

# Port Authority of NY & NJ's Experience with EPDs

**NEAUPG Annual Meeting** 

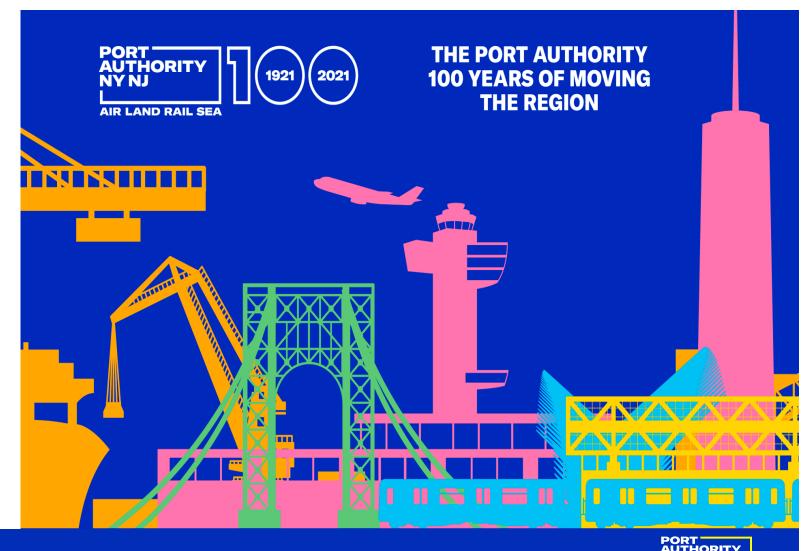
Presented By:

Darius Pezeshki, Materials Engineer, Materials Engineering Unit 10.25.2023

**AIR LAND RAIL SEA** 

### **Outline**

- Introduction
- EPDs
  - -Why?
  - -Background
  - -Current Policy
  - -Looking Ahead







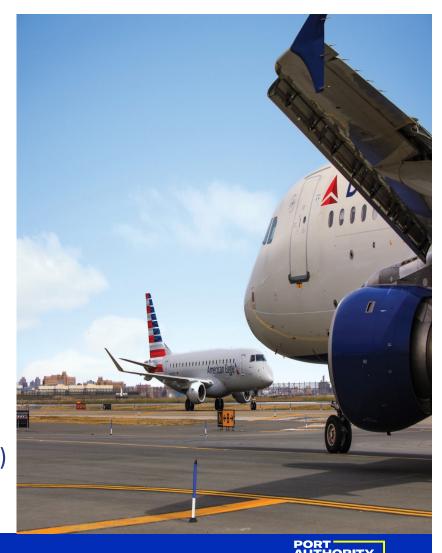
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# **Airports**

**Current and Completed Major Asphalt Projects** 

- Newark Liberty International
  - -New Terminal A (2018-Current)
    - -New Apron and Taxiway Areas as well as a New Redesigned Terminal Roadway System
- Teterboro
  - -Rehabilitation of Runway 6-24 (2022)
- John F. Kennedy International
  - -Interim Pavement Rehabilitation of Taxiway C (2022)



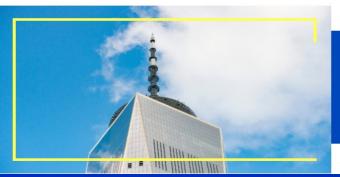
# **Clean Construction Program**



#### In September 2020, the PANYNJ Announced its Clean Construction Program

- Incorporation of LEED and Envision-equivalent standards during infrastructure design
- Specification for low carbon concrete: reduces the required cement content in certain concrete mixes by 25%, significantly reducing its carbon intensity and allowing for lower-carbon alternatives
- Pilot projects to develop low carbon concrete and materials
- Requirement for Environmental Product Declaration: enables systematic collection of environmental data directly from construction contractors to help inform more
  environmentally focused material selection
- Waste matching for concrete, asphalt and soil: creates a platform for waste matching across Port Authority construction sites to reduce waste sent to landfills and the truck trips required to bring materials to and from construction sites
- Requirement for low emissions vehicles on-site: specifies that large diesel construction equipment must be Tier 4 or newer to ensure the cleanest models available are used for

agency projects



The Clean Construction Program builds on our already industry-leading practices to further reduce carbon emissions from construction (embodied carbon), promote the reduction and reuse of construction and demolition waste (circular economy), and reduce the air quality impacts of construction activity.



