

How Precasters Can Benefit from EPD Requirements

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1

Who Am I?

- B.S. in Civil Engineering from Oklahoma State University
- Undergraduate and post-graduate research assistant under Dr. Tyler Ley
- Worked as an engineer for a concrete research and development laboratory
- Now in CDOT HQ Pavement Design and Documentation unit and on EPD Team
- Manager of CDOT’s precast qualified manufacturer list



2

Presentation Overview

- Sustainability Defined
- Buy Clean Legislation
- Colorado DOT Case Study
- Understanding EPDs
- Obtaining EPDs
- Using EPDs to Your Advantage
- Resources and Tools



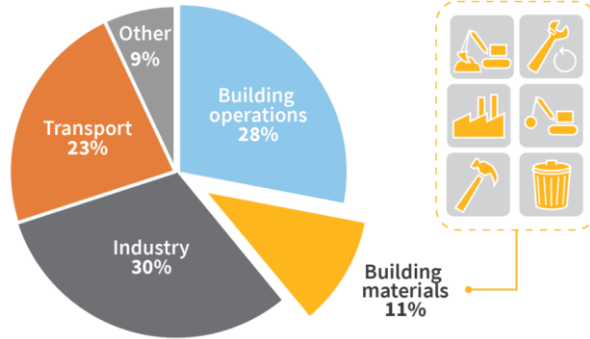
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Sustainability: People, Planet, Profit



4

Impact of Construction Materials

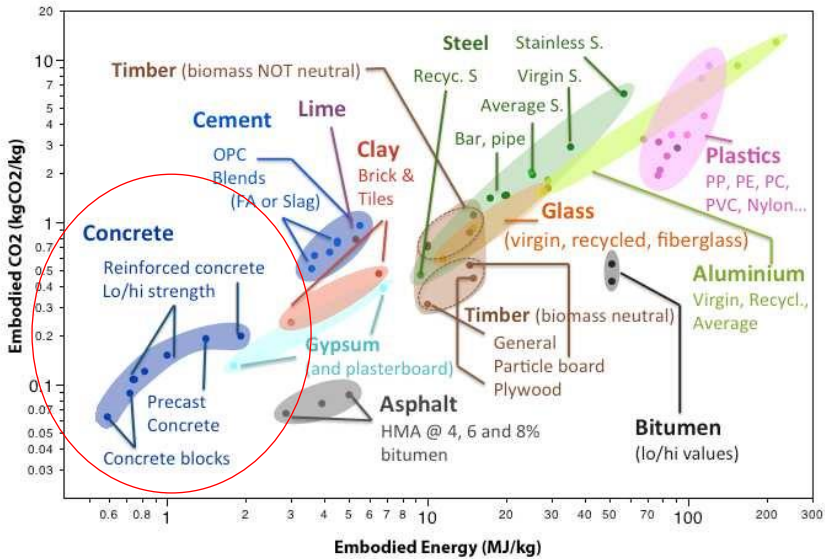


Global energy-related CO₂ emissions.
Adapted from the UNEP 2019 Global Status Report

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5



Source: Barcelo et al. 2019. Cement and carbon emissions. DOI: 10.1617/s11527-013-0114-5



6

Buy Clean Legislation – Overview

- Buy Clean-related legislation and its impact on procurement policies
- Growing importance of environmental considerations in construction materials, specifically precast concrete
- Focus on Environmental Product Declarations (EPDs) in new policies



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7

Buy Clean Legislation – Federal

[2021 Executive Order on Federal Sustainability](#)

Established Federal Buy Clean Task Force

[General Services Agency \(GSA\) Buy Clean Program](#)

Requires low-carbon materials and will set GWP limits

[Federal Highway Administration \(FHWA\) Climate Challenge](#)

35 projects across the US were granted a total of \$7.1M

[FHWA Every Day Counts 7 - EPDs for Sustainable Project Delivery](#)

[Inflation Reduction Act](#)

Allocated \$4.5B to the EPA, DOT, and GSA to procure climate-friendly construction materials

