

PennDOT District 10 APA Perpetual Pavement Award Presentation

Asphalt Pavement Alliance & NAPA Initiatives Update

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Director of Pavement
Engineering & Innovation



NATIONAL ASPHALT
PAVEMENT ASSOCIATION

Asphalt Pavement Alliance & NAPA Initiatives Update

- APA Perpetual Pavement Awards
- The Road Forward Initiative update
- Training Opportunities



Perpetual Pavement Awards



AMERICA RIDES ON US

Asphalt.

Asphalt Pavement Alliance

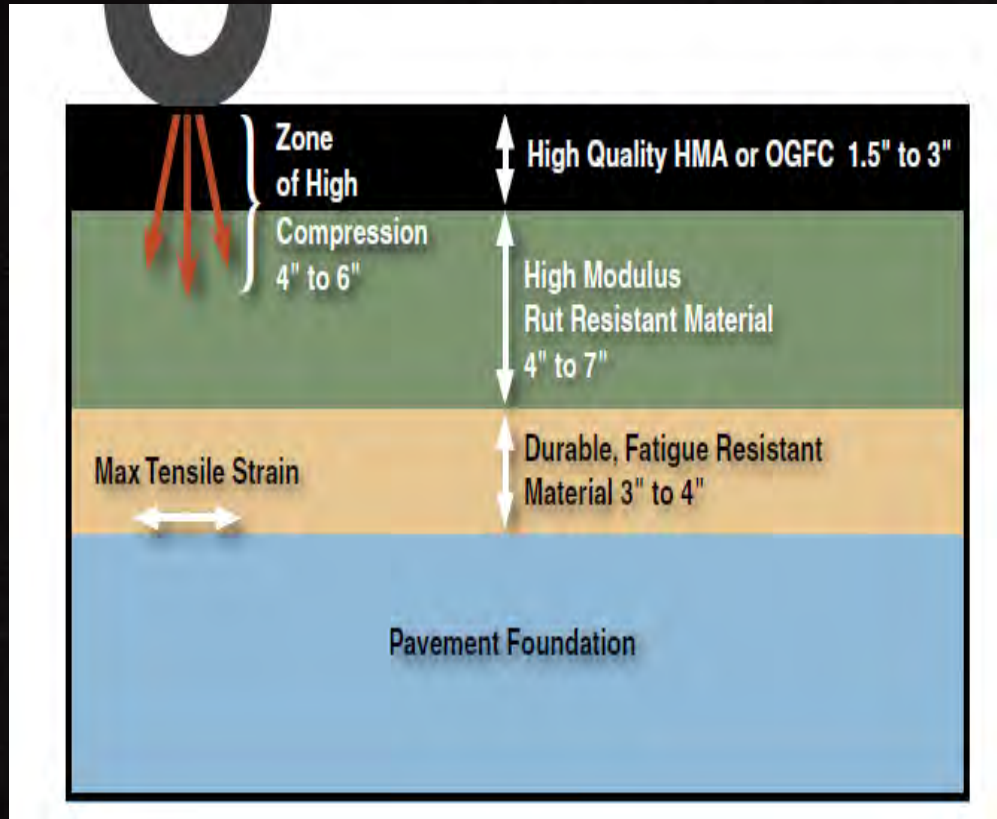
The APA is a partnership of National Asphalt Pavement Association, the Asphalt Institute, and the State Asphalt Pavement Associations.



AMERICA RIDES ON US

Asphalt.

What is Perpetual Pavement?



(Newcomb et al, 2000)

Each layer is designed for a specific function:

1. Fatigue resistant bottom layer
2. Rut resistant intermediate layer
3. Rut-Wear resistant and top-down cracking resistant surface layer.

Perpetual Pavement Awards Categories

1. By Performance

2. By Design

3. By Conversion



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Criteria:

- 35+ years old
- 13+ years between overlays (average)
- No increase > 4"



**This is how beautiful a 91-year-old
Perpetual Pavement looks!**

Constructed in 1929 by
ODOT, District 2

STATE ROUTE 199

(MM 6.79 TO MM 10.45)

IN WOOD COUNTY



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Criteria:

- Newly designed
- Built over new subgrade
- Meets Perpetual Pavement design

PPA: By Design Winners



**MARYLAND ROUTE 100
MARYLAND**

**INTERSTATE 84
CONNECTICUT**



**HIGHWAY 100
IOWA**



Criteria:

- Newly designed
- Built over existing subgrade
- Meets Perpetual Pavement design

