FHWA Wisconsin Division

FHWA Wisconsin Division Update

WAPA Conference 2022

U.S. Department of Transportation
Federal Highway Administration

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Pavement and Materials / Asset Management Engineer

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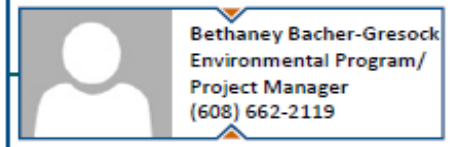

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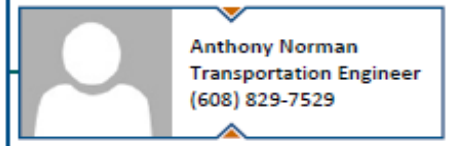

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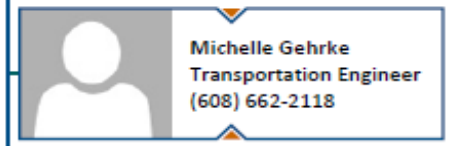

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[Wisconsin Division / FHWA (dot.gov)]

[https://www.usajobs.gov]

Build America, Buy America (BABA)

- SEC. 70914 of the Bipartisan Infrastructure Law (BIL)
- *(a) IN GENERAL.—Not later than 180 days after the date of enactment of this Act, the head of each Federal agency shall ensure that none of the funds made available for a Federal financial assistance program for infrastructure, including each deficient program, may be obligated for a project unless* ***all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States.*** *(emphasis added)*

FHWA's Existing General Applicability Waivers

- Per OMB Memo M-22-11 of April 18, 2022, all existing, non-product specific general applicability waivers that were issued more than five years before passage of BIL must be reviewed via Federal Register by November 15, 2022.
- FHWA has four general applicability waivers:
  - **Manufactured products**
  - Raw materials
  - Ferryboat parts
  - Concrete poles for Guam

What is a Construction Material?

According to OMB Memorandum M-22-11, “Construction materials” includes an article, material, or supply —other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives —that is or consists primarily of:

- **Non-ferrous metals;**
- **Plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables);**
- **Glass (including optic glass);**
- **Lumber; or**
- **Drywall.**

Construction Materials (cont'd.)

- The list of construction materials is an exclusive list. Most other items are to be treated as either steel/iron items or manufactured products.
- Pending issuance of final standards from OMB, agencies should consider "all manufacturing processes" for construction materials to include at least the final manufacturing process and the immediately preceding manufacturing stage for the construction material. See OMB Memorandum M-22-11 of April 18, 2022.

Construction Materials (cont'd.)

Items excluded from construction materials under OMB Memo M22-11:

- **An item of primarily iron or steel**
- **A manufactured product**
- **Cement and cementitious materials**
- **Aggregates such as stone, sand, or gravel**
- **Aggregate binding agents or additives**

Asphalt concrete pavement mixes are typically composed of asphalt cement (a binding agent) and aggregates such as stone, sand, and gravel. Accordingly, asphalt is also excluded from the term construction materials.

FHWA Pavement and Materials Program

P&M Vision:

Ensure that pavements are designed, constructed, preserved, and maintained to accommodate current and predicted traffic needs and consider economic, environmental, and social impacts throughout the pavement's life cycle.

Sustainable Pavements Program

SPP Goal:

To advance the knowledge and practice of designing, constructing, and maintaining more sustainable pavements through:

- Stakeholder engagement
- Education
- Development of guidance and tools

Sustainable Pavement Program - Sustainability - Pavements - Federal Highway Administration (dot.gov)

Sustainable Pavements Can…

1. Achieve the engineering goals (including performance)
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

Balance of the Triple Bottom Line

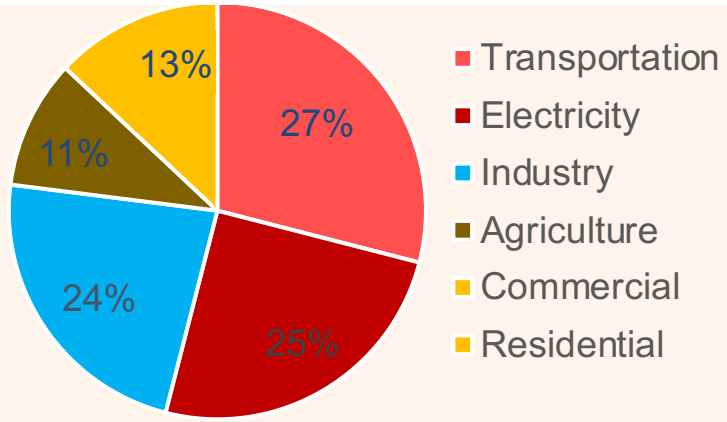
Image Source: FHWA/APTech

- **Economic:** Life Cycle Cost Analysis (LCCA) and Life Cycle Planning (LCP)
- **Environmental:** Life Cycle Assessment (LCA)
- **Social:** Sustainability Rating Systems (SRS) and Social LCA (SLCA)

