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

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Pavement Economics Committee (PEC)

PAVEMENT ECONOMICS FUND

Six NAPA-SAPA Task Groups

$1 Million Program

Funded by NAPA & SAPAs with 100% SAPA Participation

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PEC TASK GROUPS

Six NAPA-SAPA Task Groups

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

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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

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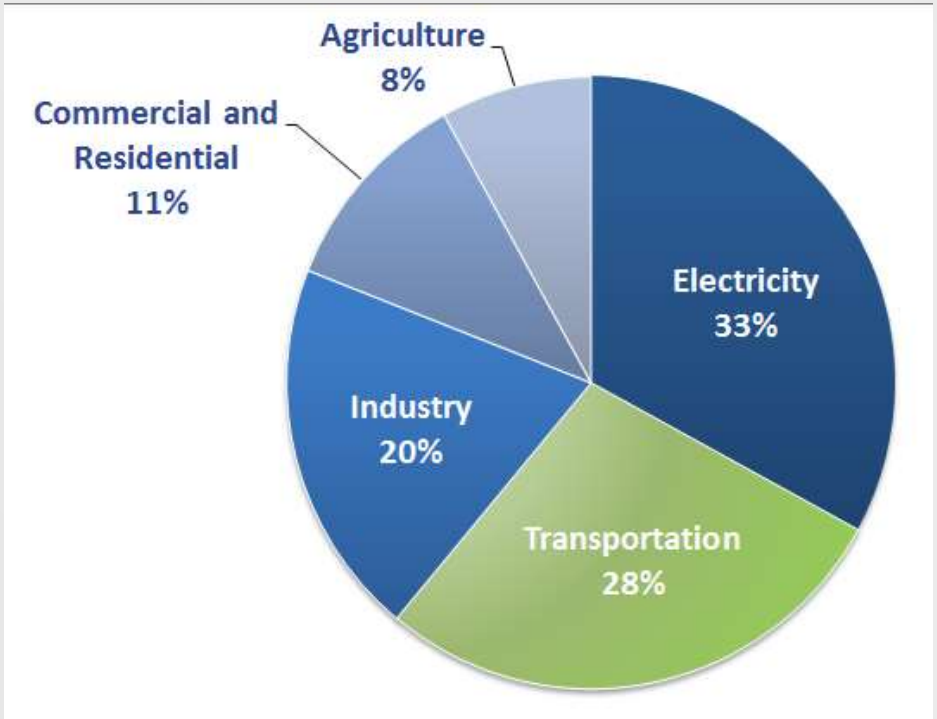
How does Pavement Influence Fuel Economy?

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

Project Motivation

Total U.S. Greenhouse Gas (GHG) Emissions by Economic Sector in 2011



- 84% of the GHG from the transportation sector from vehicle combustion

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GHG associated with Pavements

Recycle/Reuse

Raw Material	Production	Construction	Use	End of Life
				
• Aggregates • Admixtures • Asphalt Binder • Transport	• Fuel • Equipment	• Transport • Paving	• Vehicle Operation • Maintenance/ Workzone congestion	• Landfill • Recycle

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Project Objectives

- How does pavement influence fuel economy?
- Goal: Synthesize existing literature on how pavement properties might alter the vehicle fuel economy

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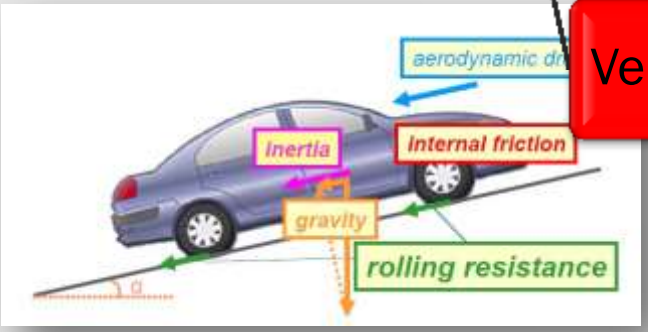
Factors Effecting Fuel Efficiencies
Total Driving Resistance

