Life Cycle Assessment Decision Making: Data and Tools

Updates on Policy Initiatives

Asphalt Paving Association of Michigan
Annual Paving Conference

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SUSTAINABLE PAVEMENTS PROGRAM

Agenda:

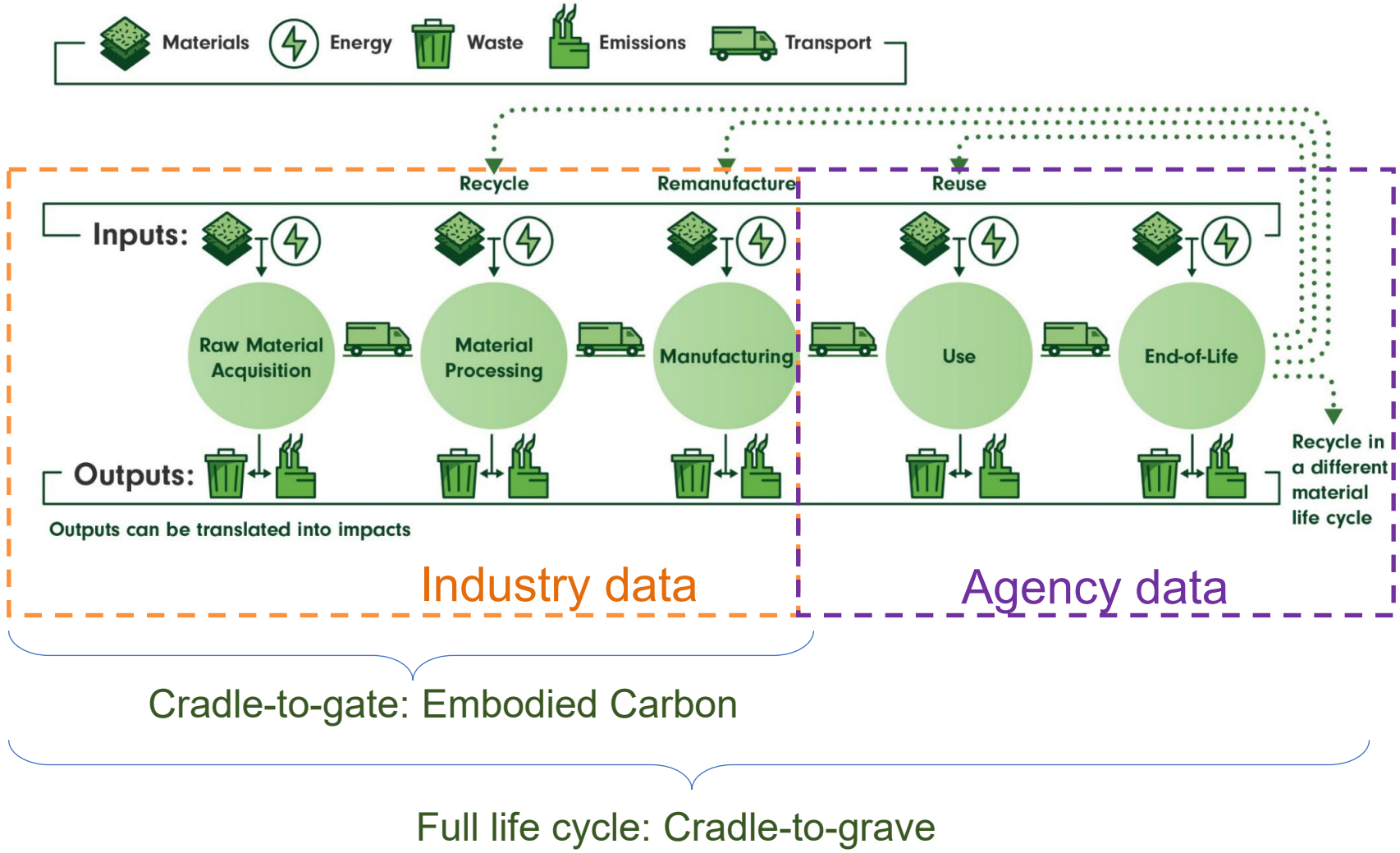
Elements of Life Cycle Thinking
- Life Cycle Assessment
- Life Cycle Cost Analysis
- Life Cycle Thinking
- LCA Construction Application

Communicating LCA Outcomes
- Product Category Rules
- Environmental Product Declarations (EPD)
- EPD Programs

EPDs in Procurement Policy
- Initiatives within EPA, FHWA and GSA
- Implementation: Climate Challenge, EDC-7

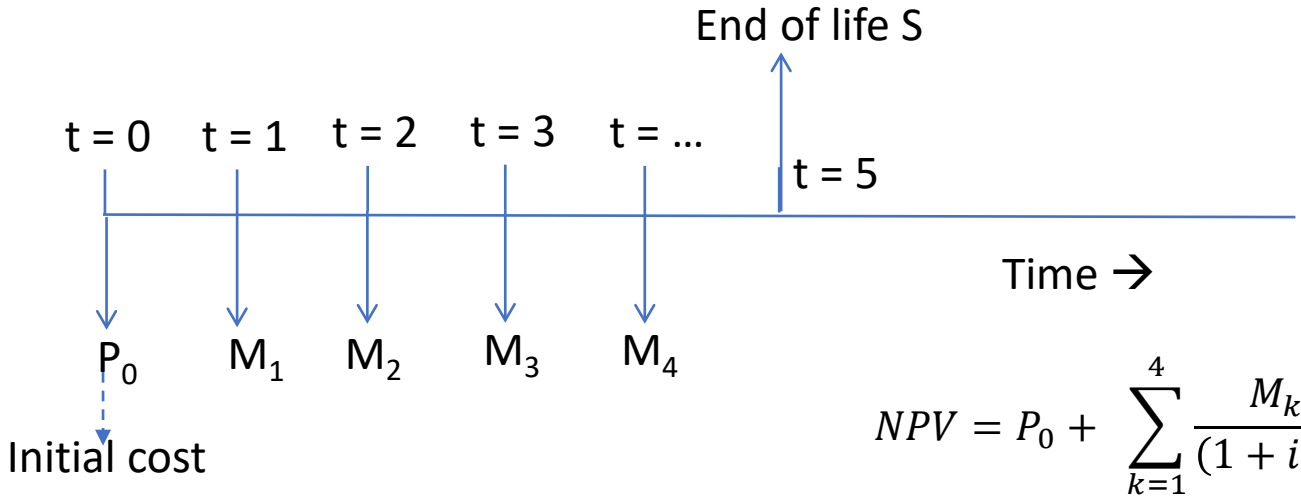
Life Cycle Assessment

- Technique to quantify environmental impacts of products and processes
- Track all material and energy flows from the system over the life cycle
- Convert environmental outputs into environmental impact potentials using TRACI – impact assessment method
- Mid-point indicators such as Global Warming Potential (GWP) – kg of CO_2 equiv.

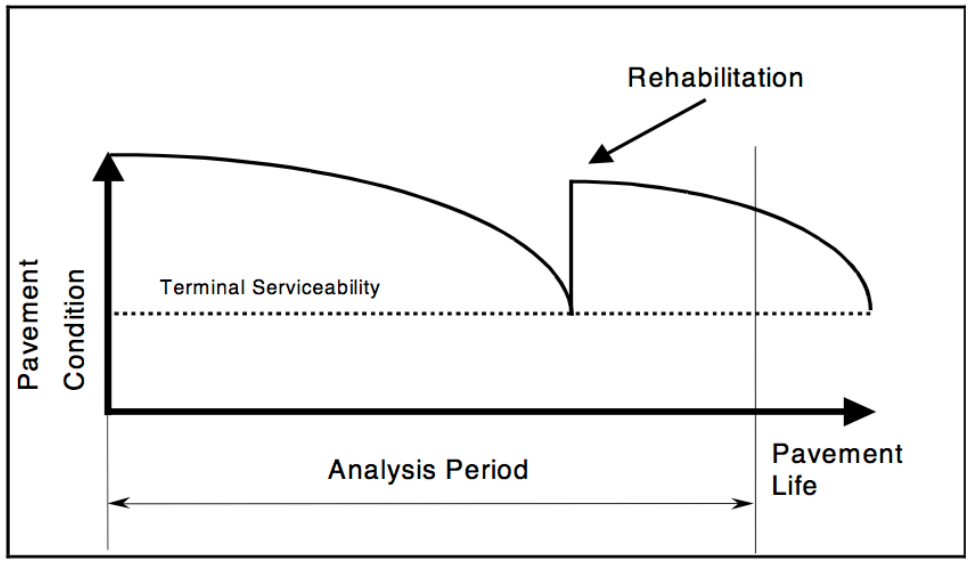


Life Cycle Cost Analysis

- Determine what is the best investment opportunity given alternatives for a project over the long term (complete life cycle).
- Does not address equity issues
- Does not account for environmental impacts
- Transportation Equity Act for the 21st Century (TEA-21) – 1998
- Required when:
  - Conducting value engineering of large projects (23 CFR 627) (all NHS > $50M + Fed $$)
  - Using alternate bidding for pavement type selection (TA5040.39)