PPA: By Conversion Winners



**ROUTE 460
VIRGINIA**

**INTERSTATE 295
NEW JERSEY**



**MONTICELLO ROAD
ILLINOIS**



2011
SR 210

2012
SR 145

2013
SR 29

2014
SR 2005

2015
I-180

2016
SR 73

2017
SR 3010

2018
SR 424

2019
SR 956

2020
SR 96

2021
SR 3022

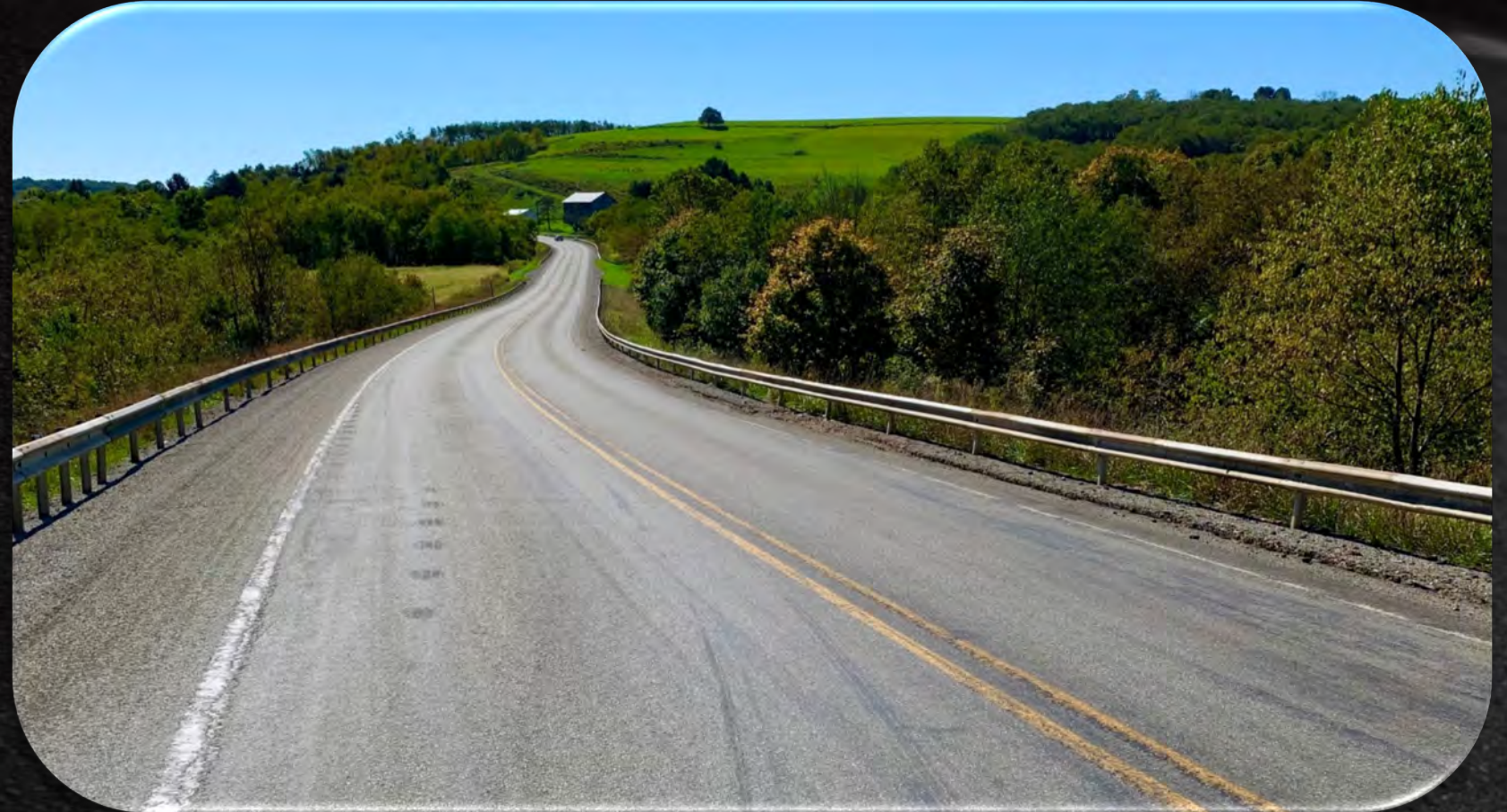
2022
SR 210



AMERICA RIDES ON US

Asphalt.

Congratulations PennDOT, District 10-0



SR 210 IN ARMSTRONG COUNTY

AMERICA RIDES ON US

Asphalt.



Thank you, Pennsylvania!

Gold Club (50+ Years)

- Genco-Sellers/Gencor
- Volvo Construction Equipment
- Warden Asphalt Co.
- York Building Products Co. Inc.

30-Plus Club

- American Asphalt Paving Co.
- Infern-O-Therm Corp.
- Joseph McCormick Construction Co. Inc.
- Meeker Equipment Co. Inc.
- Riverside Materials Inc.
- Russell Standard
- Walter R. Earle Corp.

Members

- Abatech, Inc.
- ABE Materials - Easton
- Allan Myers
- Architectural Stone
- Bechtelsville Asphalt
- Berks Products Corp.
- Bishop Brothers Construction
- Blaw-Knox
- Calvin C. Cole, Inc.
- CertainTeed by Saint-Gobain
- Charlestown Paving & Exc., Inc.
- Compliance Management International
- Conneaut Lake Asphalt Plant
- Coopersburg Materials
- Cumi Ameriaca Inc.
- Donegal Construction Corp.
- Dunmore Materials
- Eckley Asphalt
- Erie Asphalt Plant
- FORTA
- Glenn O. Hawbaker Inc.
- Golden Eagle Construction Co.
- Grannas Bros. Stone & Asphalt Co. Inc.
- H&K Group
- H&K Materials
- Harsco Environmental
- Heidelberg Materials East
- Heidelberg Materials Northeast
Adamsburg



Thank you, Pennsylvania!

Members

- Heidelberg Materials Northeast Glen Mills
- Heidelberg Materials Northeast Lake Ariel
- Heidelberg Materials Northeast Latrobe
- Heidelberg Materials Northeast Penns Park
- Heidelberg Materials Northeast Springfield Pike
- Heidelberg Materials Northeast Stroudsburg
- Heidelberg Materials Northeast Washington
- Hillsville Asphalt Plant
- Homer city Asphalt Plant
- HRI Inc. – East Region Muncy
- HRI Inc. – West Region Johnstown
- HRI Inc. Corporate Office State College
- IA Construction Corp Franklin Region
- Keystone Lime
- Koppel Asphalt Plant
- Leeward Asphalt LLC
- Liberty Tire Recycling LLC
- Lindy Paving Inc.
- Locust Ridge Quarry
- Midland Asphalt Materials Inc. Clearfield
- Miller Materials LLC
- Multitherm LLC
- Nationwide Mechanical, LLC
- Neville Island Asphalt Plant
- New Kensington Asphalt Plant
- Northeast Paving, a Div. of Eurovia Atlantic Coast
- Partatherm a division of Lubrizol
- Pennsy Supply
- Pennsy Supply Inc., Central Region A CRH Co.
- Pennsy Supply North Region, A CRH Co.
- Peter J. Caruso & Sons
- Pikes Creek Asphalt & Crushed Stone
- Pine Test Equipment, Inc.
- Pottstown Trap Rock – Sanatoga Quarry/Asphalt
- Quaker Sales Corp.
- Schlouch Inc.
- Second Avenue Asphalt Plant
- Silver Hill Quarry
- South Reading Blacktop
- Sterrettania Asphalt Plant
- Superior Tire & Rubber Corp.



Thank you, Pennsylvania!

Members

- United Employment Associates LLC
- Wheatland Asphalt Plant
- Wheelertown Asphalt Plant
- Wilkes-Barre Materials LLC
- Windsor Service
- Zelienople Asphalt Plant

State Advisor

Owen McCormick, Joseph McCormick Construction Co.

The Road Forward

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

For more information:
asphaltpavement.org/climate



Our Strategy towards carboneutrality



AsphaltPavement.org/Forward

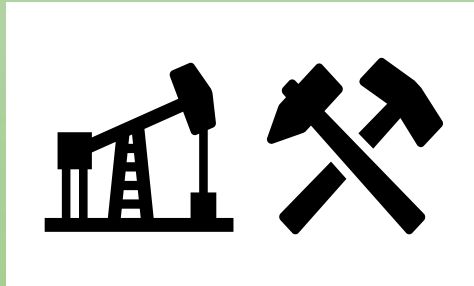
1. Production & Construction



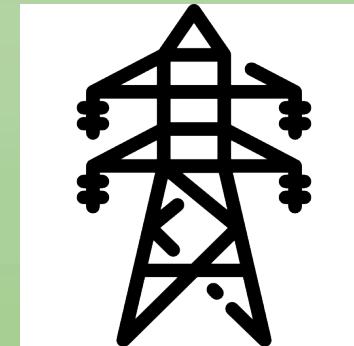
2. Eco-efficient pavements



Strategy
towards
carbon neutrality



3. Supply Chain



4. Electricity

THE "ROAD FORWARD" PARTNERS



The Rapidly Changing Policy Environment

What is an EPD?

Environmental Product Declaration

- Quantify the environmental impact of a product
- EPDS are based on industry LCA & Product Category Rules (PCR):
 1. Plant & Mix Design Specific
 2. “Cradle to Gate”
 3. To be comparable Products shall fulfill the **same function*** AND the **same specification.**
- Independently verified

Emerald
ECO LABEL



EPD “Nutrition” Label

Your Building Product

Amount per Unit	
LCA IMPACT 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)	0.03
Eutrophication Potential (kg N eq)	6.43E-04
Photo-Oxidant Creation Potential (kg O ₃ eq)	0.121

Your Product's Ingredients: Listed Here

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

*Source : ISO 14025:2006. The EPDs of different product categories should NOT be compared to each other.

What is an EPD?

