

Evotherm WMA Sustainability Duval WMA Trial

Jacksonville, FL Richard Steger, Ingevity

Project Trial Dates: May 9-11, 2022



JUVA SPHALT

Asphalt Testing Solution

Engineering

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Outline

The Road Forward

Environmental Product Declarations

NAPA Ecolabel Program

Creating an EPD

What Impacts GWP

Trial Mix EPD review

Fuel Use





Acronyms

- LCA Life Cycle Assessment
- EPD Environmental Product Declaration
- IIJA Infrastructure Investment and Jobs Act (aka Bipartisan Infrastructure Law, BIL)
- IRA Inflation Reduction Act
- CEQ White House Council on Environmental Quality



An Industry–Wide Vision

The Road Borne and the Road of the Road of

A Vision for Net Zero Carbon Emissions for the Asphalt Pavement Industry

Vision: Sustainable communities and commerce, connected by net zero carbon
4 emission asphalt pavements Mission: Engage, educate, and empower the U.S. asphalt community to produce and construct net zero carbon emission asphalt pavements

Asphalt Testing Solutions & Engineering

Frameworks to Quantify GHG Emissions



CO₂ Emitted During Asphalt Mix Production

Understanding Carbon

Embodied Carbon

CO

Manufacture, transport and installation of construction materials

Operational Carbon Building Energy Consumption

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https://www.architects.org/news/building-a-low-carbon-future-reducing-embodied-carbon-in-the-built-environment

THE BUILT ENVIRONMENT

Annual Global CO₂ Emissions



© Architecture 2030. All Rights Reserved. Data Source: IEA (2022), Buildings, IEA, Paris

Building Construction Industry and Other Construction Industry represent emissions from concrete, steel, and aluminum for buildings and infrastructure respectively.



https://architecture2030.org/why-the-building-sector/

What is an EPD?

• Environmental Product Declaration

Quantified environmental information
on the life cycle of a product
to enable comparisons between products
fulfilling the same function*

- "Nutrition label" for environmental impacts
 - ISO Standards
 - Product Category Rules (PCR)
- Independently verified



EPD "Nutrition" Label						
Your Building Product						
Amount per Unit						
LCA IMACT MEASURES	TOTAL					
Primary Energy (MJ)	12.4					
Global Warming Potential (kg CO ² eq)	0.96					
Ozone Depletion (kg CFC·11 eq)	1.80E-08					
Acidification Potential (mol H+ eq)	0.93					
Eutrophication Potential (kg N ⁻ eq)	6.43E-04					
Photo-Oxidant Creation Potential (kg 03 eq)	0.121					
Your Product's Ingredients: Listed Here						

https://westcoastclimateforum.com/cfpt/concrete/strategy1

*Source: ISO 14025:2006. EPDs from different Product Categories should NOT be compared to each other.



Corporate GHG Reporting Framework

Scope 1

• Direct Emissions

Scope 2

 Indirect Emissions from Electricity Production

Scope 3

- Other Indirect Emissions
 - Upstream
 - Downstream





Fuels

https://www.oregon.gov/odot/climate/Documents/GHG Report FINAL.pdf

Fuels

Production

Production

Gas

Our Industry Needs Leaders to create EPDs

THE READ FORVARD

A Vision for Net Zero Carbon Emissions for the Asphalt Pavement Industry Asphalt Testing Solutions

Engineering





Key Components of NAPA's EPD Program



Learn more at <u>www.asphaltpavement.org/epd</u>



Emerald Eco-Label Software

- NAPA's web-based software tool
- Asphalt mix producers use it to develop verified EPDs
- EPDs are plant-specific & mixspecific
- Can be used for asphalt plants located in the U.S.
- Simplified process that saves mix producers time and money



How to use Emerald Eco-Label

- Register at https://asphaltepd.org/
- Watch two webinars and pass the quizzes
- Compile data for plant and mixes
 - Use EPD Data Gathering spreadsheet
- Purchase access for plant(s)
- Enter data for plant and mixes to produce EPDs
- Upload supporting documentation

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Data requirements for the plant

- 12 consecutive months of data
 - Within the past five years
- Fuel consumption
 - Burner
 - Hot oil heater
 - Generator
 - Equipment
- Electricity consumption
- Water consumption
- Total mix sold (tons)





Data is confidential!

