

Advancing Low-Carbon Materials

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Unless otherwise noted, FHWA is the source for all images in this presentation.

Acronyms

- EPD Environmental Product Declaration
- GPP Green Public Procurement
- GWP Global Warming Potential
- ISO International Organization for Standardization
- LCA Life Cycle Assessment
- LCTM Low-Carbon Transportation Material
- SPP Sustainable Pavements Program

Agenda

Low-Carbon Materials

- What?
- Why?
- How?
- What's next?

What is a Low-Carbon Material?



Resource: Low-Carbon Materials Tech Brief https://www.fhwa.dot.gov/lowcarbon/resources_lcm.pdf

What is a Low-Carbon Material?

Examples

Strategies to Reduce GHG

- Develop or update performance-based specifications to facilitate the use of proven innovations such as optimized mixtures and alternative sourcing
- Optimize the use of recycled content such as reclaimed asphalt pavement (RAP) and recycled asphalt shingles (RAS)
- Develop requirements for collecting documentation of materials' GWP emissions
- Encourage industry strategies such as optimizing energy usage at manufacturing facilities



What is a Low-Carbon Material?

EPDs

- Communicate environmental impacts of material or product
- Express the results of an LCA
- Developed with stakeholder input
- Follow industry standards described in the Product Category Rule

Resource: Low-Carbon Materials Tech Brief

https://www.fhwa.dot.gov/lowcarbon/resources_lecm.pdf



An Environmental Product Declaration (EPD) for Asphalt Mixtures

Company Information
Solterra Materials LLC is an asphalt mixture producer.
Buckeye Plant asphalt plant
16402 S Turville Rd
Buckeye, AZ 85326
USA



IMPACT CATEGORY	POTENTIAL IMPACT PER METRIC TONNE ASPHALT MIXTURE (PER TON ASPHALT MIXTURE)
Global warming potential (GWP-100)	71.05 (64.46) kg CO ₂ Equiv.

Nominal Maximum Aggregate Size: 0.75 inches
Performance Grade of Asphalt Binder: PG 70-10
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 162 to 168°C (324.0 to 335.0°F). Energy and environmental impacts are based on a plant's average performance over a 12-month period and are not adjusted for mix-specific production temperatures.



This declaration is an EPD in accordance with ISO 14025:2006¹ and ISO 21930:2017². The PCR is Product Category Rules for Asphalt Mixtures³. This EPD transparently describes the potential environmental impacts associated with the identified life cycle stages of the described product.

Declaration Number: 44.130.307 v1 **Software Version:** 2.0.0
Date of Issue: April 29, 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 Jan. 1, 2021.

This EPD can be found at <https://asphalt.epd.org/epd/t/KoUvK/>
LCA performed by: Ben Ciavola, PhD

Source: NAPA

What is a Low-Carbon Material?

GWP Thresholds

- Serve as the maximum acceptable limit to qualify construction materials
- Established by a public agency
- Use data from verified sources
- Follow accepted common practices established by the ISO

