



Warm Mix Asphalt *“The Material of Today”*

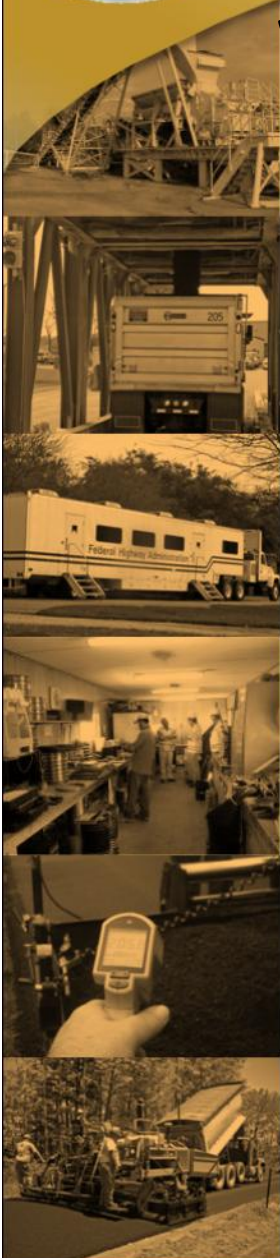
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Warm Mix Asphalt

- SCAN Definition: Warm Mix Asphalt (WMA) is the general term used for technologies that allow producers of asphalt pavement material to lower the temperatures at which the material is mixed and placed on the road.
 - Reductions of 50 to 100 degrees Fahrenheit have been documented.



NEAUPG Definition:





Warm Mix Asphalt (WMA)



Hot Mix Asphalt at 320°F

Warm Mix Asphalt at 250°F



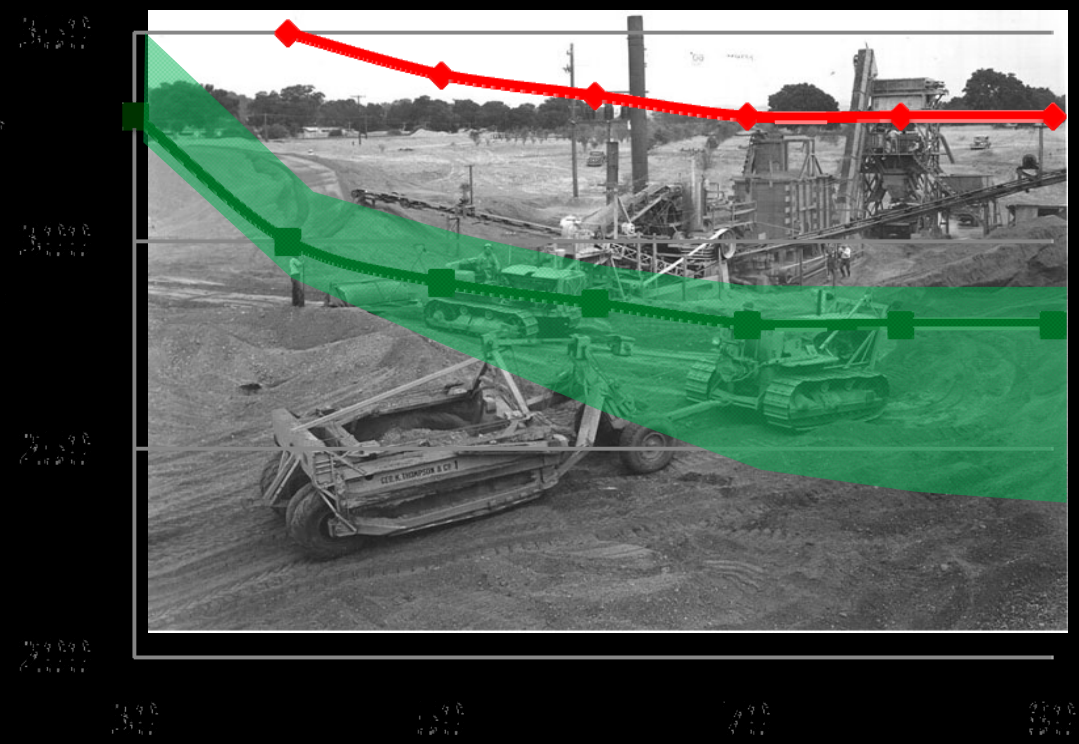
Every Day Counts



General Concept



Temperature Independent Primary Work Rates



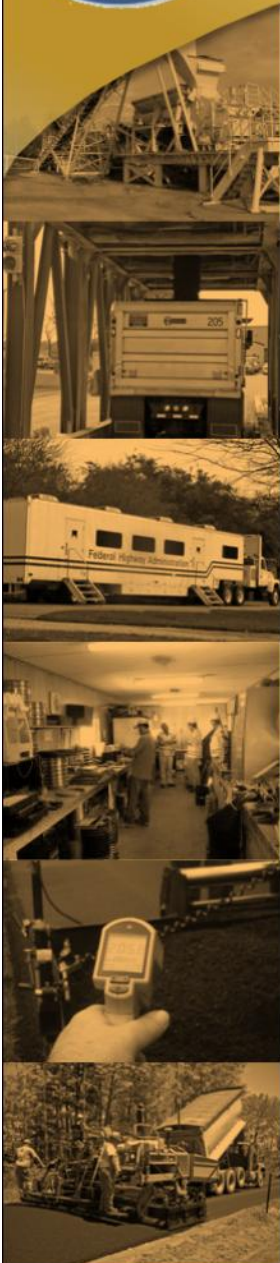
◆ Hot Mix
■ Warm Mix

Temperature Independent Primary Work Rates



Brief WMA History...

- 1995 Preliminary Lab Experiments
- 1997 German Bitumen Forum
- 2000 Euroasphalt & Eurobitume Congress
- NAPA 2002 European Scan Tour
 - Germany and Norway
- NAPA 2003 Annual Convention
 - San Diego, CA
- 2004 First public demonstration in US
 - World of Asphalt – Nashville, TN
- 2005 WMA Technical Working Group Established
- 2007 AASHTO FHWA International Scan Tour
- 2008 First US International Conference on WMA
- 2010 FHWA EDC Technology Innovation...
- 2011 Second US International Conference on WMA,
 - Oct 11-13, 2011 in St Louis, MO





Driving Factors for You...

1 • Improve field compaction... less variability ... better performance!!!

