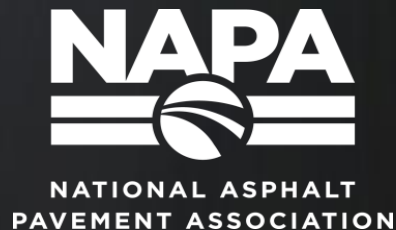


# ADVANCEMENTS IN ASPHALT SUSTAINABILITY

HEATHER DYLLA

*2016 Arizona Pavements/Materials Conference*  
*Nov. 16, 2016*





# Takeaways

- Sustainability in NAPA
- Current Challenges in Sustainability for Pavements
- Industry Research Projects



# Innovative Asphalt Technologies

Porous Asphalt



Reclaimed Asphalt Pavement (RAP)



Ground Tire Rubber (GTR)



Warm Mix Asphalt (WMA)



Recycled Asphalt Shingles (RAS)



Perpetual Asphalt Pavement







# Recent Events

2010 – FHWA Sustainable Pavements Program

2012 – Industry Roadmap Mission

To improve asphalt pavement design, material, and **sustainable** technologies to ensure the continued delivery and performance of economical, safe, **quality** pavements.

2014 – Diamond Achievement Sustainable Commendation Added

& NAPA Sustainability Committee Created





# Industry Research Fund

**7 NAPA-  
SAPA Task  
Groups**

**\$1  
Million  
Program**

**Funded by  
NAPA & SAPAs  
with 100%  
SAPA  
Participation**



# THE TEAMS



Pavement Design

---



Pavement Type Selection

---



Best Quality and  
Competitiveness

---



Pavement Preservation

---



Environmental Sustainability

---



Legislative

---

**NEW!**

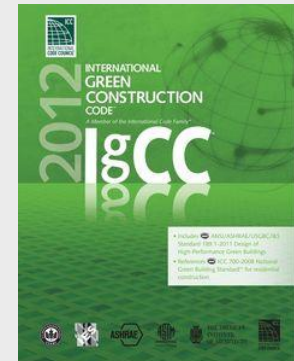
Private Sector Markets &  
Local Roads





# Challenges - New Era of Transparency

- Transitioning to Credits that Require Measurement of Environmental Performance
- Cities, States, and Federal Govt. Adopting