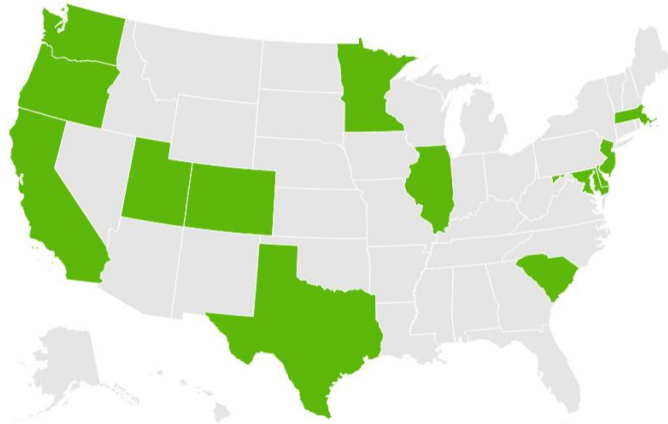
[Federal Buy Clean Initiative](#)

Prioritization of purchasing lower GHG steel, concrete, asphalt, and glass



8

Buy Clean Legislation – State



Map: NPCA



9

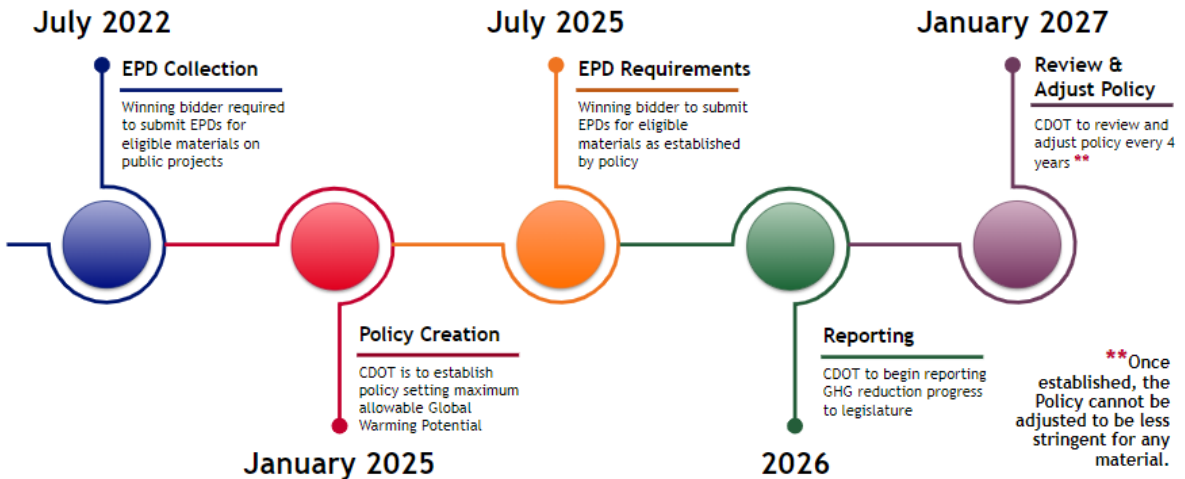
A Case Study: Buy Clean Colorado

- HB 21-1303, or “Buy Clean Colorado”, was incorporated into Colorado Revised Statutes 24-91-117/118
 - Section 117: Office of the State Architect (OSA)
 - Section 118: Department of Transportation (CDOT)
- As of July 1, 2022, Section 118 required CDOT to begin collecting Environmental Product Declarations (EPDs) on eligible materials to include:
 - Asphalt and Asphalt Mixtures
 - Cement and Concrete Mixtures
 - Steel



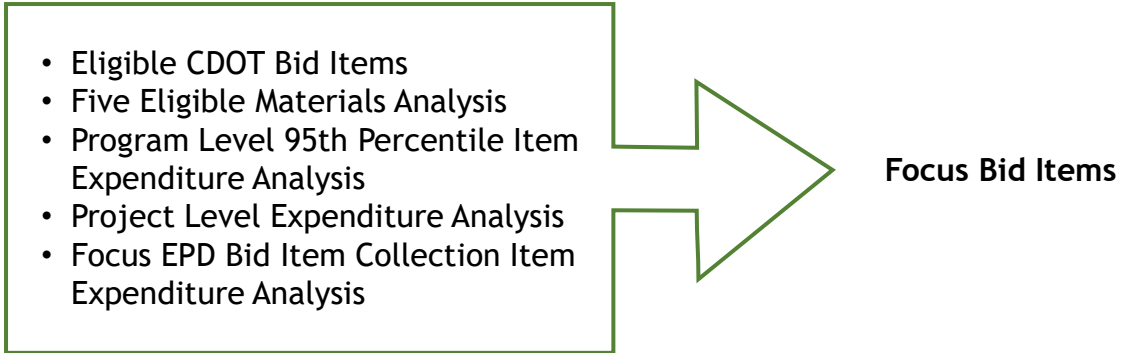
10

Buy Clean Colorado – Timeline



11

Buy Clean Colorado – Focus Bid Items



12

Buy Clean Colorado – Quantity and Cost Limits

Goals:

- Determine if small quantity exemptions for individual bid items can be implemented
- Determine if a minimum project cost limit could be implemented

Motivation:

- Limit undue burden on project staff, small suppliers, & contractors

Results:

- Quantity/cost limits determined for items with a typical associated item cost estimates between \$25K and \$50K
- \$3M project bid item cost implemented for initial implementation. It is anticipated this may be reduced in the future with industry growth and maturity of the program



13

Buy Clean Colorado – Specifics

Submission Timing and Responsibility:

- 2 weeks prior to material placement for concrete and asphalt
- Before permanent incorporation for steel and precast
- It is the contractual responsibility of the contractor to submit the required EPDs, but the material supplier may submit on the contractor's behalf in some cases

Colorado Agency Collaboration Note:

- OSA has different requirements per HB 21-1303 (e.g., additional materials, timeline, limit requirements)



14

Buy Clean Colorado – Readiness

Year 1 (July 1, 2022)

Focus of collection on those ready to provide EPDs

- Asphalt - Hot mix asphalt producers/suppliers
- Concrete - Ready mix suppliers and concrete paving companies
- Steel - Reinforcing steel

Year 2 (July 1, 2023)

Iterative growth for industries that need more time to develop

- Structural steel - Hot-rolled sections, beams, girders, etc.
- Precast and prestressed - Pipe, culverts, beams, girders, etc.



15

Buy Clean Colorado – Outreach

Stakeholders include:

- Material Suppliers
- Industry Trade Associations (Local and National level)
- Contractors (Colorado Contractors Association)
- CDOT and Consultant project staff
- FHWA and other State Agencies

CDOT has hosted multiple workshops and feedback meetings with each of the industries we are collecting EPDs from in Year 1 and Year 2

CDOT allowed industries to review and provide feedback on the Specification and Protocol document before publication

Continuously engaging with Program Operators, knowledge sharing groups, Buy Clean policymakers, etc.



16

Buy Clean Colorado – Documents

CDOT’s EPD [Specification](#) and [Protocol](#) document were published on July 1st, 2022. Revisions to the Protocol were made for Year 2 and were published on July 1, 2023

Instructions for use on CDOT construction projects:

Use this Standard Special Provision on all CDOT Engineering projects with an Engineers Estimate of \$3 million or greater, not including CE, Indirect, and Force Account item costs. This specification is not intended for use on Local Agency Construction projects.

Table 2. Bid Item Quantity Limits

Item Number Category	Item Description	Quantity Limits	Unit
206	Structure Backfill (Flow-fill)	50	CY
310	Hydraulic Cement	150	Ton
403	Asphalt Mixtures (HMA/SMA/WMA)	500	Ton
412	Portland Cement Concrete Pavement (PCCP)	1,000	SY
601	Structural Concrete (All Classes)	50	CY
602	Reinforcing Steel	15,000	LB

Table 1. Bid Items Requiring EPD Submittal

Item Number Category	Item Description	Included Item Number / Range	Interpretation
206	Structure Backfill (Flow-Fill)	206-00065	EPD submittal required for the flow-fill (concrete) design.
310	Hydraulic Cement	310-00900	EPD submittal required for the cement.
403 ¹	Asphalt Mixtures (HMA/SMA/WMA)	403-09230 through 403-96660	EPD submittal for each asphalt mixture design and plant location required. If 411 - Asphalt Cement is paid separately, it shall be included in the 403 EPD submittal item. For portable Plant EPD Guidance, see footnote.
412 ¹	Portland Cement Concrete Pavement (PCCP)	412-00200 through 412-01500; 412-06000; 412-06060	Separate EPD submittals for concrete, dowel bar, and reinforcing steel items are required. For portable Plant EPD Guidance, see footnote.
503	Drilled Shafts	503-00012 through	Separate EPD submittals for concrete and reinforcing steel items are



Buy Clean Colorado – Summary

So far, ~100 projects have been advertised that contain the EPD Specification and are eligible for EPD collection