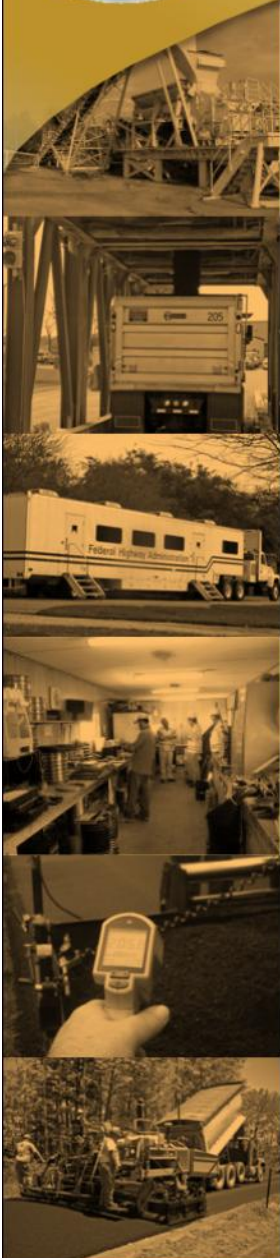
2 • Worker comfort ... reduced fatigue

3 • Extend season and increase haul time

4 • It's Green

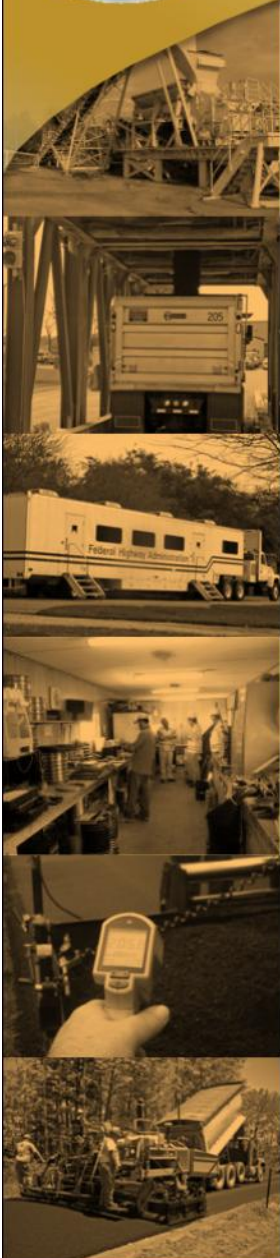
Every Day Counts







Evotherm WMA w/ 30% RAP



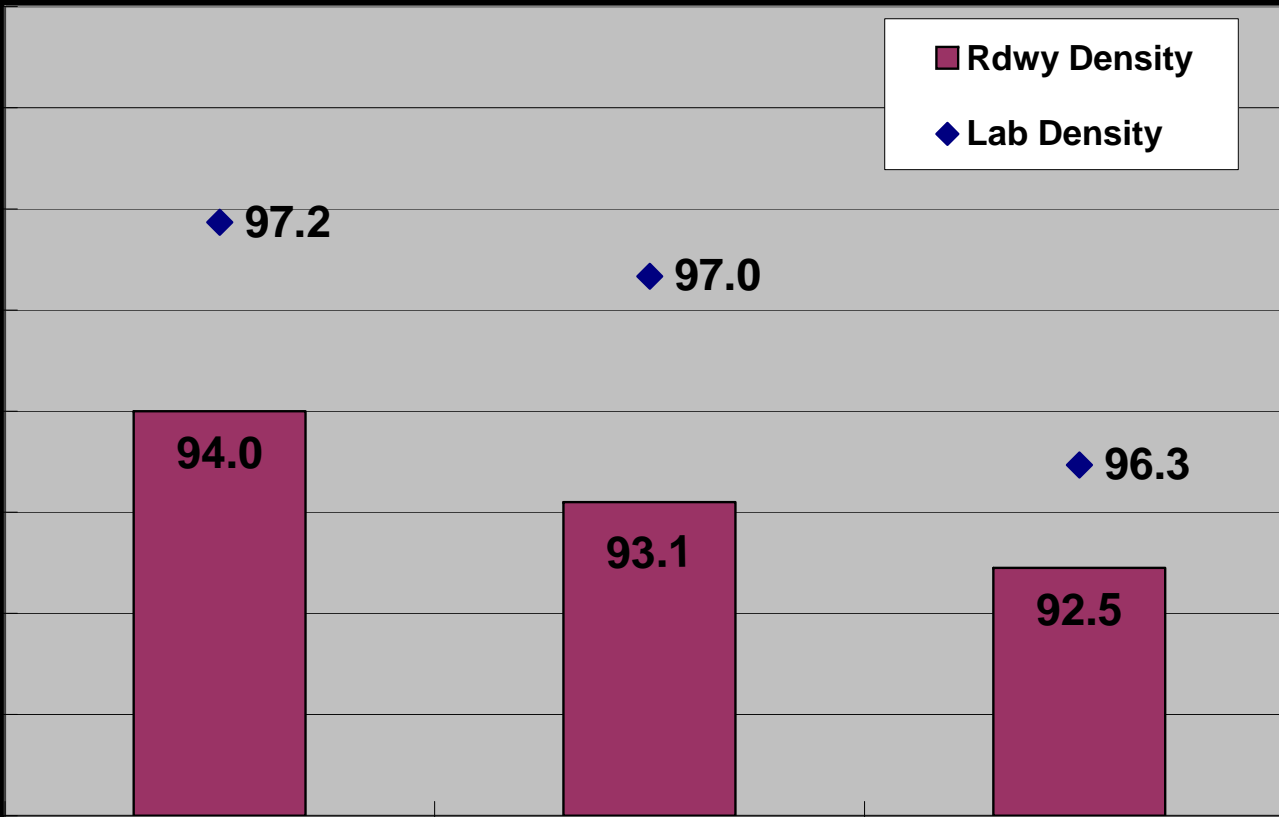


**Limestone
PG76-22
3000 Tons,
T mix: 240°F
 ΔT : 95°F**



Rdwy Densities

98.0
97.0
96.0
95.0
94.0
93.0
92.0
91.0
90.0

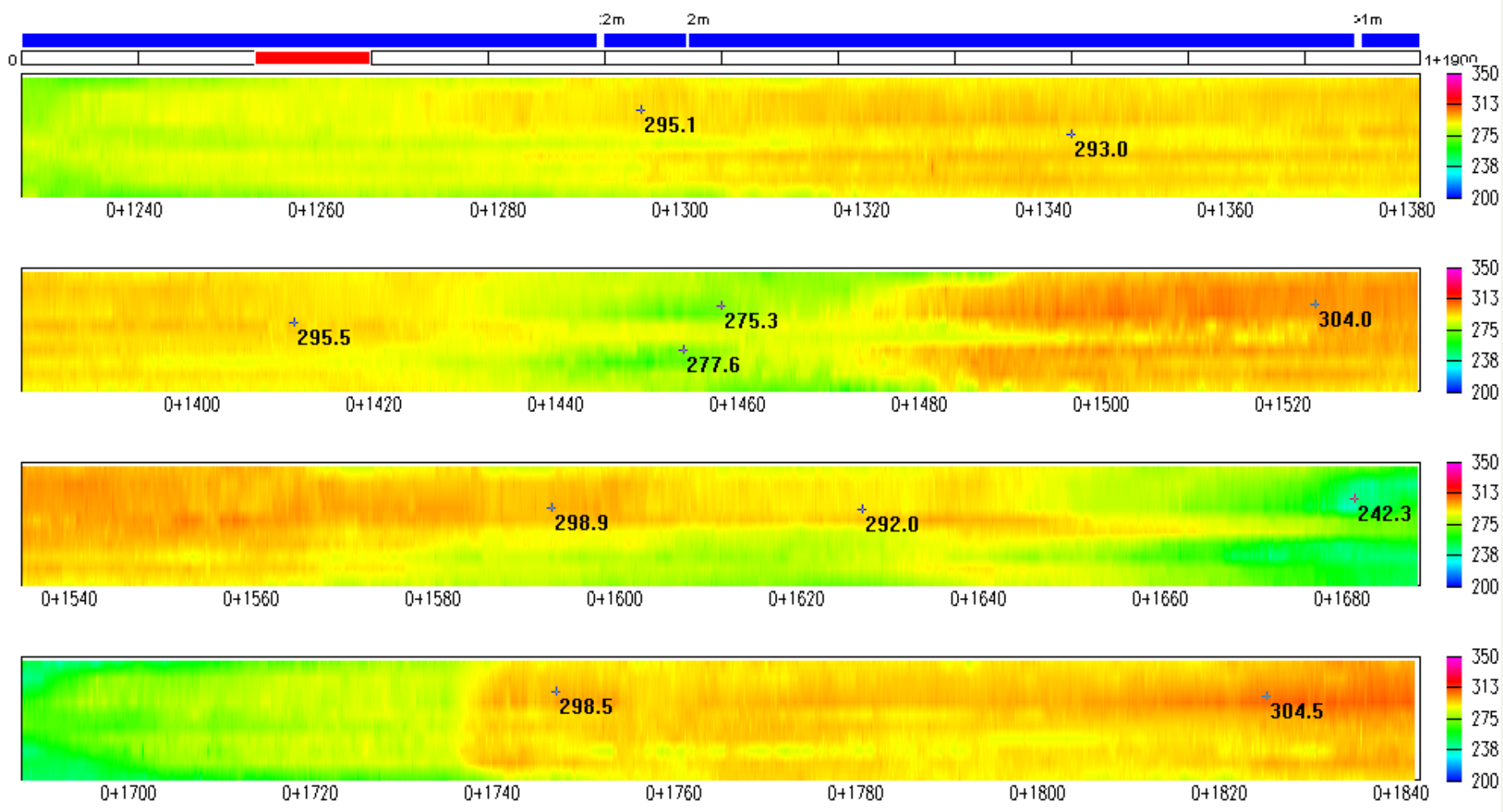


Check Sensors Field Sens Verified TEST Bad Sensor Open File View DATA File View in Segment Bar Chart GPS Setting