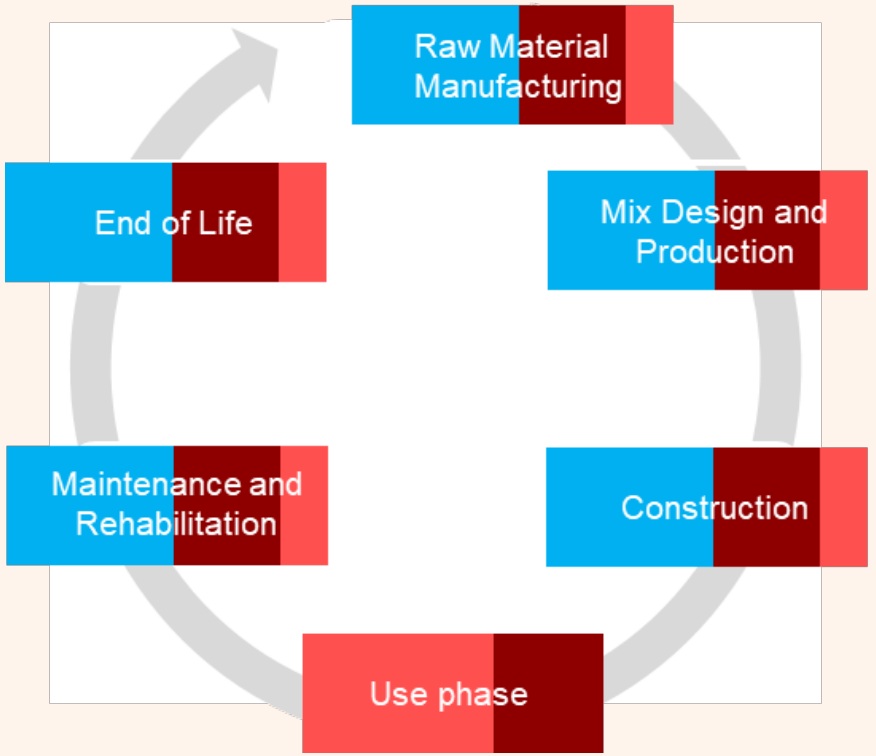
GHG Emissions in Infrastructure

- Pavements are the part of transportation system
  - A sector with high GHG emissions **(~27%)**
  - These estimates include operational emissions
  - State DOT can have decision-making influence over embodied emissions

2020 U.S. GHG Emission by Sector



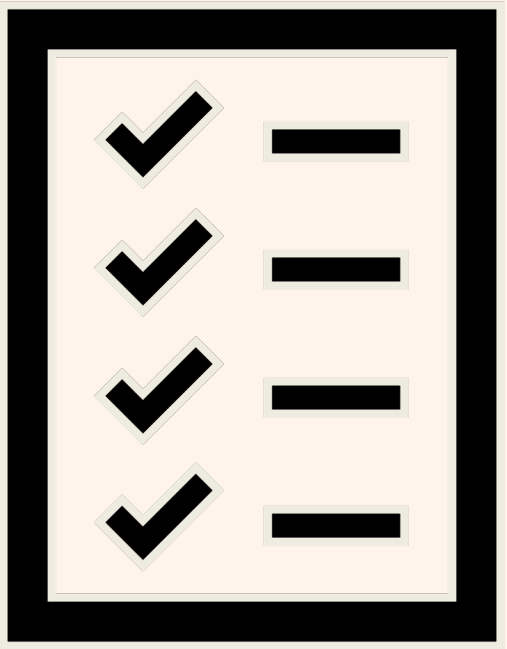
Pavement Life Cycle



Source: https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#colorbox-hidden

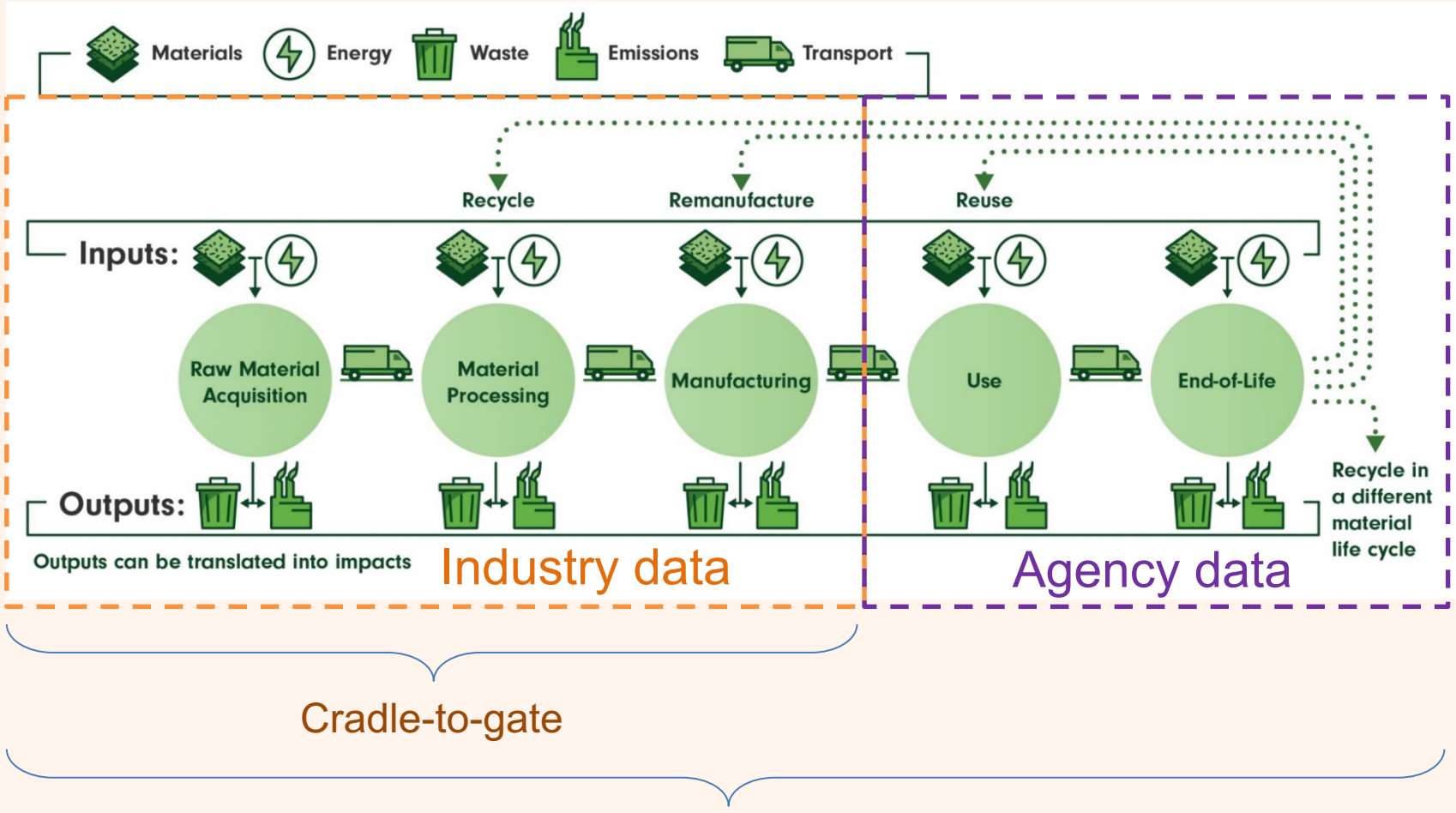
Product Category Rules (PCRs)

