FHWA EDC-7: EPDs for Sustainable Project Delivery

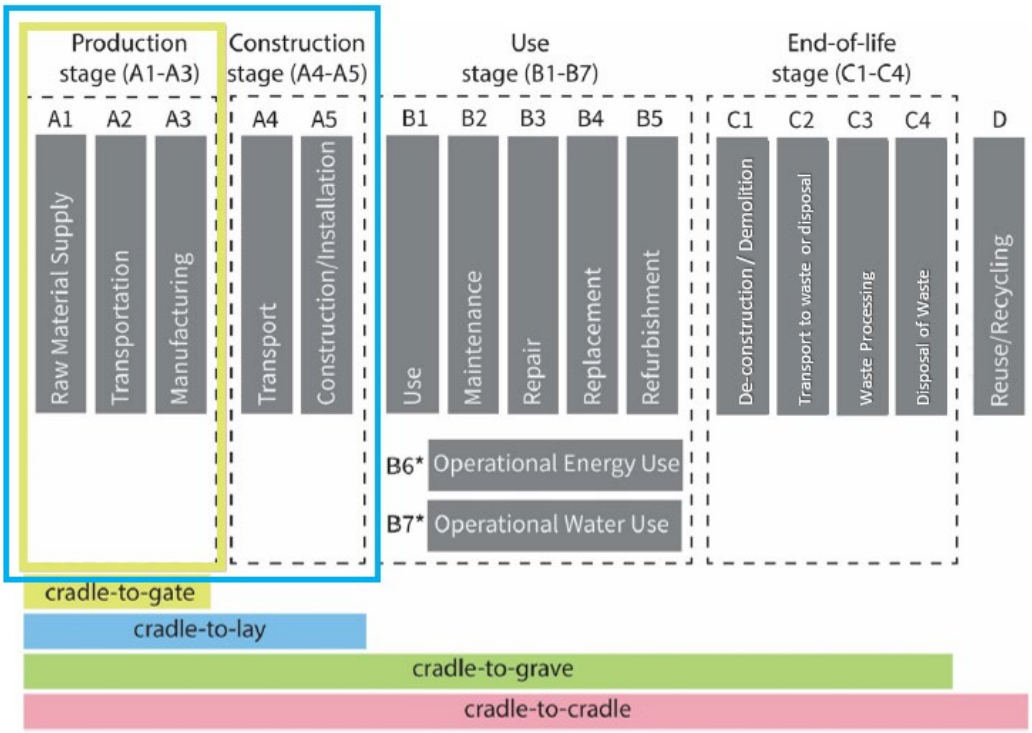
Improving Life Cycle Sustainability and the Role of Environmental Product Declarations

Construction materials such as concrete, asphalt and steel have environmental impacts during their life cycle. Environmental Product Declarations, or EPDs, document those impacts. An EPD is a standardized declaration report that resembles the nutrition statement on a food product, presented in a scientifically sound way to communicate the potential environmental impacts. EPDs help States support procurement decisions that aim to understand and lower embodied carbon reductions. EPDs are based on International Organization for Standardization (ISO) approved methodology that uses life cycle assessment (LCA) as the method for quantification. As State departments of transportation (DOT's) become increasingly conscious of infrastructure's environmental burdens and seek more sustainable strategies, they are looking for measures that accurately reflect the environmental impacts of each alternative. EPDs developed by producers communicate the greenhouse gas (GHG) emissions of construction materials in a transparent and standardized manner. They provide an opportunity to reduce negative environmental impacts and thereby they can transform the project delivery process by making the GHG impacts transparent and part of the decision making.

The Life Cycle Assessment (LCA) methodology is the basis for any EPD. The (LCA) methodology follows required International (ISO) standards for LCA and EPDs. To be called a Type III EPD, the LCA for products used in civil infrastructure must be performed in accordance with a dedicated Product Category Rule (PCR) document. There are PCR documents for the most relevant pavement construction materials including asphalt, concrete, prefab concrete, steel, etc.

Most EPDs for civil infrastructure materials in North America are only for the material production stage of the life cycle of the infrastructure, which is referred to as a "cradle-to-gate" EPD. In cradle-to-gate EPDs, the impacts are calculated starting from the extraction of raw materials from the earth and ending at the point at which the material (product) leaves the gate of the last manufacturing/processing location. Several national associations (e.g., NAPA, ACPA, NRMCA, etc.) have developed software programs or provide services for producers to utilize developing EPD's specific to their PCR product type.

