Pavement Economics Committee
Projects and Initiatives

Heather Dylla
Director of Sustainable Engineering
Outline

• Pavement Economics Committee Background
  • Pavements Impact on Fuel Economy
  • Enhancements to Life Cycle Assessment Software to Include Pavement Smoothness
  • Unintended Consequences to Urban Heat Island
• Dissemination of Research Results
Pavement Economics Committee (PEC)
PAVEMENT ECONOMICS FUND

Six NAPA-SAPA Task Groups

$1 Million Program

Funded by NAPA & SAPAs with 100% SAPA Participation
Six NAPA-SAPA Task Groups

- Best Quality and Competitiveness
- Environmental Sustainability
- Legislative
- Pavement Design
- Pavement Preservation
- Pavement Type Selection
PEC 2013 Projects

- Optimize Pavement Design & Materials
- Enhance Life Cycle Assessment Software to Include Pavement Smoothness
- Unintended Consequences of Reflective Pavements
- Develop Thinlays with High Recycled Content
- Prevent Passage of Pavement Type Mandates at State and National Level
How does Pavement Influence Fuel Economy?

National Center for Asphalt Technology
Dr. Richard Willis
Dr. Mary Robbins
Dr. Marshall Thompson
Project Motivation


- Electricity: 33%
- Industry: 20%
- Transportation: 28%
- Commercial and Residential: 11%
- Agriculture: 8%

- 84% of the GHG from the transportation sector from vehicle combustion
GHG associated with Pavements

Recycle/Reuse

Raw Material
- Aggregates
- Admixtures
- Asphalt Binder
- Transport

Production
- Fuel
- Equipment

Construction
- Transport
- Paving

Use
- Vehicle Operation
- Maintenance/Workzone congestion

End of Life
- Landfill
- Recycle
Project Objectives

• How does pavement influence fuel economy?

• Goal: Synthesize existing literature on how pavement properties might alter the vehicle fuel economy
Factors Effecting Fuel Efficiencies
Total Driving Resistance

Vehicle Driving Resistance

Vehicle Propulsion
- Inertial
- Gravitational
- Engine
- Auxiliary Equipment

Vehicle Aerodynamics
- Body Air
- Tire Air

Vehicle Rolling
- Tire/Road Rolling
- Bearing
- Transmission
- Suspension

(Courtesy of Tom Harman)
Rolling Resistance

- Force required to keep an object (i.e. wheel or tire) moving
- Energy Losses
  - Pavement Surface
  - Internal Friction
  - Tire Deformation

(Beauving, 2004)
Factors Influencing Rolling Resistance

- Tire Pressure
- Pavement
- Speed
- Temperature
What factors can we control?

- Texture
- Smoothness
- Deflection
Smoothness Matters

- Smoothness and texture have an effect of fuel economy
  - Macrotecture = 7% change in fuel economy (Sandberg, 1990)
  - Smoothest to roughest road = 11% change in fuel economy (Sandberg, 1990)

- Effect of pavement deflection unknown
  - Difficult to pull one property (stiffness) out when texture and smoothness also affect it
  - Conflicting results
Enhance Life Cycle Assessment Software to Include Pavement Smoothness

Michigan Technological University
Dr. Amlan Mukherjee
Benjamin Ciavola
Jay Vana
Project Objective

• How does Pavement Smoothness Improve Environmental Life Cycle Impacts?

• Goal:
  • Create interface to compare smoothness of different pavement types
  • Enhance existing life cycle assessment (LCA) GHG software to include pavement smoothness
Interface

- Long-Term Pavement Performance (LTPP) IRI data
  - Easy Access
  - Transparent
- Allow for customized assessment by stakeholders
  - Network
  - Pavement type
- Analyze FHWA LTPP data set
  - How does IRI change over time?
  - What conditions influence IRI?
  - What kind of maintenance plans deliver smooth pavements?
Interface

US-5
JPCP Over Non-Bituminous Treated Base
ESAL: 1612,000, Experiment 3 (GPS)

1 May 1995: Skin Patching, Full-Depth Patching of PCC Pavement Other Than at Joint.
1 July 1999: Full-Depth Patching of PCC Pavement Other Than at Joint
1 July 2000: Lane-Shoulder Longitudinal Joint Sealing, Crack Sealing, Full-Depth Patching of PCC Pavement Other Than at Joint, Transverse Joint Sealing
1 July 2002: Full-Depth Patching of PCC Pavement Other Than at Joint
1 April 2004: Lane-Shoulder Longitudinal Joint Sealing, Crack Sealing, Transverse Joint Sealing
Pavement Comparisons

HMA US-127
PCC US-23

IRI (m/km)

Time (year)
Project Next Steps

- Relate fuel efficiency as a function of change in IRI to:
  - Maintenance schedules
  - Pavement type
  - Regional factors
- Estimate use phase emissions PE-2
Project Next Steps

Recycle/Reuse

Raw Material
- Aggregates
- Admixtures
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- Transport

Production
- Fuel
- Equipment

Construction
- Transport
- Paving

Use
- Vehicle Operation
- Maintenance/Workzone congestion

End of Life
- Landfill
- Recycle

NAPA
State Asphalt Pavement Associations
Unintended Consequences of Reflective Pavements

Arizona State University
Dr. Kamil Kaloush
Dr. Zhihua Wang
Jiachuan Yang
Project Objective

• State and federal legislation, as well as green building codes increasingly penalize and/or prohibit pavements with low reflectivity to mitigate Urban Heat Island (UHI).

• Goal:
  • Illustrate the complexity UHI
  • Identify the tradeoffs with pavement reflectivity
• Increased atmospheric heating
• Decreased rainfall
• Increased heating of adjacent walls
• Air temperature above pavement is the same
Dissemination of Research Results
America depends on high-performing, safe roads.

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- It costs less than 2 cents a ton
QUESTIONS

2014 Midyear Meeting: July 14 – 16, Nashville
NAPA Asphalt Fly In: September 9 – 10, 2014
Young Leaders Conference: Fall 2014
2015 Annual Meeting: January 25 – 28, Marco Island

SAVE THE DATES

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