



**From Europe to Corrigan then onto
the Land of Lincoln**

Warm Mix Asphalt – Global View

**IAPA Annual Convention
March 9, 2009
Timothy R. Murphy, P.E.
Murphy Pavement Technology**

Lincoln Knows...



Transportation Research Board's Report 202



“Asphalt, more than any other single product, sustains the nation's highway system and facilitates the flow of commerce.”

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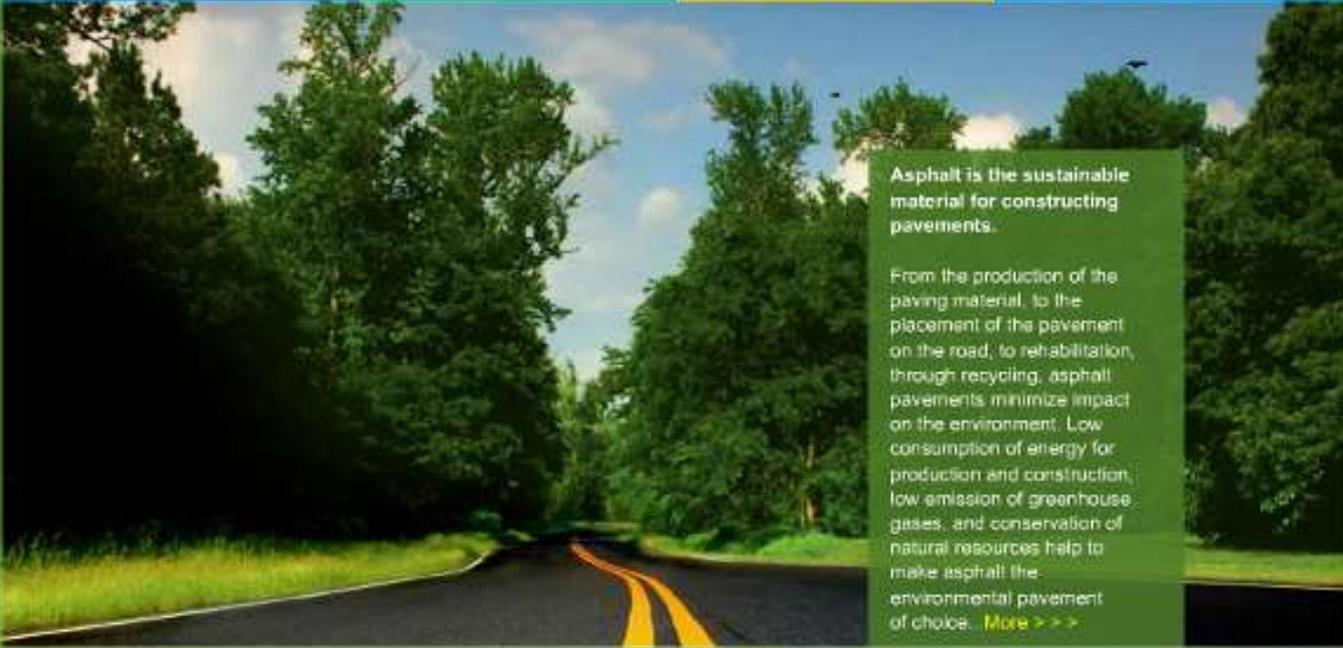
Creat
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ASPHALT

The Sustainable Pavement



ENERGY & RECYCLING **PERFORMANCE** **WATER QUALITY** **CLEAN AIR & COOL CITIES**



Asphalt is the sustainable material for constructing pavements.

From the production of the paving material, to the placement of the pavement on the road, to rehabilitation, through recycling, asphalt pavements minimize impact on the environment. Low consumption of energy for production and construction, low emission of greenhouse gases, and conservation of natural resources help to make asphalt the environmental pavement of choice. [More >>>](#)

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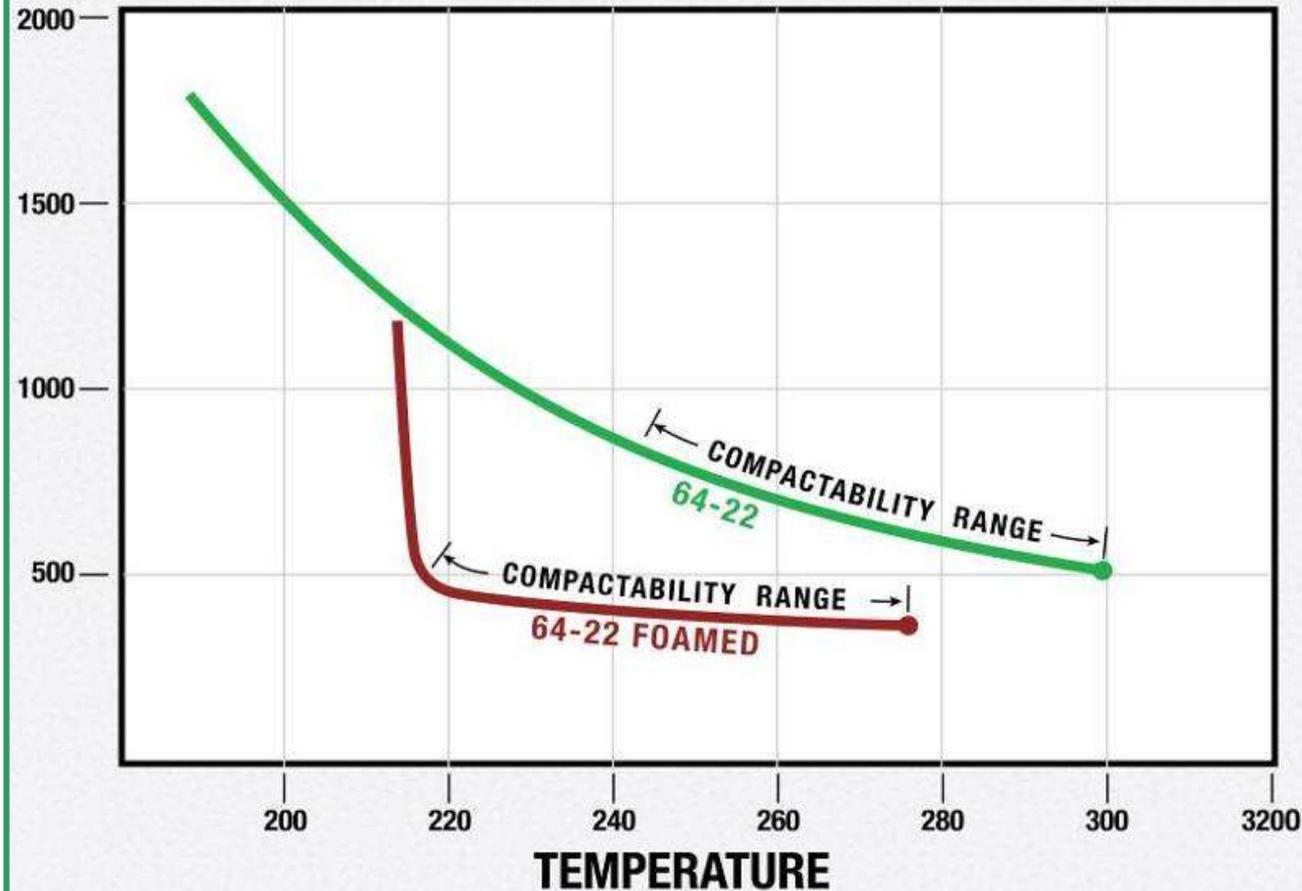


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(WMA)