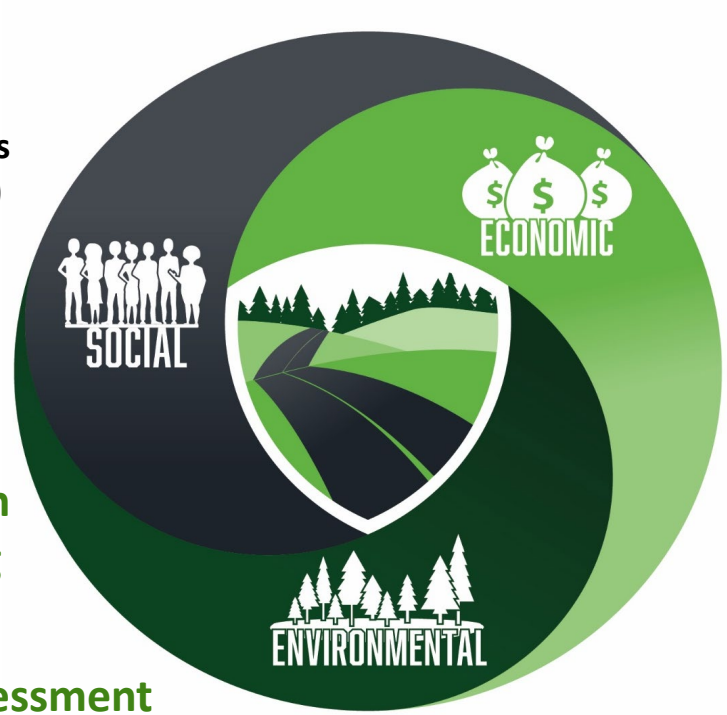


$$NPV = P_0 + \sum_{k=1}^{4} \frac{M_k}{(1+i_1)^k} - \frac{S}{(1+i_1)^k}$$



Life Cycle Thinking

Sustainability Rating Systems (e.g., INVEST) Social LCA (S-LCA)



Performance Testing

Life-Cycle Assessment (LCA)

Performance Testing

Life-Cycle Cost Analysis (LCCA)

Image Source: FHWA/APTech

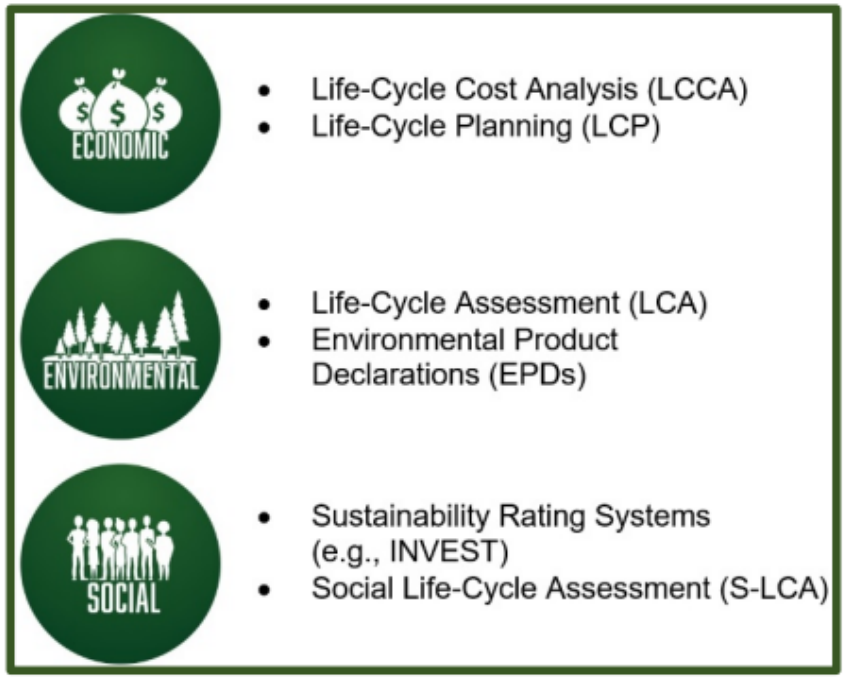


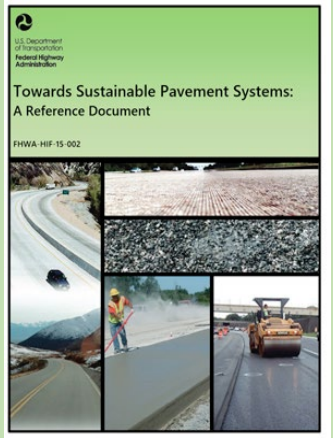
Figure 1. Pillars of sustainability with methods for measurement and communication.

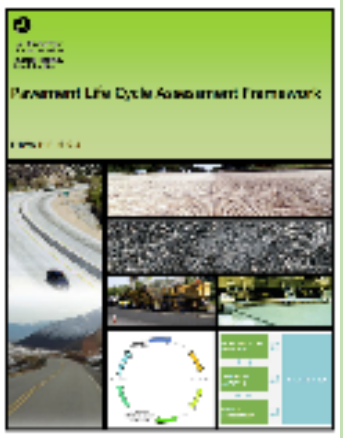
Pavement Life Cycle Assessment (LCA)

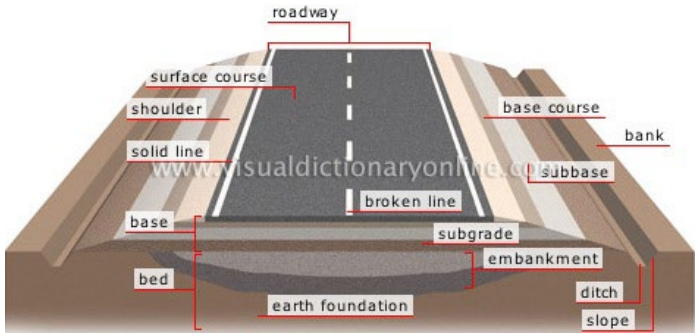
- What is the driving question?
- What is being included within the system boundaries?
- Scope of the study depends on the goal

Sustainable Pavements

Guidelines and framework (2015)
- System boundaries
- Unit processes







FEDERAL LCA COMMONS

Background Data
- *Fuels*
- *Electricity*
- *Transportation*

LCA PAVE

Arizona DOT Case Study: LCA Pave Application

Investigate the feasibility of integrating Life Cycle Assessment (LCA) information for supporting pavement design decision-making, procurement and pavement management processes.

Compare Alternative Treatments

- Mill & Fill
- Hot in Place Repaving
- Full Depth Reclamation

Hot-in-Place Repaving

Removal: Cold mill of ¾-inch

Paving: 3 inches total,

- 1-inch Hot in Place
- 1-1/2-inch new asphalt concrete (AC)
- ½-inch new AC friction course (ACFC).