MI 0 FT 1780 LC 0 TM 296 WT

62 Deg Difference

C:\PAVE_IR\Data\fm324\mb

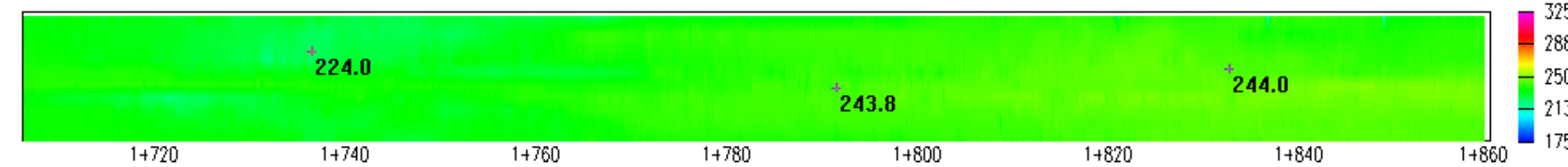
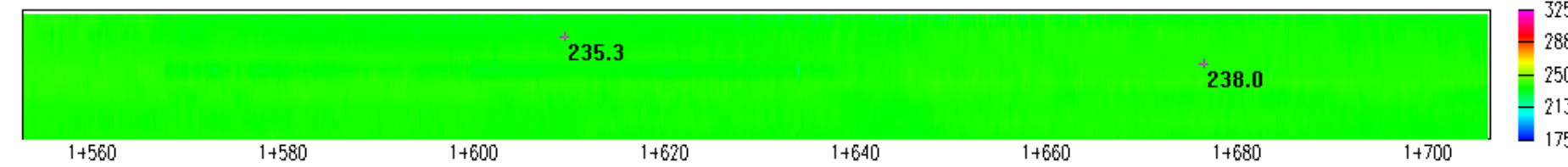
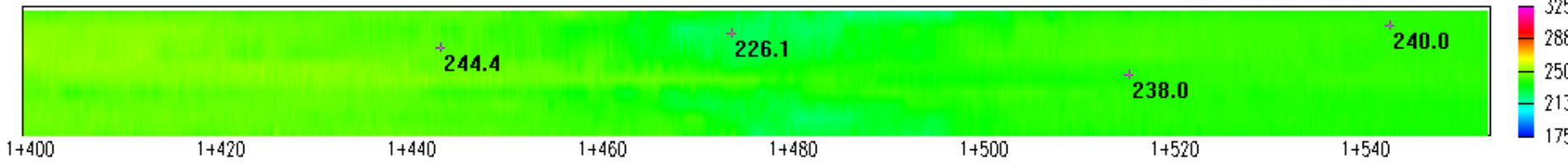
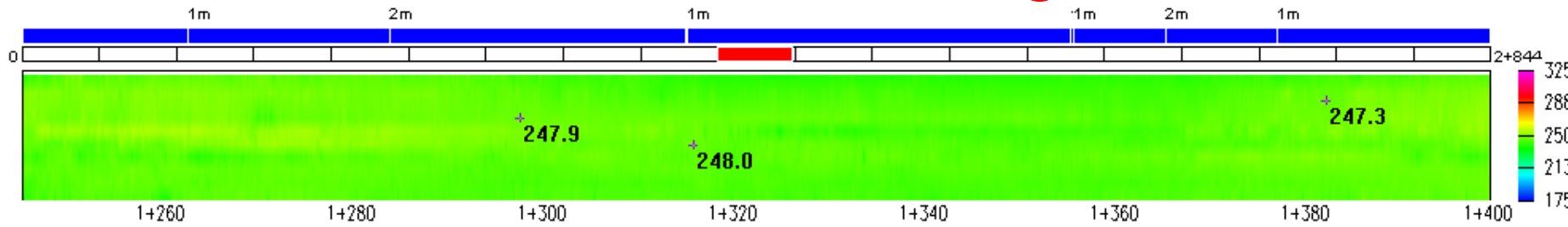


Check Sensors
Field Sens Verified
TEST
Bad Sensor
Open File
View DATA File
◀
▶
View in Segment
Bar Chart
GPS Setting