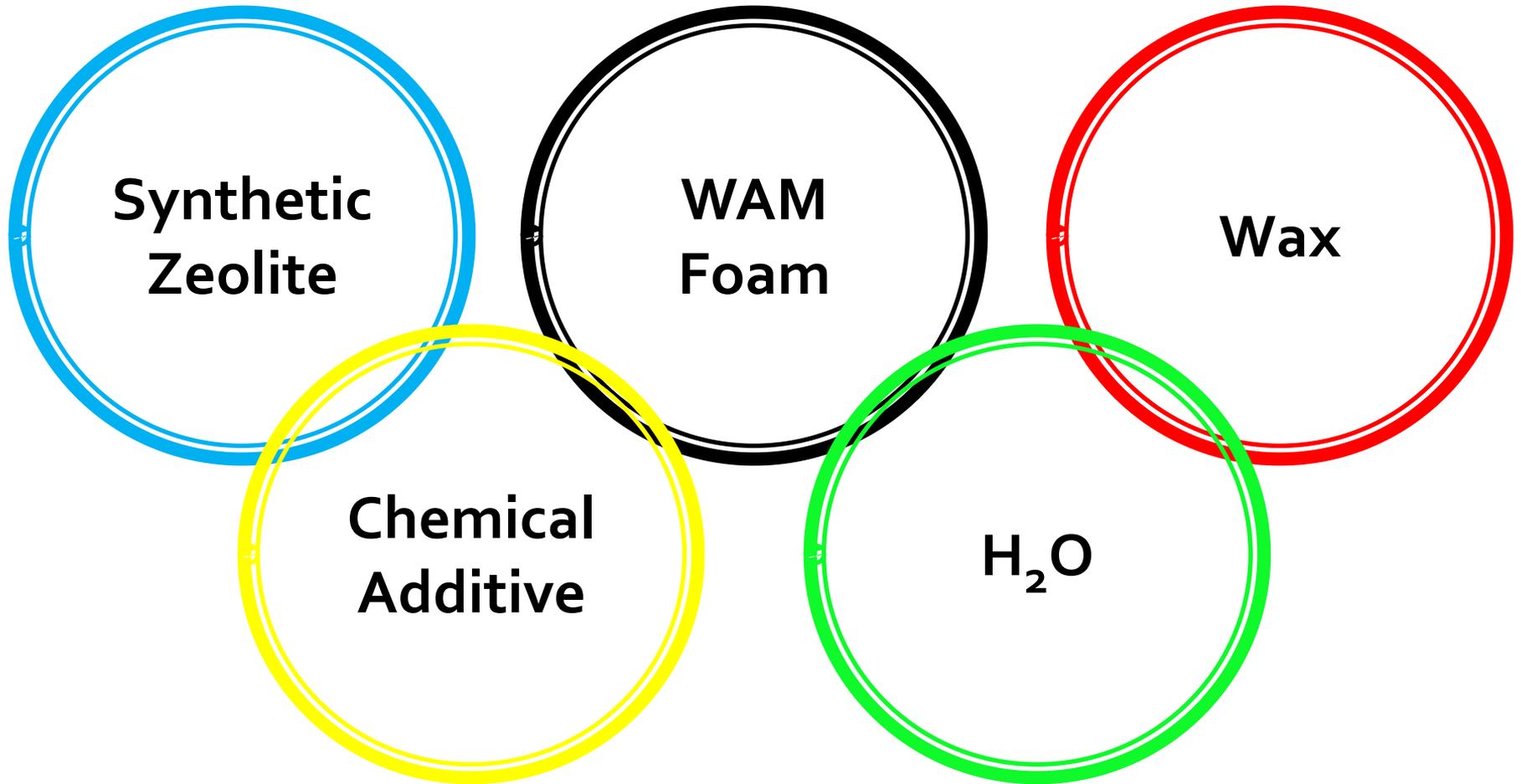
Warm Mix Asphalt

Technologies that appear to allow a reduction in the temperatures at which asphalt mixes are produced and placed.



VISCOSITY / TEMPERATURE PG 64 -22 (Approx.)

WMA technologies available



Potential Benefits of WMA

- Increased durability due to less oxidation and less absorption = better fatigue life
- Good in-place density
- Wider paving window