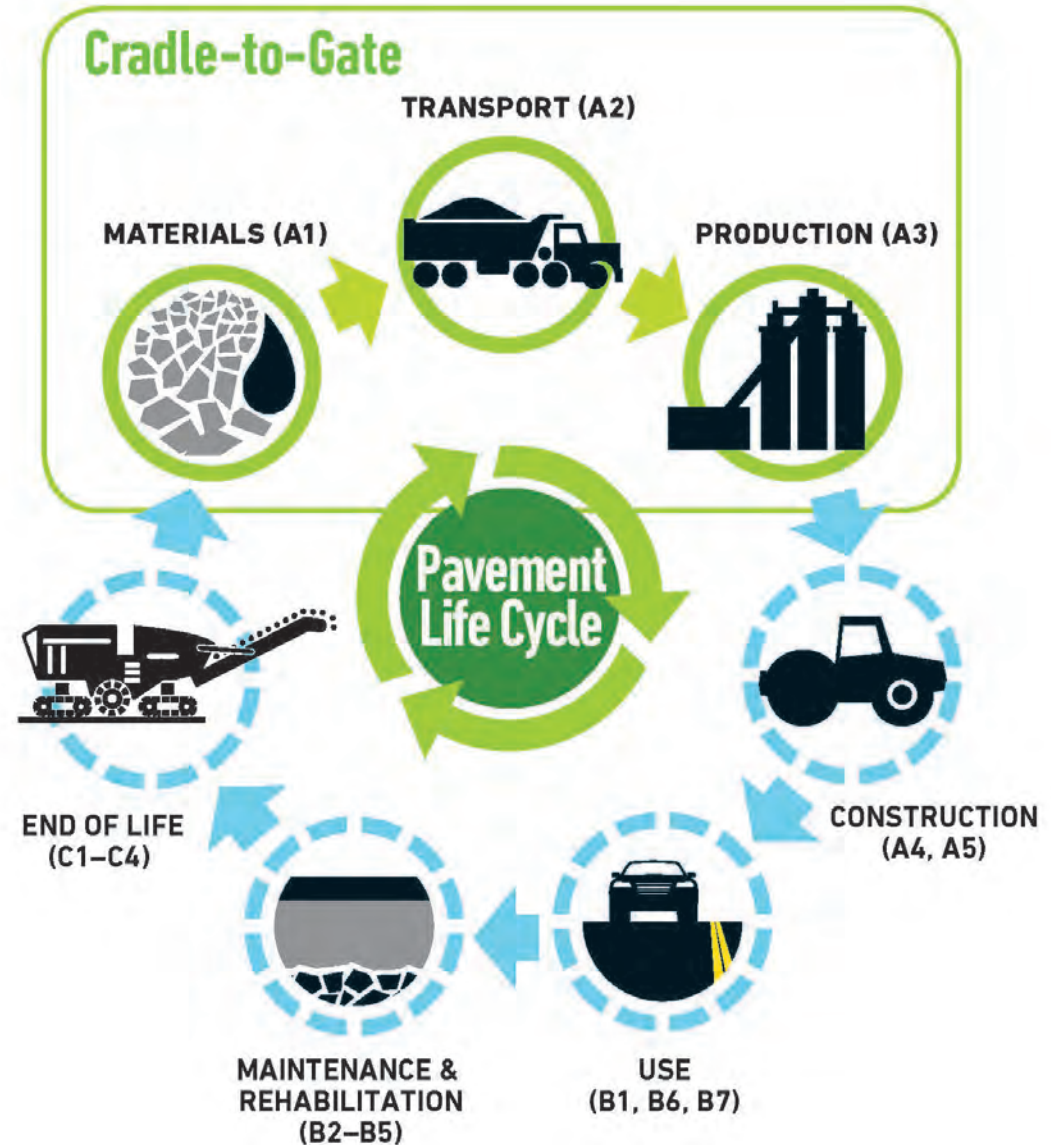
LCA

"From the cradle to the grave"

EPD

Emerald
ECO LABEL

LCA  **PAVE**



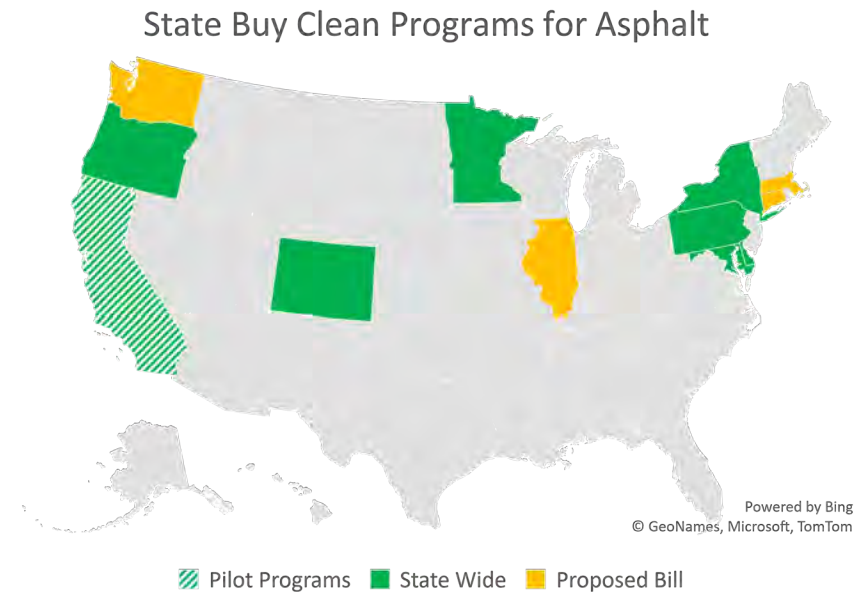
State Buy Clean Policies

Initiatives by States to integrate EPDs into their procurement process

- Companies submit EPDs to the agency
- Agency develops global warming potential (GWP) limits for each mix type

Policy options:

- Information only (collection and analysis of EPDs)
- GHG Limits (go/no-go / prequalification criteria)
- Incentives (when Low Carbon materials are cheaper)
- Differential cost (when Low Carbon materials are more expensive)



2017: California

2021: Colorado

2022: Oregon

2023: Minnesota

- Décrets: New-York & Delaware

- Autorité portuaire NY & NJ

- Pennsylvania, Maryland

- en discussion: Illinois, Washington State

-



Inflation Reduction Act

EPA

- \$250 million to standardize EPDs and help industry develop EPDs
- \$100 million to develop “low-embodied carbon construction material labeling program”

Low Carbon Construction Material Procurement

- **FHWA** – \$2 billion in grant funding to state, local, and federal agencies
- **GSA** – \$2.15 billion for federal building projects
- **FEMA** – Grants can include additional costs for low carbon materials



Inflation Reduction Act

EPA Interim Determination of Substantially Lower Embodied Carbon

- **Best performing 20%** of similar materials/products
 - If not available locally, then best performing 40%
 - If not available locally, then better than estimated industry average
 - **GSA and FHWA will define these thresholds** based on published EPDs
- Also, report **ENERGY STAR** Energy Performance Score (currently under development for asphalt plants)

<https://www.epa.gov/inflation-reduction-act/inflation-reduction-act-programs-fight-climate-change-reducing-embodied>



Interim requirements for materials with a low carbon footprint

January-May 2023: Federal General Services publishes its provisional specifications:
Federal Office Buildings, Courthouses and Land Ports of Entry

GSA IRA Limits for Low Embodied Carbon Asphalt - May 16, 2023 (EPD-Reported GWPs, in kilograms of carbon dioxide equivalent per metric ton - kgCO ₂ e/ t)		
Top 20% Limit	Top 40% Limit	Better Than Average Limit
55.4	64.8	72.6

- The same limits apply to all types of asphalt mixes, throughout the country.