- PCRs are a set of rules, requirements, and guidelines for developing EPDs.
- **Rules provide a level playing field**, enabling proper comparison of materials of the same class (asphalt OR concrete).
- PCR serves as the “Standard test method” – similarly to how we measure density.



Life Cycle Assessment

- Technique to quantify environmental impacts of products and processes
- Track all inputs and outputs from the system over the life cycle
- Convert outputs into environmental impacts

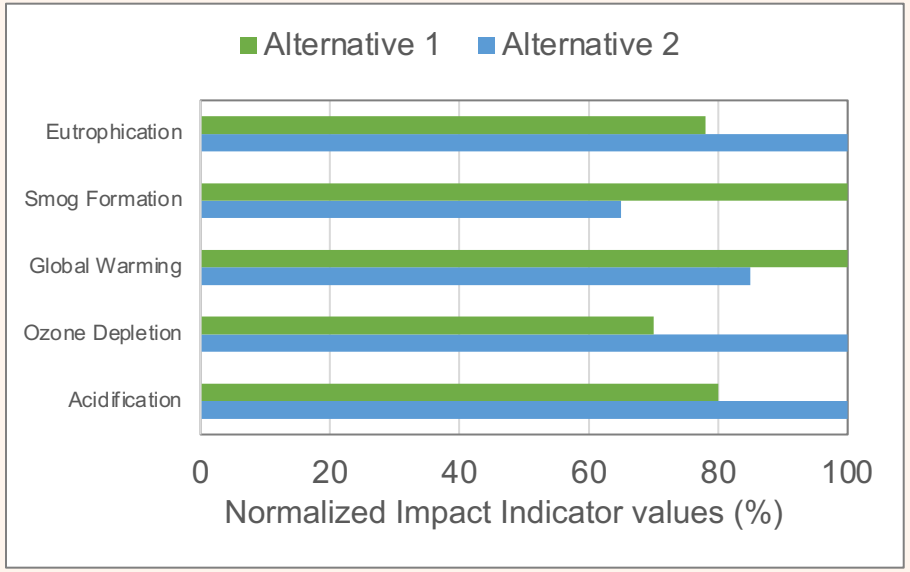


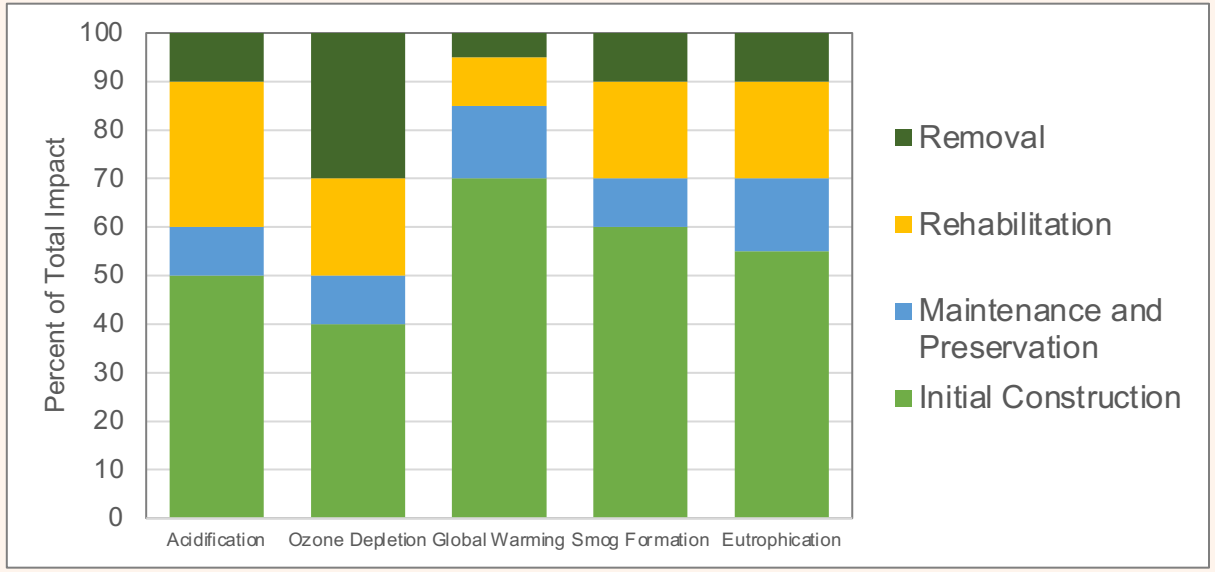
LCA Benchmarking Tool

- Created with stakeholder input
- Use the identified background datasets
- Incorporate material EPDs