Figure 1 shows where cradle-to-gate EPDs fit in the life cycle of a civil infrastructure project, including raw material supply, transportation of the raw material within the manufacturing supply chain, and product manufacturing. As Figure 1 shows, in ISO terminology, these are sub-stages A1 through A3, referred to as the "modules". Modules A1 through A3 make up the "production stage." ***This initial stage into EPDs focuses primarily on cradle-to-gate EPDs (A1 to A3).***



Source: University of California, Davis and FHWA, see references.

How Cradle-to-Gate Environmental Product Declarations Are Used

Cradle-to-gate EPDs provide a quantitative statement of the environmental impacts of a material at the end of its manufacturing. EPDs are important, first, as a source of data for materials impacts for use in assessment of the complete life cycle. Second, EPDs provide information to identify changes in impacts that can be made early in the life cycle (materials production). Third, EPDs can be used to help procure lower impact materials.

State of Practice

While the development of EPDs in the United States has been mainly initiated by the vertical construction industry and material manufacturers, transportation agencies are beginning to require and collect EPDs. This can be tied to the project procurement process to prepare for implementing EPDs as part of procurement decisions. State DOT adoption and implementation of procurement using EPDs has steadily increased over the past 5 years. Although the use of EPDs does not necessarily require a legislative mandate, various types of Buy Clean Acts have been enacted in California (2017), Colorado (2021), and Oregon (2022) that require the use of EPDs as part of the procurement process. Currently, the use of EPDs is not required under title 23, United States Code; however, the Federal government has outlined related efforts through Executive Order (EO) 14057. Under the EO, several Federal agencies are advancing activities related to EPDs. The U.S. General Services Administration (GSA) issued its first-ever specifications requiring EPDs for concrete and asphalt materials for GSA projects. The recently passed Inflation Reduction Act authorizes the Environmental Protection Agency to establish two programs for EPDs. One program will award grants and provide technical assistance to support the development, enhanced standardization, and transparency of a uniform approach to measuring and certifying the carbon content of construction materials and products. The second program will set standards for determining which construction materials have lower embodied carbon and provide for labeling that would certify lower carbon construction materials. Other Federal efforts are being advanced through the Federal Buy Clean Initiative.

ENVIRONMENTAL IMPACTS Declared Products: Description:Exterior 4000 PSI Compressive strength: 4000 PSI at 28 days Declared Unit: 1 m^3 of concrete	
Global Warming Potential (kg CO -eq)	318
Ozone Depletion Potential (kg CFC-11-eq)	7.15E-6
Acidification Potential (kg SO -eq)	0.95
Eutrophication Potential (kg N-eq)	0.24
Photochemical Ozone Creation Potential (kg O -eq)	20.7
Abiotic Depletion, non-fossil (kg Sb-eq)	5.82E-5
Abiotic Depletion, fossil (MJ)	658
Total Waste Disposed (kg)	94.2
Consumption of Freshwater (m^3)	2.40
Product Components: natural aggregate (ASTM C33), Portland cement (ASTM C150), fly ash (ASTM C618), batch water (ASTM C1602), admixture (ASTM C494), admixture (ASTM C260)	

Sample information from Concrete EPD

An Environmental Product Declaration for Asphalt Mixtures		
PRODUCT DESCRIPTION Gradation Type: dense Mix Design Method: superpave Nominal Maximum Aggregate Size: 12.5 mm Performance Grade of Asphalt Binder: PG 58-28 This mix producer categorizes this product as a Hot Mix Asphalt (HMA) asphalt mixture. This asphalt mixture was produced within a temperature range of 150 to 161°C		
IMPACT CATEGORY	**POTENTIAL IMPACT PER METRIC TONNE ASPHALT MIXTURE (PER TON ASPHALT MIXTURE)**	
Global warming potential (GWP-100)	*71.05 (64.46) kg CO2 Equiv.*	
Ozone depletion potential (ODP)	*9.92e-08 (9.00e-08) kg CFC-11 Equiv.*	
Eutrophication potential (EP)	*1.24e-02 (1.13e-02) kg N Equiv.*	
Acidification potential (AP)	*1.72e-01 (1.56e-01) kg SO2 Equiv.*	
Photochemical ozone creation potential (POCP)	*4.51 (4.09) kg O3 Equiv.*	
DECLARED UNIT: The declared unit is 1 metric tonne (1 short ton) of an asphalt mixture		
PRODUCT INGREDIENTS		
Component	***Material***	***Weight %***
Aggregate	*Natural Stone*	*15*
Aggregate	*Natural Stone*	*21*
Aggregate	*Natural Stone*	*13*
Aggregate	*Natural Stone*	*14*
Aggregate	*Natural Stone*	*8*
RAP	*Reclaimed Asphalt Pavement*	*24*
Binder	*Unmodified*	*4*

Sample information from Asphalt EPD

Source: FHWA, see references.