➤ Winter Paving

➤ Night Paving

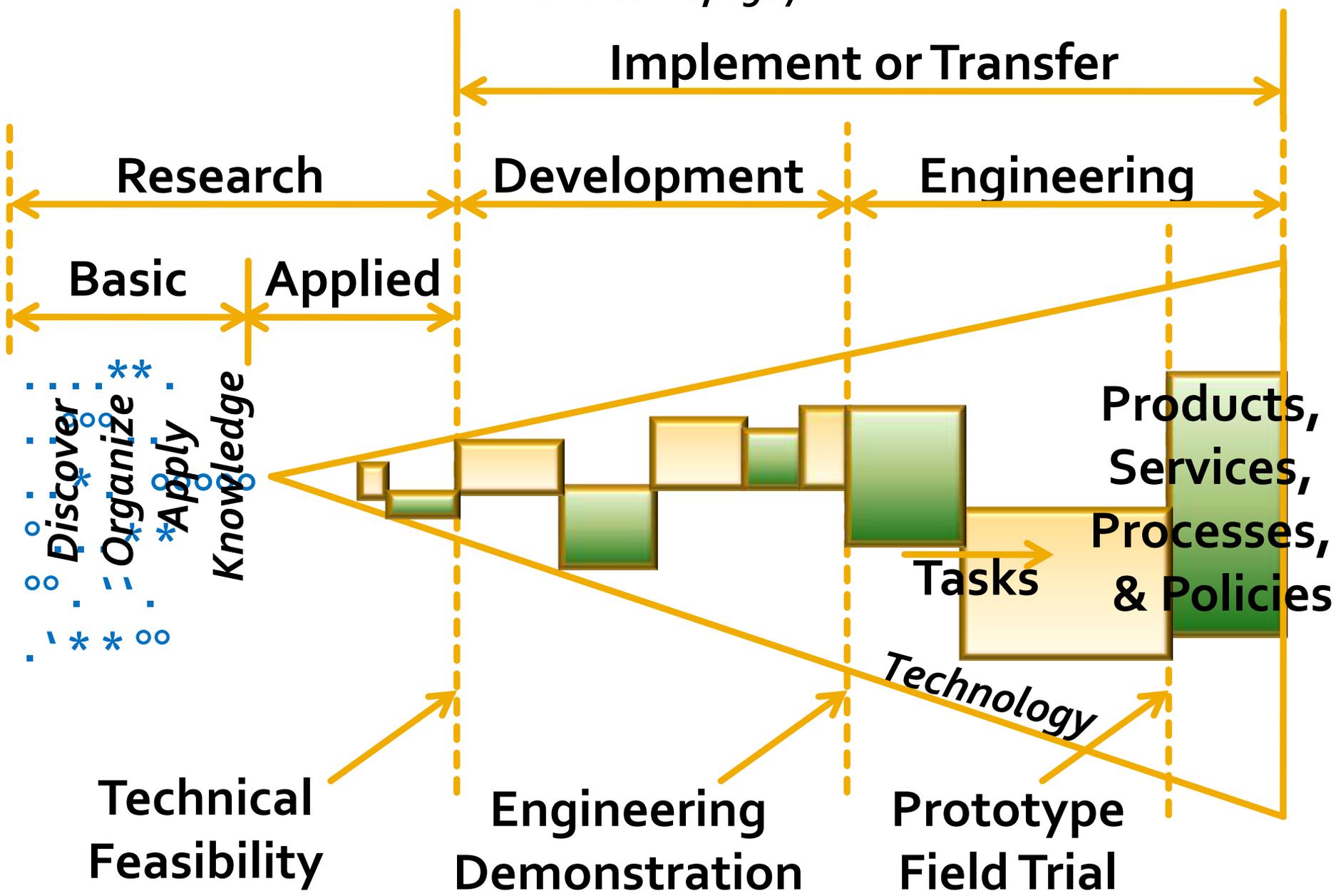


*Especially with
Polymer-Modified Asphalt*

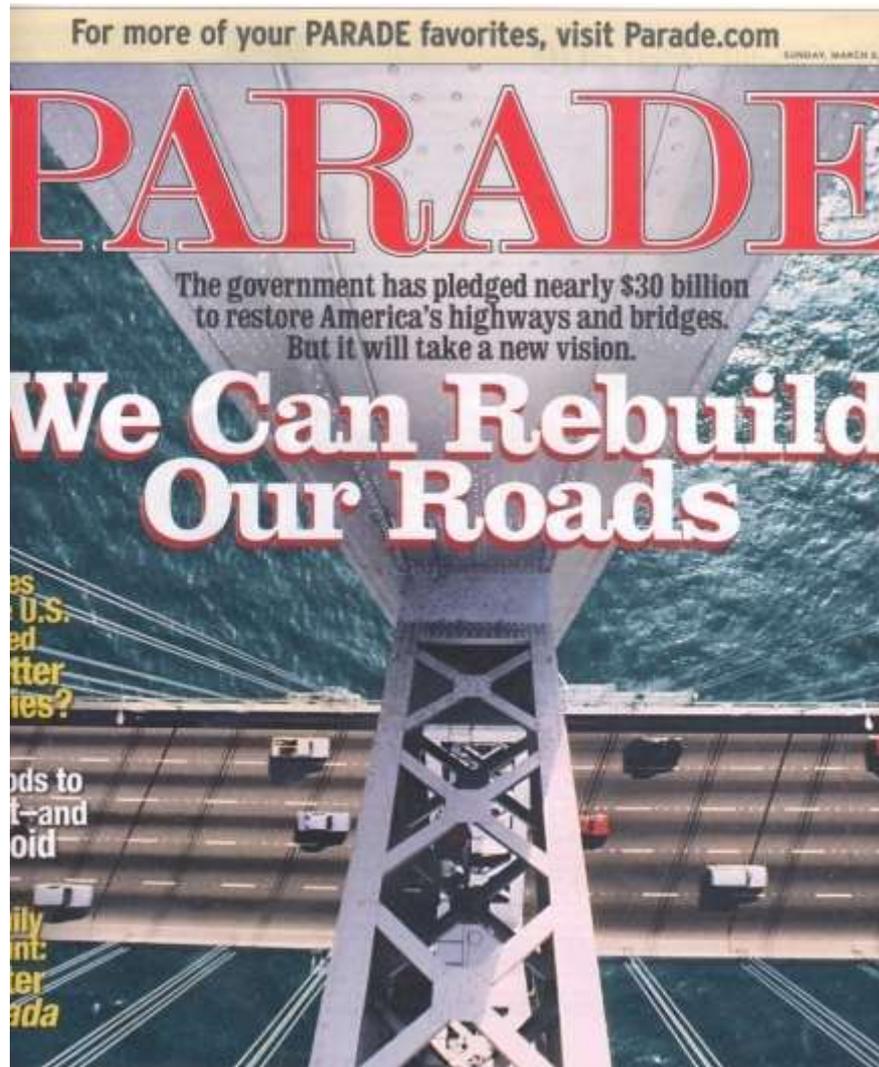
Potential Benefits of WMA

- Reduced emissions and odor
- Reduced heating and energy requirements;
direct Energy Savings ~ \$1/ton
- Reduced plant wear

MODEL OF DEVELOPMENT OF TECHNOLOGY Oujian and Carne, 1987



Yes We Can...



On a Life-Cycle Analysis, if Warm Mix Asphalt (WMA) does not perform as well, then there will not be energy savings nor reduced emissions and benefits in the long run.



Warm Mix Asphalt SCAN

May – June 2007

Norway-Germany-Belgium-France

warmmixasphalt.com

WMA SCAN 2007

 U.S. Department of Transportation
Federal Highway Administration

Issues of Interest

The purpose of the SCAN was to investigate innovative technologies and policies related to WMA.

- WMA processes
- Mix design & construction practices
- WMA performance
- Limitations
- Benefits

2007 WMA Scan Team

Plus Two German Colleagues



Who Did We Visit?



WMA SCAN 2007

European Experience The **PUSH** for Implementation

- Norway
 - Contractor/Supplier Driven
- Germany
 - Contractor Driven
 - Bitumen Forum
 - Gussasphalt (Fumes)
- France
 - Contractor Driven/Agency Supported
 - Sustainable Technologies
- Netherlands
 - Contractor Driven



Bitumen Forum

WMA Technologies

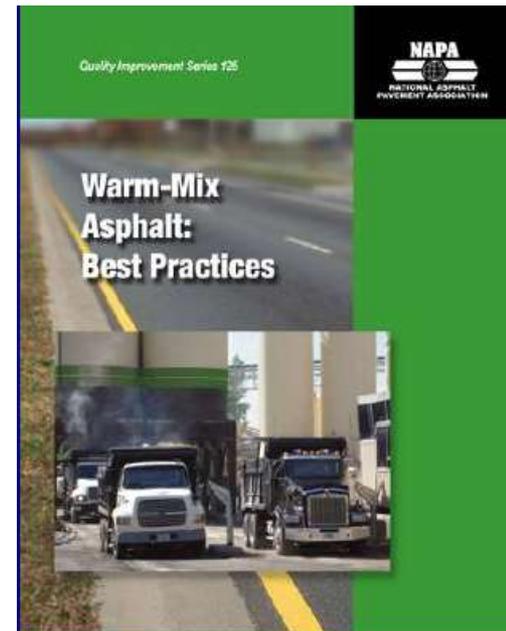
- **Organic, Wax-like additives**
 - Sasobit® – Sasol International
 - Asphaltan B – Romanta
 - Fatty Acid Amides – Licomont S 100
- **Foaming Processes**
 - Aspha-min zeolite – MHI/Eurovia
 - Low Energy Asphalt – Fairco/Eiffage Travaux Publics
 - WAM Foam – Kolo Veidekke/Shell/BP
 - LEAB® – BAM
- **Emulsion Based**
 - Evotherm™ – MeadWestvaco
- **Vegetable based synthetic binders**
- **Other ... Emerging US Technologies**

Implementation Goals

WMA should be an **acceptable alternative** to HMA, used at the Contractor's discretion, provided the WMA meets applicable HMA specifications.

WMA: Best Practices

- Quality Improvement Series 125
- Stockpile Moisture Management
- Burner Adjustments and Efficiency
- Aggregate Drying and Baghouse Temperatures
- Drum Slope and Flighting
- Combustion Air
- RAP Usage
- Placement Changes



WMA Technical Working Group

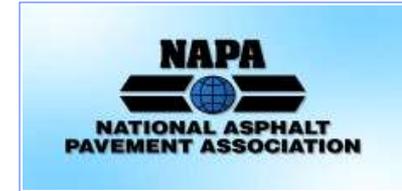
Co-Chairs

- Matthew Corrigan, FHWA
- Ron White, Industry



Represented

- State DOT
- State APA
- NCAT
- Academia
- Hot Mix Asphalt Industry
- AASHTO
- Labor
- NIOSH