LCA PAVE

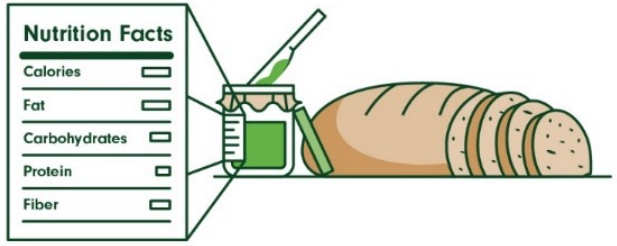
https://www.fhwa.dot.gov/pavement/lcatool/



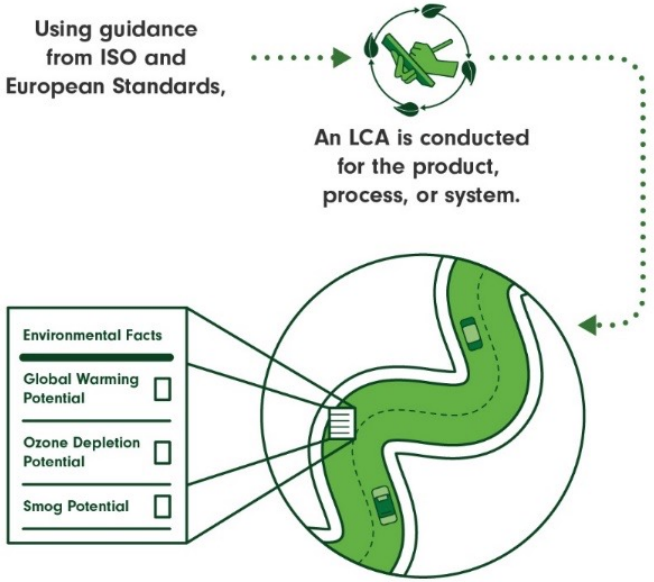


What Are EPDs?

- Communicate environmental impacts of material or product
- Express the results of an LCA
- Developed with stakeholder input
- Follow industry standards described in the PCR
- EPDs are not required by Federal law or regulation



Similar to nutrition labels for food products, EPDs communicate critical environmental information on pavement materials to the customer.



Potential Asphalt Pavement Sustainability Strategies

- Reduce virgin binder & aggregate content: ↑ recycle content
- Reduce transportation: in-place recycling, local materials
- Reduce production emissions: ↓ compaction temp, alternative energy sources
- Extend service lives: ↑ density, improved mix designs, rubber, polymer modified binder, prevent stripping

You can't improve what you don't measure!

New and Ongoing Initiatives

DOT – Policy Statement on Buy Clean Initiative

- September 15, 2022 – first Buy Clean Policy Statement.
  - DOT Embodied Carbon Working Group formed
- Commitment to assess and address the embodied carbon emissions from transportation projects
- Prioritize three actions
  - Use of EPDs
  - Develop a Buy Clean Policy
  - Education and Research commitments

Policy Statement on Buy Clean Initiative

On his first day in office, President Biden set an ambitious and historic goal: for the United States to reach net-zero emissions by 2050. Meeting that goal is a matter of our economic security, because we stand to gain millions of good-paying jobs by doing so and ensure American industry can outcompete and out-innovate the world. It is a matter of justice, because underserved populations are the hardest hit by the climate crisis. And it is, quite literally, a matter of life and death for the communities increasingly ravaged by hurricanes, droughts, wildfires, and more.

To reach net-zero emissions economy-wide, we must take a hard look at the transportation sector, which is responsible for more greenhouse gas (GHG) emissions in the United States than any other sector. At 33 percent of the nation's total, transportation produces more GHG emissions than homes and businesses, agriculture, and industry.

But this estimate does not even tell the whole story. The 33 percent statistic includes only the emissions that come from burning fossil fuels for things like our cars, trucks, ships, trains, and planes. In fact, the transportation sector has a significant impact on additional emissions that are typically associated with other sectors—particularly the emissions that come from manufacturing, installing, maintaining, and disposing of the materials that make up transportation infrastructure.

These emissions are what's called "embodied carbon emissions," and they stand to worsen the climate crisis, unless we work with our government partners, and with industry, to address them. **So today, as we work to implement President Biden's historic Bipartisan Infrastructure Law, which will modernize our infrastructure and create good paying jobs across the nation, the U.S. Department of Transportation will launch a Buy Clean Initiative that will assess and address the embodied carbon emissions that come from the engineering, design, construction, procurement, maintenance, and disposal of transportation projects.** Assessing and addressing these emissions will play an important role in fulfilling our commitment to making smart investments that help strengthen the economy and deliver a safe, affordable, reliable, equitable, and sustainable transportation system that serves all Americans.