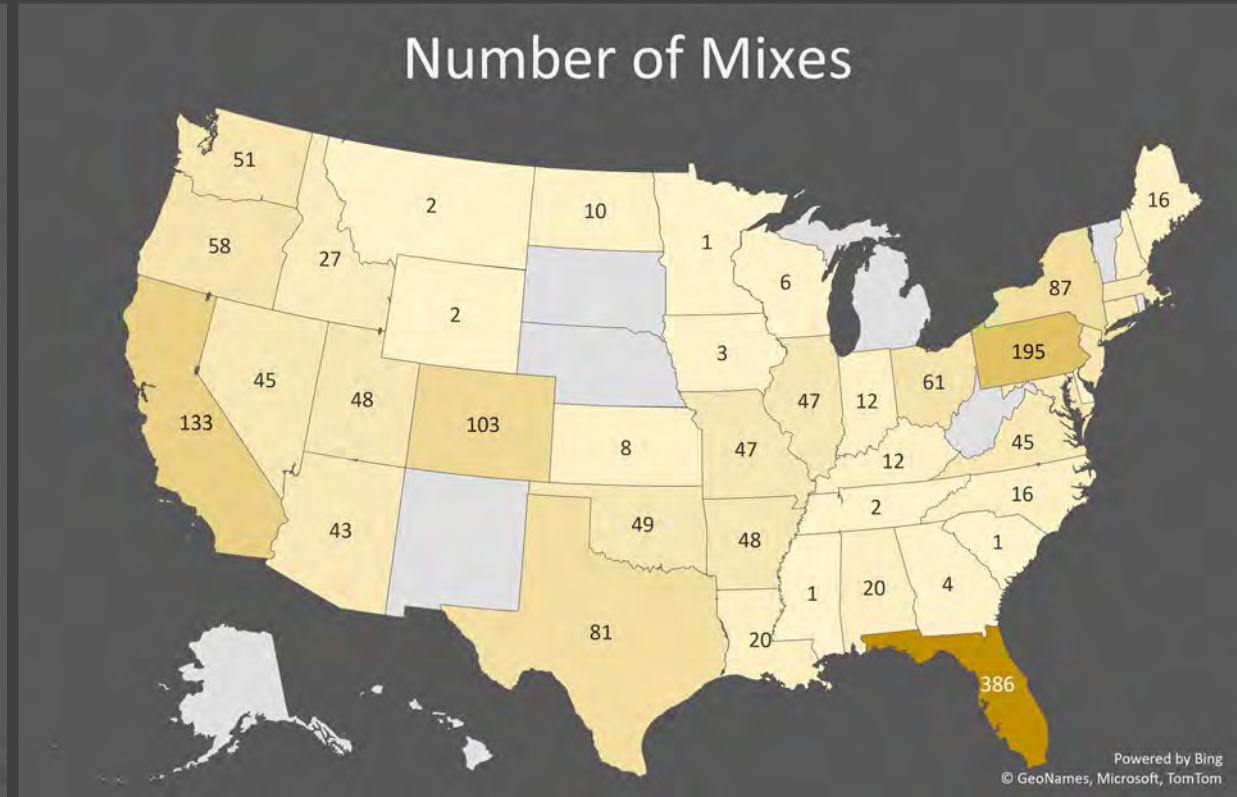
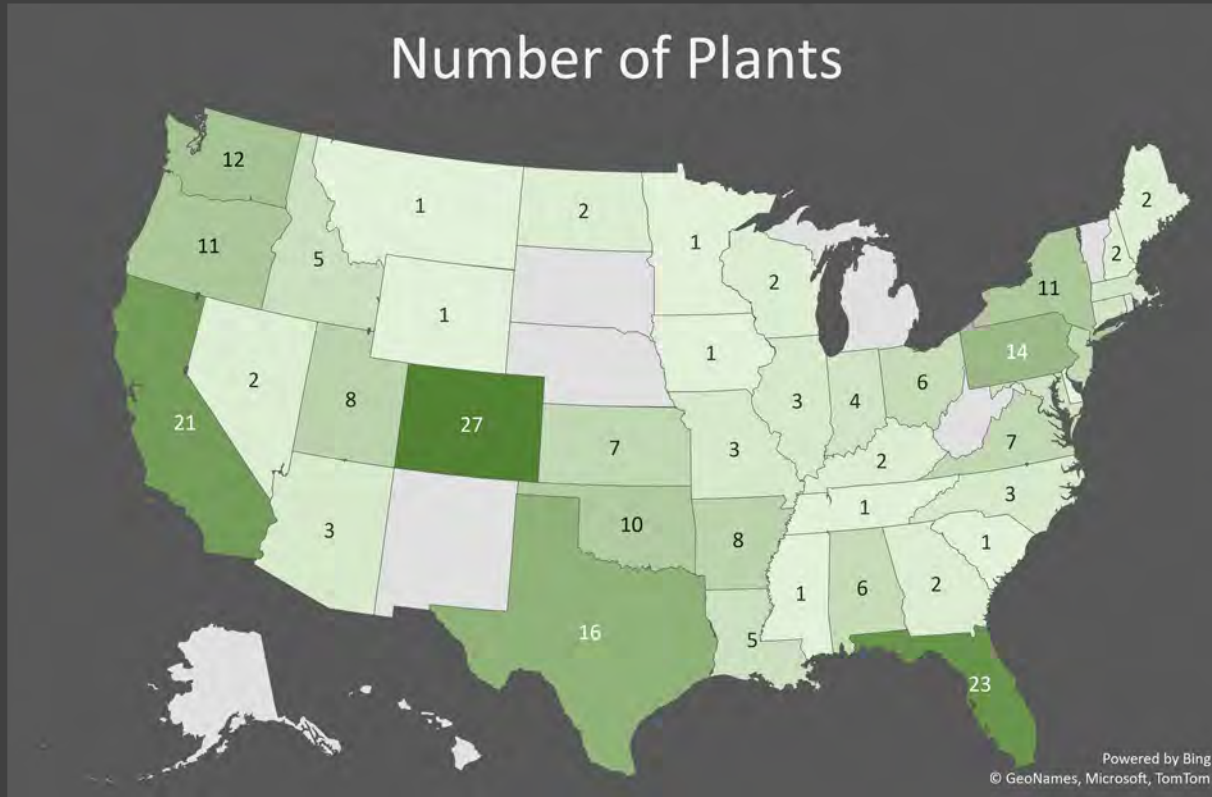
<https://www.gsa.gov/about-us/newsroom/news-releases/gsa-pilots-buy-clean-inflation-reduction-act-requirements-for-low-embodied-carbon-construction-materials-05162023>



Deployment of EPDs ongoing actions

EPDs published as of January 2024

- 255 Plants, 1,922 EPDs in 41 states.



Actions in progress:

Implementation of the Federal IRA Program, the GSA program, soon the FHWA program, and the “Buy Clean” laws of the various states.

→ **Ongoing benchmarking** to define realistic and achievable GHG emission limits, by region and by mix type:

- GHG emissions are strongly impacted by mix type and by local conditions
Example: Average GHG emissions in Florida: 85.9 kg CO2 eq/ton (US average: 66.9 kg)

→ **Complete the missing input data:**

- Beyond the basket of 4 types of bitumen and additives (SBS, GTR, additives,...) AC: ~ 50% of carbon emissions of asphalt mixtures

→ **Development of LCAs for each stage of the road life cycle.**

Benchmarking Initiative

How to Participate?

