NAPA Overview

- Mix Producers
- Paving Contractors, Equipment Producers, & Suppliers
- 1,100 Member Companies

Research & Engineering
Education & Member Services

Federal Advocacy
- Highway & Airport Investment
- EH&S Regulatory Issues
Let’s start with Sustainability
“Nor indeed would a farmer, however old, hesitate to answer any one who asked him for whom he was planting: ‘...I should not merely receive these things from my ancestors, but should also hand them on to the next generation.’”

- Cicero, *On Old Age*, 44 B.C.
What is Sustainability? The U.N. says...

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

What is a sustainable pavement? FHWA says...

Sustainable pavements should:

- Achieve the engineering goals for which they were constructed
- Preserve and (ideally) restore surrounding ecosystems
- Use financial, human, and environmental resources economically
- Meet human needs such as health, safety, equity, employment, comfort, and happiness
Reclaimed Asphalt Pavement

99+% of pavements are recycled

- 76.2 million tons of RAP used (2017)
  - 21.5 million barrels of oil
  - 72+ million tons of aggregate
  - $2.1 billion in savings

- Pennsylvania
  - 3.2 million tons of RAP (2018)
  - Average percent RAP used
    - 15.9% (2018); 14.7% (2017)
Developed in Europe to reduce CO₂ emissions

- 147.7 million tons of WMA (2017)
  - 38.9% of total market
- Pennsylvania
  - 13.2 million tons in 2017
    - 65% at reduced temp.
    - 18% chemical additive 2018
    - 55% chemical additive 2017
Perpetual Pavements

- Designed to never experience structural rutting or cracking
- PennDOT has earned 8 perpetual pavement awards
Life Cycle Considerations

Pavement Smoothness

- Vehicle wear and tear
- Pavement wear and tear
- Fuel efficiency
- Noise
- Safety
Resiliency and Asphalt Pavements
What is Resilience?

• No common definition
  • AASHTO cited 8 definitions related to transportation infrastructure

• Many faces of resilience
  • But none, by itself, represents the whole

Resilience – The elephant and the 6 blind men

It’s a Fan!

It’s a Wall!

It’s a Spear!

It’s a Snake!

It’s a Rope!

It’s a Tree!
Resilience and Asphalt Pavements

Natural disasters

- Hurricanes, floods, earthquakes, landslides, tornadoes
- Damaged roads affect mobility
  - Emergency services
  - Access to medical care
  - Food supplies
  - Commerce
- With unexpected events, the key is to quickly restore service
Resilience – Earthquake Response

- 8 major transportation corridors severely damaged
- All 8 major roads repaired within 5 days

Anchorage, AK
December 1, 2019

Resilience – Earthquake Response

- Ridgecrest, CA –
  - July 4 & 5, 2019
- Back-to-back earthquakes damage Highway 178
- Temporary repairs completed within hours
- Permanent repairs completed less than 10 days later, within a single shift

Resilience – Hurricanes

- Orange, Texas after Hurricane Harvey
- August 2017

Resilience – Speed of Hurricanes

• Hurricane Michael severely damaged U.S. 98 in Franklin County, Florida (October 2018)
• 40-mile stretch of highway affected, 15 miles badly damaged
• Lanes were reopened to traffic after every shift

Resilience – Warm Mix to the Rescue

- What happens when local plants can’t operate?
- Use of warm mix studied after Hurricane Katrina
- Haul distances up to 8-10 hours can be used with warm mix technology
- Fine graded mixes are more easily compacted

http://driveasphalt.org/resource-library/full-scale-testing-of-hot-mixed-warm-compacted-asphalt-for-emergency-paving
Resilience – Warm Mix to the Rescue
U.S. 34, Colorado, 2013

- 3-hr. haul distances
- Late season paving at high elevation
- Steep canyons with little sun and high winds
- Warm mix was key to getting the job done

https://www.roadsbridges.com/asphalt-paving-able-reconnect

Resilience and Asphalt Pavements

Climate change

- Coastal flooding, groundwater rise, hotter temperatures
- The key is to plan for expected changes

Resilience – Sea Level Rise

- Highway 80, Tybee Island Access Road
- Caused by king tides and shifting currents

3,000+ residents
October 27, 2015

https://www.ajc.com/blog/politics/supermoon-rising-sea-levels-put-tybee-island-access-under-water/kE3PD96bMn0XJDPSh0jto/
Resilience – Hotter Temps

- Use climate forecasts rather than historical data for pavement design
- Integrate design changes into routine maintenance overlays
- Can be cost effective if planned appropriately


Climate change means roads should be built differently, UNH researchers say


Researchers at the University of New Hampshire say governments should start building roads with different and thicker asphalt now so they will be ready to withstand the effects of climate change in the future.
Resilience – Will Roads Melt as the Temperatures Heat Up?

- Climate models provide long-term expected temperature changes
- Adjust binder grades to accommodate predicted conditions
- Time scale of changes is decades
- Can be a part of routine maintenance overlays

https://www.wired.com/story/this-scary-map-shows-how-climate-change-will-transform-your-city/?verso=true
FHWA references for pavement resilience

Impact of Environmental Factors on Pavement Performance in the Absence of Heavy Loads (FHWA-HRT-16-078)

Climate Change Adaptation for Pavements (FHWA-HIF-15-015)

Vulnerability Assessment and Adaptation Framework, Third Edition (FHWA-HEP-18-020)
www.fhwa.dot.gov/environment/sustainability/resilience/adaptation_framework

Adaptation Decision-Making Assessment Process (ADAP) (FHWA-HEP-17-004)
www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/teacr/adap

Synthesis of Approaches for Addressing Resilience in Project Development (FHWA-HEP-17-082)
www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/teacr/synt hesis
Paving for Performance: Built to Perform

www.AsphaltPavement.org/P4P

December 3 & 4, 2019 / Austin, Texas
Questions?

Joseph Shacat

JSHACAT@asphaltpavement.org