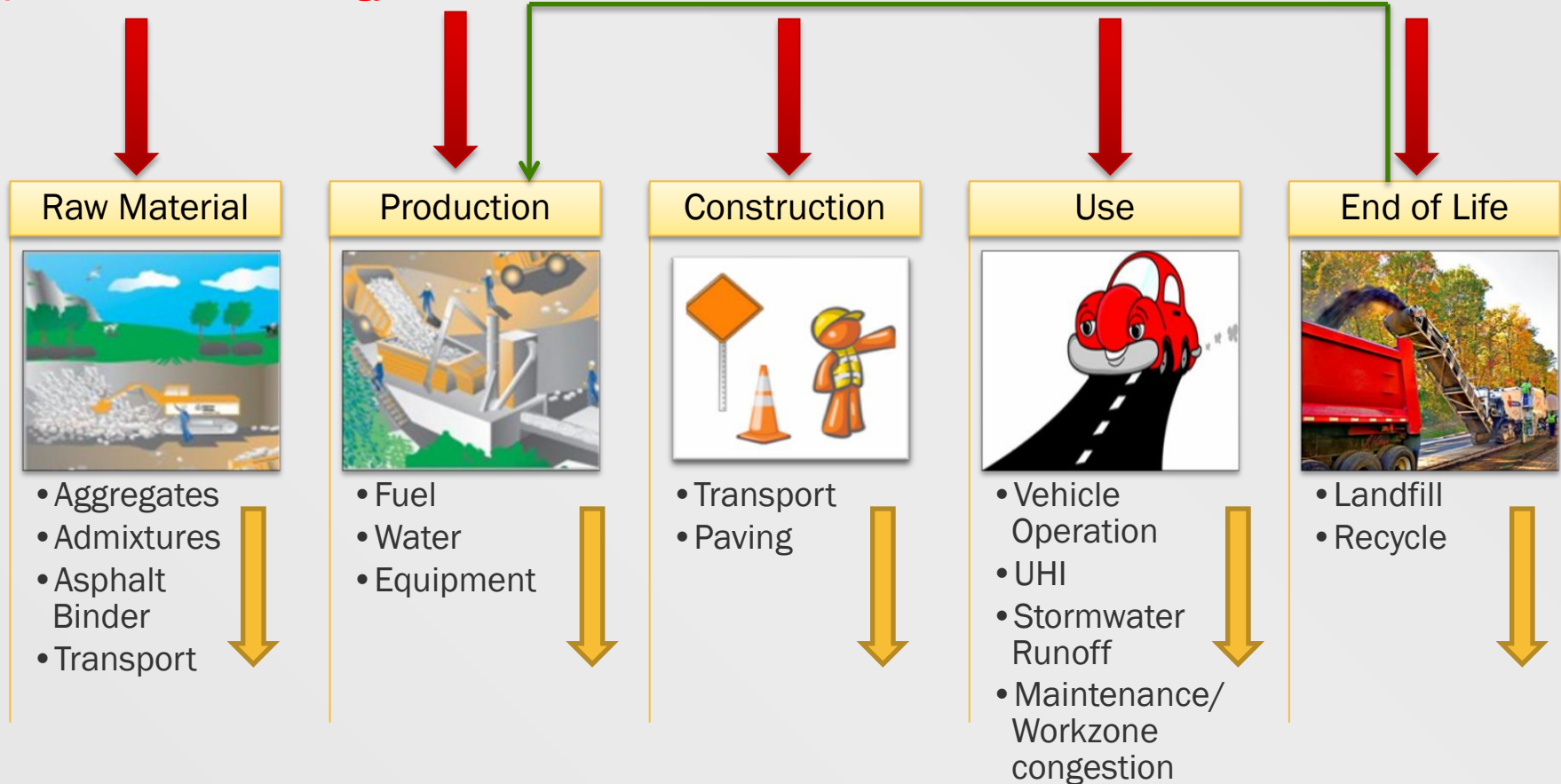


# Pavement Life Cycle Assessment

LCA

Inputs – Materials, Energy, Water

Recycle/Reuse



Outputs – Solid Wastes, Emissions to Air, Emissions to Water

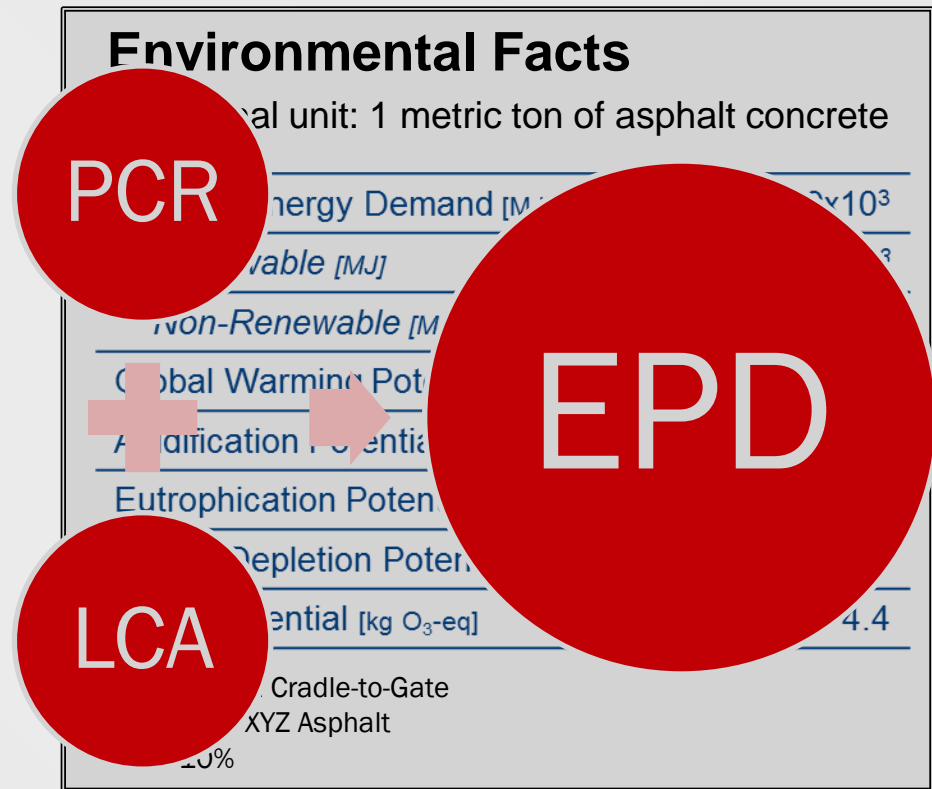




# Environmental Product Declarations

EPD declares quantified environmental data for a defined product

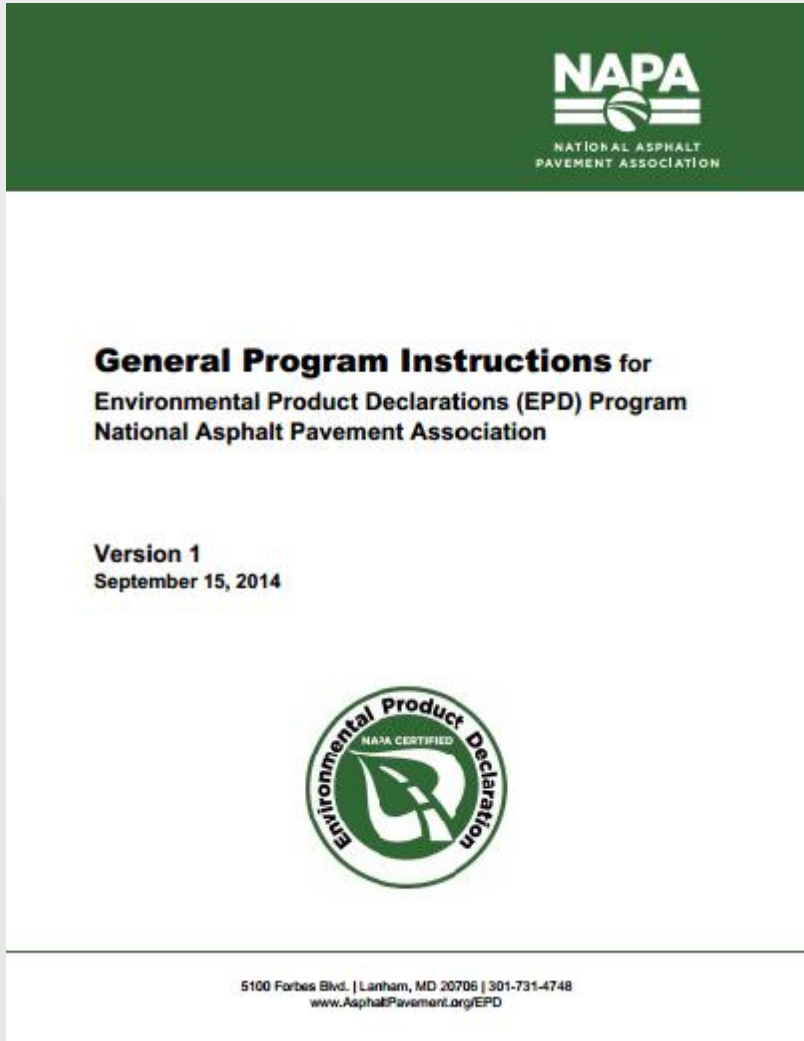
- Fair
- Comparable
- Third Party Reviewed
- Credible



Source: PE International, Values are for illustration purposes only.



# NAPA EPD Program



- Program Overseen by the Sustainability Committee
  - Created in Sept. 2014
  - International Standards
- PCR Asphalt Mixtures
  - Product: - **1 US Ton**
  - Mix-specific and plant specific
  - Meeting DOT specifications





# NAPA EPD Program Goal

- Benchmark environmental performance
- Communicate environmental performance transparently

Therefore PCR

- Prescribes Public Data
- No Proxies





# EPD Delivery

1. Identify Program Operator
2. Identify or Develop a PCR – Program Operator \$
3. Conduct LCA study – LCA Consultant \$
4. Development of EPD – LCA Consultant \$
5. Verification of EPD & LCA study – 3<sup>rd</sup> Party Reviewers \$
6. Publish EPD – Program Operator \$

NAPA EPD  
Tool

Challenge: Current Process is Timely



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# CREATE PLANT

[User Home](#)[Plants](#)[Suppliers](#)[Mixes](#)[EPDs](#)[WHAT IF?](#)[FAQ](#)[Settings](#)

Create Plant: Use this page to enter the data for a new plant. This will in turn populate the data needed to specify mixes, and create an EPD. All data is private and secure.