In particular, the Department will prioritize three actions. One, the Department will explore the use of Environmental Product Declarations, which are transparent, verified reports used to communicate the environmental impacts of construction materials. Standardized reporting would help industry to confidently move forward in investing in the production of clean and reliable materials. Two, the Department will develop a Buy Clean policy based on those reports, to ensure that materials purchased with taxpayer dollars are serving the best interests of the American people, while also supporting job creation in sustainable industry. And three, the Department will prioritize education and research on embodied carbon emissions to ensure that we continue to drive down the emissions that come from the materials and processes used in transportation infrastructure. This effort is a key part of reaching the Administration's goal of net-zero emissions by 2050, and a 50-52% reduction in emissions by 2030.

Pete Buttigieg

Source: DOT-signed Policy

Buy Clean Policies at the State Level

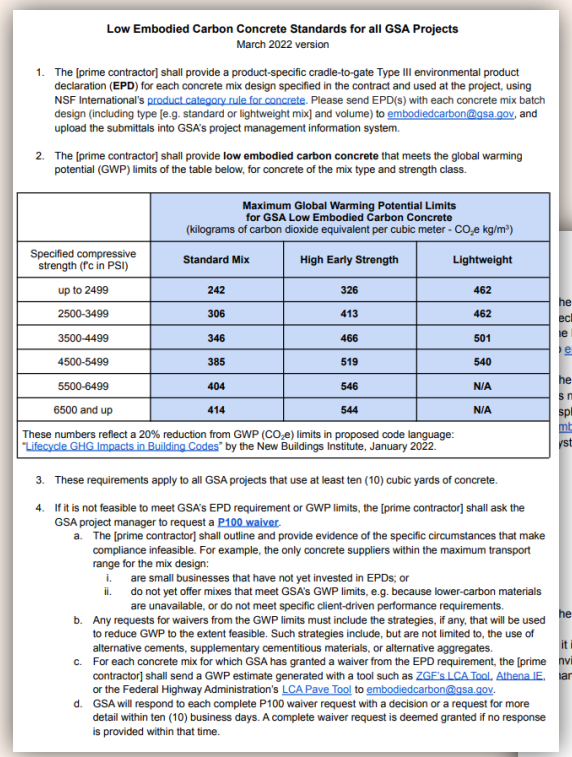
Information collected from state legislative websites.

States that legislated green public purchasing

States that have considered green public purchasing legislation in past 2 years

GSA – Lower Embodied Carbon Materials

- March 30, 2022 – GSA published Concrete and Asphalt Specifications requesting EPDs at installation
- Collaboration with FHWA SPP
- Waiver process require the use of tools such as the **FHWA LCA Pave Tool** to estimate GWP



Low Embodied Carbon Concrete Standards for all GSA Projects
March 2022 version

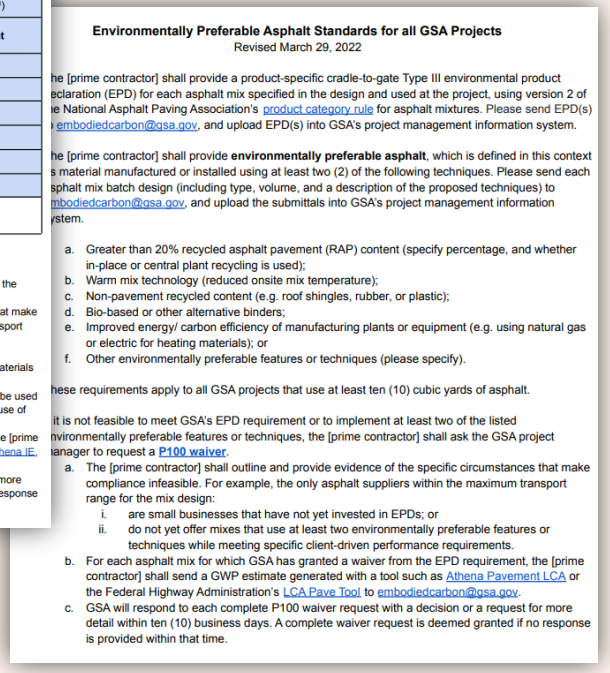
1. The [prime contractor] shall provide a product-specific cradle-to-gate Type III environmental product declaration (**EPD**) for each concrete mix design specified in the contract and used at the project, using NSF International's product category rule for concrete. Please send EPD(s) with each concrete mix batch design (including type [e.g. standard or lightweight mix] and volume) to embodiedcarbon@gsa.gov, and upload the submittals into GSA's project management information system.
2. The [prime contractor] shall provide **low embodied carbon concrete** that meets the global warming potential (GWP) limits of the table below, for concrete of the mix type and strength class.

	Maximum Global Warming Potential Limits for GSA Low Embodied Carbon Concrete (kilograms of carbon dioxide equivalent per cubic meter - CO_2e kg/m³)		
Specified compressive strength (f'c in PSI)	Standard Mix	High Early Strength	Lightweight
up to 2499	242	326	462
2500-3499	306	413	462
3500-4499	346	466	501
4500-5499	385	519	540
5500-6499	404	546	N/A
6500 and up	414	544	N/A

These numbers reflect a 20% reduction from GWP (CO_2e) limits in proposed code language: "Lifecycle GHG Impacts in Building Codes" by the New Buildings Institute, January 2022.