Ongoing National Research



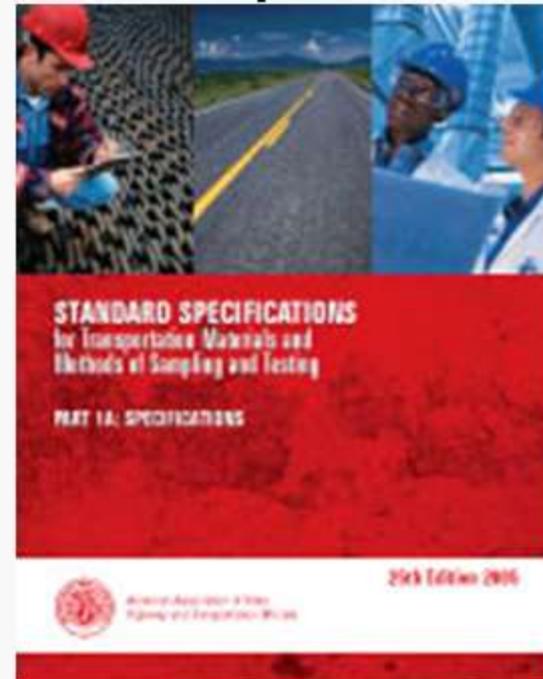
TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES



- NCHRP 9-43 “Mix Design Practices for Warm Mix Asphalt” \$500,000
- NCHRP 9-47 “Engineering Properties, Emissions, and Field Performance” \$900,000

To adapt a laboratory mixture design and analysis procedure to WMA

- Compatible with HMA procedures
- Address wide range of warm mix processes
 - Organic Additives
 - Foaming
 - Chemical



Advanced Asphalt Technologies, LLC

"Engineering Services for the Asphalt Industry"

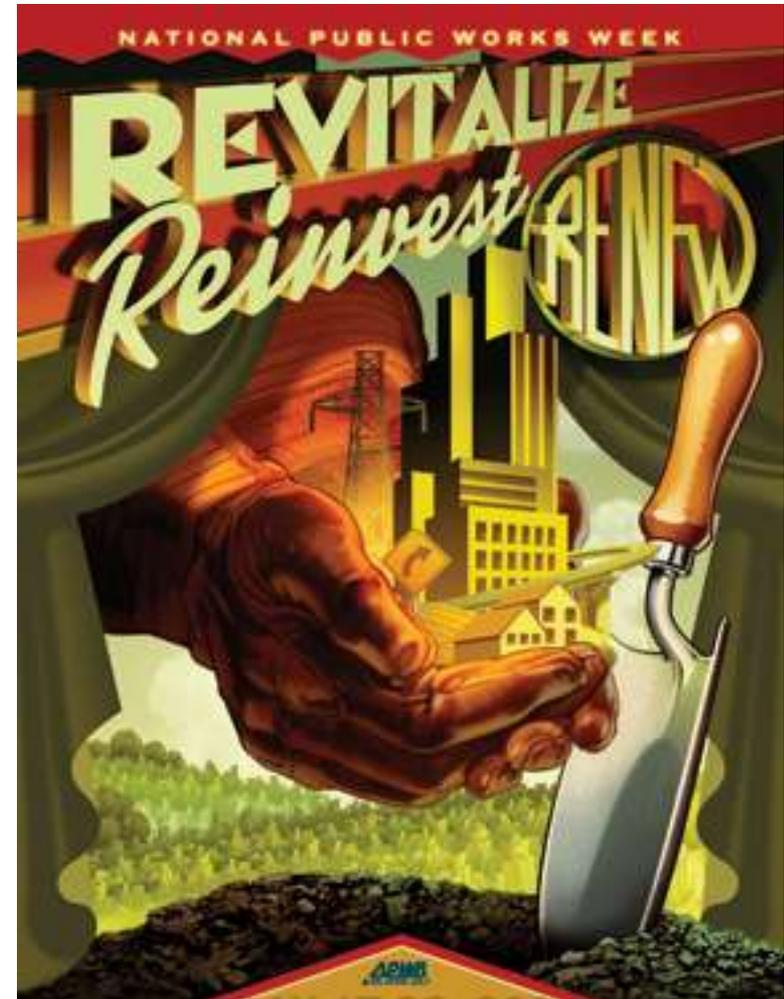
Future National Research?



TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES



- Short Term Ageing of WMA Binders During Production
- Differences between Field Produced WMA and HMA Volumetric Properties
- More to come ...??



Proposed National Research



TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES



- **D-06 “Long Term Field Performance of Warm Mix Asphalt Technologies”**
\$1,200,000
- **D-08 “Moisture Sensitivity of Warm Mix Asphalt Technologies”** \$600,000
- **D-05 “Development of a New Protocol for Determination of Moisture Susceptibility of Asphalt Mixtures”** \$300,000



Initial U.S. Research Partners

2004 - 2005



Evotherm®



Sasobit®



Aspha-Min®



Technology Overview**

WAM-Foam 



Rediset WMX



Low Emission Asphalt



Aspha-Min



Ultrafoam GX



Advera



Terex



Sasobit



Stansteel **Stansteel**[®]
ON TARGET EVERY TIME!

REVIX



Aquablack



Evotherm



Double Barrel Green



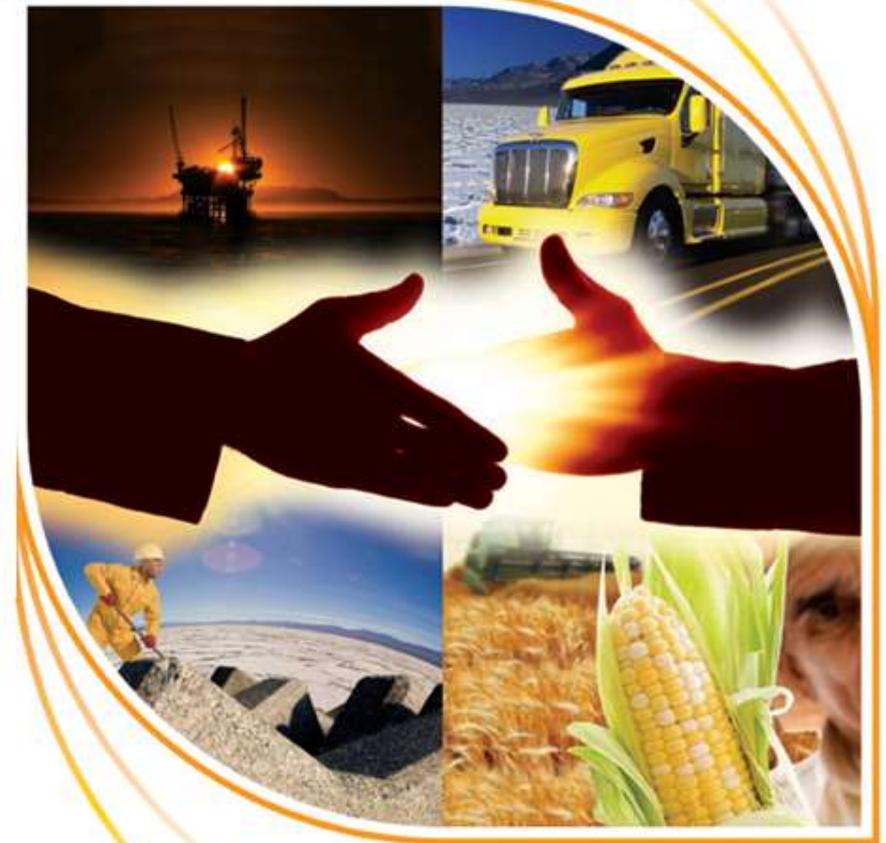
Cecabase RT



WMA-Texas Experience

2009 TRB Annual Meeting

Gary L. Fitts, P.E.
SE Regional Manager
Sulphur Asphalt Solutions
Shell Oil Products, USA