Mill & Fill

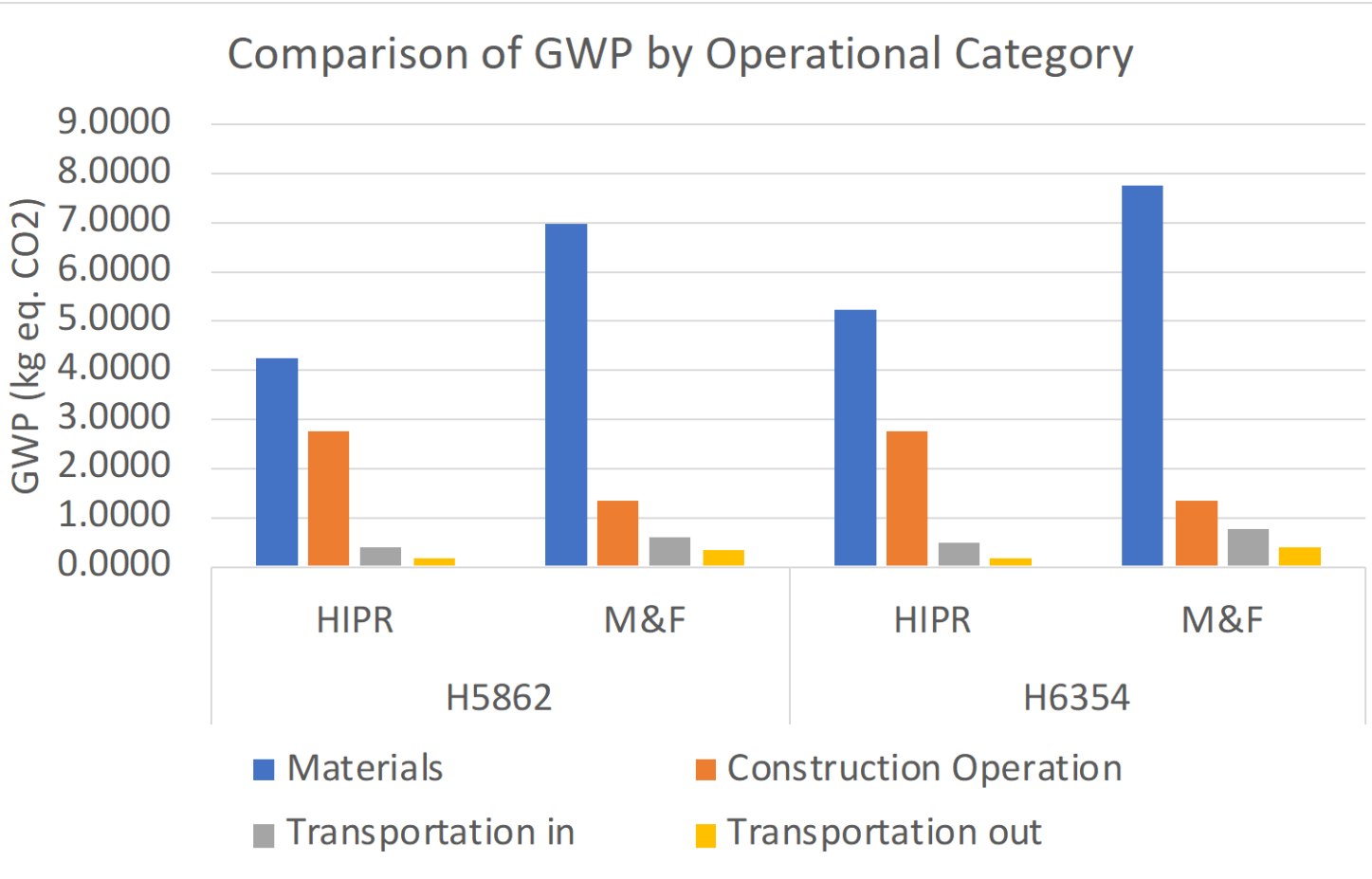
Removal: cold mill 1-3/4 inch

Paving: 3 inches total

- 2-1/2 inch of new AC,
- ½ inch of new ACFC.

LCA PAVE

Comparison - GWP

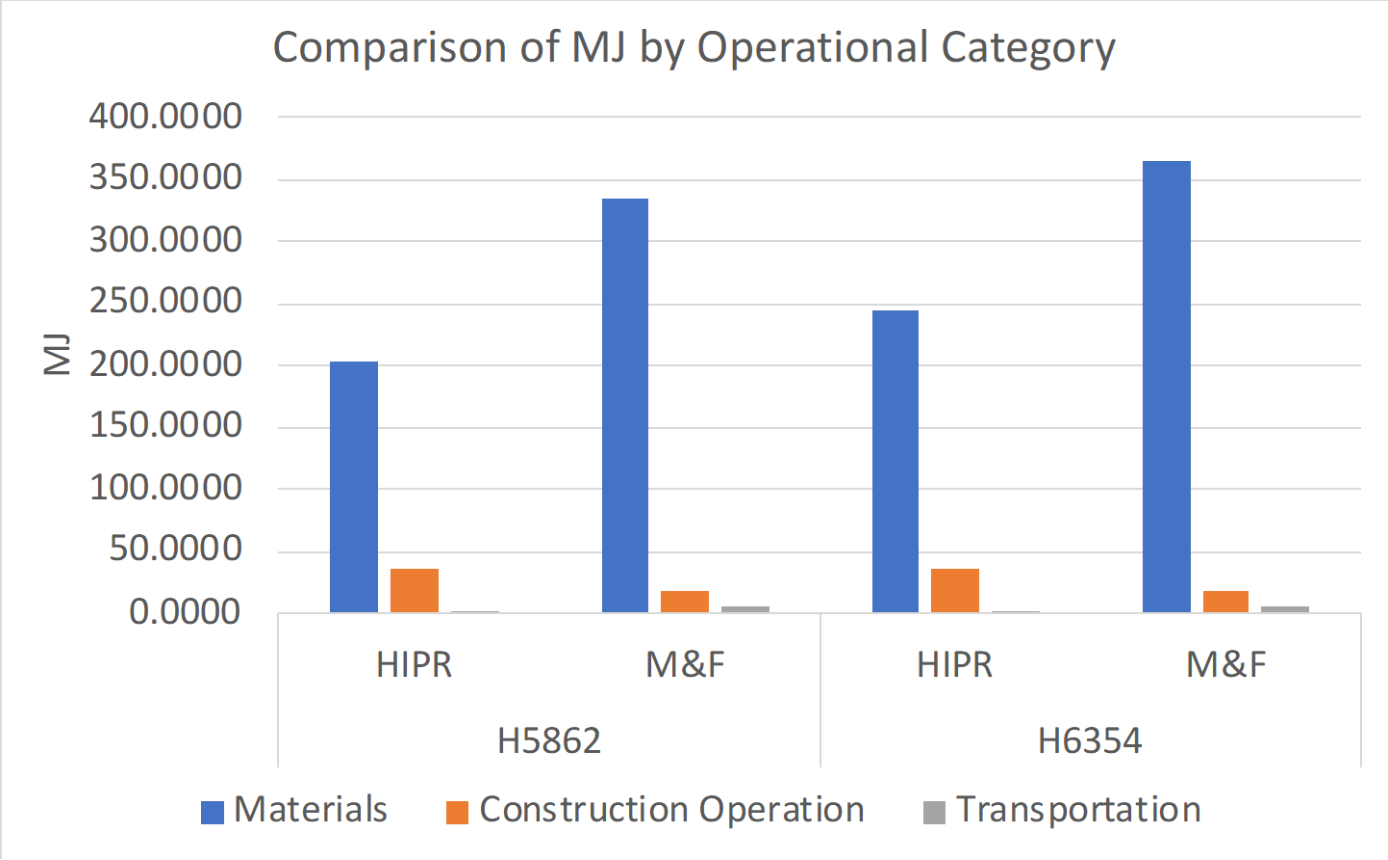


HIPR: 7.5494 kg of CO2 Eq./sq yd

M&F: 9.2918 kg of CO2 Eq./sq yd

- Impact from new material use drives GWP
- HIPR is a lot more energy intensive during construction

Comparison - Energy



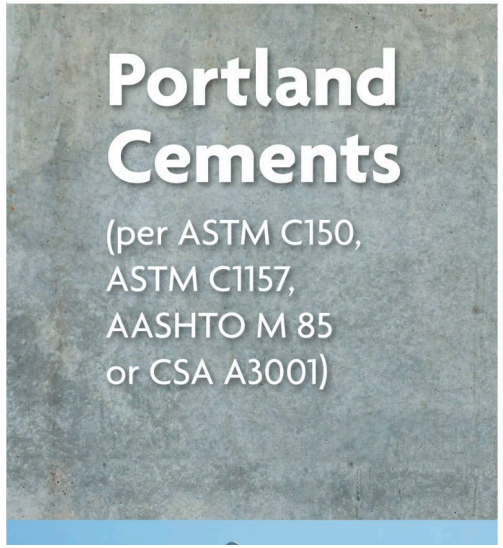
HIPR: 242.42 MJ/sq yd

M&F: 359.68 MJ/sq yd

- Net energy impact from new material governs
- Transportation of milling off site not a contributor – in this case

How do we Communicate LCA Outcomes?

Product Category Rules and Environmental Product Declaration



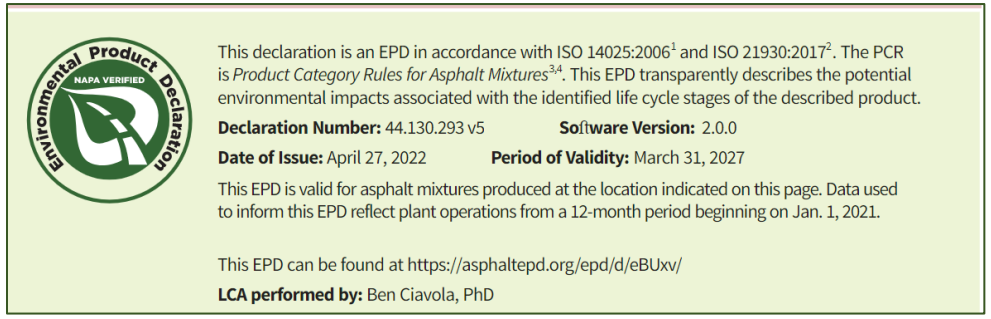
Product Category Rules

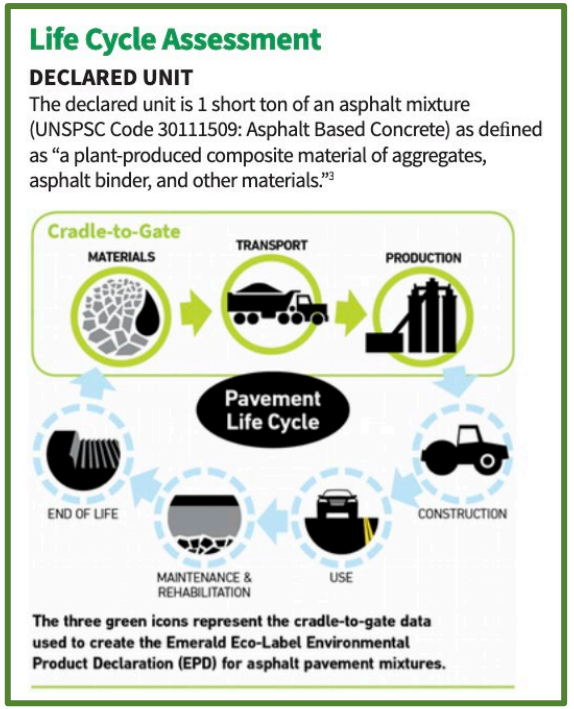
PCR Principles and Procedures: ISO 14025
Core PCR (part A): ISO 21930

Rules that govern LCA supporting an Environmental Product Declaration (EPD)

A PCR specifies:

- The goal, scope
- Functional and/or declared units
- The modules and processes
- Guidelines for data collection
- Time horizon of reporting
- Use of geographically pertinent data.