3. These requirements apply to all GSA projects that use at least ten (10) cubic yards of concrete.
4. If it is not feasible to meet GSA's EPD requirement or GWP limits, the [prime contractor] shall ask the GSA project manager to request a **P100 waiver**.
   a. The [prime contractor] shall outline and provide evidence of the specific circumstances that make compliance infeasible. For example, the only concrete suppliers within the maximum transport range for the mix design:
      i. are small businesses that have not yet invested in EPDs; or
      ii. do not yet offer mixes that meet GSA's GWP limits, e.g. because lower-carbon materials are unavailable, or do not meet specific client-driven performance requirements.
   b. Any requests for waivers from the GWP limits must include the strategies, if any, that will be used to reduce GWP to the extent feasible. Such strategies include, but are not limited to, the use of alternative cements, supplementary cementitious materials, or alternative aggregates.
   c. For each concrete mix for which GSA has granted a waiver from the EPD requirement, the [prime contractor] shall send a GWP estimate generated with a tool such as ZGF's LCA Tool, Athena IE, or the Federal Highway Administration's LCA Pave Tool to embodiedcarbon@gsa.gov.
   d. GSA will respond to each complete P100 waiver request with a decision or a request for more detail within ten (10) business days. A complete waiver request is deemed granted if no response is provided within that time.

Source: GSA Concrete Spec.



Environmentally Preferable Asphalt Standards for all GSA Projects
Revised March 29, 2022

…he [prime contractor] shall provide a product-specific cradle-to-gate Type III environmental product …eclaration (EPD) for each asphalt mix specified in the design and used at the project, using version 2 of …e National Asphalt Paving Association's product category rule for asphalt mixtures. Please send EPD(s) … embodiedcarbon@gsa.gov, and upload EPD(s) into GSA's project management information system.

…he [prime contractor] shall provide **environmentally preferable asphalt**, which is defined in this context …s material manufactured or installed using at least two (2) of the following techniques. Please send each …sphalt mix batch design (including type, volume, and a description of the proposed techniques) to …mbodiedcarbon@gsa.gov, and upload the submittals into GSA's project management information …ystem.

a. Greater than 20% recycled asphalt pavement (RAP) content (specify percentage, and whether in-place or central plant recycling is used);
b. Warm mix technology (reduced onsite mix temperature);
c. Non-pavement recycled content (e.g. roof shingles, rubber, or plastic);
d. Bio-based or other alternative binders;
e. Improved energy/ carbon efficiency of manufacturing plants or equipment (e.g. using natural gas or electric for heating materials); or
f. Other environmentally preferable features or techniques (please specify).

…hese requirements apply to all GSA projects that use at least ten (10) cubic yards of asphalt.

… it is not feasible to meet GSA's EPD requirement or to implement at least two of the listed …nvironmentally preferable features or techniques, the [prime contractor] shall ask the GSA project …anager to request a **P100 waiver**.

a. The [prime contractor] shall outline and provide evidence of the specific circumstances that make compliance infeasible. For example, the only asphalt suppliers within the maximum transport range for the mix design:
   i. are small businesses that have not yet invested in EPDs; or
   ii. do not yet offer mixes that use at least two environmentally preferable features or techniques while meeting specific client-driven performance requirements.
b. For each asphalt mix for which GSA has granted a waiver from the EPD requirement, the [prime contractor] shall send a GWP estimate generated with a tool such as Athena Pavement LCA or the Federal Highway Administration's LCA Pave Tool to embodiedcarbon@gsa.gov.
c. GSA will respond to each complete P100 waiver request with a decision or a request for more detail within ten (10) business days. A complete waiver request is deemed granted if no response is provided within that time.

Source: GSA Asphalt Spec.

GSA – Environmentally Preferable Asphalt Standards

Defined in this context as material manufactured or installed using at least two (2) of the following techniques:

- Greater than 20% recycled asphalt pavement (RAP) content (specify percentage, and whether in-place or central plant recycling is used);
- Warm mix technology (reduced onsite mix temperature);
- Non-pavement recycled content (e.g. roof shingles, rubber, or plastic);
- Bio-based or other alternative binders;
- Improved energy/ carbon efficiency of manufacturing plants or equipment (e.g. using natural gas or electric for heating materials); or
- Other environmentally preferable features or techniques (please specify).

Inflation Reduction Act of 2022 (Pub. L. 117-169) - link

FHWA Wisconsin Division

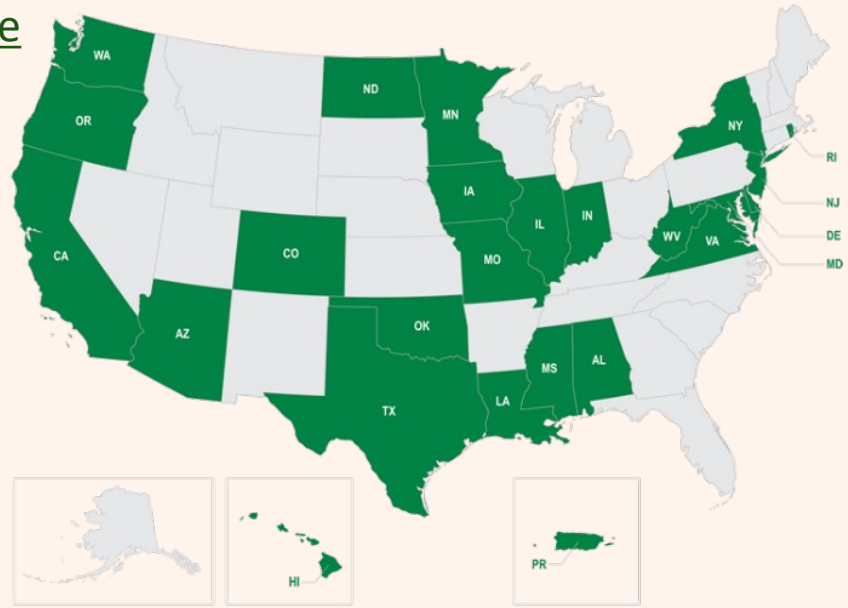
Section No.	Agency	Funding	Title	Expiration Date
60112	EPA	$250M	Environmental Product Declaration Assistance	Sept. 30, 2031
60116	EPA	$100M	Low-Embodied Carbon Labeling for Construction Materials • Identify and label construction materials with lower embodied GHG • Production, Use, and Disposal	Sept. 30, 2026
60503	GSA Federal Buildings Fund	$2.15B	Use of Low-Carbon Materials	Sept. 30, 2026
60506	DOT FHWA	$2B	Low-Carbon Transportation Materials Grants • Use of construction materials and products that have substantially lower embodied GHG Production, Use, and Disposal	Sept. 30, 2026