MIRIAM

- Vehicle Driving Resistance
  - Vehicle Propulsion
    - Inertial
    - Gravitational
    - Engine
    - Auxiliary Equipment
  - Vehicle Aerodynamics
    - Body Air
    - Tire Air
  - Vehicle Rolling
    - Tire/Road Rolling
    - Bearing
    - Transmission
    - Suspension

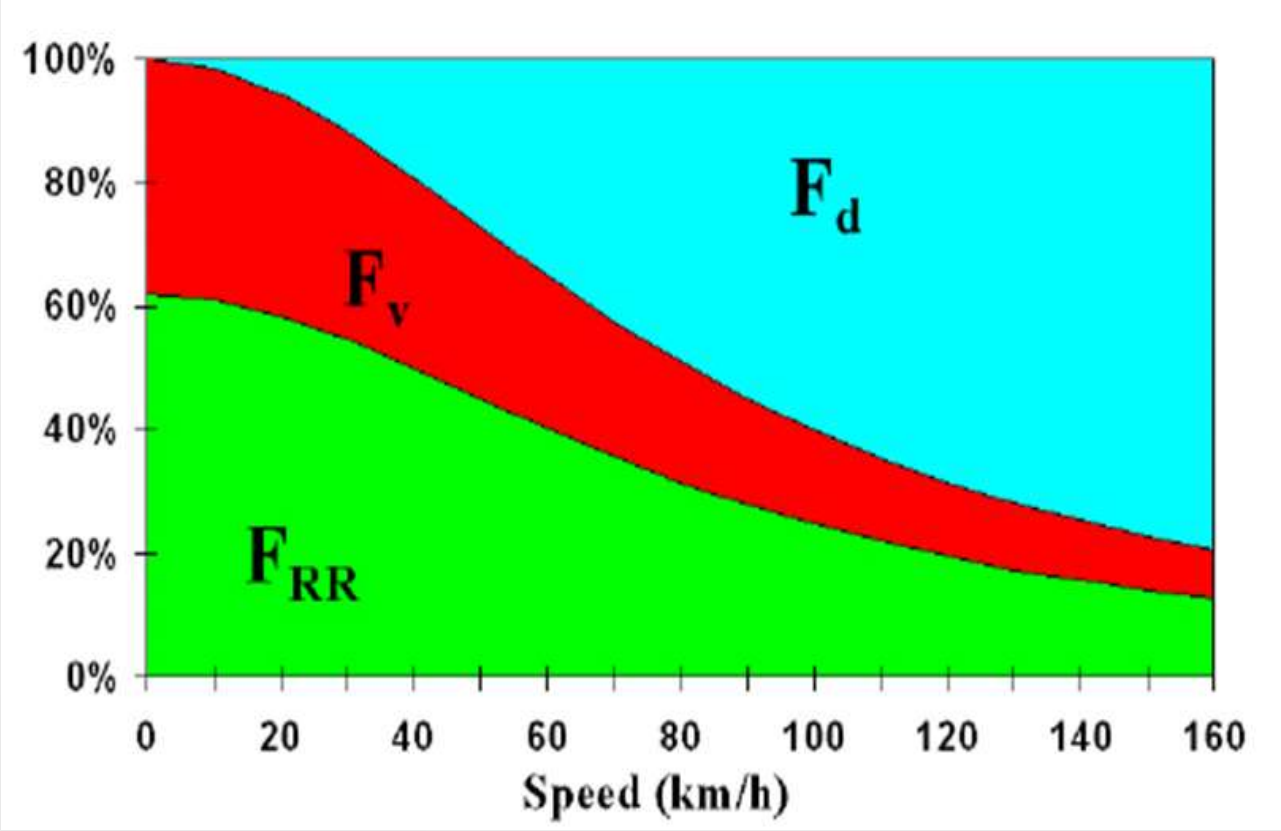
IRI/MPD



(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)