Background Data

- *Fuels*
- *Electricity*
- *Transportation*

FEDERAL LCA COMMONS

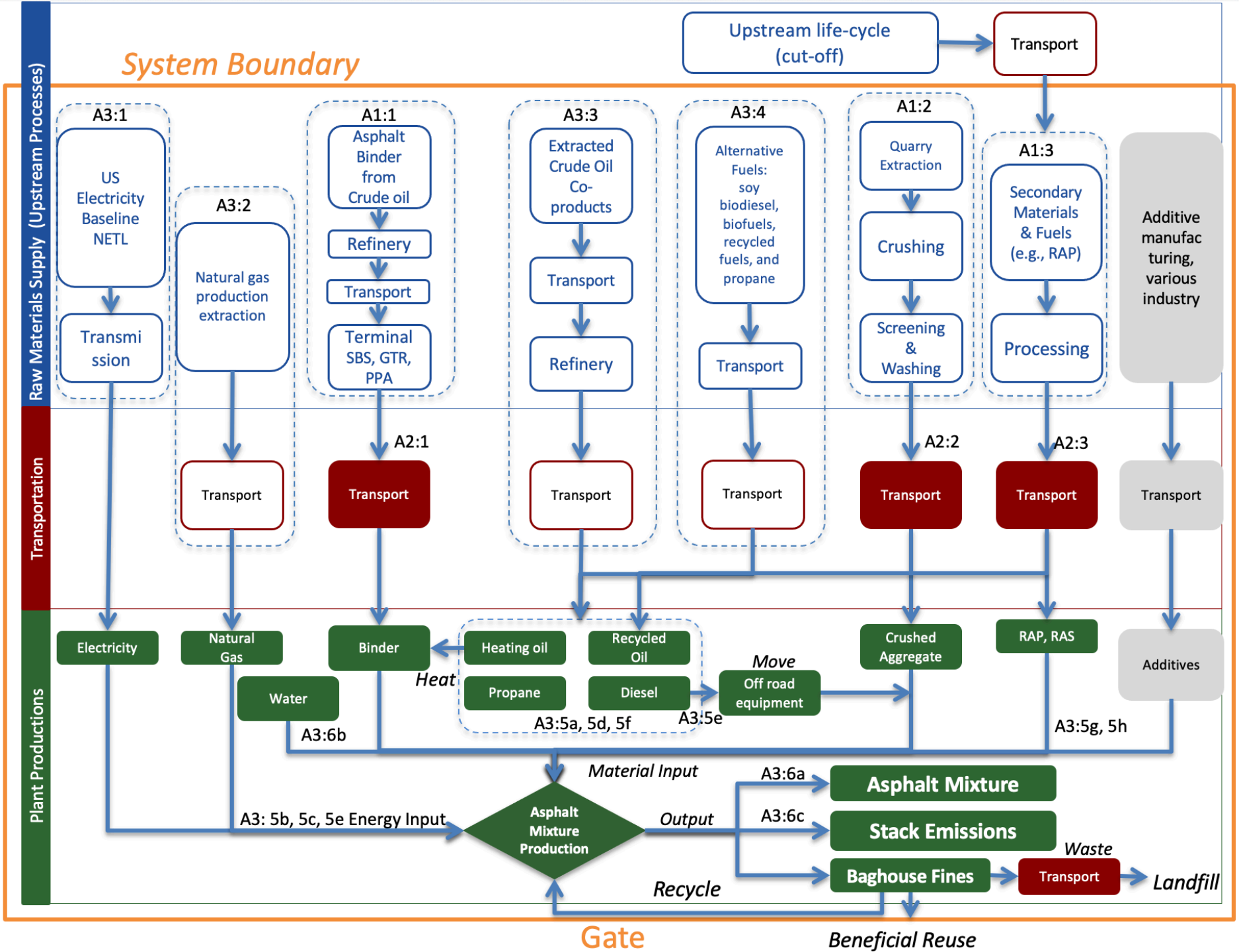
Environmental Product Declarations

Standard instrument to reporting LCA outcomes based on a Product Category Rule

- ✓ Environmental impact indicators (such as Global Warming Potential),
- ✓ Total primary energy consumption and material resource consumption.

TABLE 3. ENVIRONMENTAL IMPACT SUMMARY TABLE

IMPACT CATEGORY	POTENTIAL IMPACT PER METRIC TONNE ASPHALT MIXTURE (PER TON ASPHALT MIXTURE)
Global warming potential (GWP-100)	*67.09 (60.87) kg CO2 Equiv.*
Ozone depletion potential (ODP)	*8.33e-08 (7.55e-08) kg CFC-11 Equiv.*
Eutrophication potential (EP)	*1.22e-02 (1.11e-02) kg N Equiv.*
Acidification potential (AP)	*1.99e-01 (1.81e-01) kg SO2 Equiv*
Photochemical ozone creation potential (POCP)	*4.34 (3.94) kg O3 Equiv.*



Scope: Cradle-to-grave

Improved Background Data sets

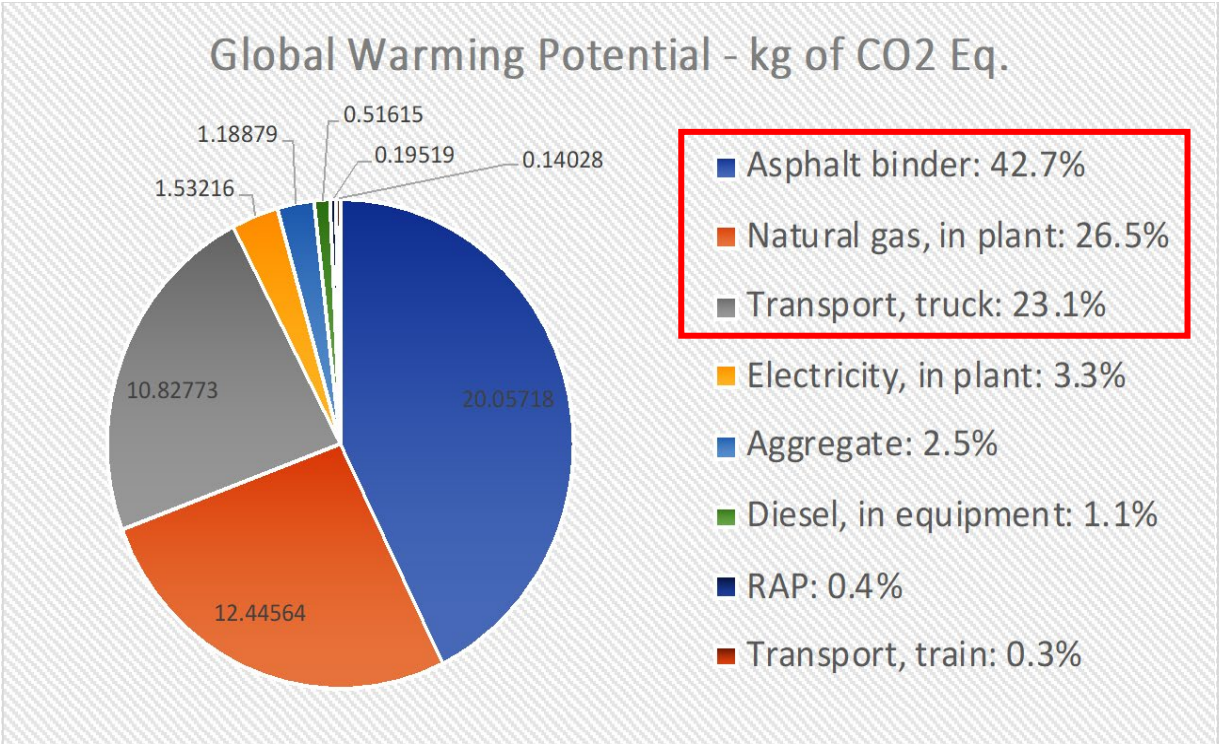
Foreground Data supported by EPD data collected 2016 – 2020