Technology - Delivery - Partnership

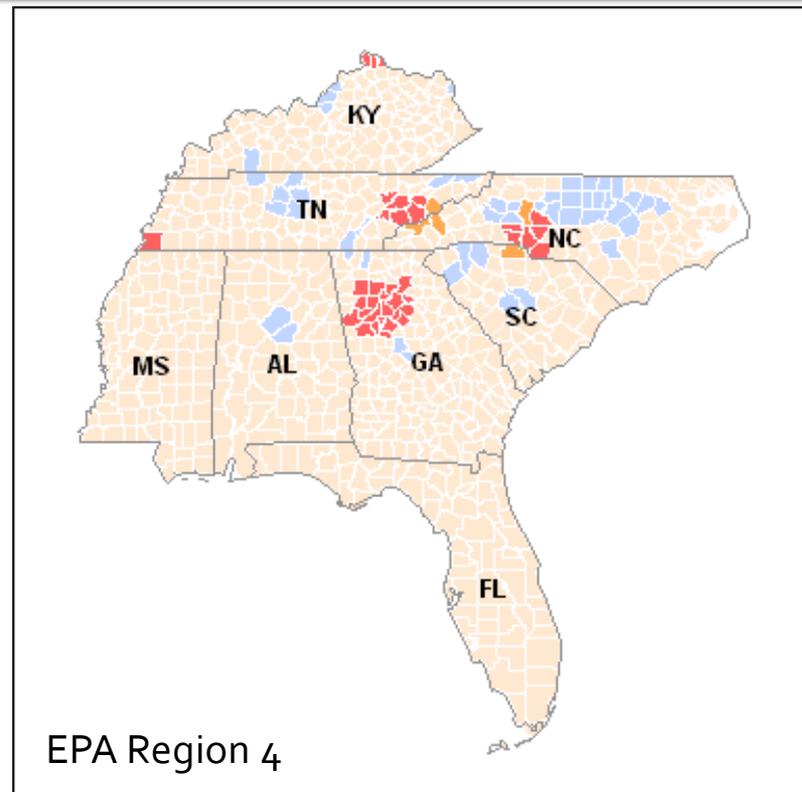
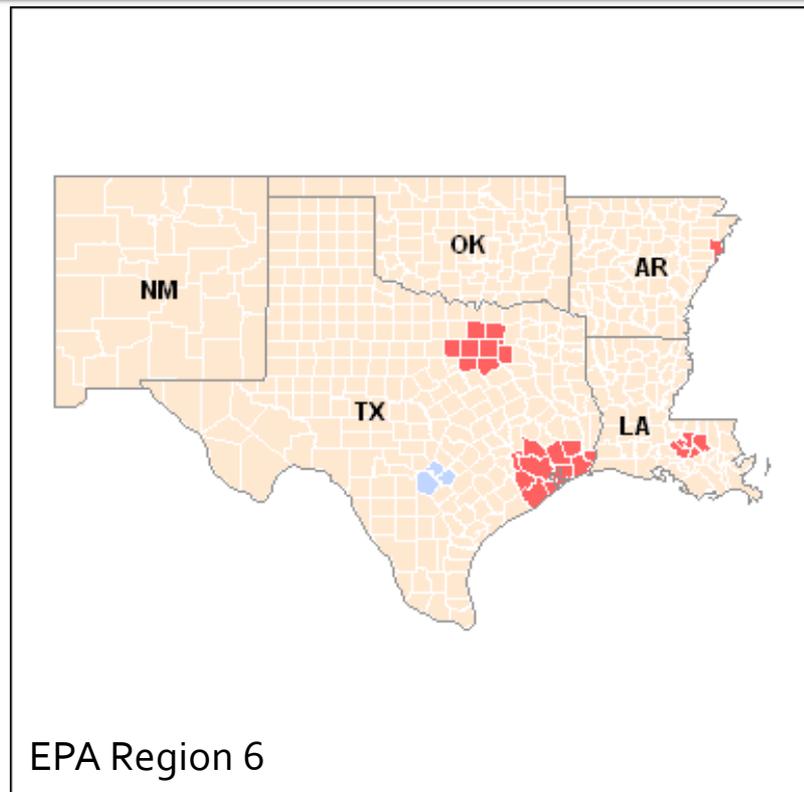
DELIVERING INNOVATION TO YOUR ADVANTAGE

<http://www.shell.com/sulphur>



Shell Sulphur Solutions

Ozone Non-Attainment Areas



8-Hour Ozone Designations

- Attainment
- Nonattainment
- Nonattainment (part county)
- Redesignated to Attainment

Ground level ozone is considered to be a respiratory irritant. It is caused by chemical interaction between sunlight, nitrous oxides (NOx) and volatile organic compounds (VOC's).

LP 368-San Antonio



- No visible fumes, minimal odor
- Acceptable HMA in-place density and joints

WMA

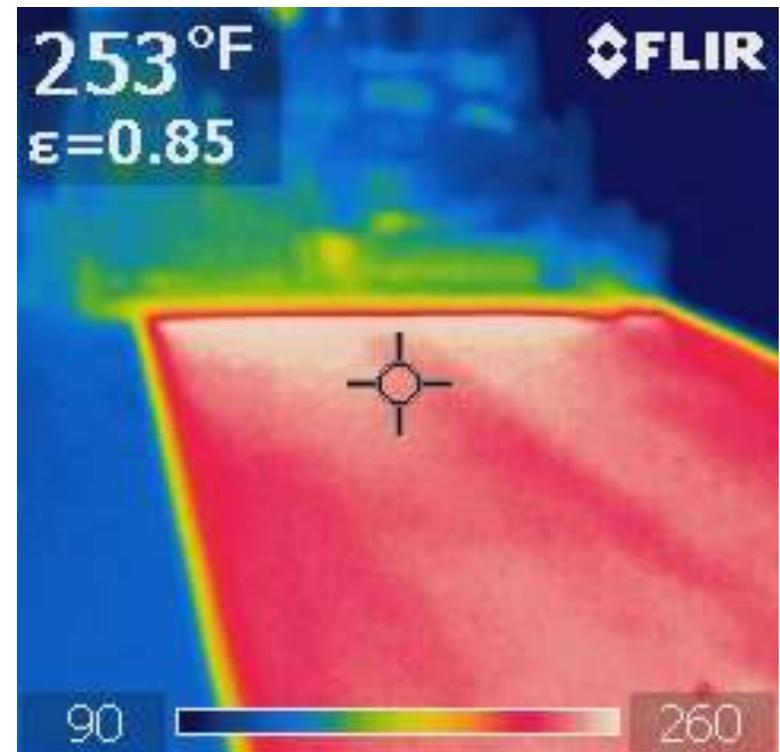
Absorption

HMA



US 380 – Young Co.

