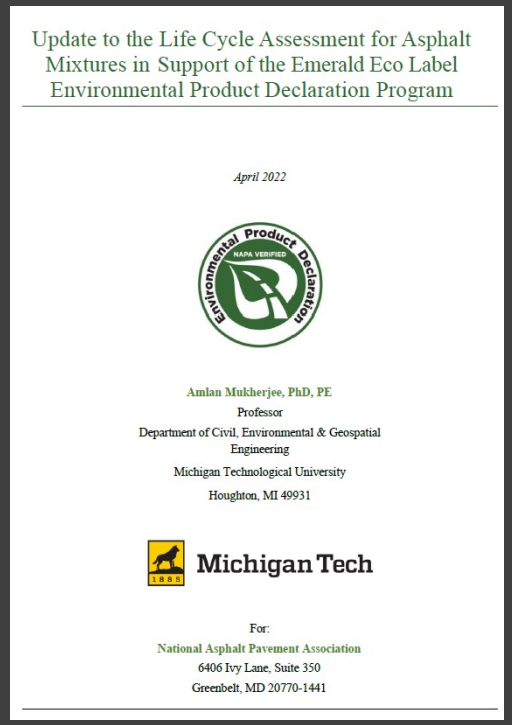
National Asphalt Pavement Association

Version 2
June 9, 2020

Emerald ECO LABEL

6406 Ivy Lane, Suite 350 | Greenbelt, MD 20770 | 301-731-4748
www.AsphaltPavement.org/EPD

Underlying Life Cycle Assessment


Update to the Life Cycle Assessment for Asphalt Mixtures in Support of the Emerald Eco Label Environmental Product Declaration Program

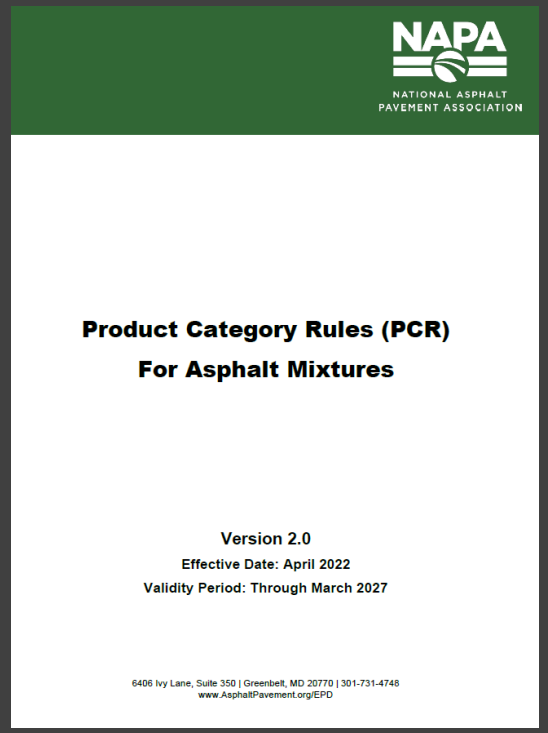
April 2022

Amlan Mukherjee, PhD, PE
Professor
Department of Civil, Environmental & Geospatial Engineering
Michigan Technological University
Houghton, MI 49931

Michigan Tech

For:
National Asphalt Pavement Association
6406 Ivy Lane, Suite 350
Greenbelt, MD 20770-1441

Product Category Rules (PCR)