Have received ~70 EPDs received so far and expecting more submissions soon



Buy Clean Colorado – Training and Support

- Resources and support email address posted to [CDOT EPD webpage](#) (CDOT_EP@STATE.CO.US)
- Publication of [white paper](#) on EPD implementation process
- Video tutorials demonstrating example EPD submissions for each material
- Annotated EPDs showing the location of required information for each material
- Recordings and PDFs of workshops we've conducted to date
- A [spreadsheet tool](#) to assist project staff and contractors in determining when and how many EPDs are required per project based on bid items and quantities
- Team attendance at pre-bid, pre-construction, and pre-pave conferences for eligible projects to offer EPD guidance



19

Buy Clean Colorado – Next Steps

CDOT was granted \$312,000 & intends to use on the following projects:

- Project 1:** Continued support for compliance with HB 21-1303 (ongoing industry outreach, improvements to EPDs and PCRs)
- Project 2:** Data analyses and benchmarking methodology recommendation to establish GWP limits based on EPD data we collect between now and 2025 (how to categorize materials, how to identify outliers and handle uncertainty, and developing documentation of this process) - In collaboration with CU Boulder
- Project 3:** Beyond A1-A3 (gaining familiarity with lifecycle thinking and the LCA Pave tool)



20

Buy Clean Colorado – Challenges

- **Timing**
- **Limited Personnel**
- **Lack of Knowledge / Unknowns**
 - Material costs
 - Improvements to data, tools, etc.
 - Policy alignment
 - Lack of data collected before policy must be established
- **Burden on Smaller Suppliers**
- **Communication Gaps**
- **Database Simplification**
- **Verification and Accuracy**
 - Current reporting needs
 - Industry averages
 - Necessary data - As-built quantities



21

Understanding Embodied Carbon

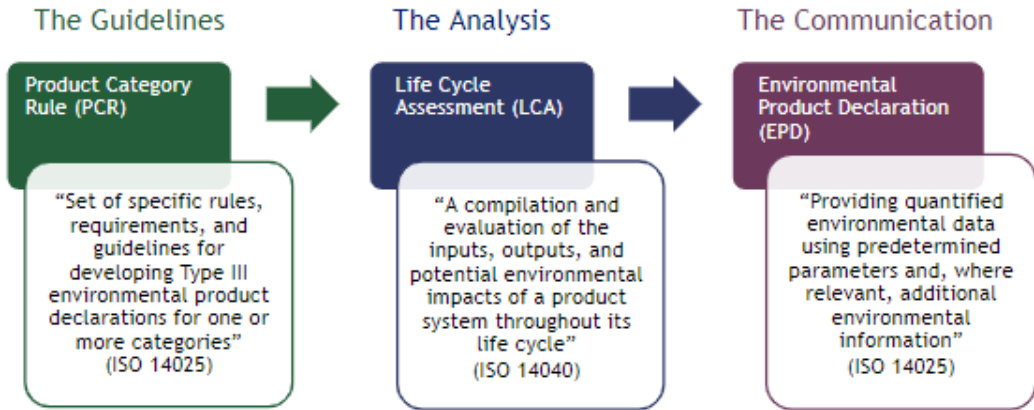


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22

Understanding EPDs – Process



23

Understanding EPDs – Definitions

Environmental Product Declaration (EPD)

Transparent, verified “nutrition label” that communicates the environmental impacts of a material or product.

Note: This is what most buy clean policies use and require

Global Warming Potential (GWP)

Allows comparison of the global warming impacts of different gases

Note: Commonly a key metric

Nutrition Facts	
8 servings per container	
Serving size	2/3 cup (55g)
Amount per 2/3 cup	Calories 230
% DV*	
12%	Total Fat 8g
5%	Saturated Fat 1g
	Trans Fat 0g
0%	Cholesterol 0mg
7%	Sodium 160mg
12%	Total Carbs 37g
14%	Dietary Fiber 4g
	Sugars 1g
	Added Sugars 0g
	Protein 3g
10%	Vitamin D 2mcg
20%	Calcium 260mg
45%	Iron 8mg
5%	Potassium 235mg

Environmental Facts	
3 servings per box culvert	
Serving size	1 ton
Amount per ton	GWP kg CO2 eq 305
2.34E-05	Ozone Depletion Potential
1.04 kg	Acidification Potential
0.09 kg	Eutrophication Potential
2870 MJ	Total primary energy consumption
2340 MJ	Nonrenewable energy
530 MJ	Renewable energy
	Total Waste Disposed
3.20 kg	Non-hazardous waste generated
0 kg	Hazardous waste generated
	Material resources consumption
.780 kg	Nonrenewable material
24 kg	Renewable material
.2610 L	Net fresh water