MI 1 FT 833 LC 0 TM 244 WT

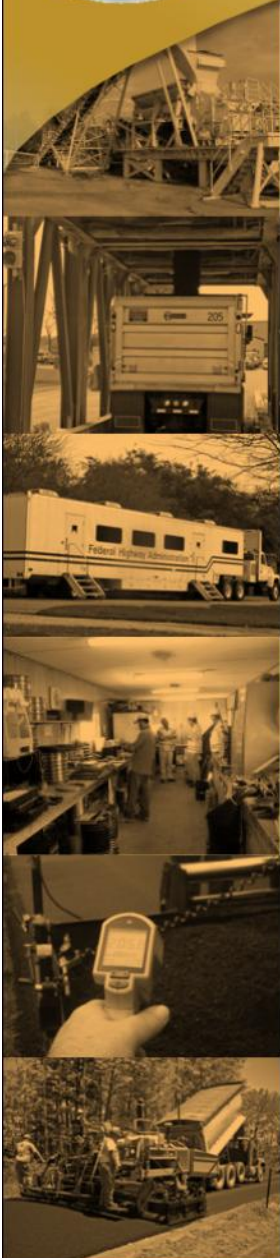
24 Deg Difference

C:\PAVE_IRData\fm324\sb





- Improve field compaction





HMA Control



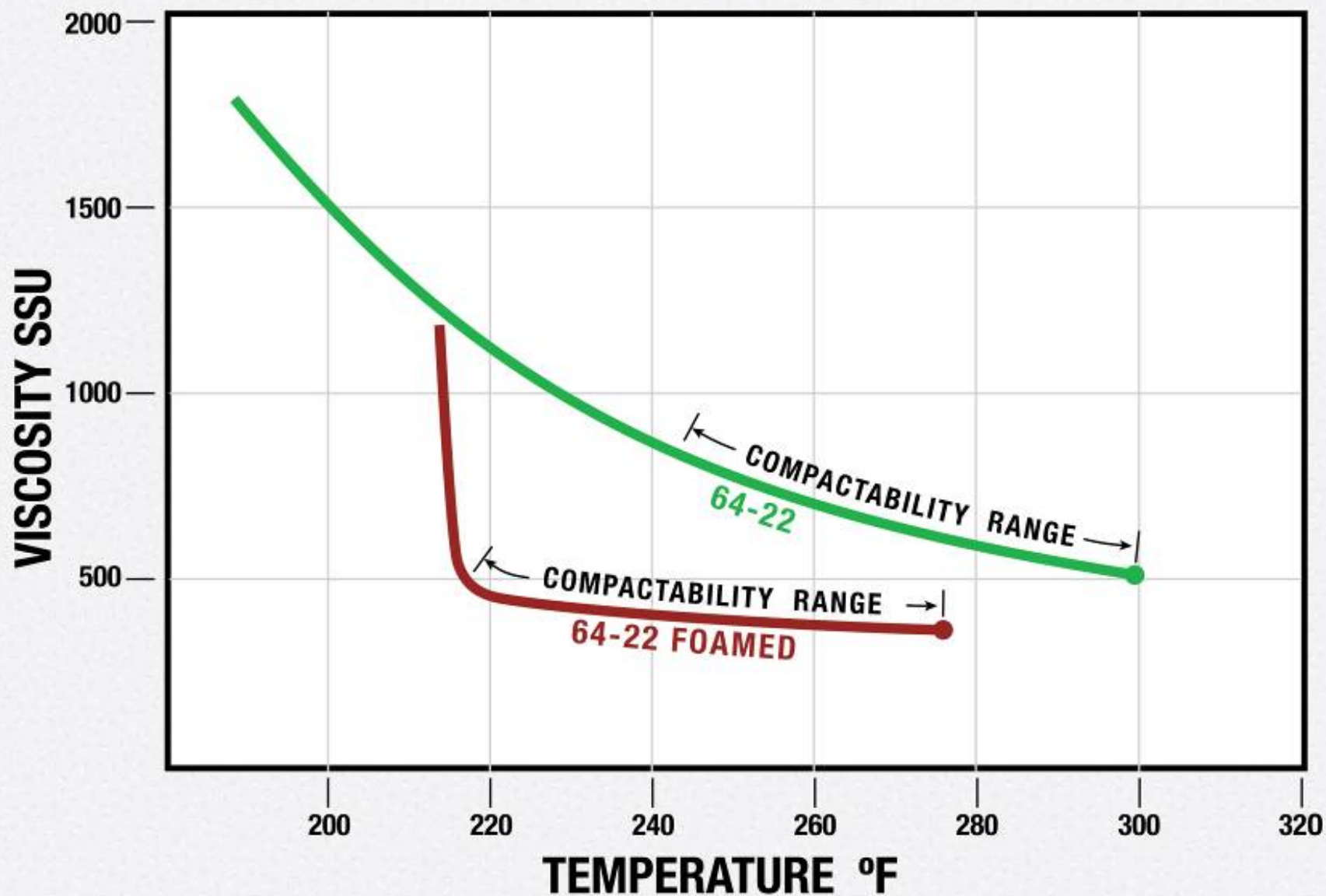
Warm Mix



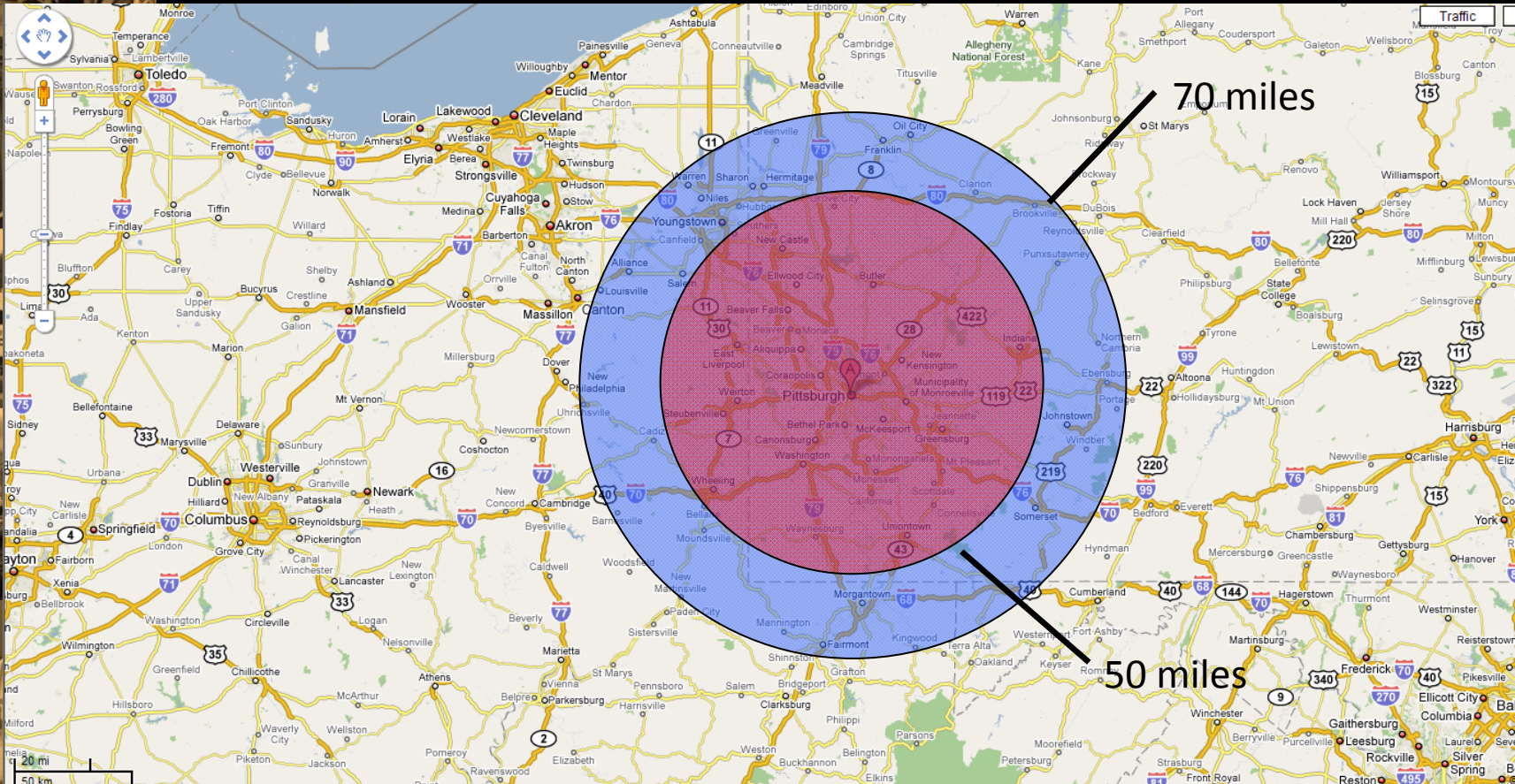


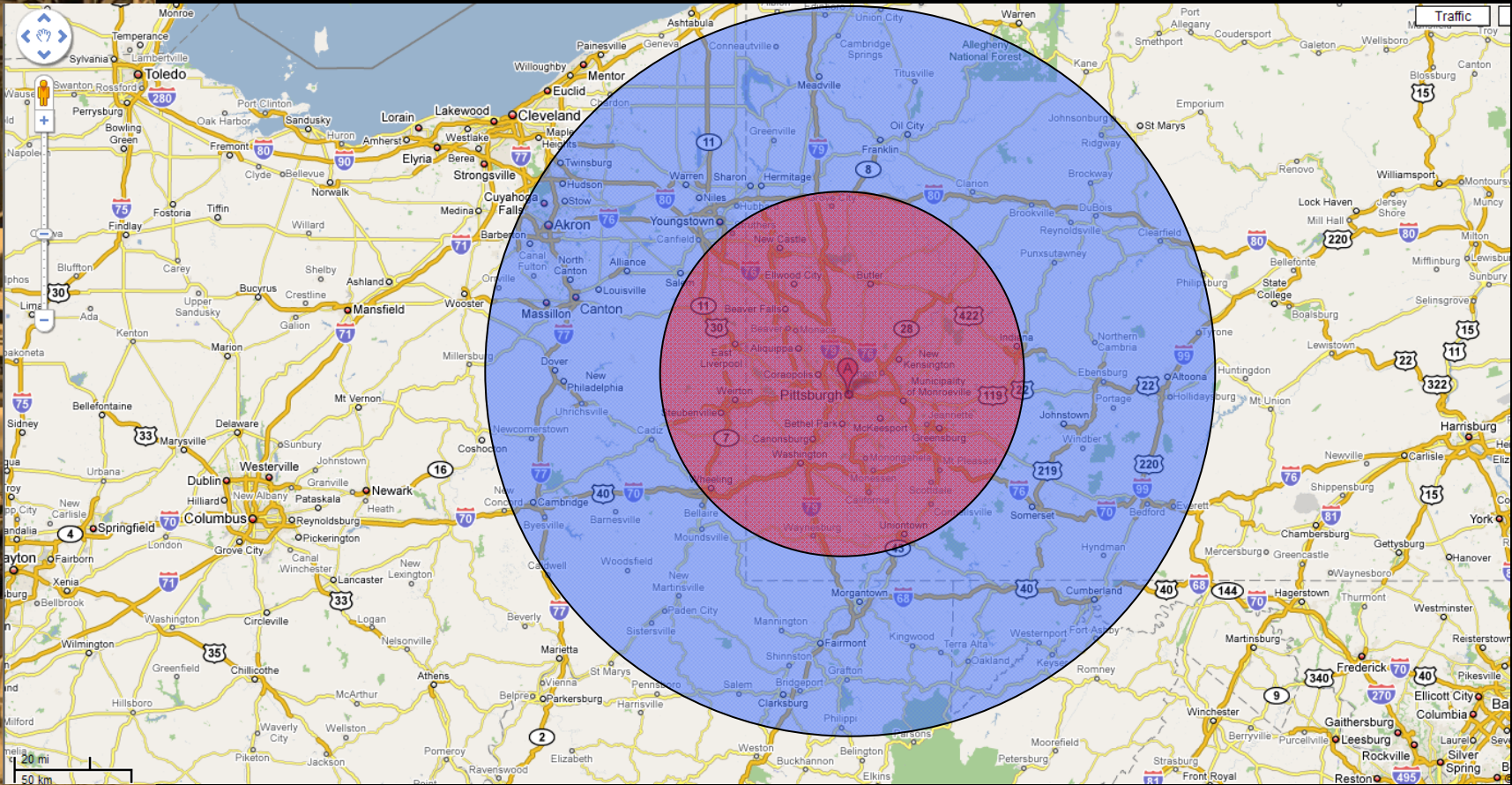
- Improve field compaction
- Worker comfort





VISCOSITY / TEMPERATURE PG 64 -22 (Approx.)