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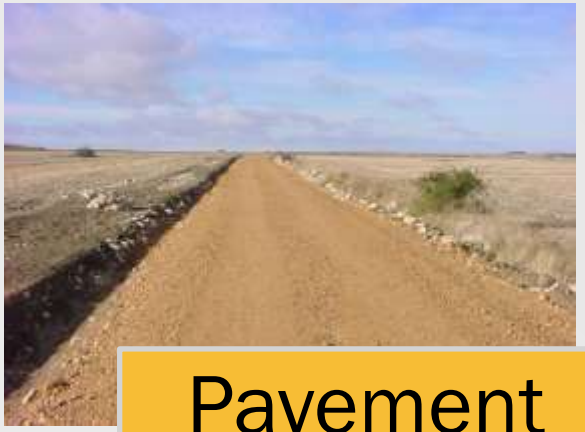
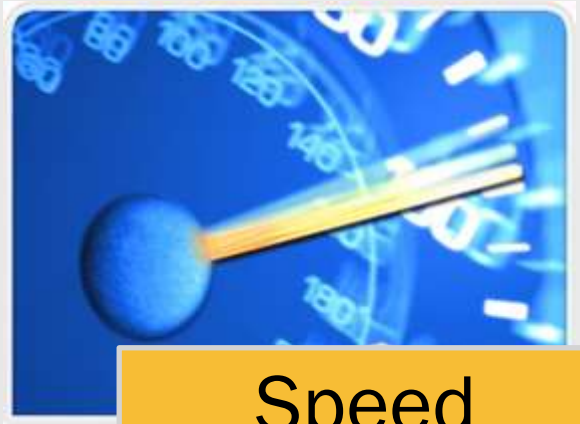
Factors Influencing Rolling Resistance

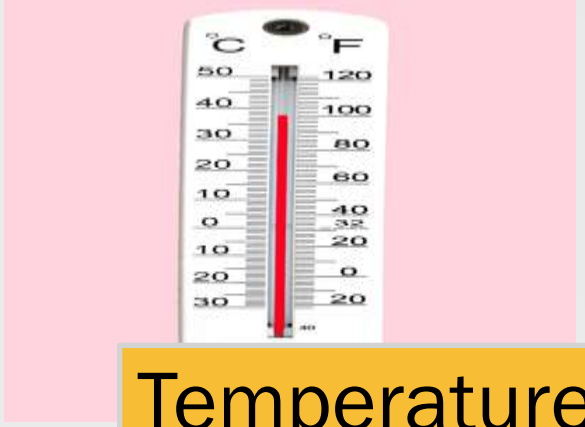
Tire Pressure



Pavement



Speed



Temperature

13

What factors can we control?

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Smoothness Matters

- Smoothness and texture have an effect of fuel economy
  - Macrotexture = 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

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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?