Table 1. Threshold values by state for four asphalt mix functional categories

State	Typical Sub-Surface Mixes Characterized by Unmodified Binder and NMAS* > 12.5 mm			Typical Surface Mixes Characterized by Unmodified Binder and NMAS ≤ 12.5 mm			Typical Sub-Surface Mixes Characterized by Modified Binder and NMAS > 12.5 mm			Typical Surface Mixes Characterized by Modified Binder and NMAS ≤ 12.5 mm		
	20th percentile	40th percentile	Better than Average	20th percentile	40th percentile	Better than Average	20th percentile	40th percentile	Better than Average	20th percentile	40th percentile	Better than Average
	GWP (kgCO ₂ eq/tonne mix)			GWP (kgCO ₂ eq/tonne mix)			GWP (kgCO ₂ eq/tonne mix)			GWP (kgCO ₂ eq/tonne mix)		
AL	46.07	53.50	60.80	51.23	59.85	65.96	54.42	62.20	69.80	58.96	66.83	74.72
AR	44.90	53.07	59.23	50.06	59.42	64.39	53.25	61.77	68.23	57.79	66.40	73.15
CA	38.60	45.23	51.38	43.76	51.58	56.54	46.95	53.93	60.38	51.49	58.56	65.3
CO	40.98	46.6	55.55	46.14	52.95	60.71	49.33	55.3	64.55	53.87	59.93	69.47
CT	41.34	46.43	50.14	46.50	52.78	55.30	49.69	55.13	59.14	54.23	59.76	64.06
FL	51.60	74.94	107.13	56.76	81.29	112.29	59.95	83.64	116.13	64.49	88.27	121.05
HI	83.21	103.76	138.91	88.37	110.11	144.07	91.56	112.46	147.91	96.10	117.09	152.83
IL	43.46	47.09	49.70	48.62	53.44	54.86	51.81	55.79	58.70	56.35	60.42	63.62

Resource: Development and Use of Embodied Carbon Benchmarks for Setting GWP Thresholds for the LCTM Program https://www.fhwa.dot.gov/lowcarbon/Embodied_Carbon_Benchmarks_Tech_Brief.pdf

Why Low-Carbon Materials?