Plant Name:	Test Plant 5	
Total Tonnage Produced:	210,000	Ton/yr
Natural Gas Usage (yearly):	80,268	MCF/yr
Natural Gas Usage (daily):	321	MCF/day
Electricity Usage (yearly):	617,240	kW/yr
Electricity Usage (daily):	1,691	kW/day
Onsite Generator Fuel Type:	CHOOSE ONE	
Onsite Generator Fuel Usage:		Gal/yr

Need help?  
Download  
our Guide  
to Plant  
Data [HERE](#).

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# ASPHALT MIXES

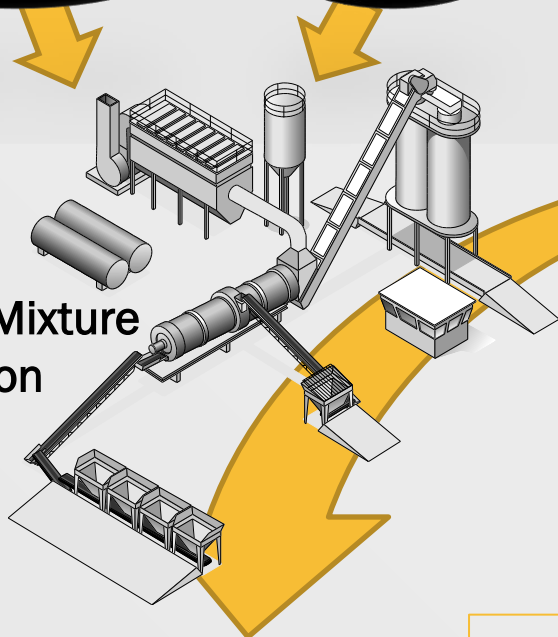
[User Home](#)[Plants](#)[Suppliers](#)[Mixes](#)[EPDs](#)[WHAT IF?](#)[FAQ](#)[Settings](#)

Mix Page: Complete an incomplete mix by choosing Edit, or create an EPD for a particular mix by choosing Make EPD. Want to create a new mix? Go to the [NEW MIX](#) page.

Mixes	Plant	Status	Actions			
Mix 1A	#44 Georgia	Incomplete	Make EPD	Edit	Delete	
7-42C	#7	Complete	See EPD	Edit	Delete	
Mix 1B	#44 Georgia	Complete	Make EPD	Edit	Delete	
Mix 1C	#44 Georgia	Complete	Make EPD	Edit	Delete	



Source Materials



Asphalt Mixture  
Production



Transportation

Challenge: What about full LCA  
for asphalt pavements?



Construction



Maintenance



Use Phase



**ASPHALT**  
100% RECYCLABLE

Reuse



End of Service Life



<0.1%

Disposal



**Surface texture**  
the roughness of the  
aggregate materials in  
a pavement



**Smoothness**  
surface unevenness  
that affects perceived  
ride quality



**Pavement stiffness**  
how the pavement deflects  
under a vehicle's weight



**Almost 75 percent** of the oil consumed in the United States is used as vehicle fuel. Increases in vehicle fuel economy over the past few decades, fuel costs remain a significant item for the public and businesses alike. Numerous factors influence the fuel economy of a vehicle: its aerodynamic properties, engine, tire pressure, and air temperature; however, just three best impact fuel economy: vehicle internal friction, air drag, and rolling resistance. While these three always affect fuel economy, they vary in importance based on the vehicle speed. In addition, pavement properties only truly have an impact on rolling resistance.