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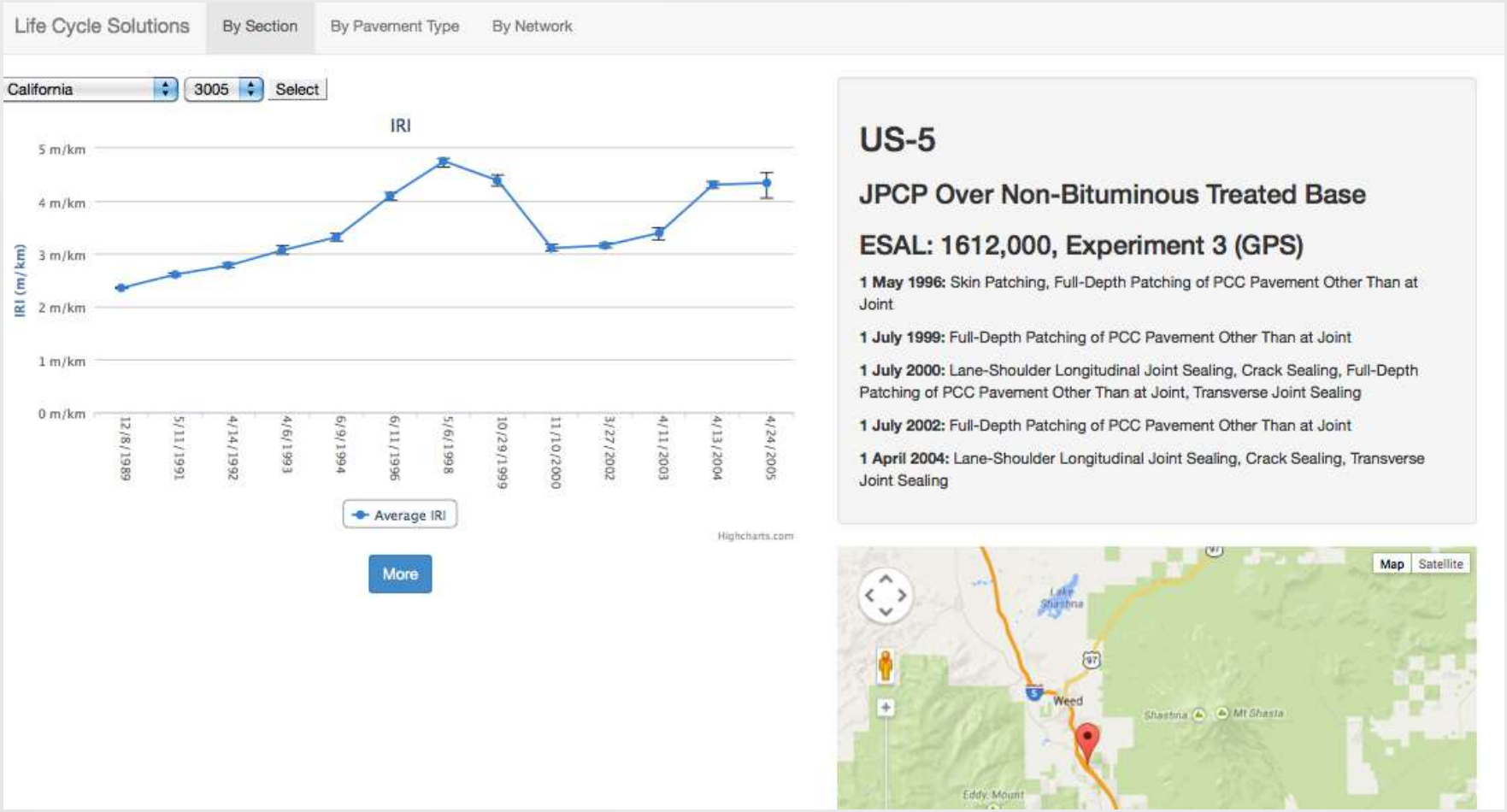
Interface



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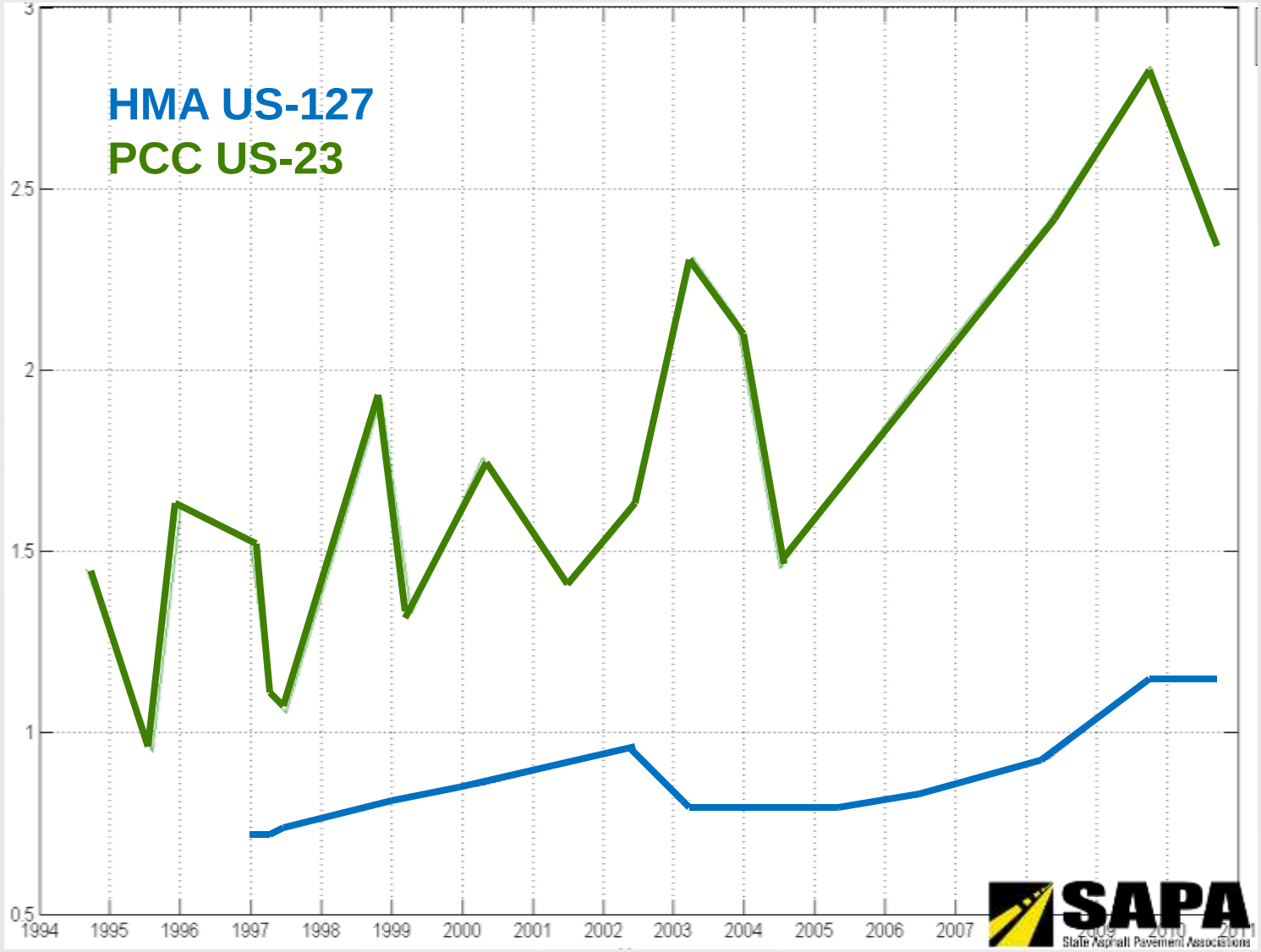
Pavement Comparisons