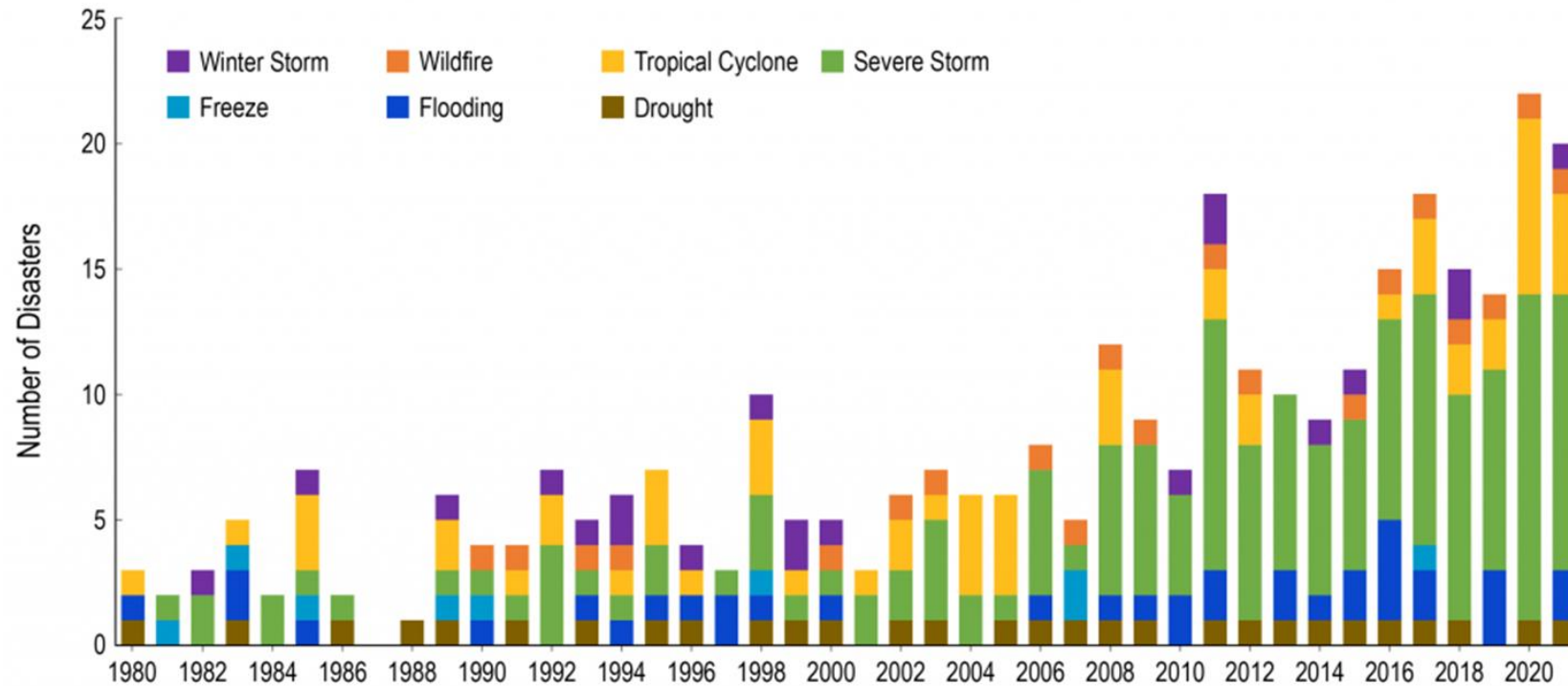
The Pursuit of Sustainable Thinking

“Minimize environmental impacts while maximizing economic benefits and ensuring equitable social outcomes”

Resulting in cost and environmental-effective, long-lasting, well-performing infrastructure

Why Sustainability?

U.S. Billion-Dollar Disaster Event Types by Year



Source: globalchange.org

Why Sustainability?

- **Extreme weather events** occurring with higher frequency and higher intensity.
- Agencies are focusing on **resilience** to deal with these changes.
- Focus needed on mitigation to curb emissions that cause these weather events, thus the need for **sustainability**.

Why Sustainability?

Embodied Carbon of Construction Materials

- U.S. manufacturing sector is responsible for nearly a third of annual U.S. GHG emissions
- Production of asphalt, concrete, flat glass, and steel account for nearly half of all U.S. manufacturing GHG emissions.
- Reducing these emissions is a critical piece of reducing emissions in the Federal supply chain.