24

Understanding EPDs – Types

Type III EPDs:

- Industrywide EPD
- Facility-specific EPD
- Product-specific EPD
- Supply Chain-specific EPD



Understanding EPDs – Lifecycle

- Cradle-to-Gate
 - “Includes the impacts calculated from initial material production (e.g., oil exploration and extraction, mining of rock) up to the gate of the manufacturing site (and before transport to the paving site) (EN15804 modules A1-A3).”
- Cradle-to-Site
 - “Includes the impacts of cradle-to-gate plus the transportation to the paving site, and the construction operation of paving (EN15804 modules A1-A5).”
- Cradle-to-Grave
 - “Includes the impacts of cradle-to-site, plus the use stage processes (e.g., vehicle operation, stormwater, noise) and maintenance and rehabilitation ending just before the first reconstruction (EN15804 modules A1-A5, B1-B7, and C1-C4).”



FHWA Tech Brief: Environmental Product Declarations, July 2020



Understanding EPDs – Lifecycle

Production Stage			Construction Stage		Use Stage							End of Life Stage			
Extraction & Upstream Production	Transport to Factory	Manufacturing	Transport to Site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Demolition/Reconstruction	Transport	Waste Processing	Disposal
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4



27

Understanding EPDs - Misconceptions

Per each PCR, EPDs cannot be used to compare dissimilar materials

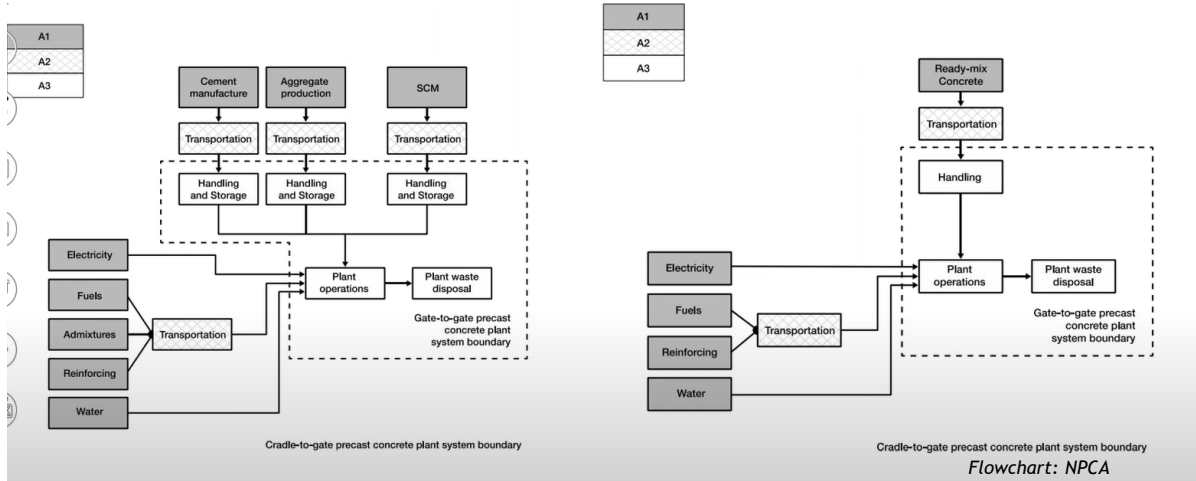
They are only intended to compare materials with the same function and performance characteristics

**** Performance is not to be compromised when using EPDs**



28

Obtaining an EPD: Process



29

Obtaining an EPD: Opportunities



Let us strive to improve ourselves, for we cannot remain stationary; one either progresses or retrogrades.

Marie Anne de Vichy-Chamrond

Source: people-e-quation.com/self-improvement-are-you-progressing/

30

Strategies to Lower Embodied Carbon



- Optimized mix design (aggregate gradation)
- Recycled materials (RCA)
- Alternative materials (Type II cement)
- SCMs
- Innovation
- Reduce transportation distances



31

Resources and Tools

- [NPCA Contact: Claude Goguen](#)
- [Data Survey](#)
- [NPCA Magazine Article](#)
- [EPD Webinar](#)
- [Instructional Video](#)
- [WAP Sustainability](#)



32

Questions?



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