Go to the Emerald Eco-Label Registration Process page:

asphaltpavement.org/programs/napa-programs/emerald-eco-label/registration-process

1. Watch the recorded training webinar: [Building an Industry Average for EPDs](#)
2. Compile benchmarking data Use the benchmarking worksheet in the [EPD Data Gathering Spreadsheet v5](#)
3. If you are not an existing user Create your Organization(s) and Plant(s) in the software
4. Enter your operational and benchmarking data for each asphalt plant
5. Submit data for benchmarking

Inflation Reduction Act (IRA) Benchmarking

Reclaimed Asphalt Pavement (RAP)	
%	Average RAP Content (%)
tons	Total RAP (short tons)
Aggregates	
<u>Most Used Quarry/Pit</u>	
tons	Approximate Quantity Purchased From This Source
miles	Truck Distance
miles	Train Distance
miles	Barge Distance
miles	Ocean Distance
<u>Second Most Used Quarry/Pit</u>	
tons	Approximate Quantity Purchased From This Source
miles	Truck Distance
miles	Train Distance
miles	Barge Distance
miles	Ocean Distance
Asphalt Binder	
miles	Truck Distance
miles	Train Distance
miles	Barge Distance
miles	Ocean Distance

Data Entries

Energy Performance Indicator (EPI) Benchmarking

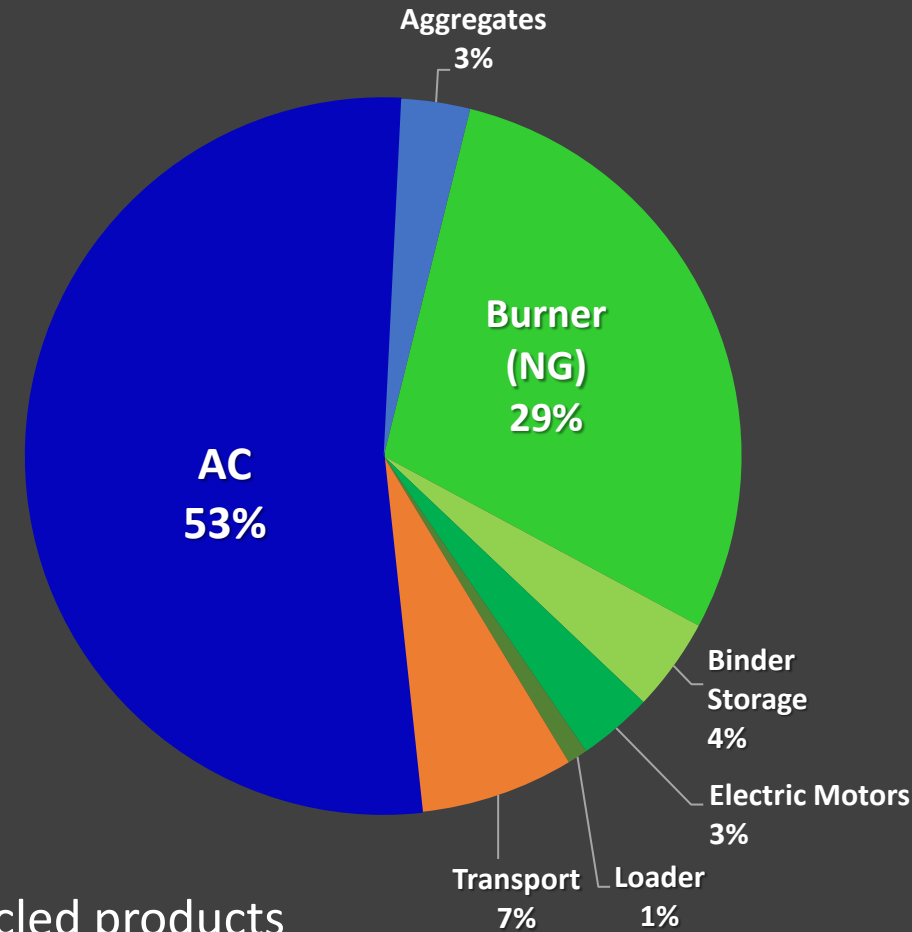
EPI Plant Information	
	Plant Type
tons/hr	Manufacturer's Rated Capacity
ft	Drum Diameter
	Production Details
hours	Total Operating Hours
no. of months	Production Months per Year
days/week	Production Days per Week
hours/day	Production Hours per Day
tons	Polymer or Rubber Modified Mix Produced.
	Electricity Metering
	Natural Gas Metering

How can we reduce emissions?
(and save money)

CO₂e emissions Distribution

		kgCO ₂ e/ton
Materials (A1)	5% AC	28.7
	95% Aggregates	1.7
Transport (A2)	22 miles by truck	3.8
Plant Operations (A3)	Burner (Natural Gas)	15.8
	Binder Storage	2.3
	Electric Motors	1.8
	Loader	0.5

Total = 54.7 kg



The bulk of emissions are generated by:

1. A1 (56%) and especially AC (53%)
2. Burner ~ 30% (A3)

Next:

- Transport (A2)
- Factors related to plant efficiency (A3)

Levers:

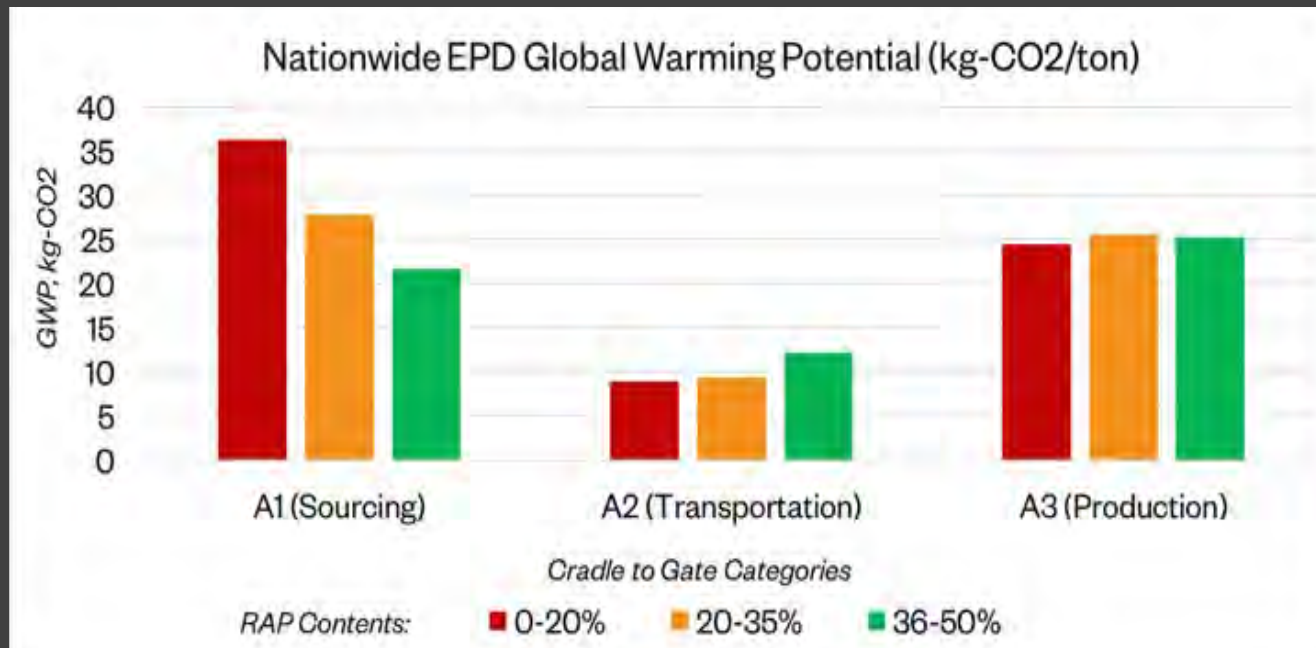
1. A1: Increase the % of recycled products
2. A3: T° production, Materials moisture
3. A2: Transport