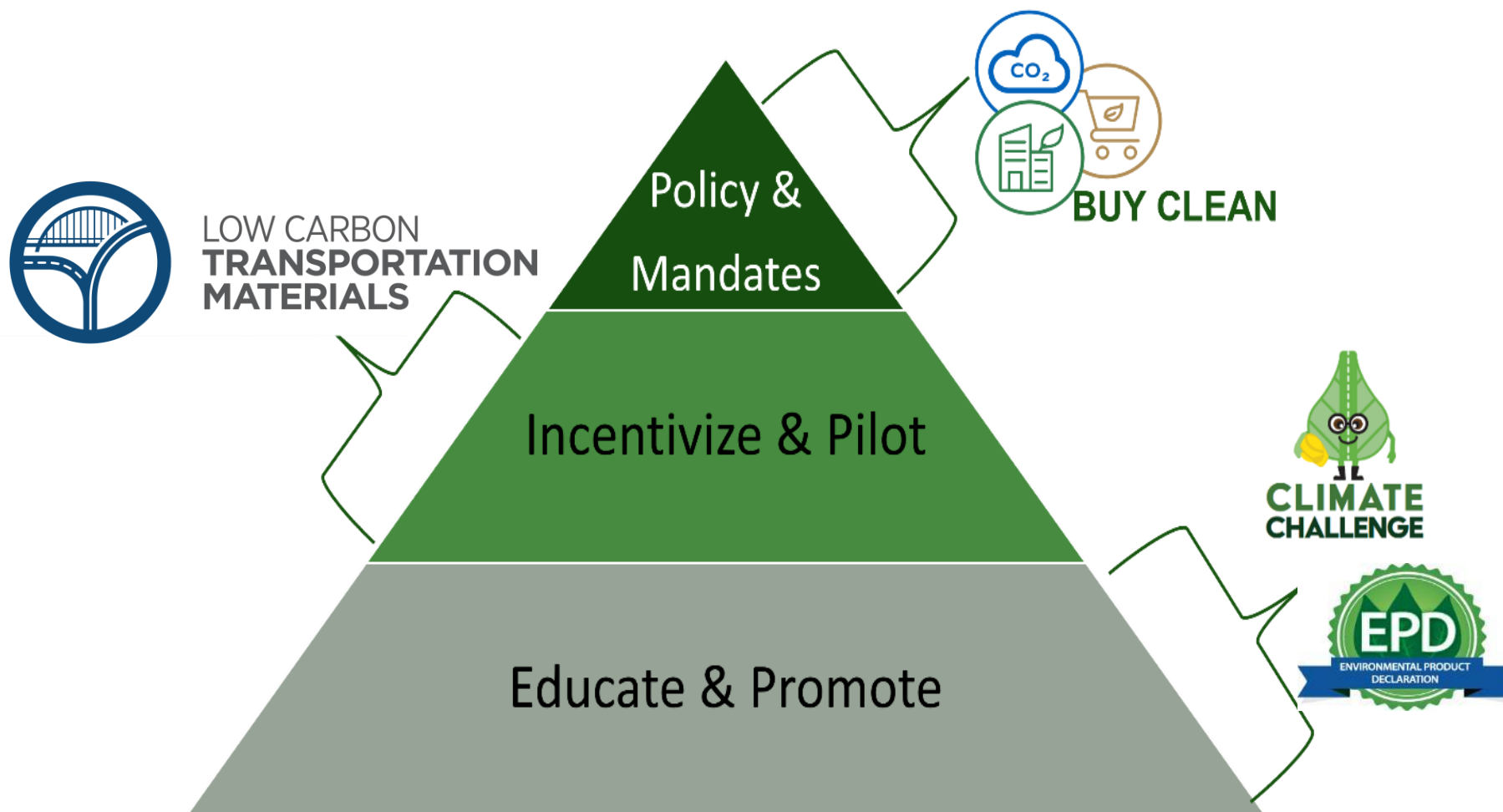
Government Procurement

- U.S. federal government is world's largest purchaser of goods and services (\$650B+/year)
- ~32% of construction-related embodied carbon in U.S. is from government funded projects
- Intent to prioritize the use of American-made, low carbon construction materials for consideration in Federal Government procurement and federally-funded projects

How are we implementing Low-Carbon Materials?



FHWA building-block approach to achieve a Sustainable Transportation Infrastructure



What's next for Low-Carbon Materials?



Green Public Procurement (GPP)

The practice by public authorities of sourcing goods, services, or works with reduced environmental impact.