The rolling resistance forces a vehicle must overcome to maintain speed are linked to its suspension system, bearings, transmission, tire pressure, and in part, the properties of the pavement. Three pavement properties are commonly understood to influence rolling resistance:



**Surface texture**  
the roughness of the  
aggregate materials in  
a pavement



**Smoothness**  
surface unevenness  
that affects perceived  
ride quality



**Pavement stiffness**  
how the pavement  
deflects under a vehicle's  
weight

Research has been conducted over the past 40 years to determine how each of these three pavement properties affects rolling resistance. Pavement texture influences fuel economy through the interaction of the tire and the pavement. As the tire deforms, energy converts into heat, which the rest of the tire and the atmosphere. Pavement stiffness may influence rolling resistance because tires and pavements interact: the pavement compresses causing the tire to continually deform. Smoothness influences the fuel consumption through energy lost by the shock absorbers and the vehicle moves down the roadway and these systems work to make the ride more comfortable.

English Pavement Alliance | 1300 Forbes Blvd., Suite 100, Silver Spring, MD 20910 | Phone: 301-916-6001 | Toll Free: 877-476-3027 | Email: info@englishpavementalliance.org | The English Pavement Alliance is a part of NAPA, the National Asphalt Pavement Association, and the State Asphalt Pavement Association.



**About 75 percent of the oil consumed** in the United States is used as vehicle fuel. Despite increases in vehicle fuel economy over the past few decades, fuel costs remain a significant budget item for the public and businesses alike. Numerous factors influence the fuel economy of a vehicle: its aerodynamic properties, engine, tire pressure, and air temperature; however, just three best impact fuel economy: vehicle internal friction, air drag, and rolling resistance. While these three forces always affect fuel economy, they vary in importance based on the vehicle speed. For example, when a vehicle is traveling at 30 miles per hour, 40 percent of the energy needed to move the car is used to overcome rolling resistance, but at 70 miles per hour, the rolling resistance only comprises about 2 percent of the energy requirement.

#### Vehicle Energy Consumption by Speed<sup>1</sup>

	30 mph	70 mph
Rolling Resistance	40%	2%
Internal Friction	30%	10%
Aerodynamic Drag	25%	88%



The rolling resistance forces a vehicle must overcome to maintain speed are linked to its suspension system, bearings, transmission, tire pressure, and in part, the properties of the pavement. Three pavement properties are commonly understood to influence rolling resistance:



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**When it comes to America's roads**, drivers want surfaces that are safe, durable and support fuel efficiency. Pavement smoothness is critical to achieving each of these goals, and the Federal Highway Administration (FHWA) recently determined that smoothness is a key factor in ensuring satisfaction for road users.<sup>1</sup>

Thanks to advanced materials and construction techniques, asphalt provides a smooth, comfortable surface that meets drivers' standards while adding to pavement longevity and requiring less maintenance than rougher roads<sup>2</sup> and lowering vehicle operating costs.<sup>3</sup>

As drivers, policymakers and regulators grow increasingly concerned with fuel economy, the impact of smoothness on vehicle efficiency is receiving greater attention. Three pavement properties are commonly thought to affect fuel consumption:



**Texture**  
how rough the surface is



**Smoothness**  
how rough the road  
feels to a driver



**Pavement stiffness**  
how much the pavement  
deflects under a vehicle's  
weight

No study has grasped how all three pavement properties simultaneously impact vehicle fuel economy.<sup>4</sup> However, the current scientific consensus is that pavement smoothness typically has the greatest influence, and that the effect of texture is smaller on well-maintained pavements. No real agreement has been reached as to the effect of pavement stiffness.<sup>5</sup>

All told, Americans burn nearly 170 billion gallons of fuel driving approximately 3 trillion miles a year.<sup>6</sup> If roads across the nation were built and maintained to ensure a smoother ride, drivers could see an approximately 1.5 percent decrease in fuel consumption<sup>7</sup> — the equivalent of saving about 10¢ per gallon.<sup>8</sup> Similarly, rough and poorly maintained roads increase wear and tear on vehicles — about \$275 per year for the average driver.<sup>9</sup>

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**NATIONAL ASPHALT  
PAVEMENT ASSOCIATION**



# PAVEMENT HEALTH ANALYSIS TOOL



[www.IRIExplorer.com](http://www.IRIExplorer.com)

- Utilizes LTPP Data
- Free
- Web Based, Customizable
- Life-Cycle Emission Benchmarking

## Why Should Customers Use IRI Explorer?

- IRI Explorer is a free, web-based tool for examining LTPP data, as well as benchmarking life-cycle emissions for roadway projects.
- Road roughness (or, conversely, road smoothness) is crucial to vehicle fuel efficiency, wear-and-tear on cars and trucks, and highway maintenance schedules. The IRI Explorer is a tool for exploring historical trends in road roughness data.
- IRI is a simple measure of the broad health of a roadway. Just as an elevated heart rate can indicate a health problem, a high IRI can indicate an ailing roadway.
- IRI Explorer helps determine the greenhouse gas emissions associated with roadway maintenance.
- Compare pavement types and their performance by your state or similar climate regions.
- Check up on 20 years of data from 2,000 pavement test sections in the Federal Highway Administration's Long-Term Pavement Performance (LTPP) program.
- Add data from local state road networks for analysis.