FHWA Climate Challenge

State DOTs and other public agencies explore the use of LCA and EPDs as a standard practice to inform pavement material and design selection for enhancing sustainable pavement practices and quantify the emissions and impacts of those practices.

For the latest information, visit the website: https://highways.dot.gov/climatechallenge

- 30+ proposals from 27 agencies (including 2 local agencies)
- Education, implementation, benchmarking, fundamental research projects
- Providing technical and funding ($7.1 million) assistance



Demonstration to Advance New Pavement Technologies Pooled Fund Study

- Sustainability identified as a topic of interest
- Provides $250,000 +100 hours of technical assistance

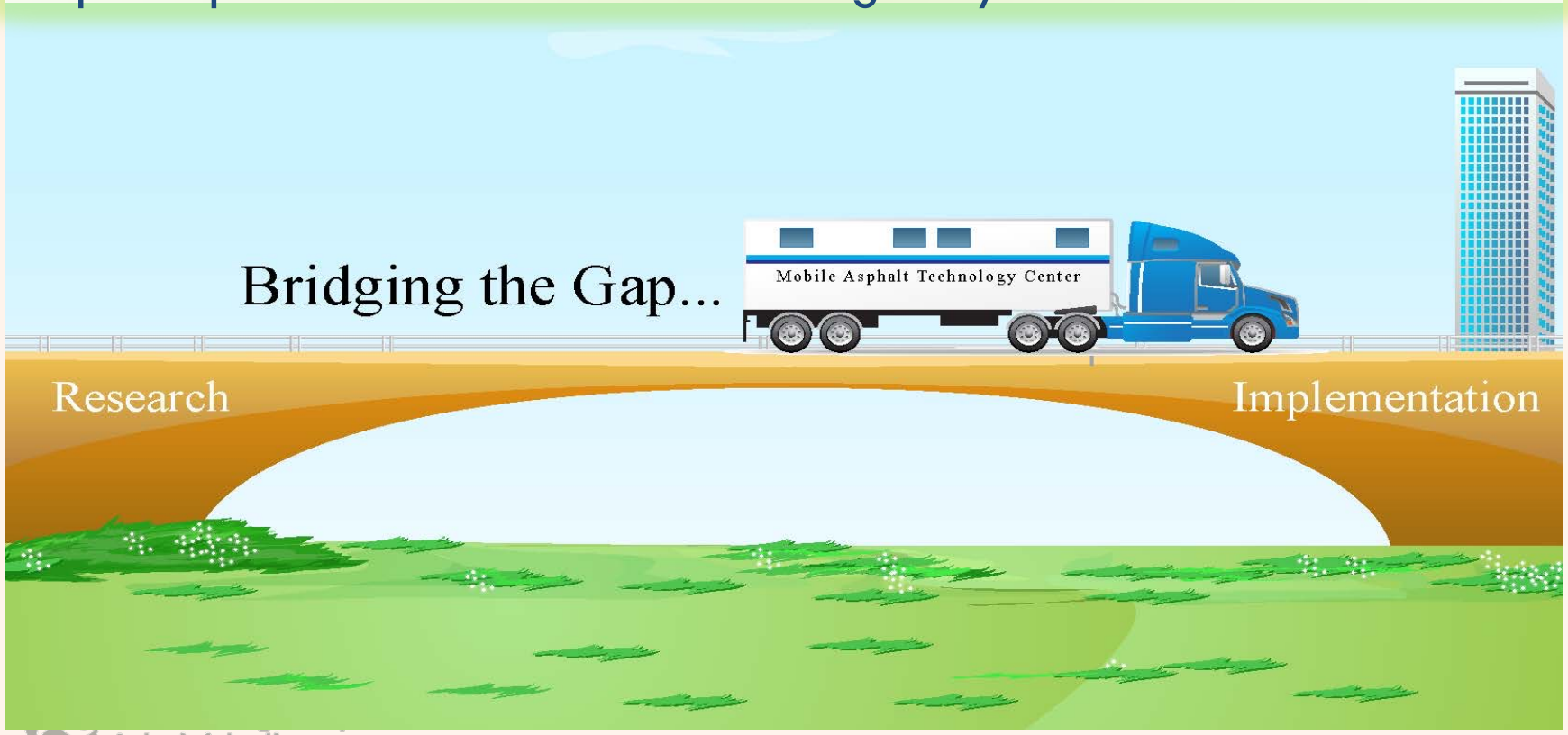
Information collected from pooled fund website.
https://www.pooledfund.org/Details/Study/705

Resources

Education	Research	Deployment
Pavement LCA Framework	LCA fit in transportation decision-making	LCAPave Tools
Webinars	EPDs in Green Public Procurement	Pilot projects with State DOTs
Tech briefs, studies	LCA of recycled plastics in pavements	Mobile Pavement Technologies Centers
Technical articles	LCA of ground tire rubber in pavements	Informing pre-engineering with ICE Tool

Mobile Asphalt Technology Center

Innovative technologies and practices are implemented by agencies and industry to provide durable, safe, and sustainable asphalt pavements on our nation's highways.