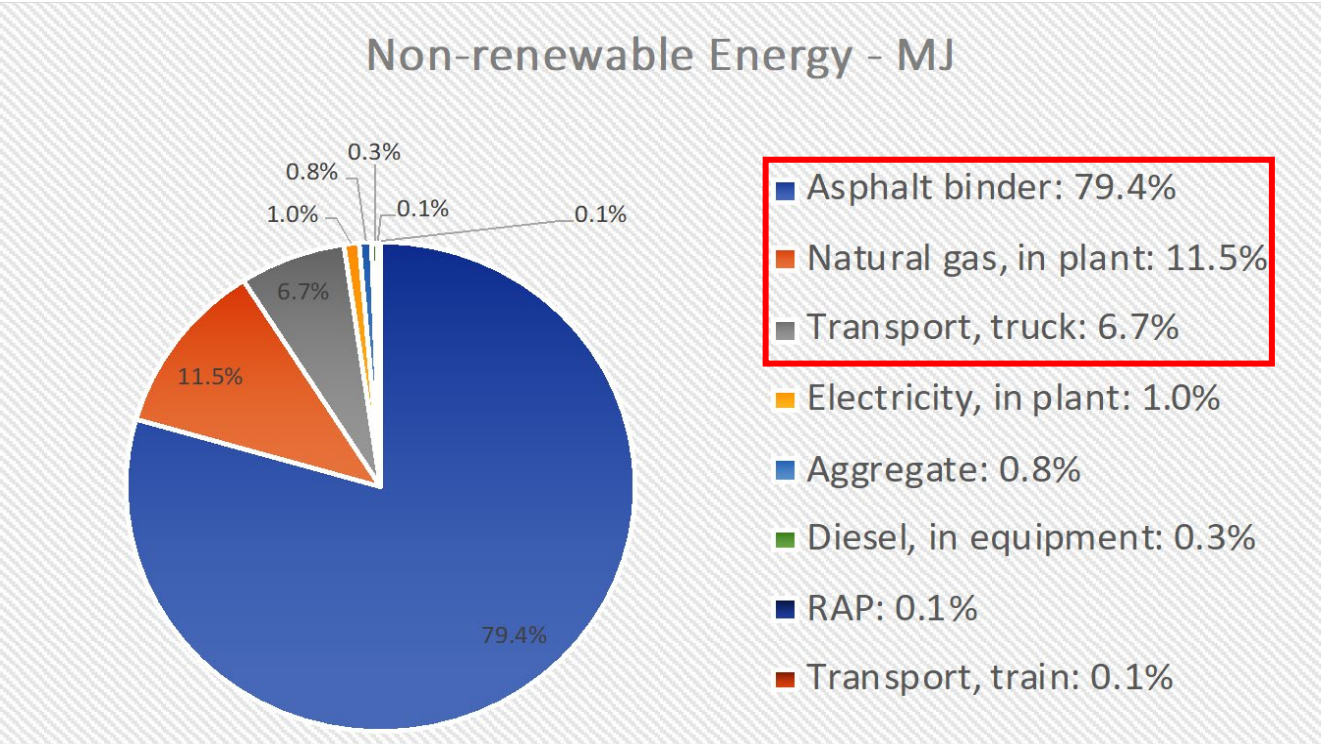
Portable Plants included

Baghouse fines: waste to landfill and beneficial reuse

Extended sensitivity analysis

Analysis of Asphalt Mix Contributions





Mix with 5% asphalt binder, 30% RAP

Average ton-miles travelled (sample of 15 plants):

- Truck: Aggregate: 21.5 ton-miles/ton, RAP: 50 ton-miles/ton
- Binder: 3.9 ton-miles/ton (Rail)

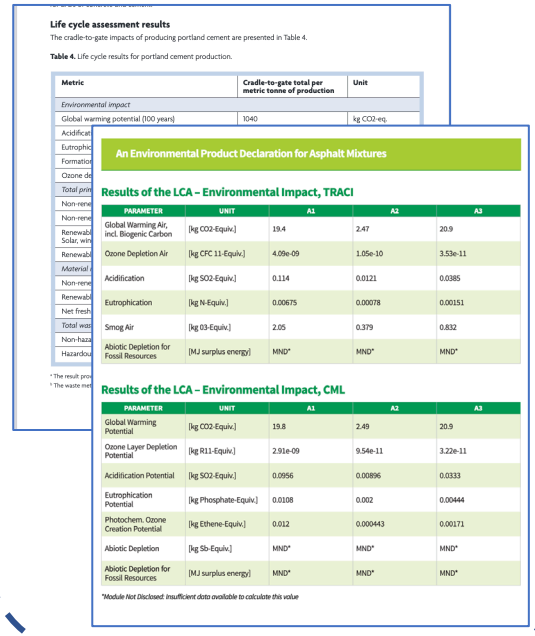
LCA Information Flow

Procurement Process

Construction Phase

Cradle-to-Gate Impacts

Background Data
Federal LCA Commons



Life cycle assessment results

The cradle-to-gate impacts of producing portland cement are presented in Table 4.

Table 4. Life cycle results for portland cement production.

Metric	Cradle-to-gate total per metric tonne of production	Unit
Environmental impact		
Global warming potential (100 years)	1040	kg CO2-eq.

An Environmental Product Declaration for Asphalt Mixtures

Results of the LCA – Environmental Impact, TRACI

PARAMETER	UNIT	A1	A2	A3
Global Warming Air, incl. Biogenic Carbon	[kg CO2-Equiv.]	19.4	2.47	20.9
Ozone Depletion Air	[kg CFC 11-Equiv.]	4.09e-09	1.05e-10	3.53e-11
Acidification	[kg SO2-Equiv.]	0.114	0.0121	0.0385
Eutrophication	[kg N-Equiv.]	0.00675	0.00078	0.00151
Smog Air	[kg 03-Equiv.]	2.05	0.379	0.832
Abiotic Depletion for Fossil Resources	[MJ surplus energy]	MND*	MND*	MND*

Results of the LCA – Environmental Impact, CML

PARAMETER	UNIT	A1	A2	A3
Global Warming Potential	[kg CO2-Equiv.]	19.8	2.49	20.9
Ozone Layer Depletion Potential	[kg R11-Equiv.]	2.91e-09	9.54e-11	3.22e-11
Acidification Potential	[kg SO2-Equiv.]	0.0956	0.00896	0.0333
Eutrophication Potential	[kg Phosphate-Equiv.]	0.0108	0.002	0.00444
Photochem. Ozone Creation Potential	[kg Ethene-Equiv.]	0.012	0.000443	0.00171
Abiotic Depletion	[kg Sb-Equiv.]	MND*	MND*	MND*
Abiotic Depletion for Fossil Resources	[MJ surplus energy]	MND*	MND*	MND*

*Module Not Disclosed: Insufficient data available to calculate this value

Product & Plant Specific EPDs

+

Foreground Data
Observed Construction Data

+

LCA PAVE

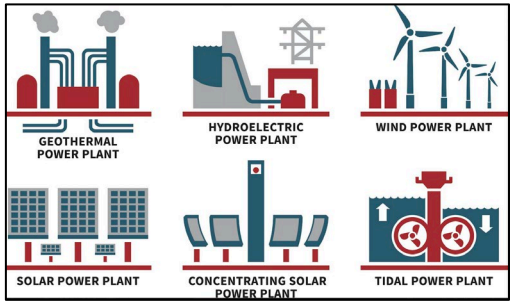
LCA Metric
GWP per sq yd of Operation

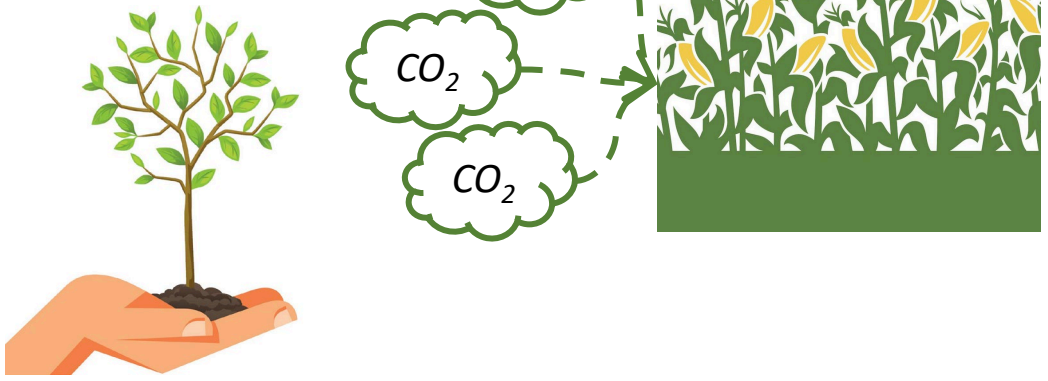
Construction Stage Data

Calculation	Source
Asphalt tonnage per yd^2 of asphalt mixture	From bid tabs
Fuel used = total yd^2 * consumption rate	From bid tabs and equipment parameters
Fuel used = sum of all fuel consumed by equipment	From bid tabs and equipment parameters
Tack Coat and Rejuvenator tonnage per yd^2	Bid tabs
Propane used per yd^2 recycling	From contractors and equipment parameters
Transportation distance * ton per yd^2	Assumed 30 mile distance