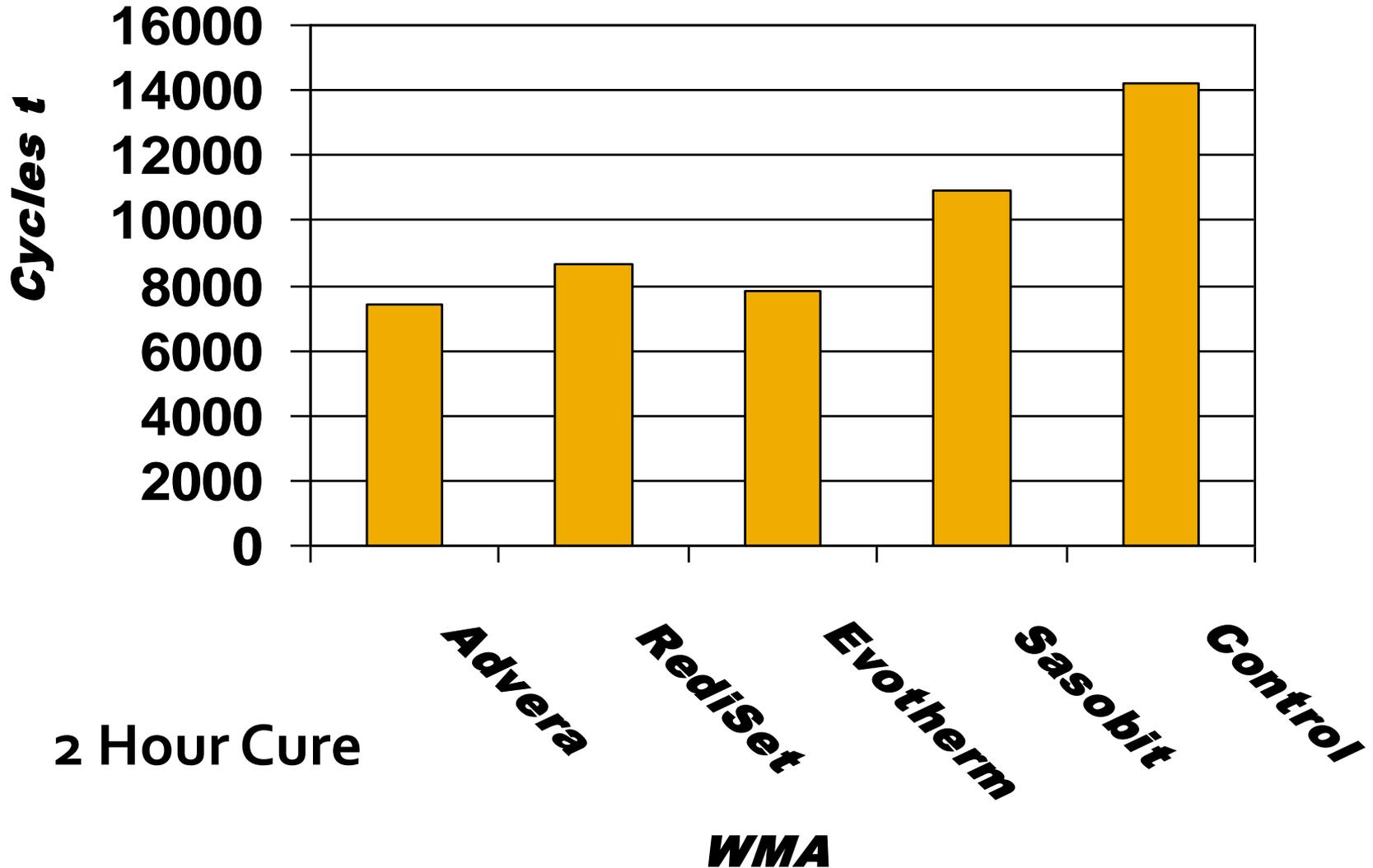
PG 70-22 (Polymer-modified)