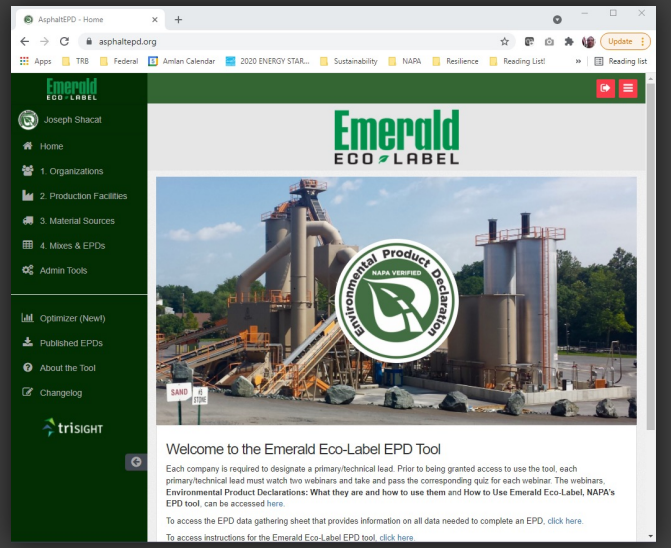

NATIONAL ASPHALT PAVEMENT ASSOCIATION

Product Category Rules (PCR)
For Asphalt Mixtures

Version 2.0
Effective Date: April 2022
Validity Period: Through March 2027

6406 Ivy Lane, Suite 350 | Greenbelt, MD 20770 | 301-731-4748
www.AsphaltPavement.org/EPD

EPD Software



Learn more at www.asphaltpavement.org/epd

Emerald Eco-Label Software

- NAPA's web-based **software tool**
- Asphalt mix producers use it to develop **verified EPDs**
- EPDs are **plant-specific** & **mix-specific**
- Can be used for **asphalt plants** located in the U.S.
- **Simplified process** that saves mix producers time and money

Independent Verification

Upstream datasets

- **The PCR requires the use of public datasets for upstream energy and materials**
  - Fuels and electricity
  - Aggregates
  - Asphalt binder
- **Data gaps are noted in the EPD**
  - Binder additives (polymers, ground tire rubber, etc.)
  - Mix additives (WMA, rejuvenators, fibers, etc.)
- **Cannot develop EPD if data gap >1% (individual material) or 5% (total) of mix by weight**

FEDERAL LCA COMMONS

Cover Page

Company and Plant Information →

Product Description →

Red box indicates a data gap →

Green box has info about the EPD →

Emerald ECO LABEL

An Environmental Product Declaration (EPD) for Asphalt Mixtures

Company Information

Test Organization is an asphalt mixture producer.

Baseline Natural Gas asphalt plant

101 W Lakeshore Dr

Houghton, MI 49931

USA

[[Company_logo]]

Product Description

This EPD reports the potential environmental impacts and additional environmental information for an asphalt mixture, which falls under the United Nations Standard Products and Services Code 30111509. Asphalt mixtures are typically incorporated as part of the structure of a roadway, parking lot, driveway, airfield, bike lane, pedestrian path, railroad track bed, or recreational surface.

Mix Name: Baseline with Terminal Blended Binder Additive Data Gap

Specification Entity: DOT

Specification: N/A

Gradation Type: dense

Mix Design Method: None

Nominal Maximum Aggregate Size: 0.75 inches

Performance Grade of Asphalt Binder: PG 64-22

Customer [Project/Contract] Number: Not Reported

This mix producer categorizes this product as a Hot Mix Asphalt (HMA) asphalt mixture. This asphalt mixture was produced within a temperature range of 149 to 154°C (300.0 to 310.0°F). Energy and environmental impacts are based on a plant's average performance ov a 12-month period and are not adjusted for mix-specific production temperatures.

Data Completeness Statement: Upstream data for one or more of the ingredients representing less than 1% (individually) or 5% (total) of the total mass of this asphalt mixture is not available. The upstream environmental impacts associated with manufacturing these ingredients are not accounted for in this EPD. See Table 1 for more information.

Environmental Product Declaration — NAPA VERIFIED

This declaration is an EPD in accordance with ISO 14025:2006[1] and ISO 21930:2017[2]. The PCR is *Product Category Rules for Asphalt Mixtures*[3,4]. This EPD transparently describes the potential environmental impacts associated with the identified life cycle stages of the described product.

Declaration Number: 1.145.302 v4 **Software Version:** 2.0.0

Date of Issue: March 16, 2022 **Period of Validity:** March 31, 2027

This EPD is valid for asphalt mixtures produced at the location indicated on this page. Data used to inform this EPD reflect plant operations from a 12-month period beginning on March 8, 2021.