Data requirements for mix designs

- Material content (by weight of total mix)
 - Aggregates
 - Asphalt binder
 - RAP and RAS
 - Additives
- Transportation mode and distance
 - Truck, rail, or barge
- Mix production temperature







Sample Mix GWP from a Typical Plant

• Materials (A1)

- 95% aggregates
- 5% asphalt binder
- Transport (A2)
 - 22 miles by truck
- Plant Energy (A3)
 - Burner fuel Natural Gas
 - 289,000 Btu/ton
 - 3.3 kWh/ton Average grid





How RAP can Reduce Emissions





The # of plants in the US with EPDs As of 3/20/2023



Ingevity

of EPDs by State As of 3/20/2023





Common Questions about EPDs







What are the biggest contributors to GHG emissions?

- Sometimes, aggregate hauling exceeds everything else
- Burner fuel consumption
- Asphalt binder content

Will low-embodied carbon asphalt mix sacrifice quality and durability?

- Specifications are not going away!!!!
- **Balanced Mix Design** is an excellent framework for innovation without sacrificing mix quality and performance
- <u>Recent NCAT case study using</u> <u>WMA in Alabama</u>









Does the EPD give credit for Warm Mix?

Not yet...

Photo Credit https://www.fhwa.dot.gov/publications/focus/08apr/03.cfm

CONCRETE VS ASPHALT

Can EPDs be Used for Pavement Type Selection?

- Not directly different PCRs
- As data inputs to full LCA?
 - Harmonization issues
 - Lots of uncertainty in use stage modeling
 - Scarce knowledge, experience, and capacity at agencies

Key Takeaways

- EPDs provide verified data to quantify environmental impacts
- Buy Clean policies are spreading quickly
- Inflation Reduction Act will accelerate demand for low carbon materials
- Emission reductions can be achieved with existing practices and technologies
- Prepare your company by developing EPDs
 - Start with one plant
 - Expand to other plants, benchmark your operations



EPD for the mix produced on this trial

Note: trial mixtures were produced at 325, 275, 265 and 250°F

Emerald ECO / LABEL

An Environmental Product Declaration (EPD) for Asphalt Mixtures

Company Information

Duval Asphalt Products, Inc. is an asphalt mixture producer. A0712 12th Street asphalt plant 6820 West 12th Street Jacksonville, FL 32254 USA



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Product Description

This EPD reports the potential environmental impacts and additional environmental information for an asphalt mixture, which falls under the United Nations Standard Products and Services Code 30111509. Asphalt mixtures are typically incorporated as part of the structure of a roadway, parking lot, driveway, airfield, bike lane, pedestrian path, railroad track bed, or recreational surface.

Mix Name: 40% SP-9.5 (52-28) SP 21-19522A

Specification Entity: FDOT

Specification: SP-9.5, TLC

Gradation Type: dense

Mix Design Method: superpave

Nominal Maximum Aggregate Size: 9.5 mm

Performance Grade of Asphalt Binder: PG 52-28

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 149 to 160°C (300.0 to 320.0°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.

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Notice this statement

This mix producer categorizes this product as a Hot Mix Asphalt (HMA) asphalt mixture. This asphalt mixture was produced within a temperature range of 149 to 160°C (300.0 to 320.0°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 Mixtures*^{3,4}. This EPD transparently describes the potential environmental impacts associated with the identified life cycle stages of the described product.

 Declaration Number:
 142.336.875 v13
 Software Version:
 2.0.0

 Date of Issue:
 Feb. 21, 2023
 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://asphaltepd.org/epd/d/bBUPMr/ LCA performed by: Ben Ciavola, PhD

Note: trial mixtures were produced at 325, 275, 265 and 250°F



Ingredients for mix

Product Ingredients

The product ingredients as identified in the mix design are provided in the table below.