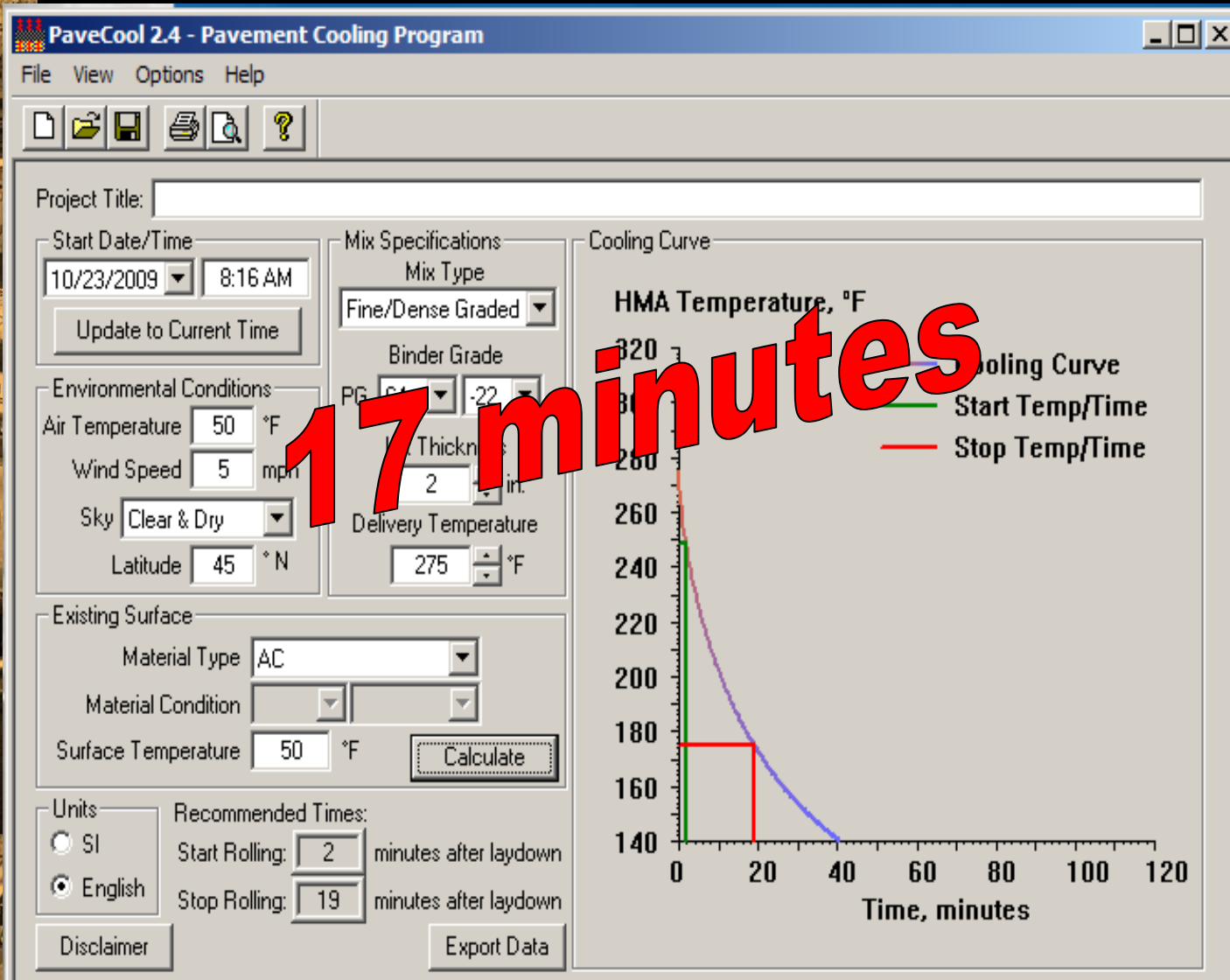






2011 Paving Project
Advera WMA
2.5 hr Avg. Delivery
290 F Mix Temp
250 F Laydown Temp







PaveCool 2.4 - Pavement Cooling Program

File View Options Help

Project Title: _____

Start Date/Time: 10/23/2009 8:16 AM

Mix Specifications
Mix Type: Fine/Dense Graded
Binder Grade: PG 64 -22

Environmental Conditions
Air Temperature: 50 °F
Wind Speed: 5 mph
Sky: Clear & Dry
Latitude: 45 °N

Existing Surface
Material Type: AC
Material Condition: _____
Surface Temperature: 50 °F

Units: SI English
Recommended Times:
Start Rolling: 2 minutes after laydown
Stop Rolling: 32 minutes after laydown

Cooling Curve

HMA Temperature, °F

| Time (minutes) | HMA Temperature (°F) |
|----------------|----------------------|
| 0 | 309 |
| 2 | 260 |
| 10 | 200 |
| 20 | 160 |
| 32 | 140 |