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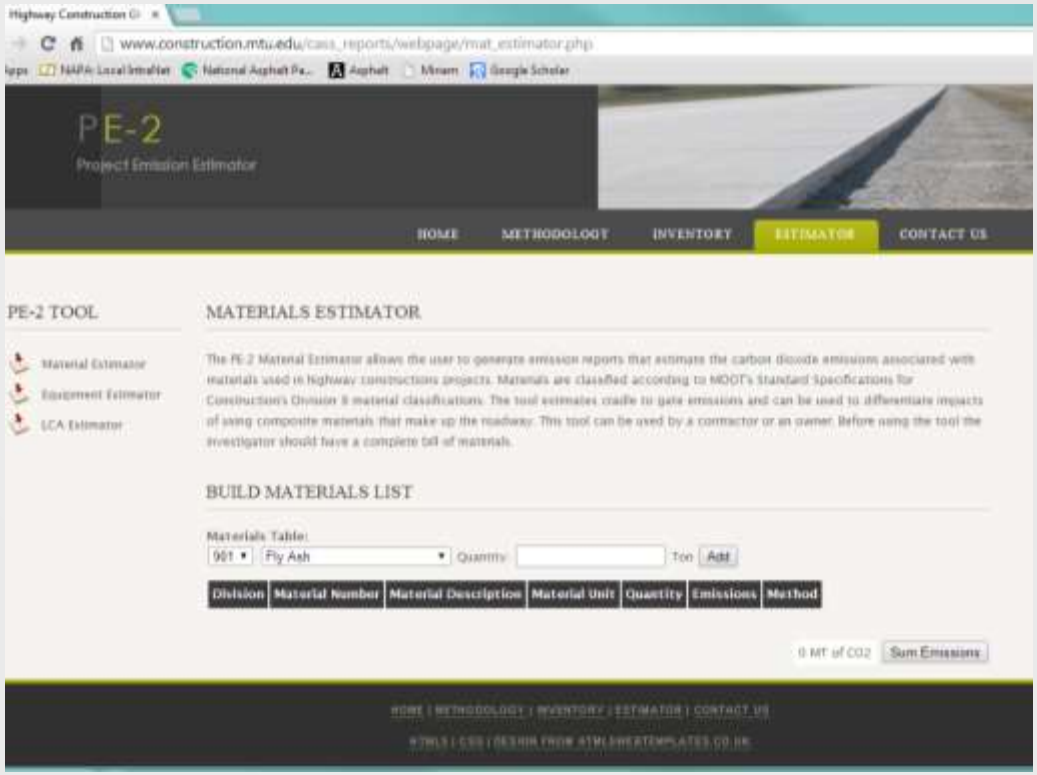
Project Next Steps