TABLE 1. PRODUCT INGREDIENTS

COMPONENT	MATERIAL	WEIGHT %
Aggregate	Natural Stone	29
Aggregate	Natural Stone	14
Aggregate	Natural Stone	15
RAP	Reclaimed Asphalt Pavement	39
Binder	Unmodified + 1 terminal additive(s)	4

*Indicates that this material is a data gap. Upstream data associated with extraction and processing is not accounted for in this EPD.



Environmental Impact Summary

IMPACT CATEGORY	POTENTIAL IMPACT PER METRIC TONNE ASPHALT MIXTURE (PER TON ASPHALT MIXTURE)
Global warming potential (GWP-100)	72.69 (65.95) kg CO2 Equiv.
Ozone depletion potential (ODP)	2.35e-07 (2.14e-07) kg CFC-11 Equiv.
Eutrophication potential (EP)	2.74e-02 (2.48e-02) kg N Equiv.
Acidification potential (AP)	4.14e-01 (3.76e-01) kg SO2 Equiv
Photochemical ozone creation potential (POCP)	13.05 (11.84) kg O3 Equiv.

DECLARED UNIT

TABLE 3. ENVIRONMENTAL IMPACT SUMMARY TABLE

The declared unit is 1 metric tonne (1 short ton) of an asphalt mixture (UNSPSC Code 30111509: Asphalt Based Concrete), which is defined as "a plant-produced composite material of aggregates, asphalt binder, and other materials." ³



Life Cycle Impact Indicators

TABLE 4. LIFE CYCLE IMPACT INDICATORS

	INDICATOR	UNIT	QUANTITY PER METRIC TONNE ASPHALT MIXTURE (PER SHORT TON ASPHALT MIXTURE)					
ACKONYM			MATERIALS (A1)	TRANSPORT (A2)	PRODUCTION (A3)	TOTAL (A1-A3)		
GWP-100	Global warming potential, incl. biogenic CO2	kg CO2 Equiv.	24.04 (21.81)	17.77 (16.12)	30.88 (28.01)	72.69 (65.95)		
ODP	Ozone depletion potential	kg CFC-11 Equiv.	1.29e-08 (1.17e-08)	1.08e-07 (9.76e-08)	1.15e-07 (1.04e-07)	2.35e-07 (2.14e-07)		
EP	Eutrophication potential	kg N Equiv.	6.55e-03 (5.94e-03)	1.71e-02 (1.55e-02)	3.78e-03 (3.43e-03)	2.74e-02 (2.48e-02)		
AP	Acidification potential	kg SO2 Equiv.	7.13e-02 (6.47e-02)	2.76e-01 (2.51e-01)	6.67e-02 (6.05e-02)	4.14e-01 (3.76e-01)		
POCP	Photochemical ozone creation potential	kg O3 Equiv.	1.52 (1.38)	9.53 (8.64)	2.01 (1.82)	13.05 (11.84)		



HMA Run at 325°F



WMA Run at 275°F



WMA Run at 265°F



WMA Run at 250°F



EPD Summary

Temp	325°F	275°F	265°F	250°F
GWP- 100	65.95	62.31	61.71	60.7
Burner Nat Gas	20.2	16.6	15.9	14.9

Units = kg CO_2e / metric ton of mix



Evotherm WMA Plant Fuel Consumption Data 2022

Input Data from Contractor (Utah)

- 360 Tons/hr run rate
- Gencor Counter Flow Drum
- 15% RAP Content
- Assume 250k Mix Tons/yr
- \$147.5k Savings (single plant) running at 260°F

Note: Natural gas fuel \$9.00/MMBtu assumption

Input Data from Contractor (Florida)

- 200 Tons/hr run rate
- Astec Double Barrel Green
- 40% RAP Content
- Assume 150k Mix Tons/yr
- \$61.5k Savings (single plant) running at 265°F

Input Data from Contractor (Virginia)

- 290 Tons/hr run rate
- Astec Double Barrel Green
- 30% RAP Content
- Assume 250k Mix Tons/yr
- \$107.5k Savings (single plant) running at 260°F





Energy/ Mix Ton (Virginia)









USD/Ton Savings vs Temperature