A1: Increasing the share of Recycled Asphalt

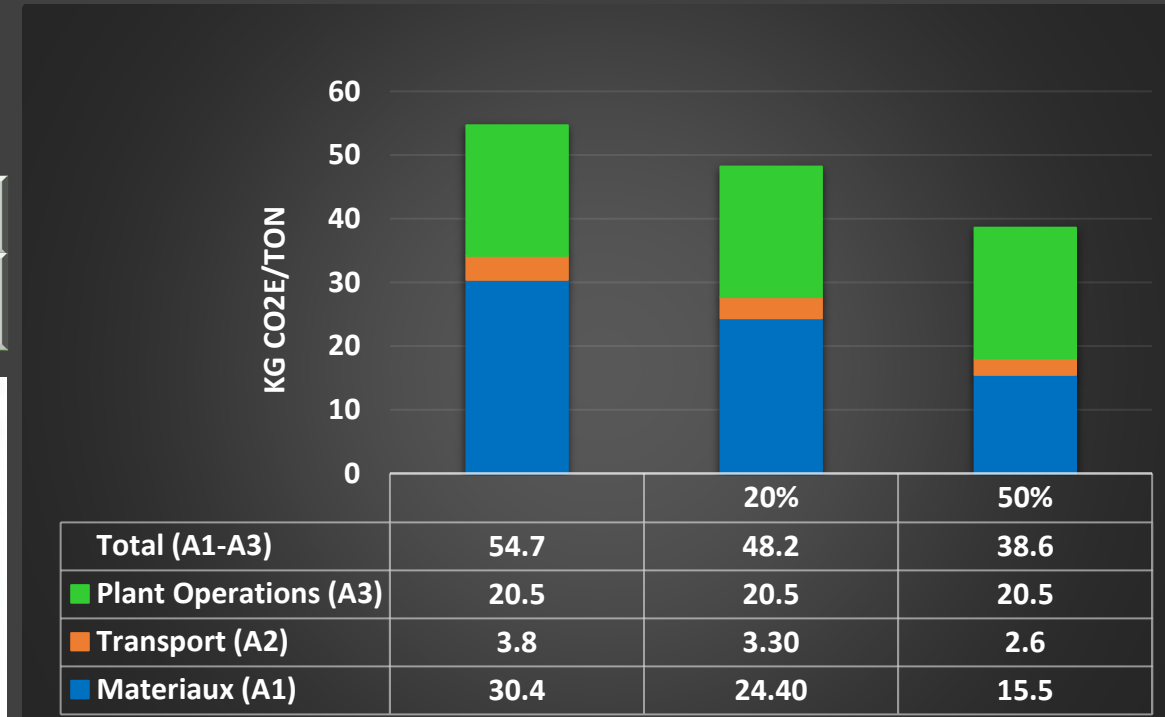
A1: Increasing the share of Recycled Asphalt

Nationwide CO2e vs. % RAP (from published EPDs)

%RAP	0-20%	21-35%	36-50%
CO2e kg/ton	69.7	62.8	59.1



Credit: David Allain ACAF



+ 1% RAP : ~ - 0.32 kg CO₂e / tonne

+ 1% RAP : ~ - \$0.30 / tonne

A1: Increasing the share of Recycled Asphalt

RAP% Evolution US (NAPA IS-138)



A1: Increasing the share of Recycled Asphalt

What are the barriers to high RAP (> 25-30%)?

2023: NAPA Surveys of DOTs and Contractors

DOTs

- Concerns about performance (cracking, raveling, etc.)
- Impact of variability
- Plants Capacity
- Availability of soft binders
- RAP Availability

Contractors

- Specifications
- RAP Availability
- Plants Capacity
- Impact of variability

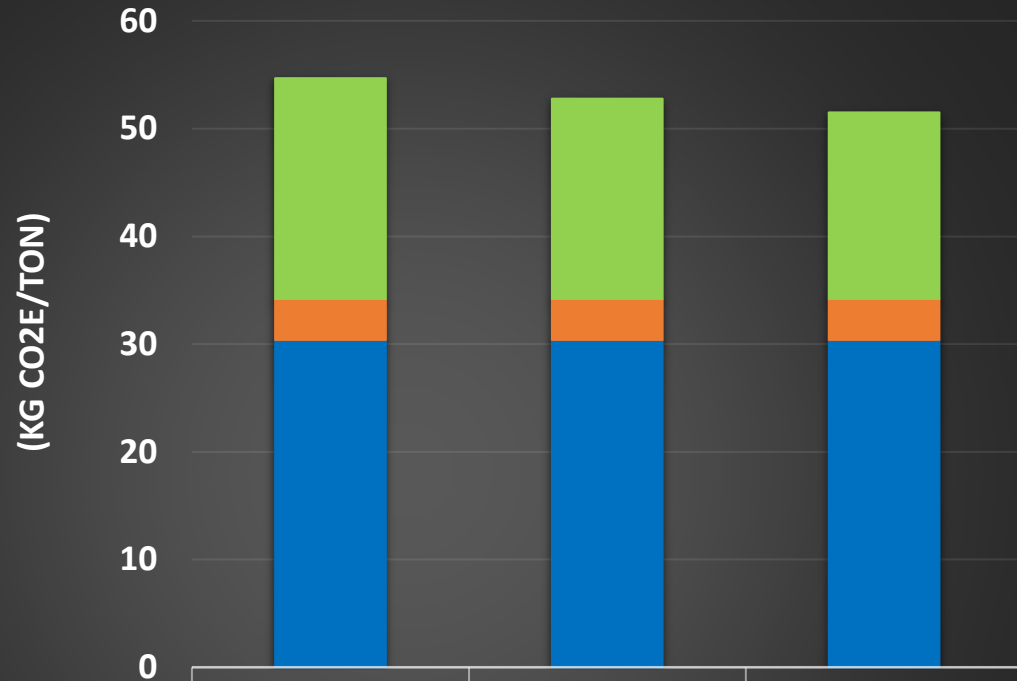
3 Top Performers Specifications

NC: 31.8%, GA: 29.4%, FL: 29.2%

- **Specs Limits:** 40% to 45% or none.
- **Variability control:** fractionation or % RAP allowed function of variability.
- **New binder control:**
 - Use of RBR (Recycled Binder Rate)
 - COAC or use RAP Gsb
- **Contract provisions:**
 - Binder paid separately.
 - Rebate on savings (NE)

- A3:
- Reduce Production Temperature
 - Controlling Material Moisture

A3: Production Temperature Reduction



	Total (A1-A3)	-30F	-50F
Materials (A1)	30.4	30.4	30.4
Transport (A2)	3.8	3.8	3.8
Plant Operations (A3)	20.5	18.6	17.3
Total (A1-A3)	54.7	52.8	51.5