30 minutes



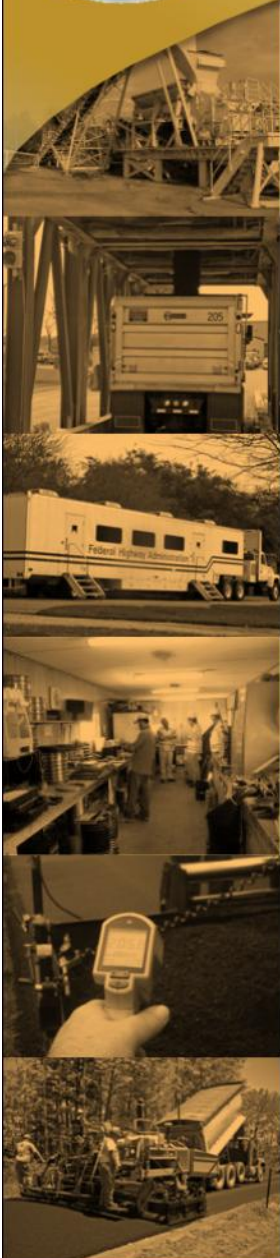
Compaction



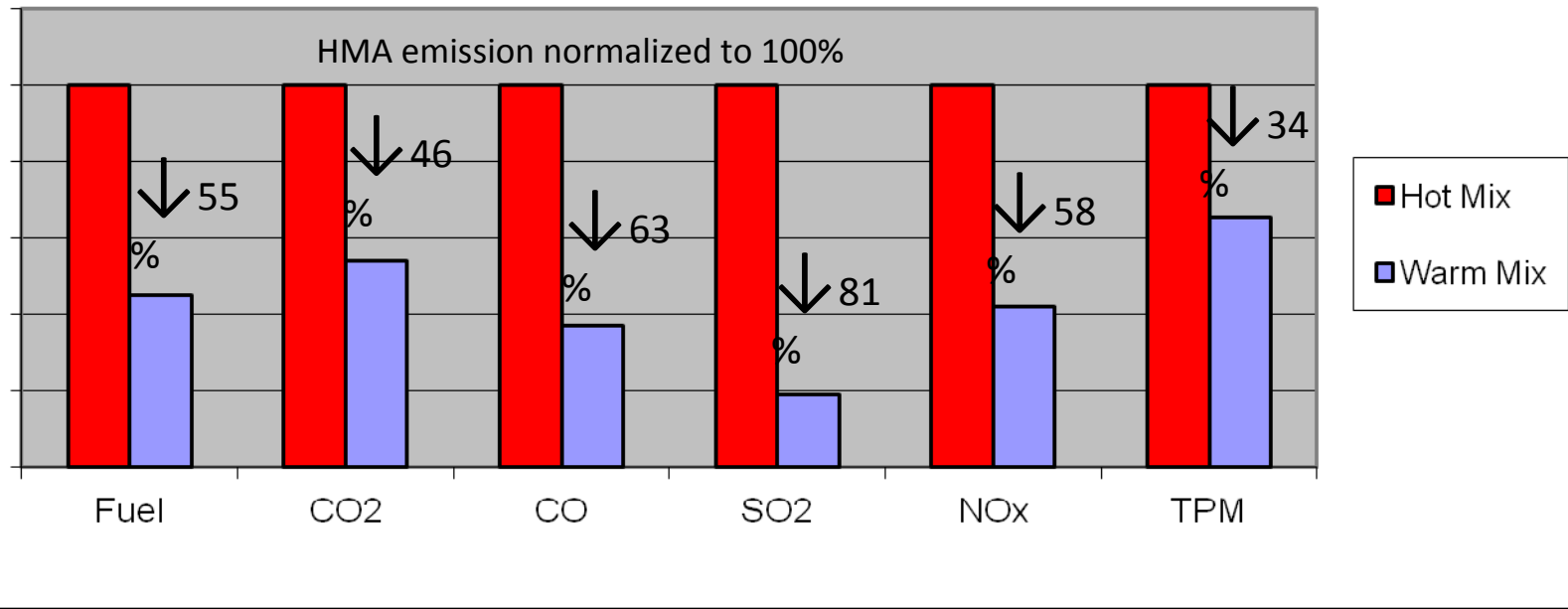


Air voids of cores
all > 92% of Gmm





- Improved field compaction
- Worker comfort
- Extended hauls & paving season





Hot Mix

Warm Mix





Warm Mix

Hot Mix





45% reduction in
fuel consumption &
CO₂ emissions

City owned &
operated mix plants

100% of HMA
production
converted to
Evotherm

WMA Technologies





- A. 18
- B. 26
- C. 29+





How Many WMA Technologies are Available in the US?



INDUSTRIES INC.

ARKEMA GROUP

Currently Twenty Nine (29+) Technologies Marketed and Available in the US.



OBEL

steel®
EVERY TIME!



Lake Asphalt of Trinidad and Tobago

Every Day Counts





General Technology Categories



Material Processing

- Ex. LEA (Hot Coated Coarse Agg + Moist Fin Agg + Additives)



Organic Additives

- Waxes, Zeolite



Chemical Additives

- Surfactants



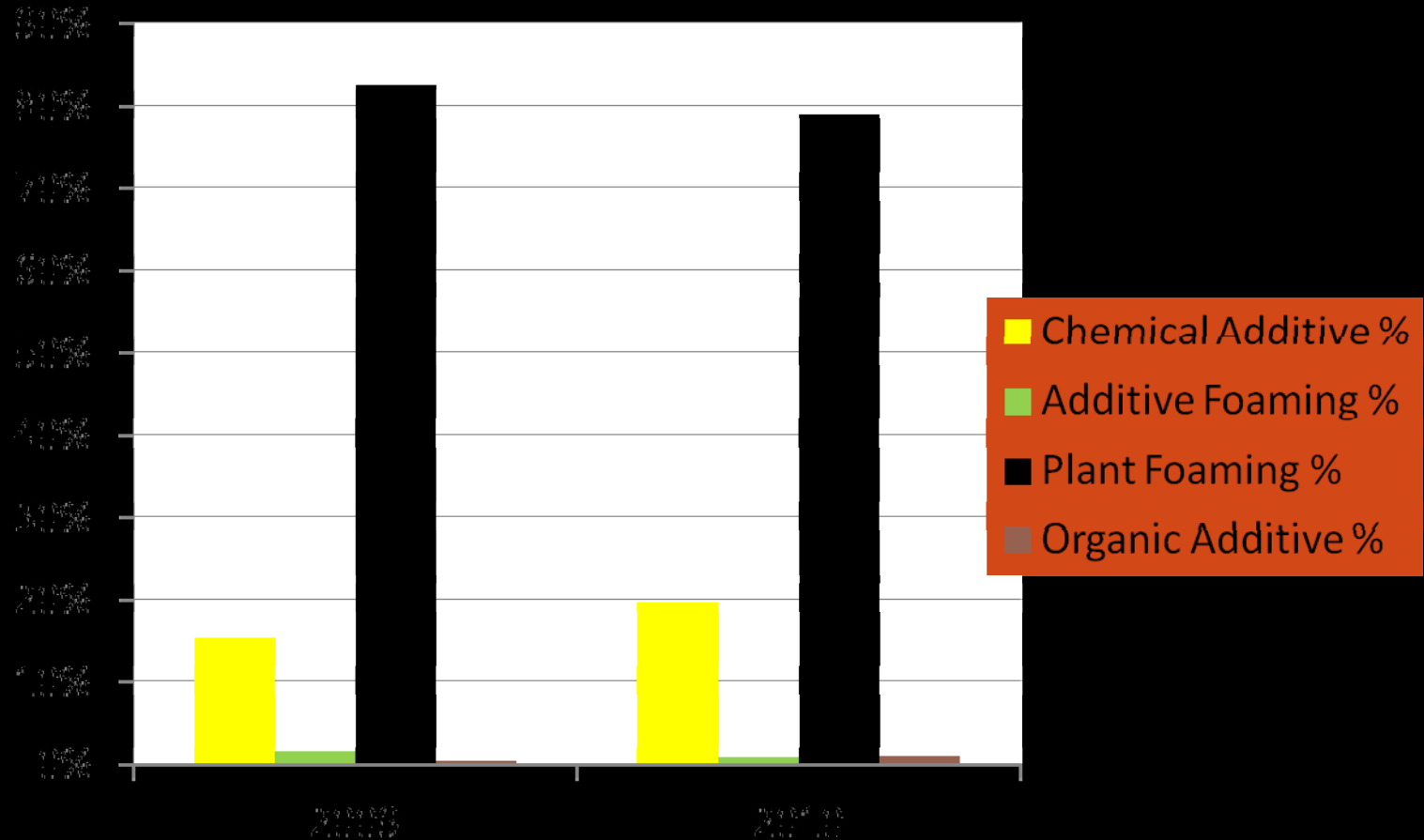
Foaming Processing

- Water Injection, Zeolite



Hybrid Systems

Ex. H₂O + Surfactant



Deployment Status



WMA Trials & Demonstration Projects

Jan 2007 - All Sources (not limited to DOT projects)



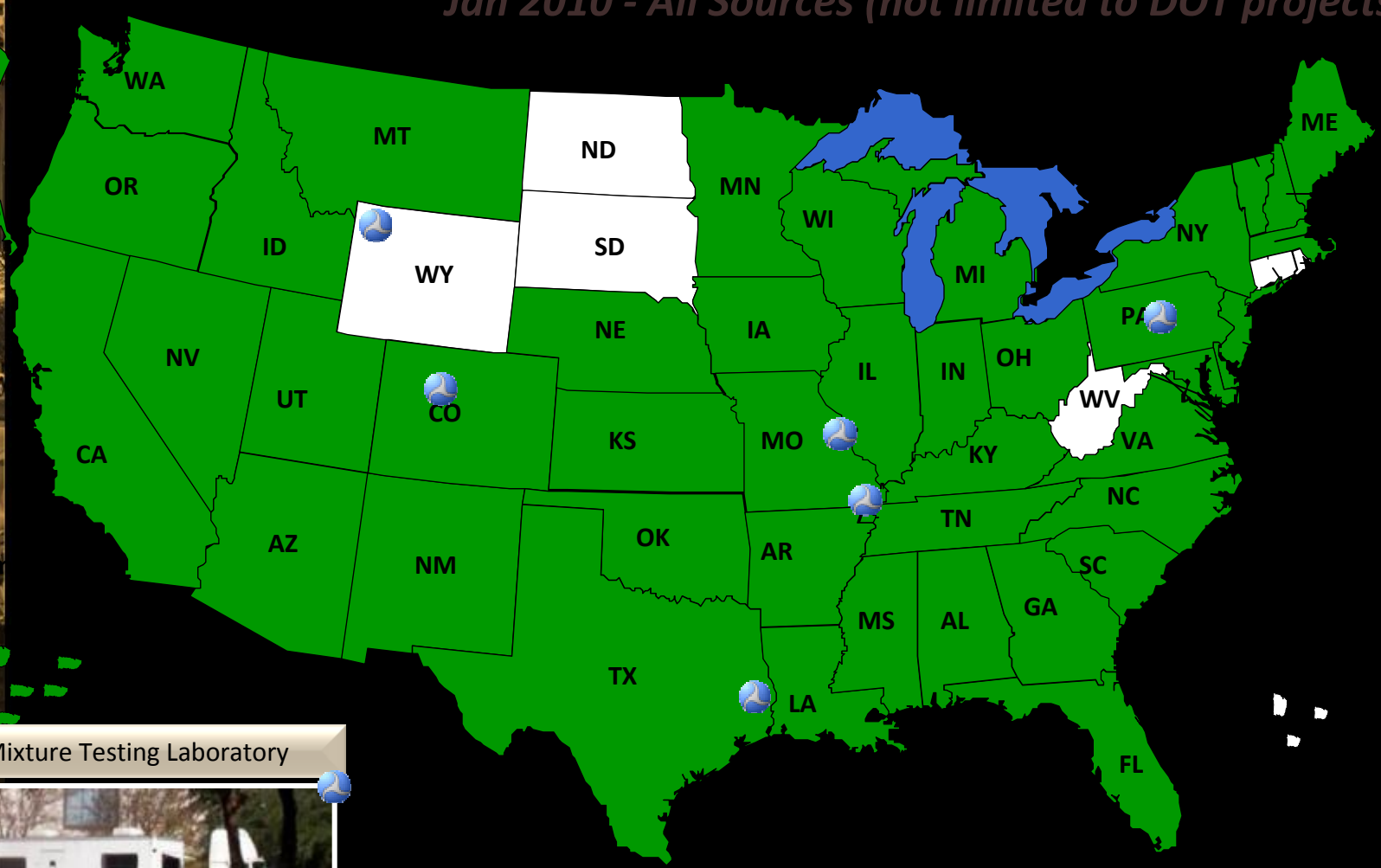
Mobile Asphalt Mixture Testing Laboratory