### **Accomplishments to Date:**

- Socialized our Policy
- Outreach Met with regional Contracting associations and material suppliers before making changes to Contract documents

Started Tracking

- Developed a Carbon Management System to calculate the Carbon Emissions based upon EPDs, and Contractor Quantity Submittals
- Codified and
  Established
  Workflows
- Updated our Contract Books to include the Embodied Carbon Clause which requires the submission of database importable files (*Electronic Data Deliverables - EDD*) for quantities of incoming materials (daily yardage/tonnage tallies reported monthly) along with corresponding *EPDs* (*Environmental Product Declarations*)



# **EPD-Environmental Product**

**Declaration** 

- Focus on incoming Construction Materials
- All new Contracts include the Embodied Carbon Clause which requires the submission of EPDs for construction materials

B. Embodied Carbon

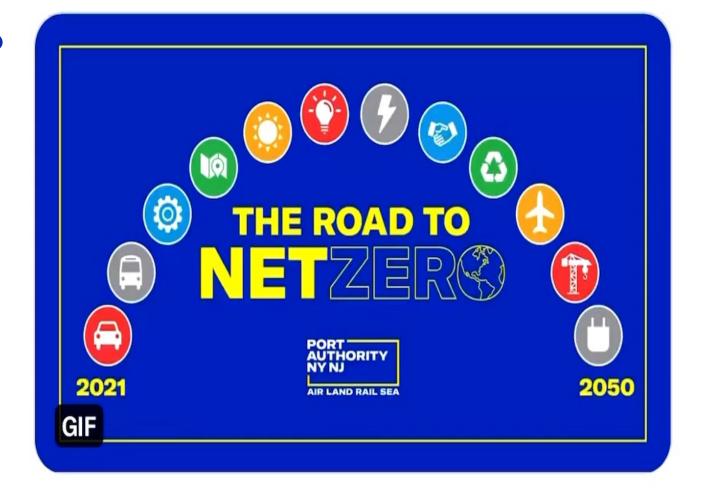
In order to comply with the Authority's greenhouse gas emissions reduction goals, and to quantify and reduce the impact of embodied carbon emissions, the Contractor and his subcontractors and suppliers shall comply with the EPD and EDD submittal requirements for data related to the embodied carbon of the following construction materials used in the Work of the Contract:

- 1.) Asphalt.
- 2.) Concrete.
- 3.) Steel.
- 4.) Aluminum.
- 5.) Wood.
- C. The Contractor shall submit EPDs for each of the materials listed in B. above. Non-third-party verified EPDs will be rejected.
  - 1.) EPDs shall be specific to the material, product, plant and mix used in the Work. In the absence of providing a specific EPD, the Contractor shall submit evidence that no material, product, plant or mix-specific EPD could be sourced. Evidence may be in the form of a computer screenshot showing a "No EPDs found" outcome from a query within *EC3* identifying the parameters used to search. Figure 1 below is a sample of the search results for a 6000 psi (28-day) ready mix concrete from a manufacturer searched with the name field containing the word "Jersey".



# Why EPDs?

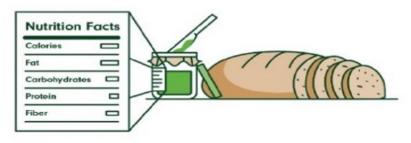
- The Port Authority of NY & NJ has a goal of a 50% GHG reduction by 2030 and achieving net-zero GHG emissions by 2050
- EPDs quantify the environmental impact



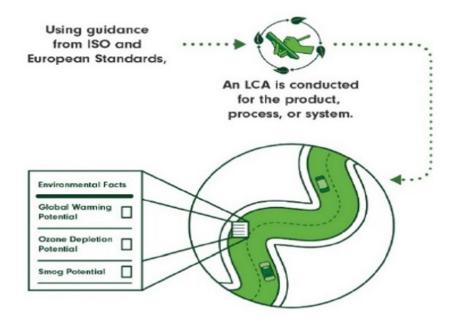


# **Understanding EPDs**

- EPDs communicate the environmental impacts of a material or product
- Developed with stakeholder input
- EPDs provide transparent information on Life-Cycle impact data which can identify areas for environmental improvement as well as encouraging industry efficiency