- 1°F ~ - 1 kBtu / tonne

- 1°F ~ - 0.064 kg CO₂e / tonne

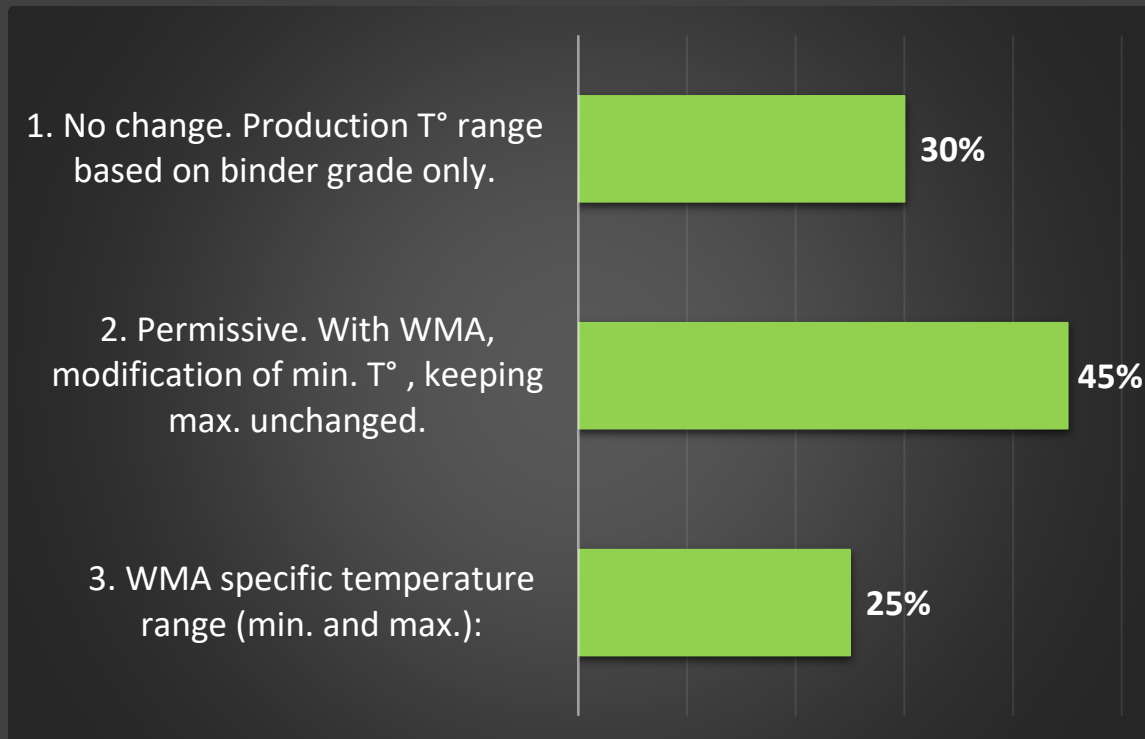
- 1°F ~ -\$0.002 → - \$0.020/ tonne

A3: Production Temperature Reduction

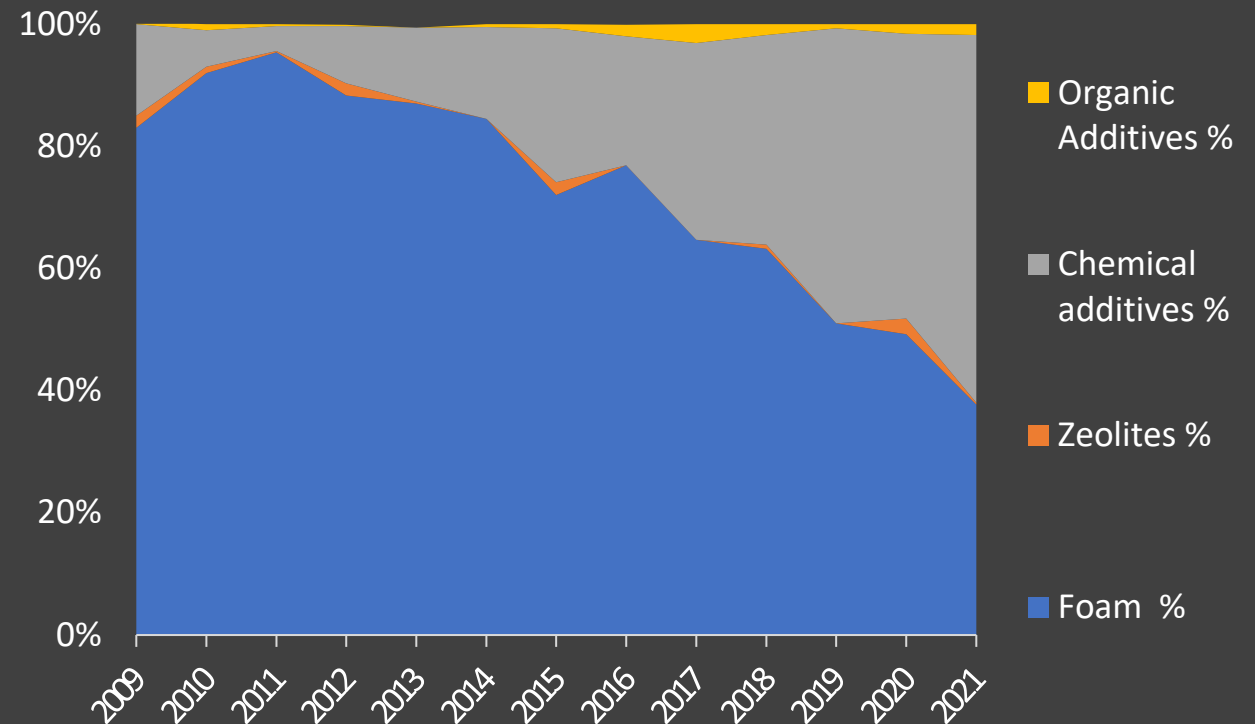
2021: 41% of US total mix production uses Warm Technology, ~50% for compaction aid, with no T° reduction

NAPA Survey: 69% of states use WMA technologies.

WMA technologies market share (NAPA IS-138)



Few specifications mandate max. production T° (3)



2021: 60% Chemical Additives, 40% Foam

A3: Production Temperature Reduction

→ 2023: NAPA Surveys of DOTs and Contractors

What are the barriers to reducing the production temperature??