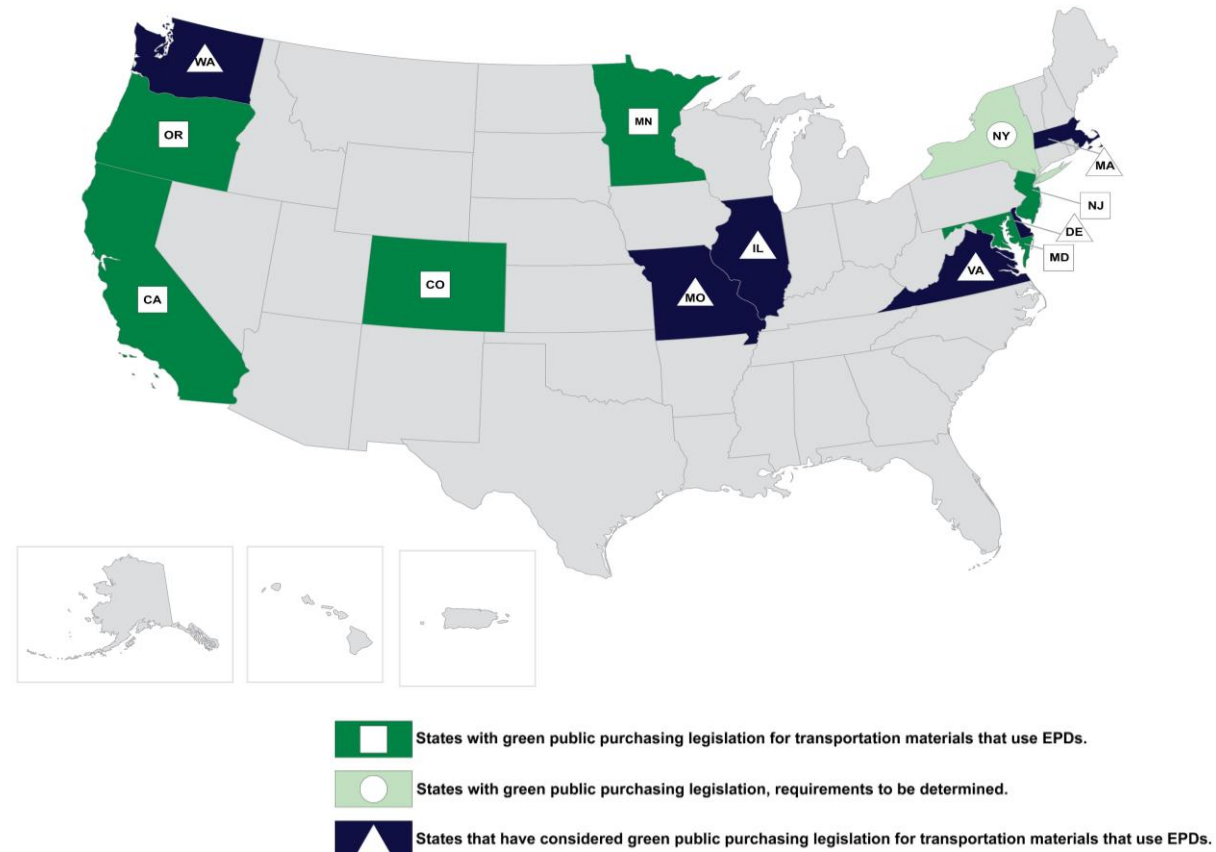
- *U.S. Environmental Protection Agency (EPA)*