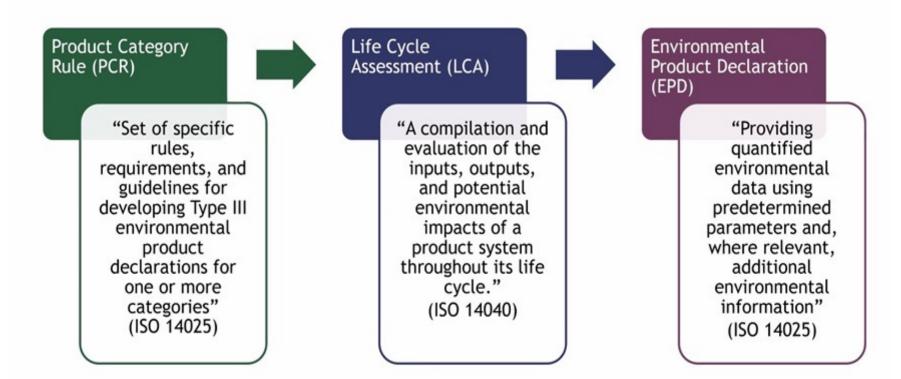
Similar to nutrition labels for food products, EPDs communicate critical environmental information on payement materials to the customer.



https://fhwa.dot.gov/pavement/sustainability/hif19087.pdf



# **Understanding EPDs**



Carrion, Migdalia. Federal Government Perspective, Buy Clean Policies and EPDs NJAPA Conference. March 7, 2023.



**Understanding Asphalt EPDs** 

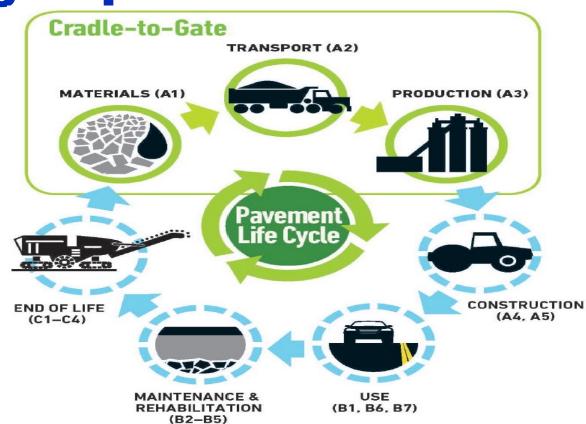
 Currently, asphalt EPDs only account for the A1-A3 portion of an LCA

A1- Materials

A2- Transport

A3- Production

 Work towards developing a complete LCA pavement EPD (Cradle-to-Grave)



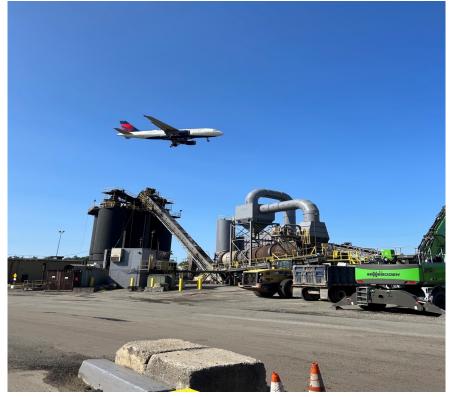
Source: Emerald Eco Label-An Environmental Product Declaration for Asphalt Mixtures



# **Understanding Asphalt EPDs**

#### Asphalt Data Requirements:

- From Asphalt Plant
  - Fuel Consumption
    - Burner
    - Hot-Oil Heater
    - Generator
    - Equipment
  - Electricity Consumption
  - Water Consumption
  - Total Tons Produced



Flushing Asphalt, Flushing, NY

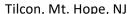


# **Understanding Asphalt EPDs**

Asphalt Data Requirements:

- From Mix Design
  - Material Content
    - Aggregates
    - Binder
    - RAP
    - Additives
  - Transportation Mode and Distance of Materials
    - Truck
    - Rail
    - Barge
  - Mix Production Temperature







### **Published EPD**



An Environmental Product Declaration (EPD) for Asphalt Mixtures

#### **Company Information**

Tilcon NY Inc. is an asphalt mixture producer.

Mt. Hope Asphalt asphalt plant

625 Mt. Hope Road

Wharton, NJ 07885

#### **Product Description**

This EPO reports the potential environmental impacts and additional environmental information for an asphalt mixture, which falls under the United Mixterior Standard Production and Services Code 3011509. Apphalt mixtures are lypically incorporated as part of the structure of a needless, parting lot, driveneys, artified, byte lone, pedestrain agric, solid response bed, or recreational surface.