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



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Project Next Steps

Recycle/Reuse

Raw Material	Production	Construction	Use	End of Life
				
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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

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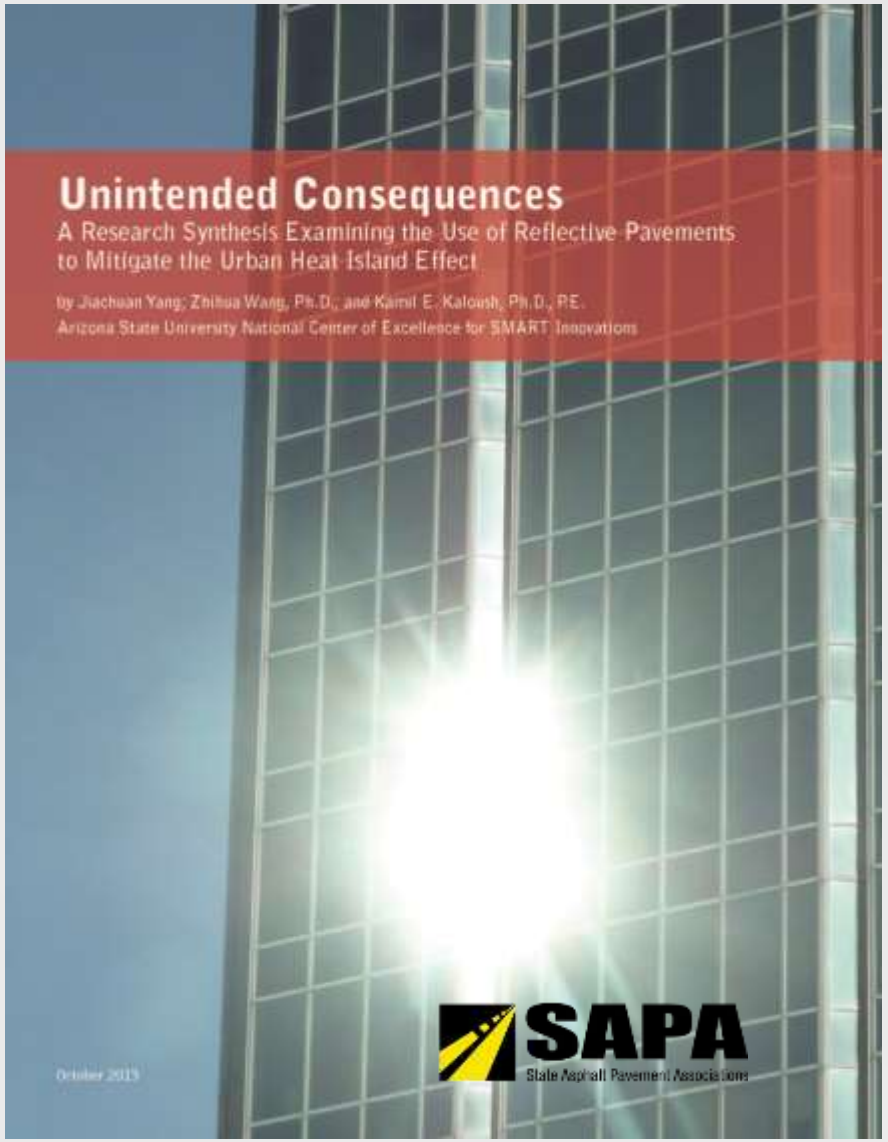
UHI – UNINTENDED CONSEQUENCES

- Increased atmospheric heating
- Decreased rainfall
- Increased heating of adjacent walls
- Air temperature above pavement is the same