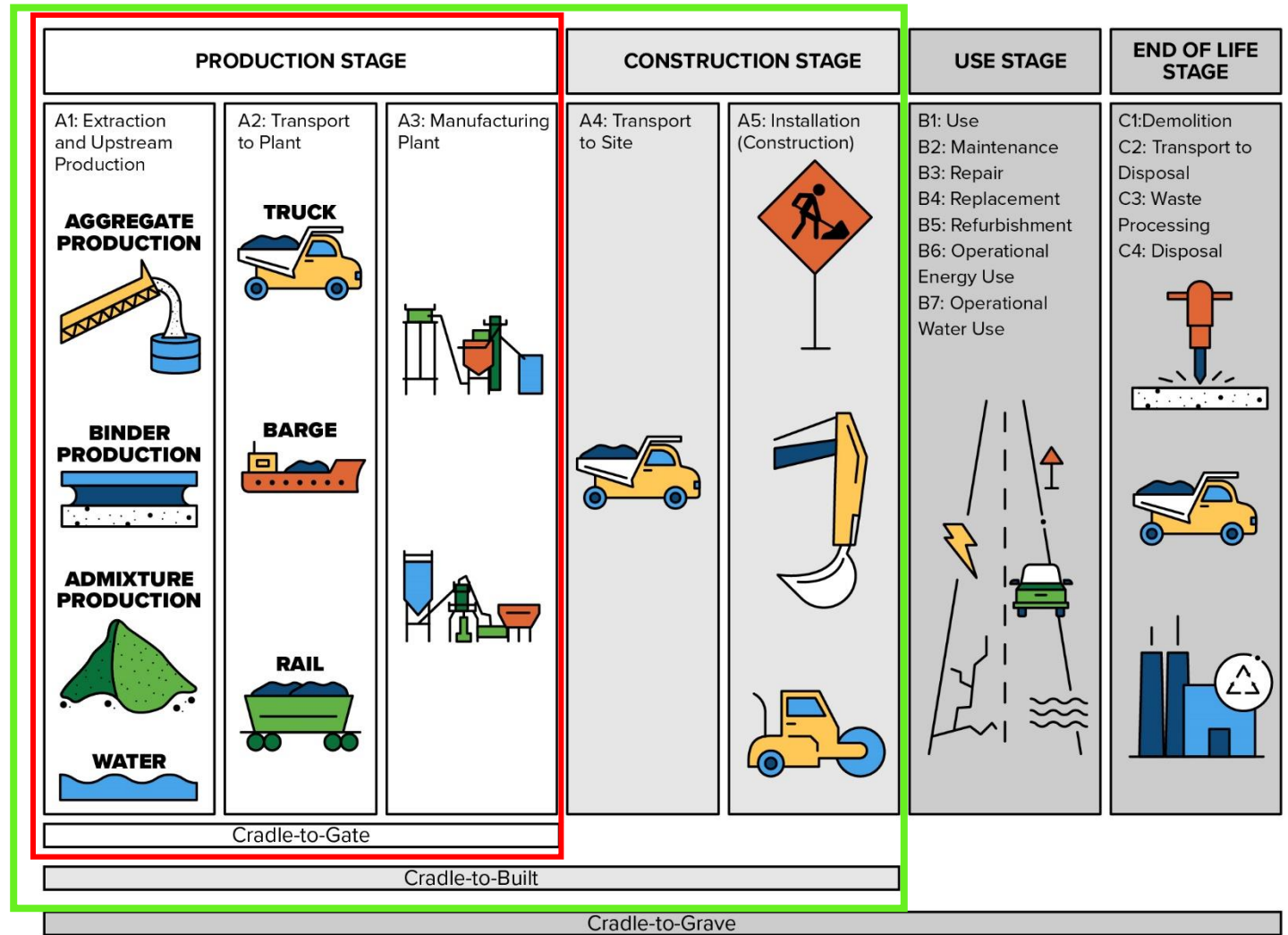
Buy Clean Policies

A procurement policy to promote the purchase of construction materials and products with lower embodied greenhouse gas (GHG) emissions, taking into account the life-cycle emissions associated with the production of those materials.

Source: <https://www.sustainability.gov/buyclean/>



Whole Life LCA Framework for Pavements



Common Life Cycle Stages and Informational Modules for Asphalt/Concrete Pavement Systems

Collaboration is Key!

Sustainable Pavements Technical Working Group



Resources - Sustainable Low-Carbon Technical Support Center

Mission: Support state and local highway agencies in quantifying, documenting, demonstrating, and promoting the sustainability benefits and co-benefits of low-carbon transportation materials through training, technical assistance, and technical guidance.

Focus areas: EPDs, EPA Interim Determination, benchmarking, green public procurement

For more information, visit the website:

<https://www.fhwa.dot.gov/pavement/sustainability/lowcarbontsc.cfm>



FHWA Sustainability Resources

<http://www.fhwa.dot.gov/pavement/sustainability>



Education

[Community of Knowledge
Webinars](#)

[Sustainable Pavements Technical
Working Group](#)

[Low-Carbon Materials Tech Brief
Tech briefs, Studies, Webinars](#)



Research

[EPDs in Green Public Procurement](#)

[LCA of recycled plastics in pavements](#)

[LCA of ground tire rubber in pavements](#)



Deployment

[LCAPave Tool](#)