Mix Name: Mix 3/PA 5 64 10% RAP

Specification Entity: Port Authority of New York New Jersey Specification: Mix 3/PA 5

Specification: Mix 3/FA 5 Gradation Type: dense

Mix Design Method: marshall

Nominal Maximum Aggregate Size: 19.0 mm

Performance Grade of Asphalt Binder: PG 64-22

Customer (Project/Contract) Number: Port Authority NYNJ

This mix producer categorizes this product as a Hot Mix Asphalt (#64%) apphalt minture. This sophalt minture was produced within a temperature range of 14 to \$152°C (\$90.0 to \$25.0°F). Energy and environmental impacts are based on a plant's average performance over a 22-month period and are not adjusted for mis-specific production temperatures.



This declaration is an EPO in accordance with ISO 14025/2006\* and ISO 21930/2017\*. The PCR is Product Category White-Iror Asphalt Minuses\*\*. This EPO transparently describes the potential environmental impacts associated with the identified 88 option stages of the described product.

Declaration Number: 60.150.396 v2 Software Version: 2.0.0

Date of Issue: July 7, 2022 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, 2020.

This EPO can be found at https://asphaltepd.org/epd/d/JSUMa/ LCA performed by: Ben Ciavola, PhD

#### **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	43
Aggregate	Natural Stone	15
Aggregate	Natural Stone	27
RAP	Reclaimed Asphalt Pavement	10
Binder	Unmodified + 1 terminal additive(s)	5

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

#### TABLE 4. LIFE CYCLE IMPACT INDICATORS

ACRONYM	INDICATOR	UNIT	QUANTITY PER METRIC TONNE ASPHALT MIXTURE (PER SHORT TON ASPHALT MIXTURE)			
			MATERIALS (A1)	TRANSPORT (A2)	PRODUCTION (A3)	TOTAL (A1-A3)
GWP-100	Global warming potential, incl. biogenic CO2	kg CO2 Equiv.	35.20 (31.94)	1.39 (1.26)	19.36 (17.56)	55.95 (50.75)
ODP	Ozone depletion potential	kg CFC-11 Equiv.	1.66e-08 (1.50e-08)	8.37e-09 (7.59e-09)	2.28e-08 (2.07e-08)	4.78e-08 (4.33e-08)
EP	Eutrophication potential	kg N Equiv.	9.40e-03 (8.53e-03)	4.13e-04 (3.75e-04)	1.99e-03 (1.81e-03)	1.18e-02 (1.07e-02)
AP	Acidification potential	kg SO2 Equiv.	1.01e-01 (9.15e-02)	7.06e-03 (6.41e-03)	3.46e-02 (3.14e-02)	1.42e-01 (1.29e-01)
POCP	Photochemical ozone creation potential	kg 03 Equiv.	2.08 (1.89)	0.23 (0.21)	1.06 (0.96)	3.37 (3.06)

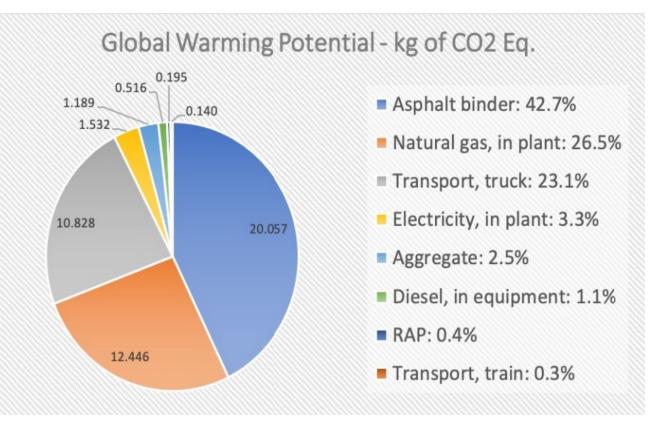
#### TABLE 3. ENVIRONMENTAL IMPACT SUMMARY TABLE

IMPACT CATEGORY	POTENTIAL IMPACT PER METRIC TONNE ASPHALT
IMPACT CATEGORY	MIXTURE (PER TON ASPHALT MIXTURE)
Global warming potential (GWP-100)	55.95 (50.75) kg CO2 Equiv.
Ozone depletion potential (ODP)	4.78e-08 (4.33e-08) kg CFC-11 Equiv.
Eutrophication potential (EP)	1.18e-02 (1.07e-02) kg N Equiv.
Acidification potential (AP)	1.42e-01 (1.29e-01) kg SO2 Equiv
Photochemical ozone creation potential (POCP)	3.37 (3.06) kg O3 Equiv.