IRI Explorer analyzes roadway data, and provides customized reports to suit your needs.

FOR MORE INFORMATION  
[IRIExplorer.com](http://IRIExplorer.com)



[IRIExplorer.com](http://IRIExplorer.com)





# Measuring Rolling Resistance

- Evaluating Equipment that Measure RR
  - Most equipment only simulates passenger cars
  - Couple of equipment in R&D phase for heavy vehicles
  - TUG – Most repeatable and robust but only simulates passenger cars
- In contact with Miriam Study Researchers



# THE IMPACT OF **ASPHALT SUSTAINABILITY**



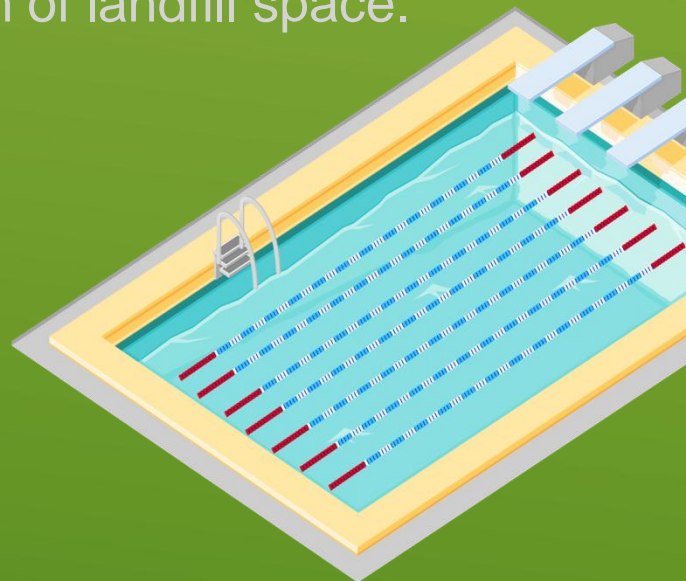


About **4.16M**  
scrap tires were used to  
make quiet, rubberized  
asphalt pavements.

Reuse of  
old pavements

**SAVES**  
**13,500**

Olympic-size pools  
worth of landfill space.






About **1.9M**  
tons of roofing shingles  
were put to use in new  
pavement mixes and  
other road-building uses.



**72M**

tons of old pavements  
were put to use in new  
pavement mixes and other  
road-building activities.





**99%+**

of the material removed from old asphalt pavements is reused in new pavements.

## **WARM-MIX ASPHALT**

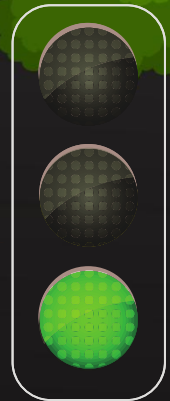
technologies have the benefit of reducing energy consumption which decreases the production of greenhouse gases.

**\$2.8B+**  
**SAVINGS**

from recycled materials compared to the cost of raw materials.

**32%+**

Nearly a third of all asphalt pavement mixtures are produced using warm-mix technologies.





# Specialization in Asphalt Sustainability Implementation Webinar Series

## Drivers

- Legislative, Regulatory and Market

## Opportunities

- Design, Construction and Maintenance of Porous Pavements
- Recycled Materials: Ground Tire Rubber
- Recycled Materials: RAP and RAS
- Sustainable Plant Operations

## Tools

- FHWA Sustainable Pavements Program
- Green Rating Systems: Infrastructure
- Green Rating Systems: Buildings
- Creating a Successful Sustainability Program
- Environmental Product Declarations





# THANK YOU

[hdylla@asphaltpavement.org](mailto:hdylla@asphaltpavement.org)

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