This EPD can be found at http://dev.asphaltepd.org/epd/d/495/

LCA performed by: Ben Ciavola, PhD

Common Questions About EPDs

What is the time and cost of developing EPDs?

Pricing Schedule as of Apr. 1, 2022

Year	Member Rate	Non-member Rate	Years of Tool Access
2022	$3,000 per plant	$6,000 per plant	5
2023	$3,000 per plant	$6,000 per plant	4
2024	$2,750 per plant	$5,500 per plant	3
2025	$2,500 per plant	$5,000 per plant	2
2026	$2,250 per plant	$4,500 per plant	1

- **Initial data collection and plant setup takes most companies a couple of weeks**
- **New mixes typically take 10-15 minutes**

Does the EPD give credit for Warm Mix?

https://www.fhwa.dot.gov/publications/focus/08apr/03.cfm

- **What are the biggest contributors to GHG emissions?**
  - **Burner fuel** consumption
  - **Asphalt binder** content
  - Sometimes, **aggregate hauling** exceeds everything else

Can EPDs be Used for Pavement Type Selection?

- **Not directly – different PCRs**
- **As data inputs to full LCA?**
  - Harmonization issues
  - Lots of uncertainty in use stage modeling
  - Scarce knowledge, experience, and capacity at agencies

Where are we going with EPDs?

Policy Considerations

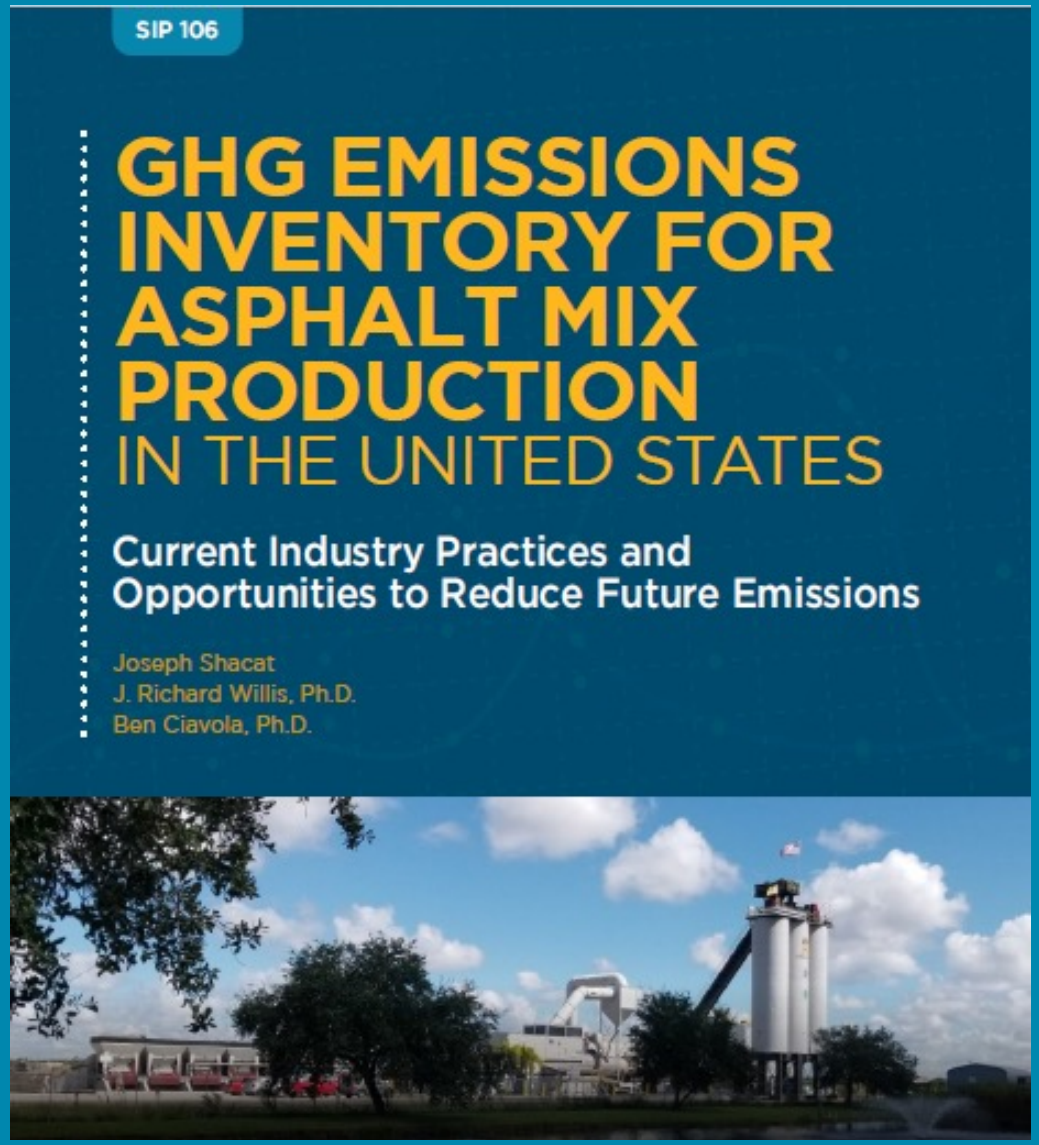
- **Each agency spec is a different "product"**
- **GWP Limits/Benchmarks/Thresholds**
  - Prequalification?
  - Incentive?
  - A + B + C?
- **Regional variations**
  - Climate
  - Aggregate supply
  - Availability of fuels / grid location
- **Impact of getting better data**
  - GWP may go up or down