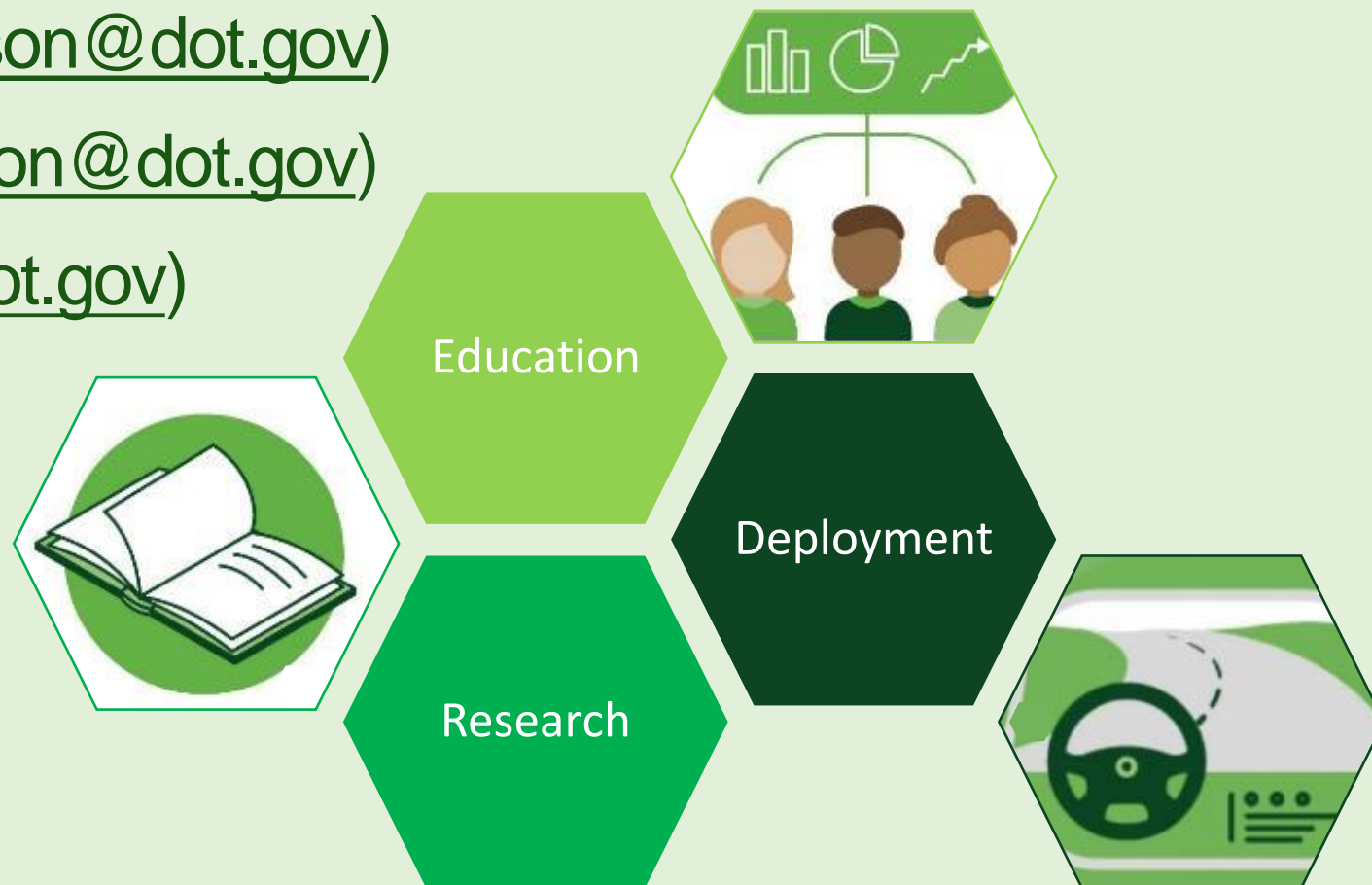
[Climate Challenge
EDC-7 EPDs for Sustainable Project
Delivery](#)

[Low-Carbon Transportation Materials Grant
Program](#)

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<http://www.fhwa.dot.gov/pavement/sustainability>