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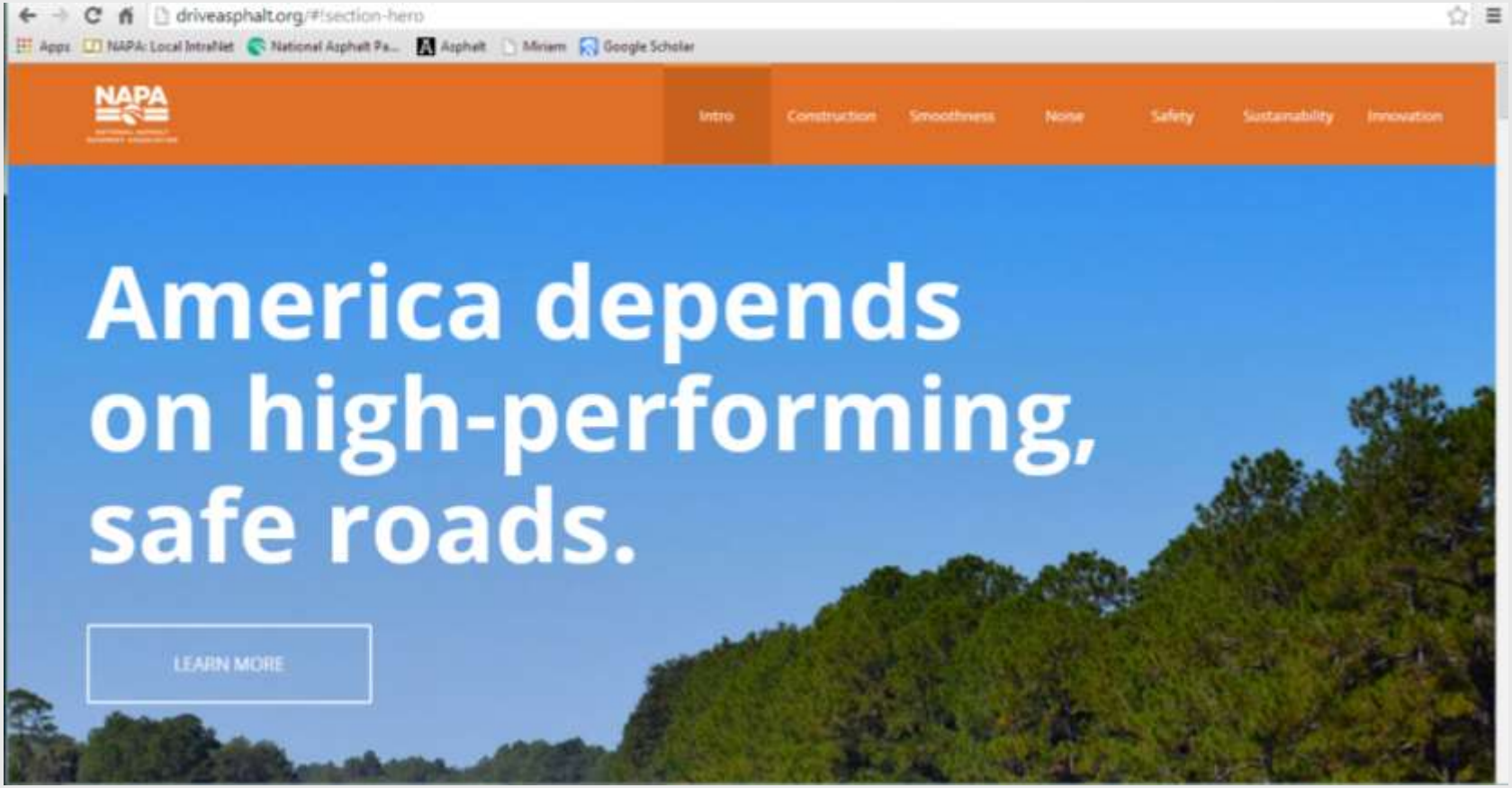
Dissemination of Research Results

Driveasphalt.org



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NAPA MEMBERSHIP

- Three reasons why you should join.
  1. NAPA's professional staff become members of your staff.
  2. NAPA is always on the cutting edge of technology and thus NAPA members will always be more competitive than non members.
  3. NAPA protects your investment by making sure you have a market to operate effectively in.
- It costs less than 2 cents a ton

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QUESTIONS

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