The Report – SIP 106

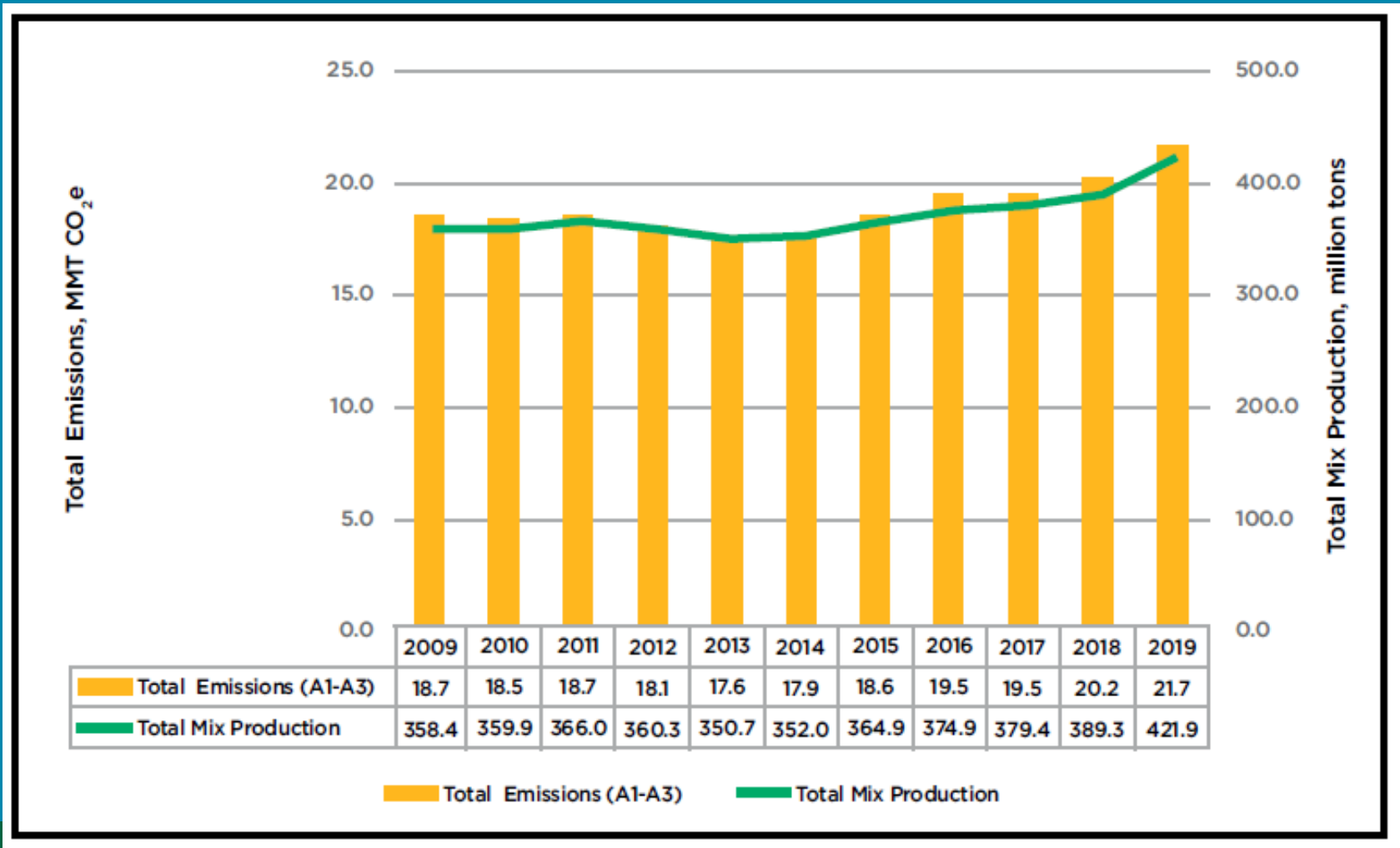
- Published by NAPA in June 2022

www.asphaltpavement.org/climate

- Click on the Research link
- All references cited in this presentation are provided in the report



Total emissions have tracked with mix production