Pathways to NetZero

- Decarbonization: Choice of Materials
  - Lower embodied carbon
  - Use of recycled materials
- Process Design: Lean engineering
- Onsite Generation of Renewable Energy: Solar, Geothermal, Wind
- Use of bio-based binders and fuels can introduce a negative carbon account due to biogenic uptake
- Use of Offsets: including Renewable Energy Credits
- Towards Consequential LCAs





EPDs in Public Procurement Policy

Climate Challenge

EPDs for Advancing Project Delivery

GSA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

U.S. Department of Transportation
Federal Highway Administration

Sustainability Initiatives in the Spotlight

EO 14057
specified goal of
Net Zero Federal
Procurement

CLIMATE CHALLENGE

25 States
(+2 Locals)
Participating
35+ projects from
27 agencies
$7.1M

Inflation
Reduction Act
$2 Billion for FHWA
Low-carbon
transportation
materials grants

EPD
ENVIRONMENTAL PRODUCT DECLARATION

EDC-7
EPDs for
Sustainable
Project Delivery

White House Buy Clean Task Force – First set of recommendations

- Priority materials and pollutant recommendations **(GHG)**:
  - Asphalt
  - Concrete
  - Flat glass
  - Steel
- Reporting tool recommended: **EPDs**
- Aligned with Inflation Reduction Act of 2022 funding

Source: [Fact Sheet: Biden-Harris Administration Announces New Buy Clean Actions]

Source: Council of Environmental Quality

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

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

Inflation Reduction Act

Inflation Reduction Act Home

Advancing Environmental Justice

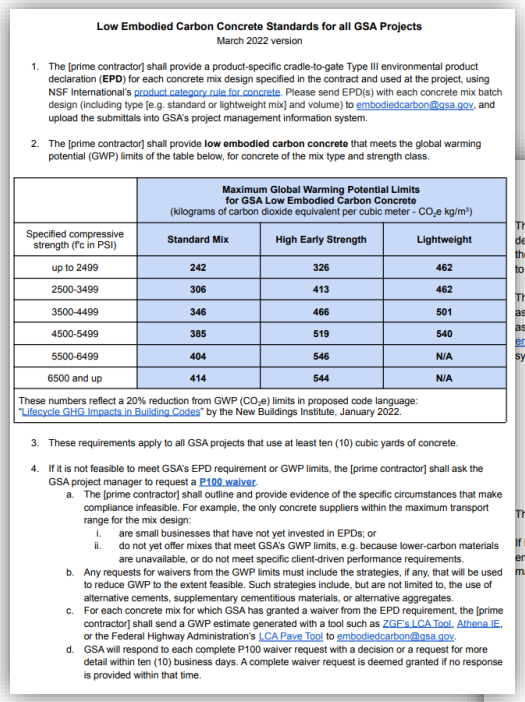
Delivering Cleaner Air

Tackling Climate Pollution

Purchase Categories	Justification	Interim Determination
Newly Manufactured Construction Materials: -Concrete (and cement) -Glass (including, but not limited to, flat/float glass, processed glass, and insulated glazing units) -Asphalt mix -Steel (including, but not limited to, hot rolled sections, plate, hollow structural sections, steel reinforcing bars/rebar, cold formed steel framing and steel joists) -Assemblies comprised of at least 80 percent of materials that qualify	Based on the EPA's initial review of state and local Buy Clean approaches and other research to-date, these materials offer the most significant opportunities to lower the embodied greenhouse-gas emissions of federal construction projects. EPDs and EPSs, are sufficient data sources to ensure compliance with Sections 60503 and 60506.	These materials/products qualify if their product-specific GWP is in the best performing 20 percent (Top 20 percent or lowest 20 percent in embodied greenhouse-gas emissions), when compared to similar materials/products (for example, materials/products within the same product category that meet the same functional requirements). If materials/products in the Top 20 percent are not available in a project's location, then a material/product qualifies per this determination if its GWP is in the Top 40 percent (lowest 40 percent in embodied greenhouse gas emissions). If materials/products in the Top 40 percent are not available in a project's location, then a material/product qualifies per this determination if its GWP is better than the estimated industry average.[4] To determine whether a specific material/product qualifies under the EPA's interim determination, above, an agency must determine both the material/product-specific GWP and estimate the Top 20 percent (or Top 40 percent) and the industry average. **Identifying the material/product-specific GWP.** **Environmental Product Declaration**. A facility-specific, material/product-specific cradle-to-gate Type III (third-party verified) EPD is required that (i) is based on the PCR for the applicable product category that was active when the EPD was issued, and (ii) conforms with ISO 14025 and ISO 21930. When an EPD with facility-specific data is not available, for this interim determination, EPDs consistent with (i) and (ii) but not using facility-specific data are sufficient. EPDs must also be based on supply chain-specific data for the associated unit processes, where feasible. For example: ● Concrete EPDs must, where available, rely on facility specific data for the upstream cement plant; ● Fabricated steel EPDs must, where available, rely on facility specific data for the upstream steel mill(s); and,

GSA – Lower Embodied Carbon Materials

- March 30, 2022 – GSA published Concrete and Asphalt Specifications requesting EPDs at installation
- February 25, 2023 - Pre-decisional discussion
- Check feedback schedule



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

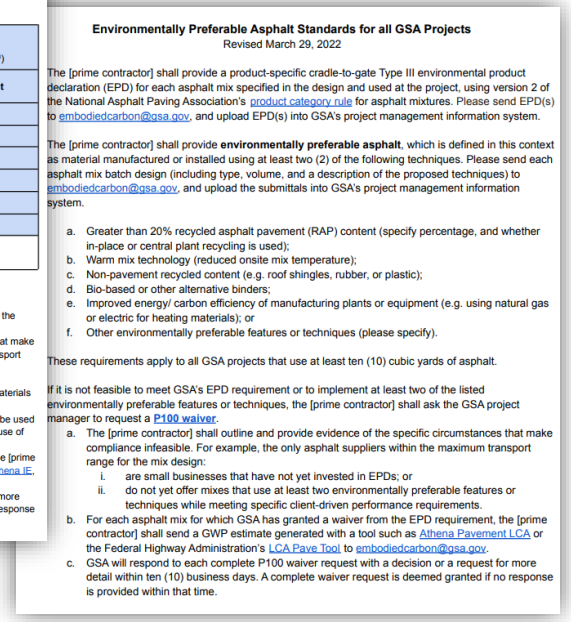
1. The [prime contractor] shall provide a product-specific cradle-to-gate Type III environmental product declaration (**EPD**) for each concrete mix design specified in the contract and used at the project, using NSF International's product category rule for concrete. Please send EPD(s) with each concrete 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/m^3)		
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

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

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

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).

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

If it is not feasible to meet GSA's EPD requirement or to implement at least two of the listed environmentally preferable features or techniques, 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 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 – Lower Embodied Carbon Materials

GSA IRA Standard:

- Require concrete mixes with Uncertainty-Adjusted GWPs equal to or lower than the applicable Top 20% Limits in this table.
  - Where Top 20% is unavailable in a project's location, require Top 40%.
  - Where Top 40% is unavailable in a project's location, require Average or Better.

	GSA IRA Limits for Low Embodied Carbon Concrete - Jan. 2023 (Uncertainty-Adjusted GWPs, in kilograms of carbon dioxide equivalent per cubic meter - $kgCO_2e/ m^3$)		
Specified concrete strength class (compressive strength [f'c] in pounds per square inch [PSI])	**Top 20% Limit**	**Top 40% Limit**	**Average or Better Limit**
≤2499	**240**	**291**	**334**
3000	**274**	**3**	
4000	**305**	**3**	
5000	**326**	**3**	
6000	**315**	**3**	
≥7200	**277**	**3**	

Add 30% to these numbers for GWP limits where high are required for technical reasons.

- Emphasize use of product and facility specific EPDs
- Inclusion of Energy Star metrics

GSA IRA Standard:

- Require asphalt mixes with Uncertainty-Adjusted GWPs equal to or lower than the Top 20% Limits in this table.
  - Where Top 20% is unavailable in a project's location, require Top 40%.
  - Where Top 40% is unavailable in a project's location, require Average or Better.

GSA IRA Limits for Low Embodied Carbon Asphalt - Jan. 2023 (Uncertainty-Adjusted GWPs, in kilograms of carbon dioxide equivalent per metric ton - $kgCO_2e/ t$)		
Top 20% Limit	**Top 40% Limit**	**Average or Better Limit**
62.8	**74.0**	**85.0**

DOT – Policy Statement on Buy Clean Initiative

- September 15, 2022 – first Buy Clean Policy Statement. DOT Embodied Carbon Working Group formed
- Details the 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.