WMA Trials & Demonstration Projects

Jan 2010 - All Sources (not limited to DOT projects)

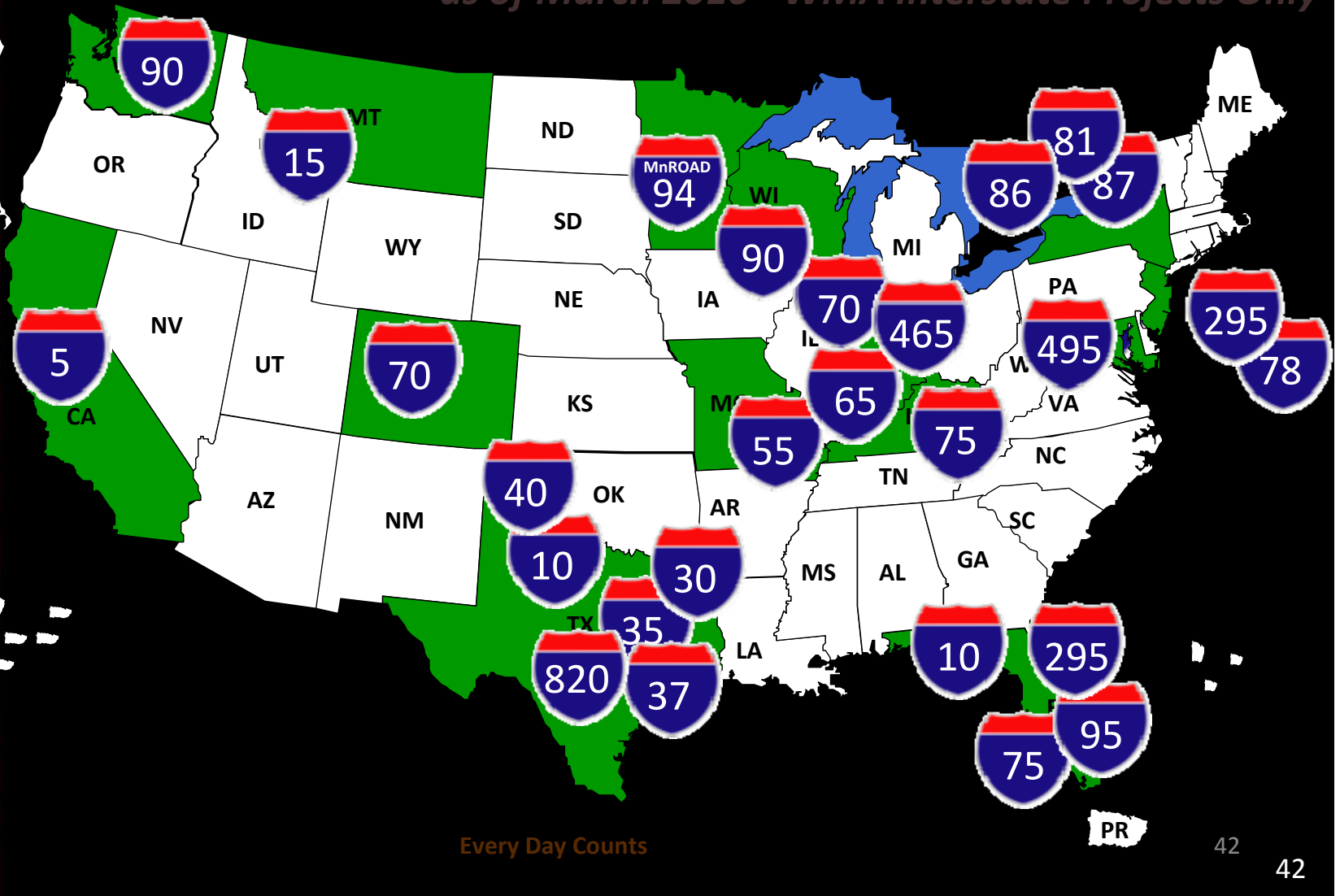


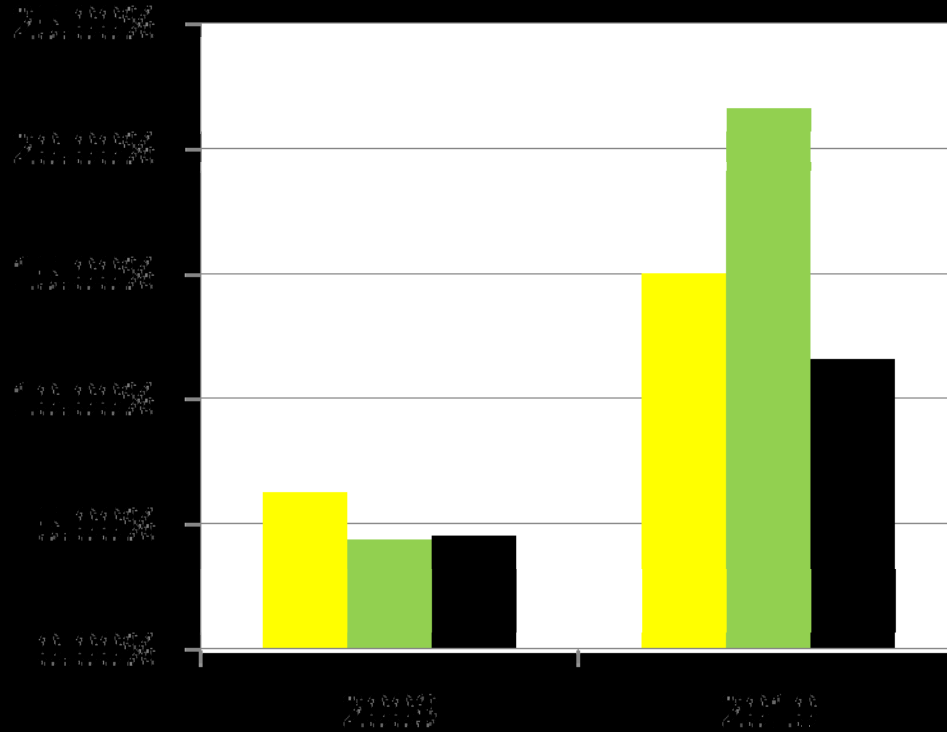
Mobile Asphalt Mixture Testing Laboratory





Interstate Highway WMA Usage as of March 2010 - WMA Interstate Projects Only





- Avg. % of DOT tons
- Avg % of Other Agency tons
- Avg % of Commercial & Residential tons