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total Emissions (A1-A3)	18.7	18.5	18.7	18.1	17.6	17.9	18.6	19.5	19.5	20.2	21.7
Total Mix Production	358.4	359.9	366.0	360.3	350.7	352.0	364.9	374.9	379.4	389.3	421.9

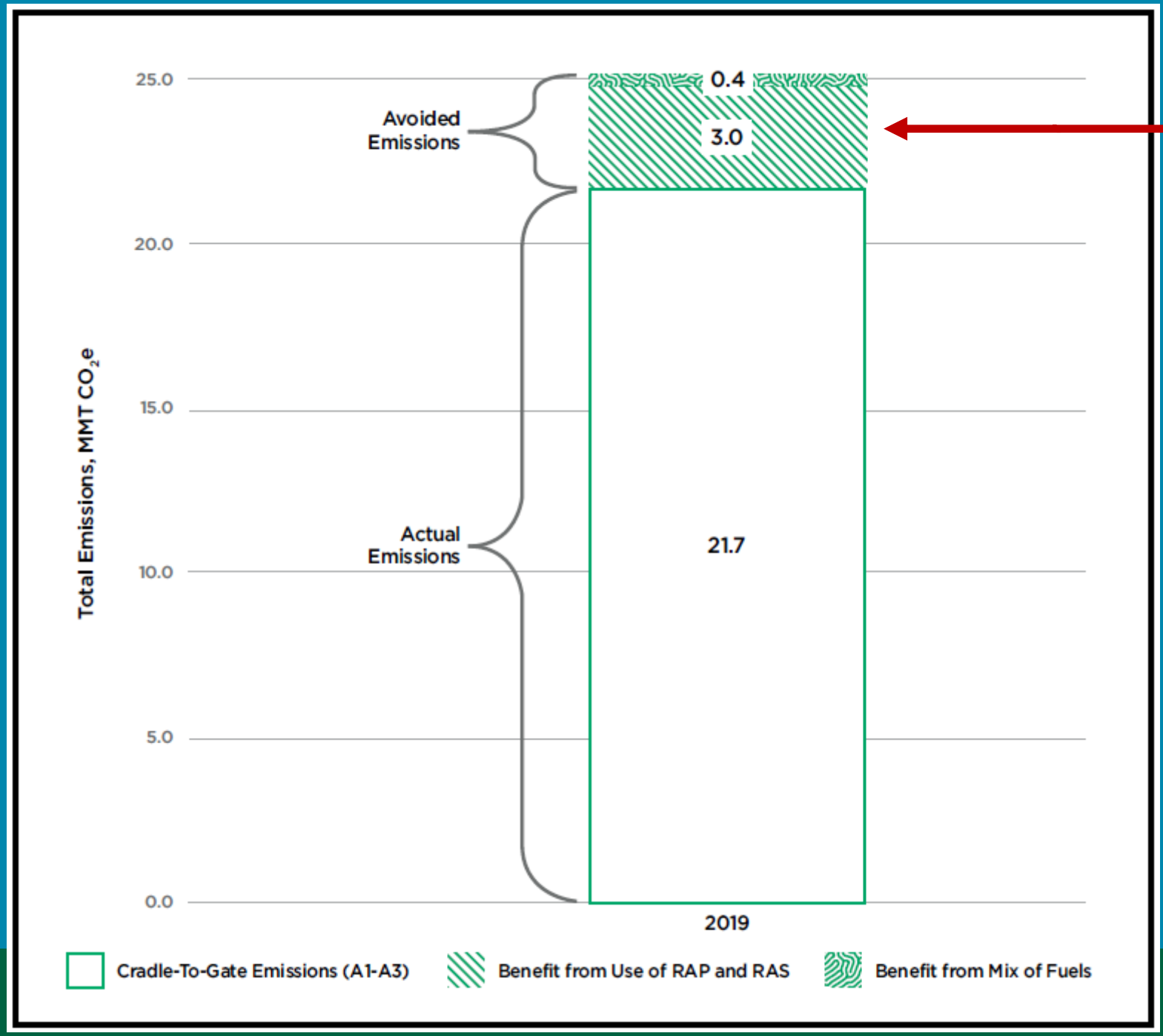
- **Production** increased by 17.7%
- Total **GHG emissions** increased by 16%