- On-site field evaluations & training + 2-day QA workshop
- Asphalt materials & field testing
- Innovation implementation
- Equipment loans
- Hands-on and virtual demos
- Specification review

https://www.fhwa.dot.gov/pavement/asphalt/MATC/

Technologies Offered by FHWA MATC

Mixture

- AMPT suite of tests (cyclic fatigue, stress sweep rut, E*)
- Overlay test for reflective cracking
- Flexibility index test (I-FIT) for fracture resistance
- ITC (IDEAL-CT) for crack resistance
- IDEAL-RT for rutting resistance
- Hamburg wheel track test

Materials

- X-Ray Fluorescence (XRF) Spectrometer for binder components
- ABT (true grade binder)
- FTIR for binder molecular analysis

Field

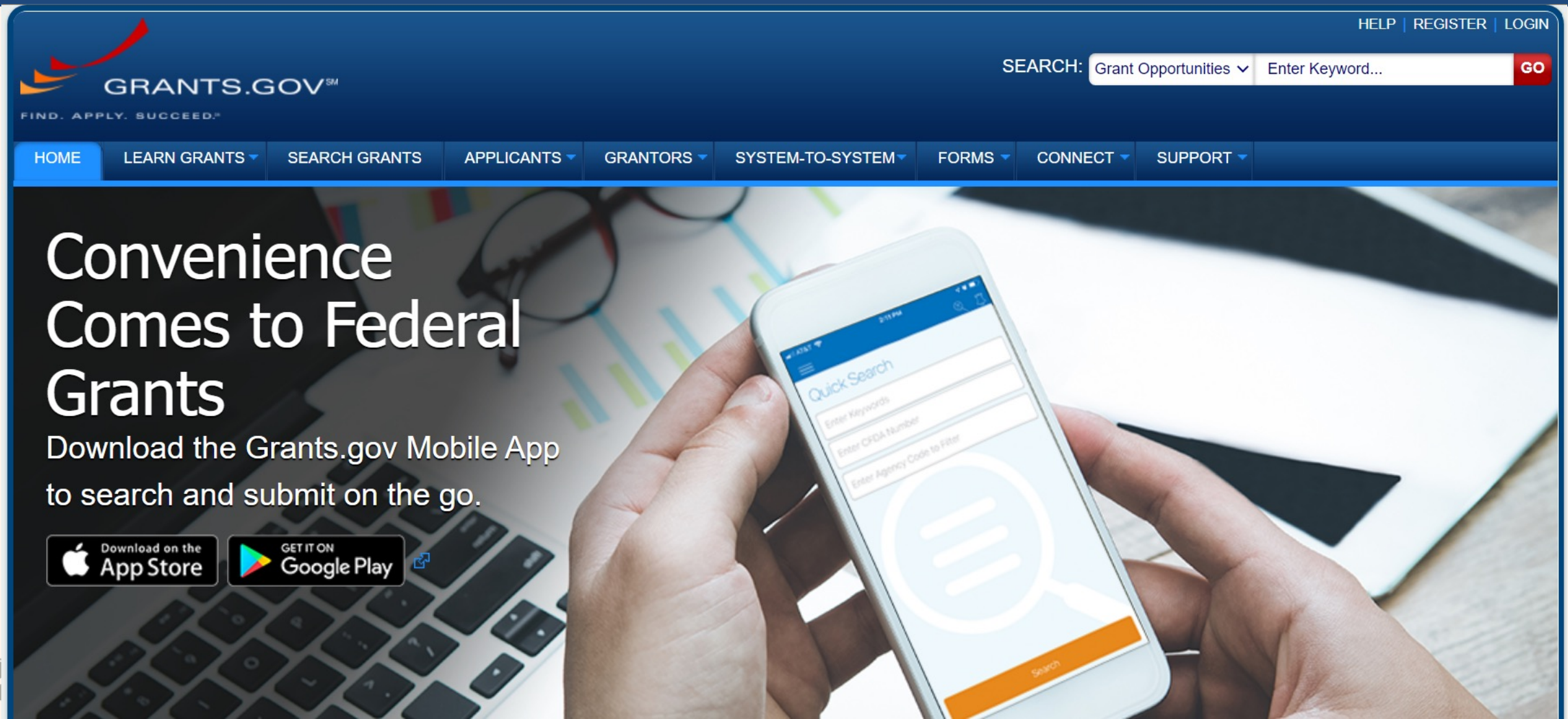
- Paver-mounted thermal profiler (PMTP) for mat temperature
- Pulse induction technology for in-place pavement thickness
- Pavement macrotexture measurements (3 methods)
- Dielectric profiling systems (DPS) for mat density

MATC Equipment Loan Program

Request form submitted via FHWA P&M Engineer in Division Office

- Dielectric profiling system (DPS)
- Paver-mounted thermal profiler (PMTP)
- Circular track meter
- Laser-based texture scanner
- AIMS device for aggregate scans
- Handheld XRF binder device
  - Limestone, titanium dioxide, REOB

Grants.gov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