Hamburg-One Year Cores



HWT Testing - Lufkin



2 Hour Cure

FM 324 - Lufkin



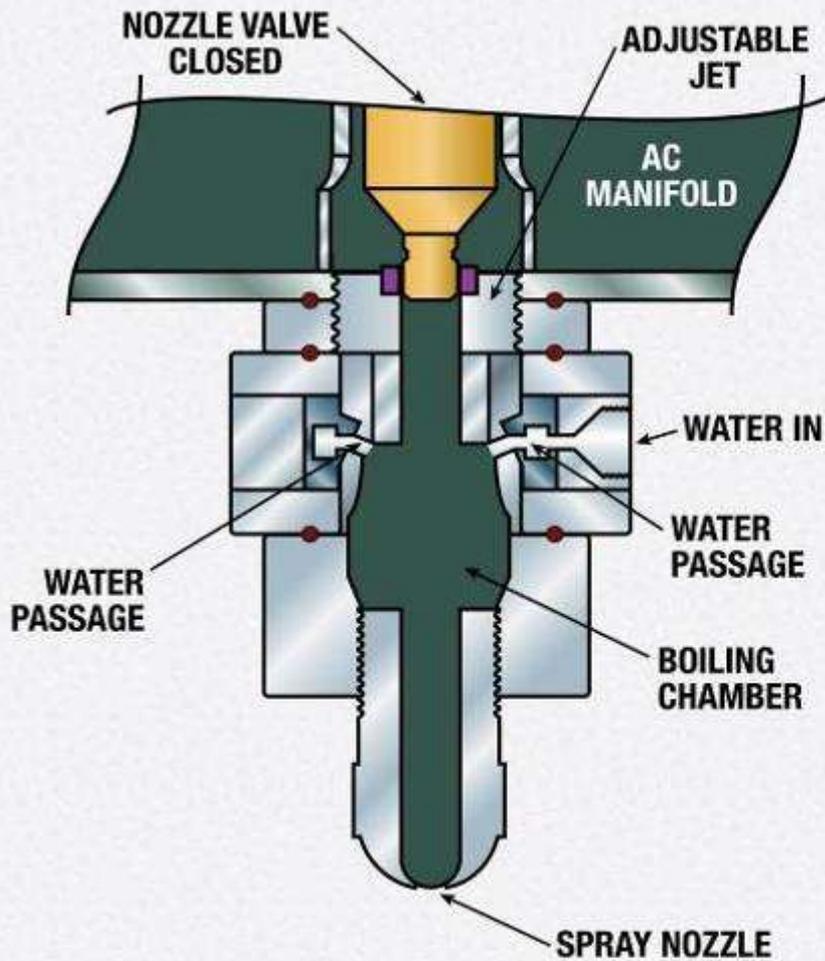
WMA

HMA

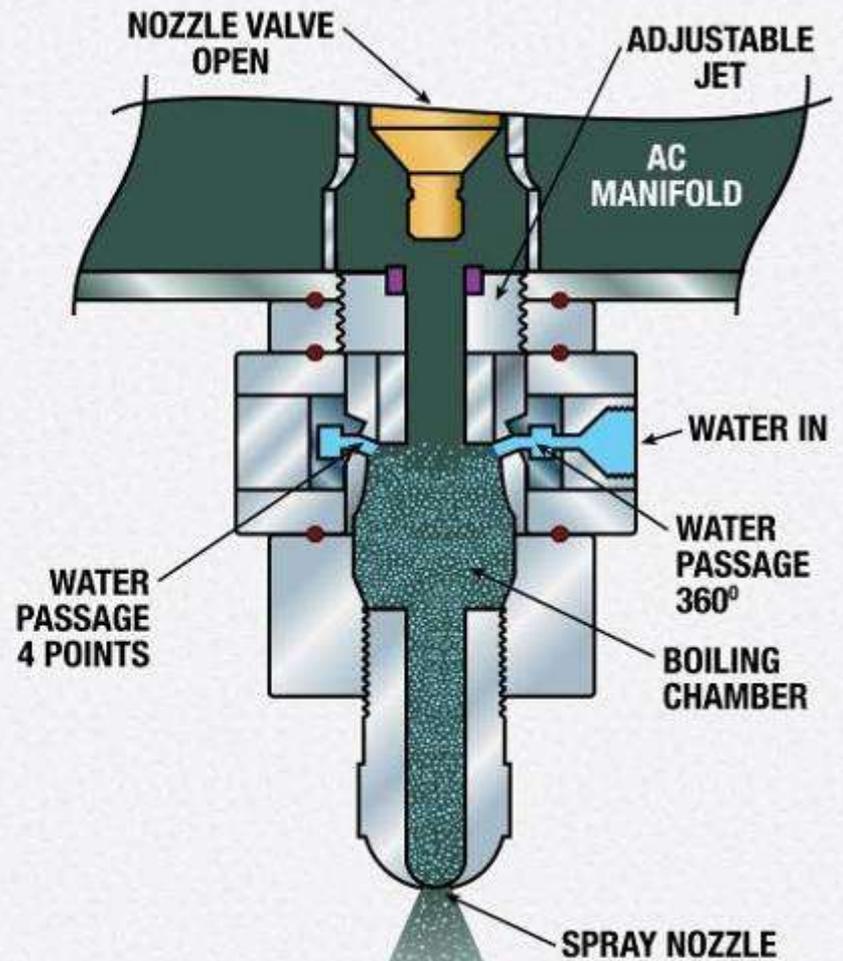


US 380 – Plant Modification Astec Double Barrel Green



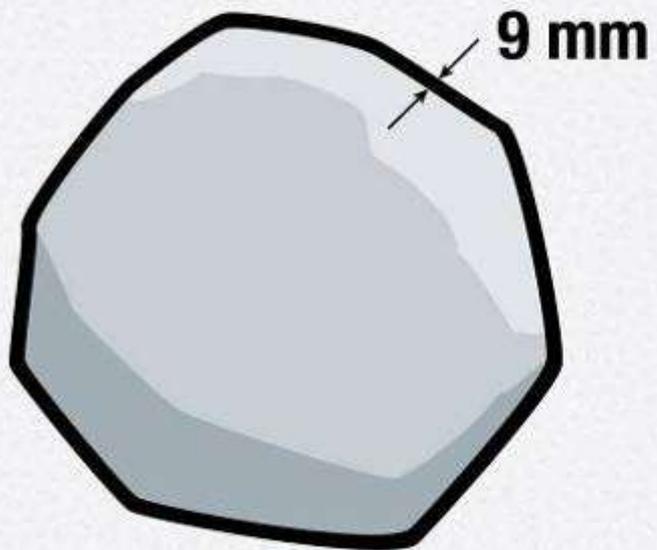


FOAM NOZZLE CLOSED

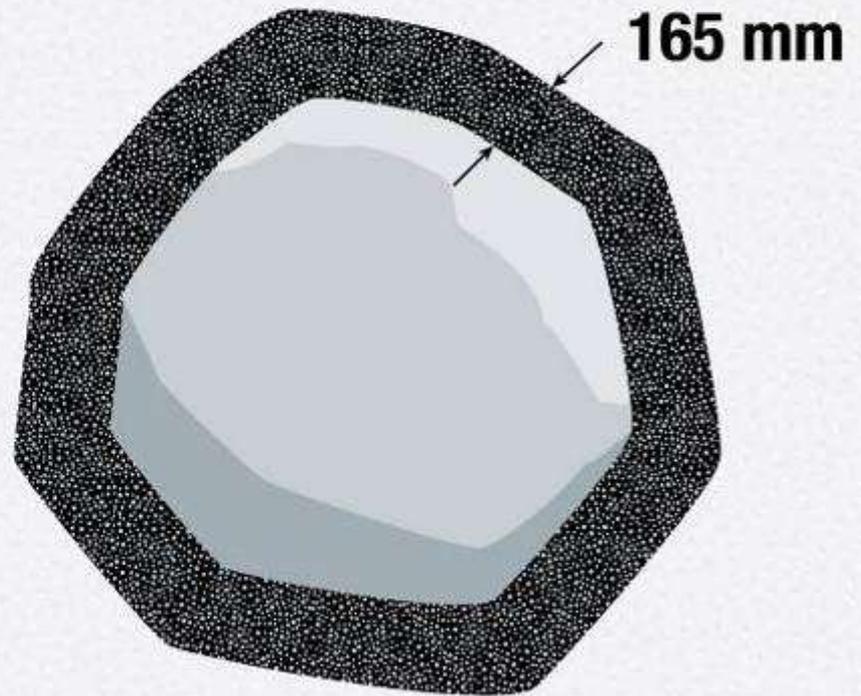


FOAM NOZZLE OPEN

FOAM NOZZLE



**NORMAL
COATING**



**DB GREEN FOAM
COATING**

COATING THICKNESS



Old Rules - New Materials

Construction temps often too high

- *Delays rolling*
- *Temperature segregation*
- **Increases fumes**
 - *10°F increase = double VOCs*
 - *Very low VOC (20 g from 75 tons of asphalt) can be visible, especially at night*
 - *Opacity - affected by plant operations, asphalt source, asphalt grade*





Here in Illinois

- We state:
'It's ok to ask permission to change'
- We might want to consider:
'You can do HMA (275 – 300) as WMA (220-275) and put the details in your QC plan.'



Experimental Features

- FHWA policy prohibits the use of a patented or proprietary material, specification, or process ...:
- ...competitive bidding with equally suitable unpatented items
 - ...used for research or for a special type of construction on relatively short sections of road for *experimental* purposes
 - www.fhwa.dot.gov/construction/cqit/proprietary.cfm

Experimental Features





Warm Mix Asphalt

The Green Alternative

The **Illinois Department of Transportation** recently partnered with **Gallagher Asphalt Corporation** and **Chicago Testing Laboratory** to complete comprehensive technical trials using Warm Mix Asphalt (WMA) technology. IDOT is very interested in this new process, and with the support of CTL will be evaluating the performance of WMA in the laboratory and field to determine how Warm

Dan Ryan Expressway: 250,000 ADT



“The Department is always interested in new technologies that will improve the quality, durability, and cost effectiveness of HMA. Warm Mix Asphalt Technology seems to have the ability to provide all that and more in terms of its positive environmental impact.”