### **Greatest Contributors to GWP**

- Material Hauling (Truck)
- Asphalt Binder Content
- Burner Fuel Consumption



Mukheriee "Update to the LCA of Asphalt Mixtures in Support of Emerald Eco Label EPD Program" April 2022



### **How Can We Reduce GWP?**

- Use Locally Sourced Aggregates
- Reduce Aggregate Moisture
  - -Moisture Management
- Lower Production Temperature
   -WMA
- Reduce Virgin Binder
  - -Increase RAP
  - -Balanced Mix Design





### **EPDs as a Procurement Aid**

Where The Port Authority of NY & NJ stands:

- EPDs are required as part of the procurement of asphalt, however, no decisions made on their content
- Increase the education and communication of stakeholders
- Increase the completeness of data
  - Asphalt additive data gaps
    - Binder Additives (Polymers, etc.)
    - Mix Additives (Anti-Strip, WMA, fibers, recycling agents, rejuvenators, etc.)



# **Looking Ahead** →

- Goal is to set GWP limits or benchmarks for PANYNJ Asphalt mixes based off local and agency-specific data
  - -Go/No-Go Specification?
  - -Incentive/Disincentive Specification?
- Benchmarks must be consistent and comparable, and set such that a significant percentage of local asphalt suppliers can attain them
- Performance of the material and its intended uses must be accounted for





# **Looking Ahead** $\rightarrow$ **Performance**

 A material with low GWP on their cradle-to-gate EPD may produce more GWP over the life cycle of the infrastructure

#### Example:

A material may have 15% less GWP in its EPD than benchmark. But if it's 25% less durable, it will emit more GWP over the life cycle.

Analysis period = 60 yrs			
Material A	Material B		
0.85 GWP	1.0 GWP		
15 year life	20 year life		
15	20		
30	40		
45			
Total GWP	Total GWP		
3.4	3.0		

Dr. John Harvey. Deriving Benchmarks for Construction Materials Based on EPDs. Buy Clean Policies and EPDs Community of Knowledge. June 6, 2023



### **EPDs & Performance**



Research Study – Mix Design and Performance Testing

- As most states are moving towards performance-based specifications, EPDs & performance should be looked at
- Interrelationship between the EPDs of typical PANYNJ mixes and their resulting performance
  - -RAP
- 0% (Virgin), 20%, 30%
- -Short-term/Long-term Aging
- -Performance Testing
  - Stiffness (Dynamic Modulus-AASHTO T378)
  - Rutting (APA-AASHTO T340 & Repeated Loading-AASHTO T378)
  - Cracking (Overlay Tester-NJDOT B-10 & IDEAL-CT-ASTM D8225)



### **EPDs & Performance**



Research Study – EPD Sensitivity Analysis

- For a given expectation of performance, examine sensitivity of GWP to changes in mix design (A2 and A3 stay constant, but A1 changes)
  - -Can the same performance be achieved by varying the Asphalt Binder Replacement percentages?
  - -Analysis will provide a starting point to incentivize suppliers to adopt mix design practices that deliver marginally lower GWP for the same performance expectations



### **EPDs & Performance**



Research Study – EPD Sensitivity Analysis

- Could a supplier be disqualified for reasons outside of their control?!
   Two suppliers using the same raw aggregate source, but are in different geographical locations
  - Assess the sensitivity of the GWP, for mixes from each supplier, to factors the supplier can improve on, versus factors that are beyond their control
  - Develop a "handicap factor" to GWP expressed through EPDs in our procurement decisions so that suppliers are incentivized to compete in a fair playing field



# **FHWA Climate Challenge**

PANYNJ Low Carbon Asphalt Support

- GOAL 1 Comprehensive Review of Low Carbon Asphalt
  - -Literature review of low carbon asphalt solutions
  - -In-Place Recycling Review and LCA Quantification
  - -Ranking of Carbon Reduction Solutions based on CO2e Reduction
- GOAL 2 Testing Plan
  - -Enables a standard method of evaluating new technologies





### **Conclusions**

- EPDs are a valuable tool for improving environmental outcomes of asphalt
   -Work towards developing EPDs that include the full pavement LCA (Cradle-to-Grave)
- Further and constant collaboration needed between asphalt industry and public agencies to improve on EPDs
- Asphalt performance and its intended uses must be accounted for



### **Points of Contact**

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- Dorian Bailey Chief of Science and Clean Construction (CCU) dbailey@panynj.gov
- Darius Pezeshki Materials Engineer in the Materials Engineering Unit (MEU) dpezeshki@panynj.gov



PORT AUTHORITY NY NJ

# **Thank You!**

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