PennDOT EDC-7: EPDs State of Practice/Draft Implementation Plan

- **Development Stage:** Fall 2023-Winter 2024
  - The State is starting to review guidance and best practices, building team and support with partners and stakeholders, and developing an implementation process.
    - Develop team to review guidance and best practices, and support with partners and stakeholders, and developing an implementation process.
    - Continued guidance/interaction with FHWA EPD Sustainability Deployment Team.
    - Participate in webinars, peer exchanges, workshops, and related educational training.
    - Request additional technical assistance.
    - Explore grant funding (e.g., NOFO's, IRA, STIC, AID Demo, Pooled Fund) to pilot tools and techniques for this innovation.
    - Develop best practices, policy, tools, techniques for deploying innovation.
    - Develop an EPD protocol to identify the construction bid item categories that will encompass the materials requiring EPD's in the future.
    - Encourage the development and use of EPD's by industries and manufacturers.
    - Identify potential pilot opportunities.
    - Explore databases being used by other DOT's to be able to efficiently house EPDs and extract needed data.

- **Demonstration Stage:** Spring 2025-Fall 2026
  - The State is ready to pilot or is already piloting projects under contract to collect EPDs.
    - Develop procedures and reporting practices for EPDs in a public database to support EPD consistency.
    - Develop plans/details for pilot opportunity.
    - Explore additional grant funding (e.g., NOFO's, IRA, STIC, AID Demo, Pooled Fund) to pilot tools and techniques for this innovation.
    - Use at least one tool or technique supporting this innovation to expand use into regular business practices.

- **Assessment Stage:** Winter 2026-Winter 2027
  - The State evaluates and archives EPDs that are created, transmitted and collected to build a database, data quality, data integrity and data integration.
    - GHG Goals & Material contribution.
    - Consider innovation for regular use.
    - Consider EPD's for materials procurement once a level playing field is established for competition.
    - Incorporate lessons learned for use in future projects.
    - Incorporate into contract language, guidance, and policies.
    - Establish an Industry outreach and support program.

- **Institutionalized:** Spring 2028
    - The State collects EPDs as part of project development and delivery processes and procedures.
        - Collection of EPDs successfully integrated into policies, procedures and guidance, contract language, and/or specifications.
        - Consistently letting projects that collect EPDs on a regular basis.

FHWA EPD Team Recommendations

- **Project Delivery/Contract Mgmt.:** This person or team would be responsible for developing and managing the implementation of using EPDs and/or LCAs, including setting specifications, contract language, construction process to verify EPDs, design directives/policies, depending on the process the state DOT's want to implement.
    - **Specification Section**

- **Procurement Specialist:** This person or team would be responsible for developing the contract language and help the Project Delivery Team understand the state DOT's practice and state laws that should be considered when using EPDs in procurement processes (either Deign procurement services or construction and maintenance procurement services).
    - **Specification Section/ Maintenance**

- **Pavement design and Analysis Unit (PDAU):** This team would be responsible for considering sustainability and life cycle assessment (LCA) in the design of pavements, and as part of the Sate DOT Design Policy
    - **PDAU**

- **Materials and Acceptance unit:** This team would consider quality assurance processes (in case of EPDs collection and implementation at the construction or mix design approval).
    - **District Level/ Bureau of Construction & Materials (BOCM)**

- **Other:** Recommend that PennDOT create a core team of at least 2-3 staff members and 1-2 consultants/academia experts to ensure that all aspects of the initiative are considered. As part of the Climate Challenge Program, we are doing customized training for our participants to help state DOT's go through this brainstorming section to decide the processes, reasonable resources, and timeline needed to move to execution, helping them create a first strategic/implementation plan.
    - In addition to these core roles, other stakeholders may be involved, such as consultants, suppliers, contractors, and legislators to set and support the DOT expectations.

- **FHWA Deployment Team Contact Information**

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References

1. FHWA- Every Day Counts 7 (EDC-7), *EPDs for Sustainable Project Delivery.* https://www.fhwa.dot.gov/innovation/everydaycounts/edc_7/sustainable_epds.cfm

2. University of California, Davis, *Recommended Approach for Use of Cradle-to-Gate Environmental Product Declarations (EPDs) in Procurement of Civil Infrastructure Materials.* https://escholarship.org/content/qt3fn4n3q6/qt3fn4n3q6.pdf?t=rt9afe