Placement Experiences



In-Place Density Achieved

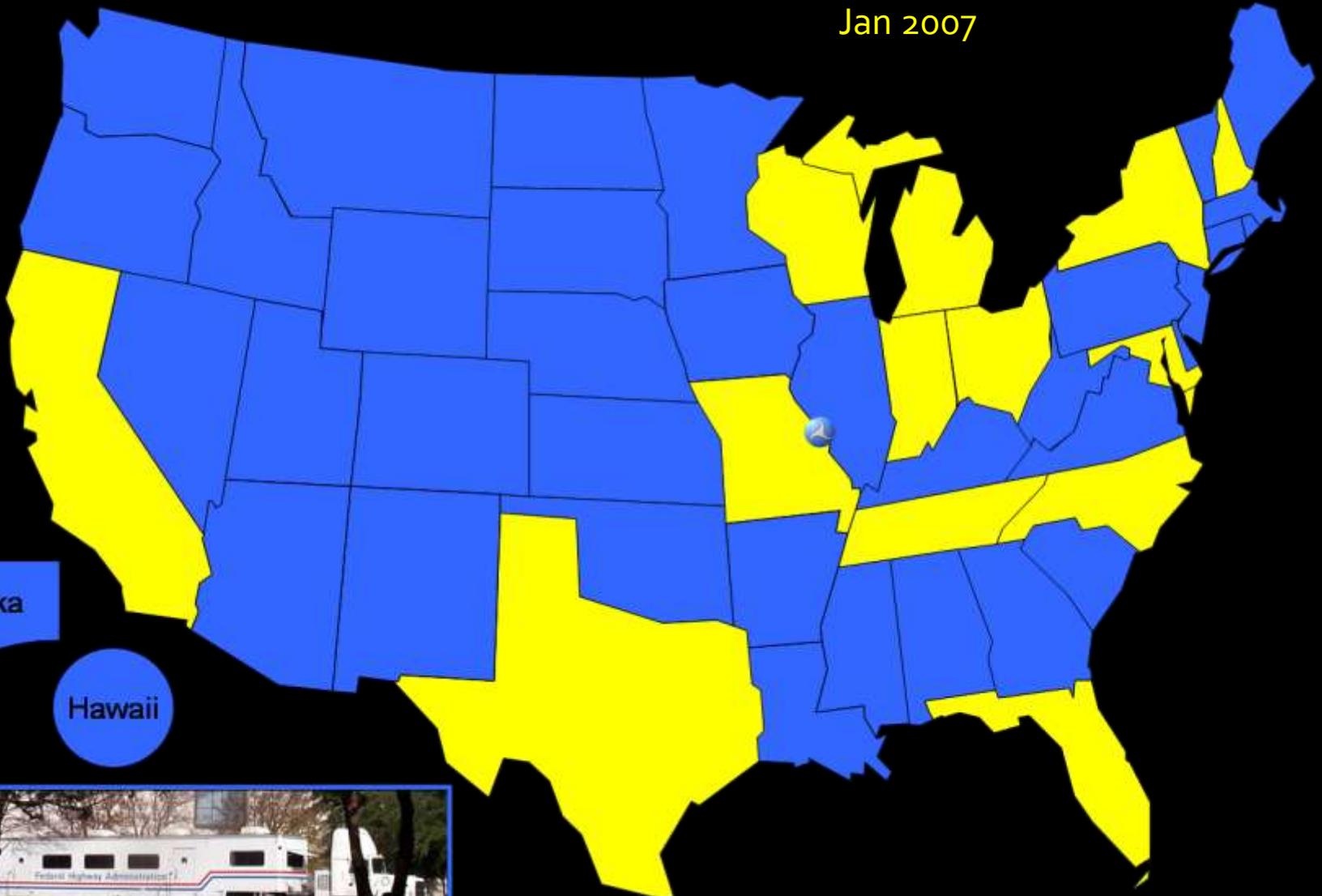


From MLT...

At NAPA convention I met with the other 37 state executives and WMA was a real hot topic that is being pushed all across the country and everything still points up.

WMA Trials and Demonstrations

Jan 2007



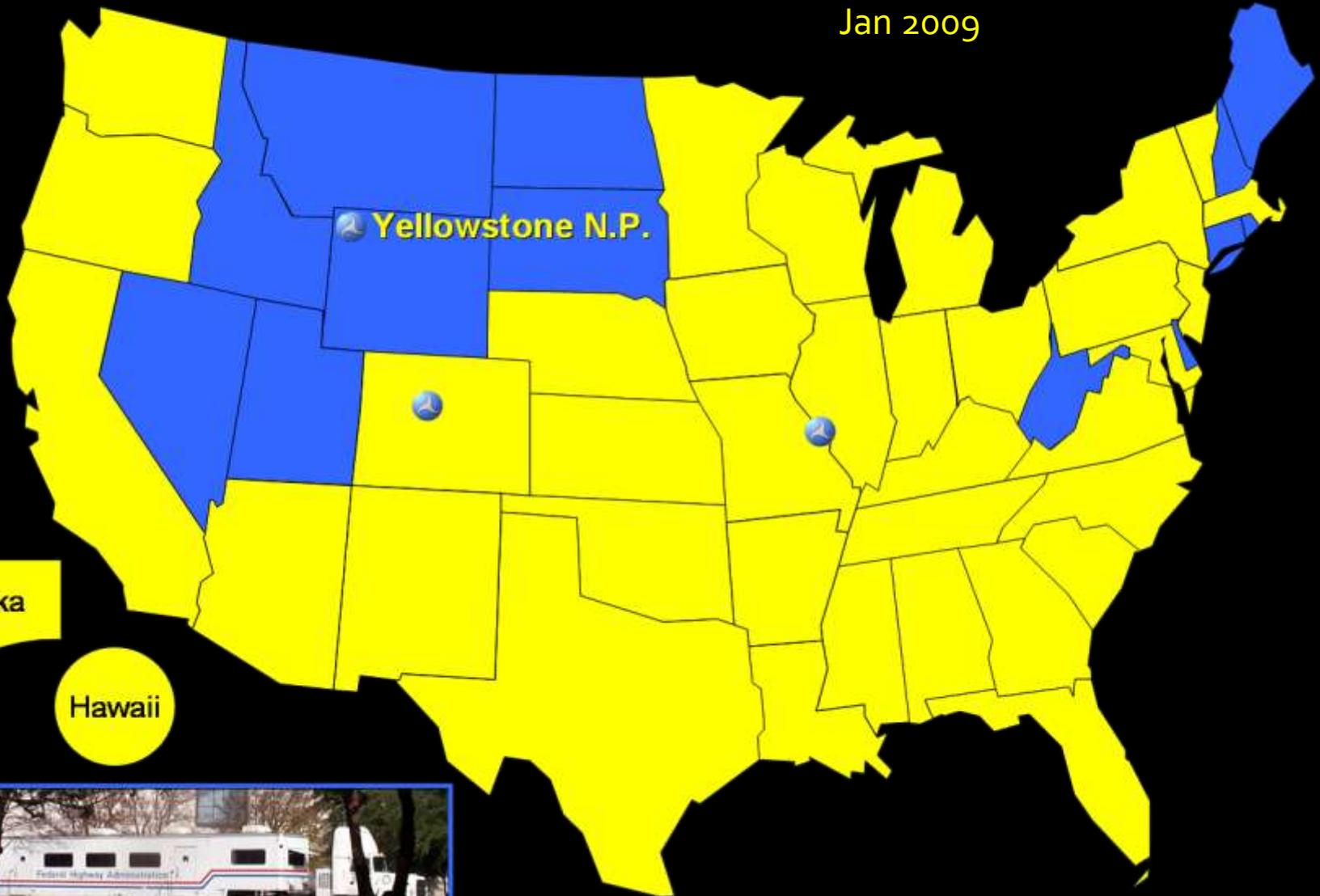
Alaska

Hawaii



WMA Trials and Demonstrations

Jan 2009



WMA Investigation and Implementation Premise

Many factors are driving the development and implementation of WMA technologies globally.

WMA Investigation and Implementation Premise

In order for WMA to succeed in the U.S., these pavements must have equal or better performance when compared to traditional HMA pavements and be economically affordable.

Data collection guidelines developed and cataloged by the WMA TWG



warmmixasphalt.com

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QUICK FINDS:

[Introduction to WMA](#) >>>

[WMA Test Frameworks](#) >>>

PLEASE NOTE:

The contents of this web site are to promote the understanding of warm-mix asphalt during its research and development phase in the United States. This web site cannot be used to promote or single out any one specific asphalt technology.

WMA Technologies

Test Frameworks

The Warm-Mix Asphalt Technical Working Group has devised test frameworks to help researchers obtain data in a uniform format so that analysis can be done by using data from a multitude of projects. There is one framework for material properties and another for emissions and energy reductions.

Products and Processes

These products and processes are listed for information only. The WMA Technical Working Group does not endorse any particular proprietary product or technology. These applications should be considered as experimental.

Advanced Concepts Engineering Co.: [LEA CO](#) >>>

Arkema Group: [CECABASE RT](#) >>>

Aspha-mix: [Aspha-mix Online](#) >>>

Astec Industries: [Durable Barrel Green System](#) >>>

MeadWestvaco Asphalt Innovations: [Evothem](#) >>>

PQ Corporation: [Advera WMA](#) >>>

Sasol Wax Americas, Inc.: [Sasobit](#) >>>

www.warmmixasphalt.com

america (18) american (38) banks (12)
bring (7) budget (13) businesses (7) care (18) children (10)
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help (12) invest (11) jobs (19) lending (8) meet (7) money (10)
nation (17) people (20) plan (21) power (7) problems (7)
recovery (12) reform (11) responsibility (12) school (13)
system (8) tax (11) times (8) tonight (11) ve (7) work (13) world (11)
years (15)

Questions about WMA

Future Plans

- Economic Analysis (LCC)
- Industry Response and Responsibilities
- Research
 - Performance,
 - Economics,
 - Specifications
- Time-table