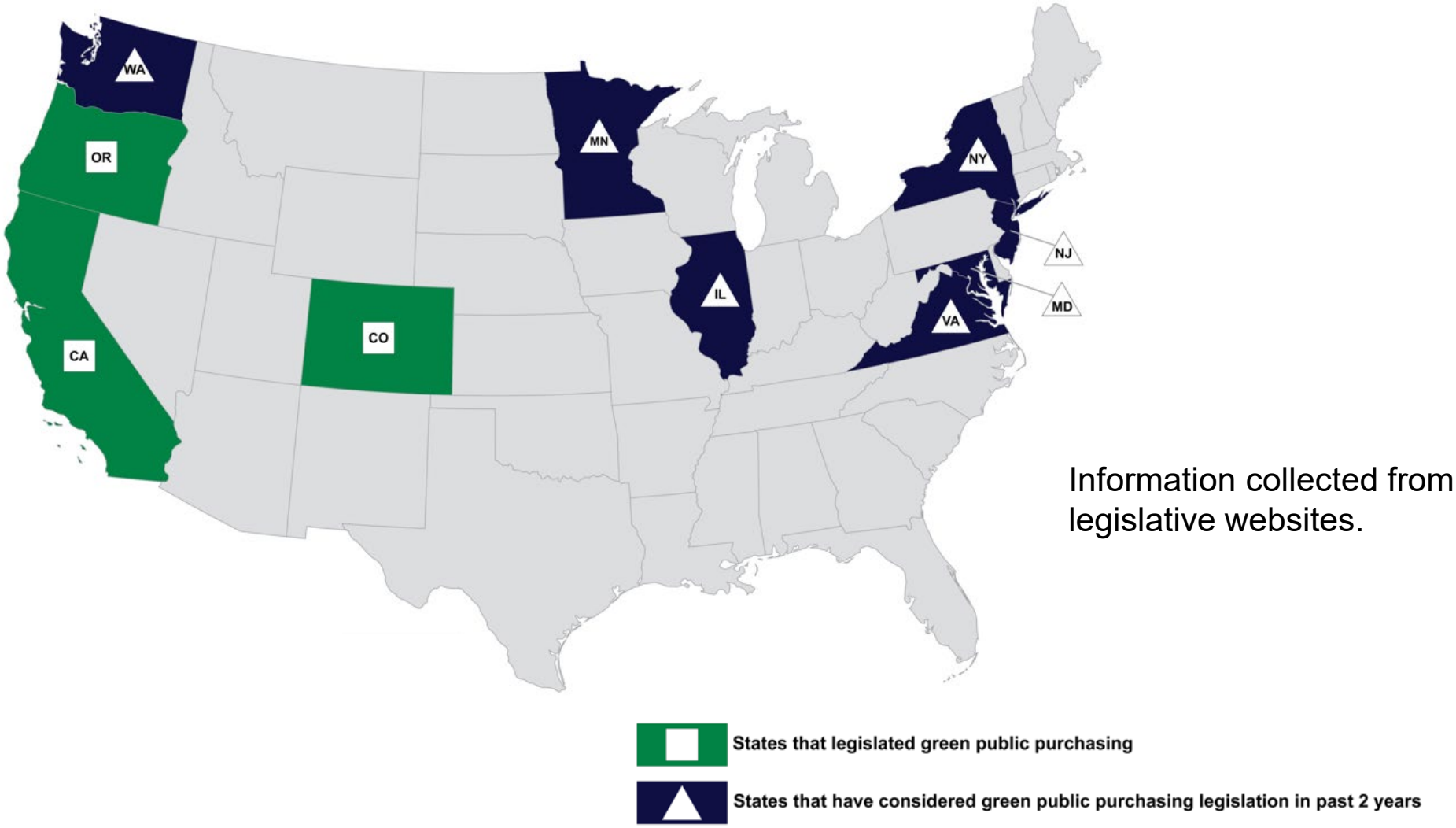
These emissions are what's called "embodied carbon emissions," and they stand to worsen the climate crisis, unless we work with our government partners, and with industry, to address them. **So today, as we work to implement President Biden's historic Bipartisan Infrastructure Law, which will modernize 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

State Level Initiatives



Information collected from State legislative websites.

FHWA Climate Challenge:
Quantifying the Emissions of Sustainable Pavements

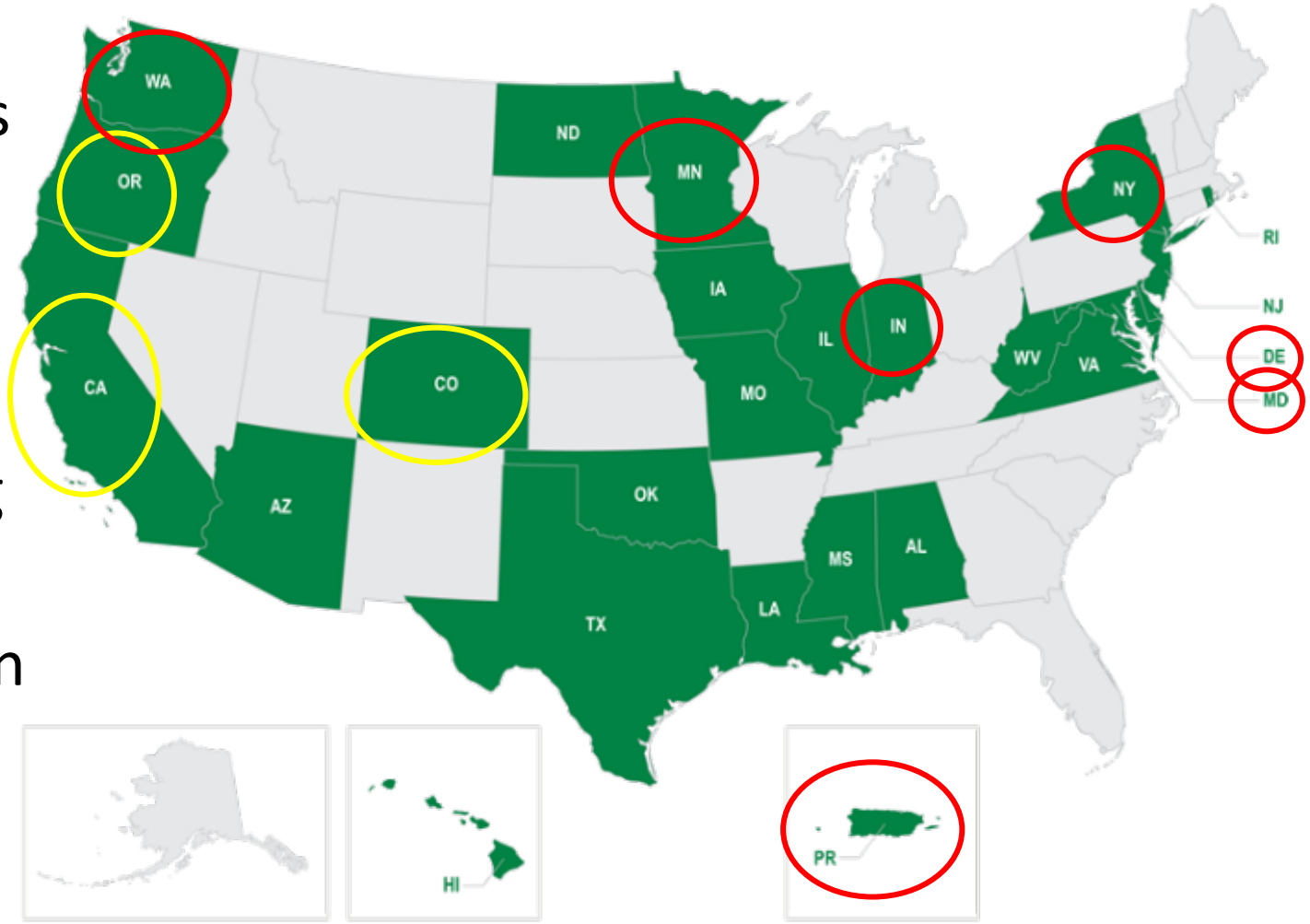
State DOTs and other public agencies explore the use of LCA and EPDs as a standard practice to inform pavement material and design selection for enhancing sustainable pavement practices and quantify the emissions and impacts of those practices.