DOTs':

- Low production temperatures can affect the density in place, especially in cold weather or long hauls.
- Incomplete drying and residual moisture in the mix can affect the performance.
- Need more guidance on specifying low temperature production as well as product certification procedures.
- It's the choice of companies

Contractors:

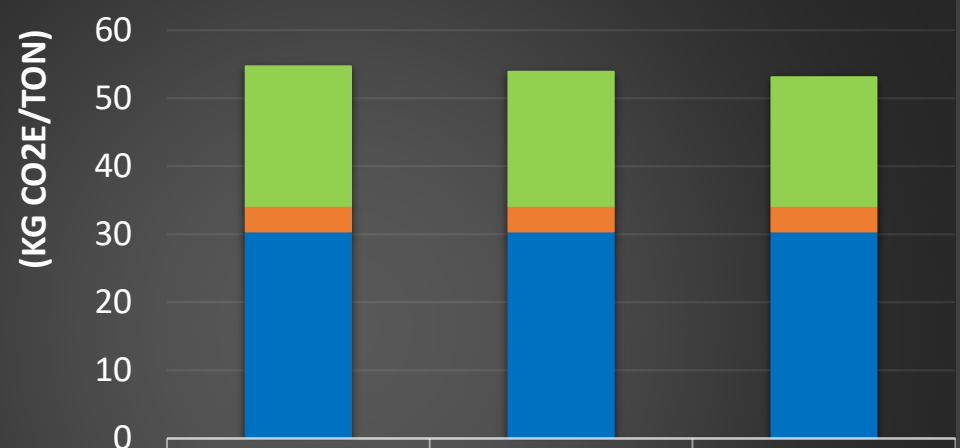
- Specifications
- Poor "Perception" of workability, compactability and quality
- Maintain RAP content
- Cost

A3: Materials moisture control

1. Each Lb. of water requires about 1 kBtu to vaporized
2. Materials need to be dried to be heated.
3. Each Lb. of water generates 30 cft of steam (x 1700)

~ 50% of the energy used in drying

+1% H₂O = +11% Energy - 11% Production



-1% H₂O ~ - 30 to - 40 kBtus / tonne

- 1% H₂O ~ - 1.60 kg CO₂e / tonne

- 1 % H₂O ~ - \$0.10 → - \$0.30/ tonne

What strategy to minimize the carbon footprint of our production?
(and maximize our profitability?)

Strategy to minimize the carbon footprint of our production

1. Assessing the impact on the carbon footprint (A1-A3),
2. Ensuring the performance of pavements,
3. At competitive costs.

	Unit impact per tonne of asphalt mix	CO ₂ e / ton	Energy / ton	\$ / ton
A3	Materials Moisture (%)	~ - 1.60 kg	~ - 35 kBtus	~ - \$0.10 to - \$0.30
A1	Recycled asphalt (%)	~ - 0.32 kg		~ - \$0.30
A3	Production Temperature (°F)	~ - 0.06 kg	~ - 1 kBtu	~ - \$0.002 to - \$0.02

1. Controlling materials moisture:

- Immediate profitability (\$\$)
- Highest impact on CO₂e reduction
- Positive impact on Performance
- Facilitates RAP use and Production T° Reduction

2. Increasing Recycled Asphalt %

- Immediate high profitability (\$\$\$)
- Strong impact on CO₂e reduction
- Controlled Performance (BMD)

3. production T° reduction

- Profitability (\$)
- Contributes to CO₂e reduction
- Reduction of emission & ageing
→ Adjustment variable

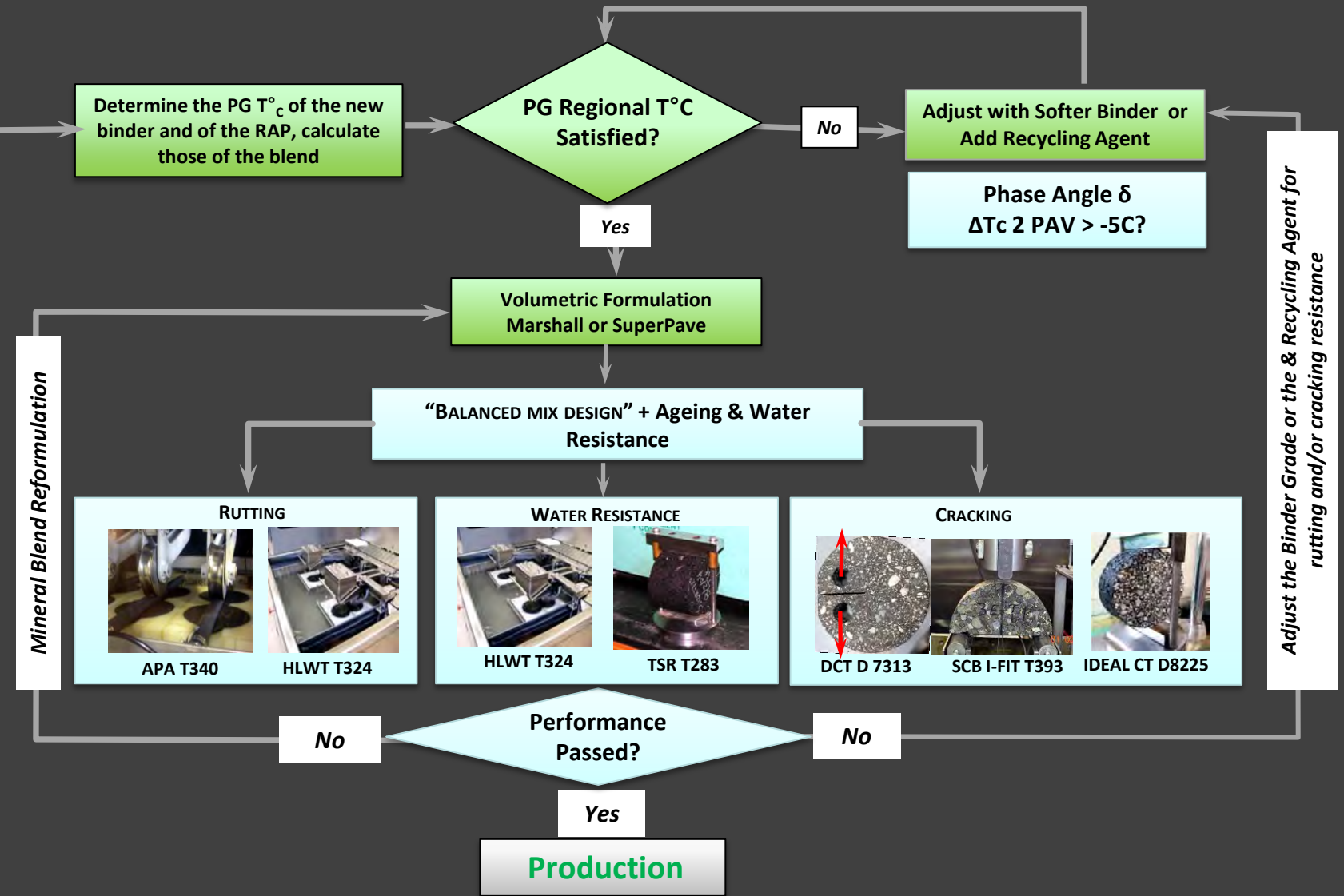
Formulate High RAP Mixes while lowering production temperature

Spécifications AASHTO M323 & R35

% RAP / Mix	New Binder PG Selection
< 15%	1. No change
15 to 25%	2. PG one Grade softer
> 25%	3. Blending Charts

1. This specification assumes a complete mixture of the RAP binder with the new binder
2. The impact of aging on the rheology of the binder is not considered
3. Insufficient volumetric method

For more information:
asphaltpavement.org/bmd



Training Opportunities

Training Opportunities

driveasphalt.org/events/training-opportunities

APA: driveasphalt.org/events/webinars

NAPA: asphaltpavement.org/bmd

asphaltpavement.org/programs/napa-webinars

Asphalt Institute: asphaltinstitute.org/training/webinars/

NCAT: eng.auburn.edu/research/centers/ncat/education/tiyp.html

AAPT asphalttechnology.org/



HEY NAPA!



<https://heynapa.com/>



Interested in learning more?

Please contact:

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Jean-Paul Fort: jfort@asphaltpavement.org

Thank You!