General Observations

- Emissions Intensity and total emissions were lowest in 2012-2015
  - Highest consumption of natural gas (2014)
  - Highest use of RAS (2014)
  - Lower use of modified binder
  - Lower total mix production
- Not enough data to see changes in energy efficiency over time

Scenarios to Quantify Benefits of Existing Practices (2019)

- What if no RAP or RAS were used?
- What if the industry's use of natural gas were equivalent to the industrial sector as a whole?
  - 51.7% instead of 69.5%
  - Adjust other fuels proportionately



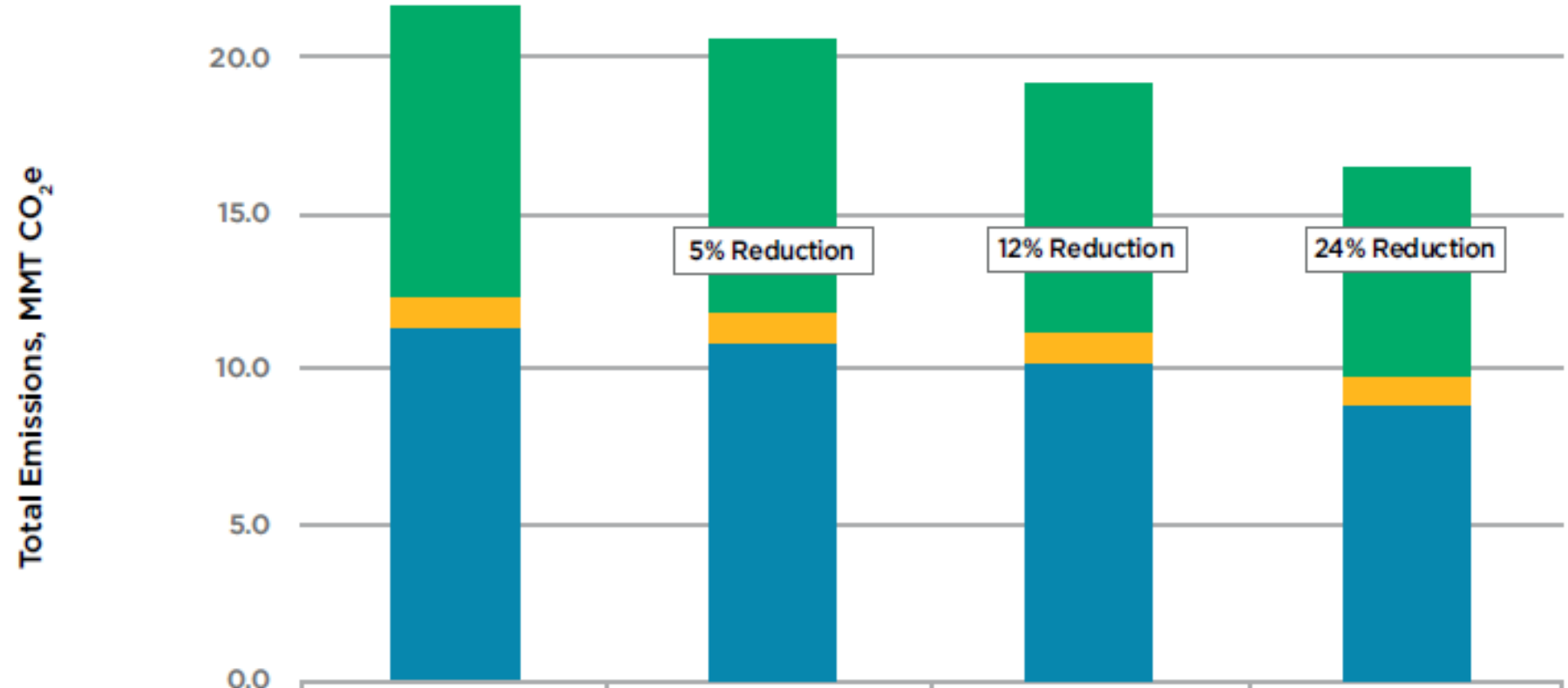
Emissions would be 16% higher if we:

- Used no RAP or RAS, and
- Burned less natural gas

Emissions Reduction Scenarios

Parameter	2019 Baseline	Short-Term	Intermediate	Long-Term
RAP Content	21%	25%	30%	40%
Natural Gas Consumption as Percentage of Fuel Combusted	69%	72%	75%	90%
Aggregate Moisture Content Reduction	N/A	0.25%	0.50%	1.0%
Asphalt Mix Production Temperature Reduction	N/A	10 °F	25 °F	40 °F
Reduction in Electricity Consumption Intensity	3.32 kWh/ton	5%	10%	20%

Results - Emissions Reduction Scenarios



	2019 Baseline	Short	Intermediate	Long-Term
Total (A1-A3)	21.7	20.6	19.1	16.5
Mix Production (A3)	9.4	8.8	8.0	6.8
Transportation (A2)	1.0	1.0	1.0	0.9
Raw Materials (A1)	11.3	10.8	10.1	8.8

General Observations

- The good news:
  - We can reduce GHG emissions (relative to 2019) by 24% with existing technologies and practices!
- Challenges to achieving GHG reductions:
  - Policy & Economic Headwinds
- Opportunities to address challenges
  - Inflation Reduction Act (IRA), others

Policy Headwinds – Use of RAP

- Mix specifications that limit RAP use
  - Need to revise hundreds (thousands?) of agency specifications
  - Slow process due to conservative, risk-averse approach
  - Balanced Mix Design (BMD) offers an opportunity to accelerate innovation
- Some agencies retain ownership of RAP
  - Not the highest and best use
  - Consider allowing contractor to retain ownership and recycle into new mixes

Economic Headwinds

Low bid environment

- High capital costs
  - Covering aggregate stockpiles
  - Plant upgrades for higher RAP
- Higher operating costs for some solutions
  - Alternative fuels at remote locations)
- Balancing risk and reward
  - Fuel savings for reduced mix production temperature vs. achieving density requirements/incentives

Potential Opportunities with Inflation Reduction Act

Funding for Low-Embodied Carbon Construction Materials

- $2 billion available to pay for differential cost or project incentive
- $250 million to help industry develop EPDs
- $100 million to develop a “low-embodied carbon construction materials” labeling program
  - How will be these defined?
  - Limitations to recognizing some emissions reductions on EPDs (e.g., mix-specific temperature adjustment, 12 months of data to recognize new fuels)

THANK YOU

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PAVEMENT ASSOCIATION