CLIMATE CHALLENGE

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

Climate Challenge Participants

- 30+ proposals from 27 agencies (including 2 local agencies)
  - Education, implementation, benchmarking, fundamental research projects
- Providing technical and funding ($7.1 million) assistance
- +7 DOTs are exploring Buy Clean Policy



Training / Workshop

- Educational Outreach
  - LCA and EPD assistance for all Climate Challenge Participants
  - Demonstration and support for use of FHWA LCA Pave Tool
- Dissemination and knowledge transfer
  - Project close out meeting and final symposium
- Integration with FHWA Community of Knowledge
  - Ongoing knowledge sharing and peer support

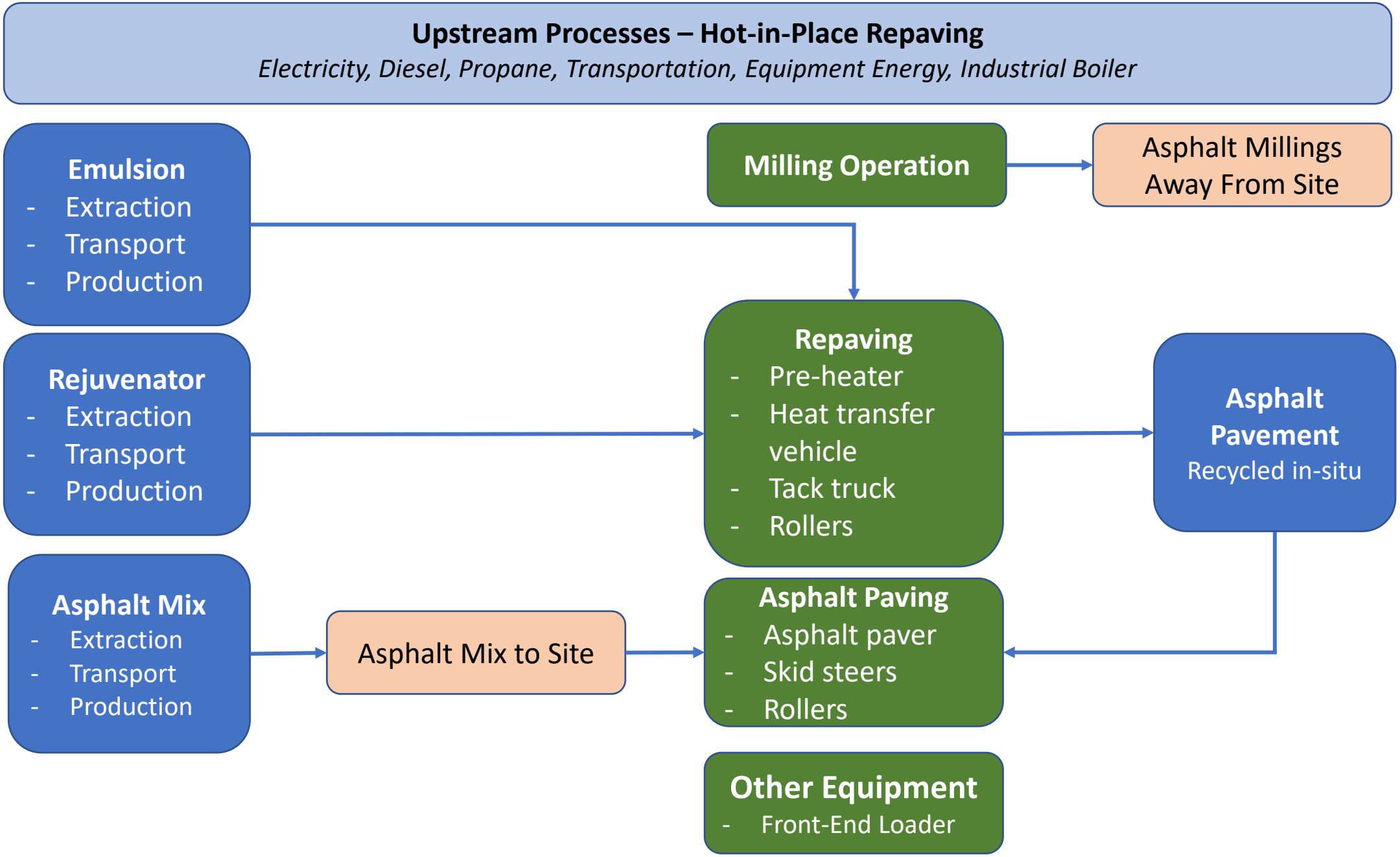
Contact Migdalia Carrion
Migdalia.carrion@dot.gov

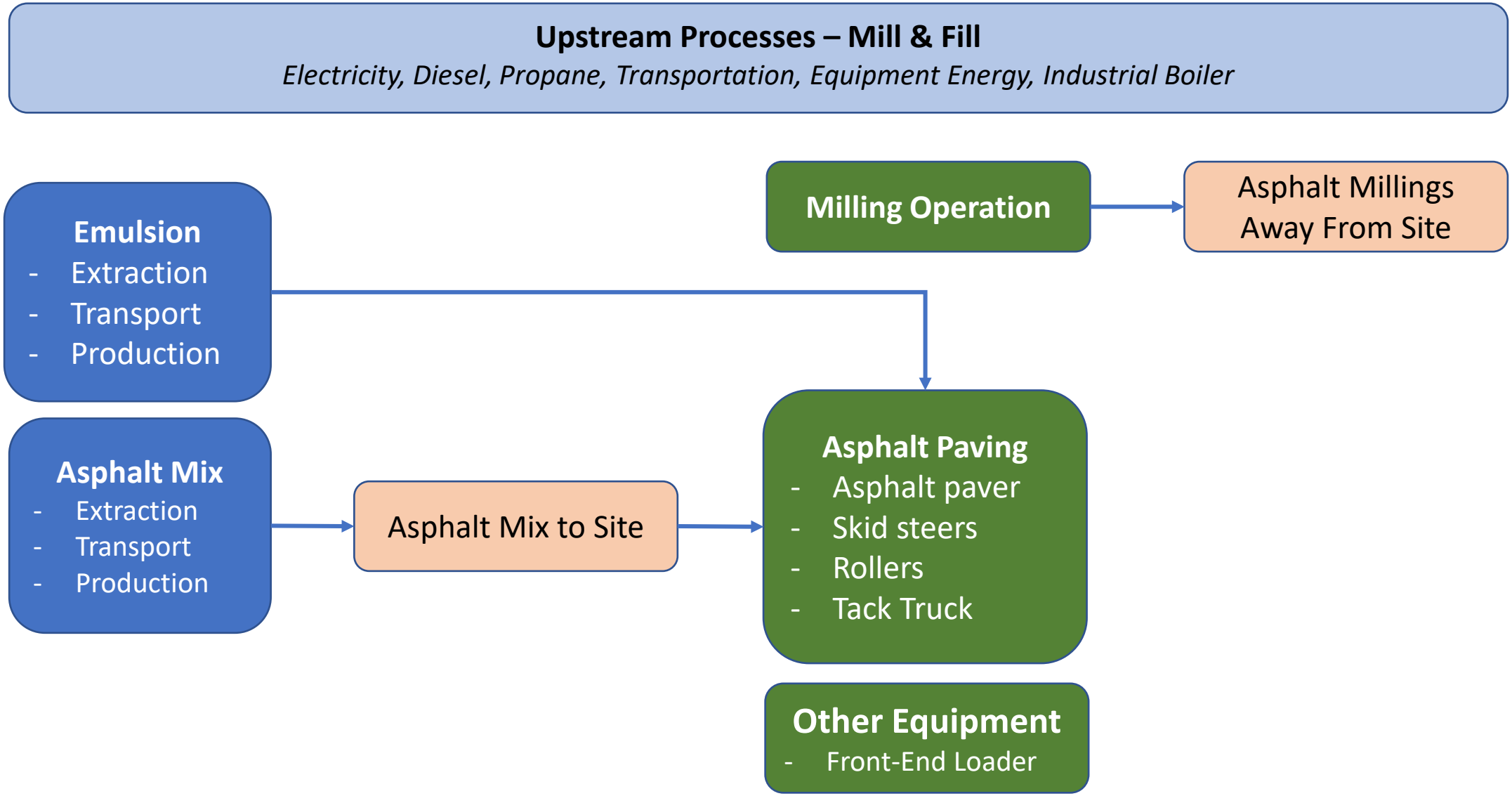
Next Community of Knowledge:
February 2023

If you want to go fast go alone,
If you want to go far go together.

- Wisdom of the Ancients

Thank You


Upstream Processes – Hot-in-Place Repaving
Electricity, Diesel, Propane, Transportation, Equipment Energy, Industrial Boiler
Emulsion
- Extraction
- Transport
- Production
Rejuvenator
- Extraction
- Transport
- Production
Asphalt Mix
- Extraction
- Transport
- Production
Asphalt Mix to Site
Milling Operation
Asphalt Millings Away From Site
Repaving
- Pre-heater
- Heat transfer vehicle
- Tack truck
- Rollers
Asphalt Paving
- Asphalt paver
- Skid steers
- Rollers
Other Equipment
- Front-End Loader
Asphalt Pavement
Recycled in-situ
Materials
Transportation
Operations
Transportation


Upstream Processes – Mill & Fill
Electricity, Diesel, Propane, Transportation, Equipment Energy, Industrial Boiler
Emulsion
- Extraction
- Transport
- Production
Asphalt Mix
- Extraction
- Transport
- Production
Asphalt Mix to Site
Milling Operation
Asphalt Millings Away From Site
Asphalt Paving
- Asphalt paver
- Skid steers
- Rollers
- Tack Truck
Other Equipment
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Materials
Transportation
Operations
Transportation