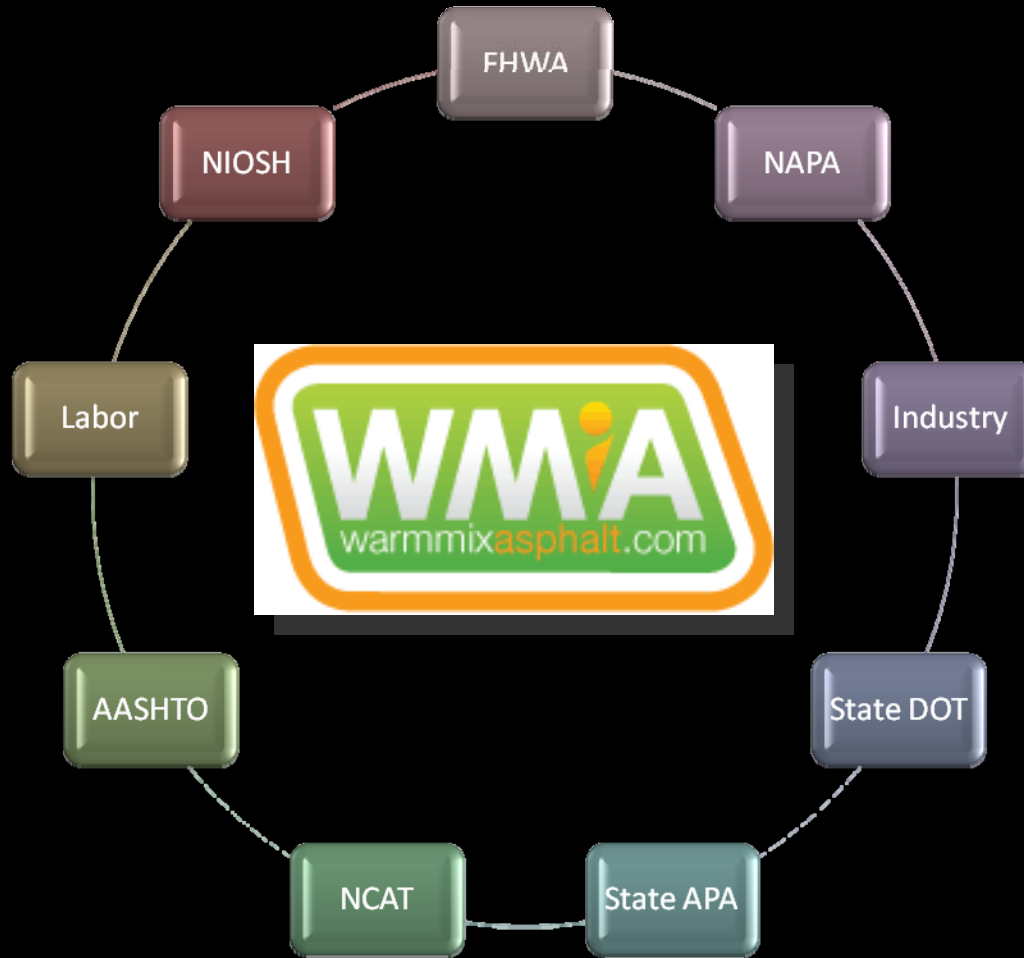


| | 2009 | 2010 |
|----------------------|---------|---------|
| HMA/WMA Tons | 358 MT | 358 MT |
| RAP used in HMA/WMA | 56 MT | 62 MT |
| Total RAP Recycled | 64 MT | 71 MT |
| Total RAS in HMA/WMA | 0.72 MT | 1.14 MT |
| Total WMA Tons | 16.7 MT | 47.2 MT |



Resources







- Many US technologies' web-link at: <http://warmmixasphalt.com/wmatechnologies.aspx>

WMA warmmixasphalt.com

HOME ABOUT US ABOUT WMA PUBLICATIONS WMA TECHNOLOGIES SUBMISSION FORM

QUICK FINDS

- [WMA European Practice Report](#)
- [WMA at NAPA Annual Meeting](#)
- [WMA Best Practices](#)
- [December TWG Meeting](#)
- [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
This listing of products and technologies does not constitute an endorsement or approval. The composition, application, performance, and legitimacy of these listed technologies has not been determined. It is the responsibility of the user or specifying agency to determine the product or technology's merits for usage.

- Advanced Concepts Engineering Co.: [LEA.CO](#)
- AESCO/Madsen: [Eco-Foam II](#)
- Akzo Nobel: [Rediset WMX](#)
- All States Materials Group: [ECOBIT](#)
- Arkema Group: [CECABASE RT](#)
- Aspha-min: [Aspha-min Online](#)
- Astec Industries: [Double Barrel Green System](#)
- Gencor Industries: [Green Machine](#)
- Herman Grant Company: [HGrant Warm Mix System](#)
- Iterchimica: [Ecolitherm](#)
- Ham Equipment Inc: [Amulias Warm Mix Asphalt](#)
- Donnaughay Technologies: [Low Emission Asphalt](#)
- MeadWestvaco Asphalt Innovations: [Exotherm](#)
- Polysar: [Polysar Warm Mix Asphalt](#)
- Polysar: [Polysar Warm Mix Asphalt](#)
- Sasol Wax North America Corporation: [Sasobit](#)
- Shell: [Shell Thiopave](#)

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NATIONAL ASPHALT PAVEMENT ASSOCIATION

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Enter Email Address
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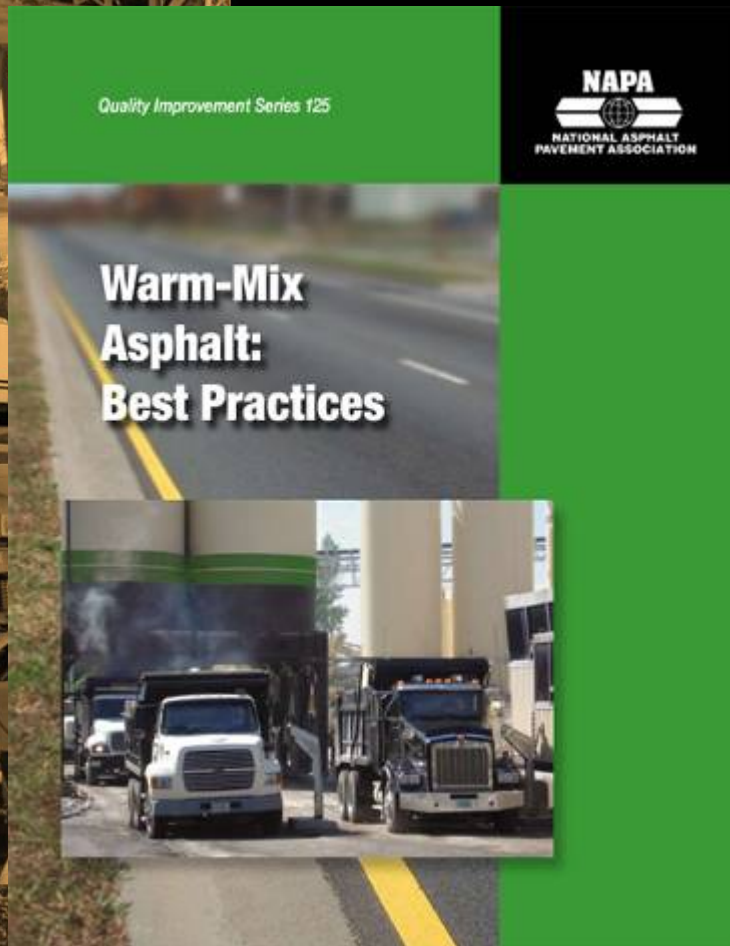
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Warm-Mix Asphalt: Best Practices, 2nd Edition

- Stockpile Moisture Management
- Burner Adjustments and Efficiency
- Aggregate Drying and Baghouse Temperatures
- Drum Slope and Flighting
- Combustion Air
- RAP usage
- *Placement Changes*



Quality Improvement Series 125

The following **references** detail specifics related to **plant modifications and operational changes** in order to **maximize the benefits of WMA** production:

- Quality Improvement Series 125 (QIP 125),
“Warm Mix Asphalt: Best Practices”
- Quality Improvement Series 126 (QIP 126),
“Energy Conservation in Hot Mix Asphalt Production”
- Environmental Council 101 (EC-101),
“Best Management Practices to Minimize Emissions During HMA Construction”
- *“The Fundamentals of the Maintenance System in Asphalt Facility”* (IS-52)





National Research Initiatives

- NCHRP 9-43 *“Mix Design Practices for Warm Mix Asphalt”*
- NCHRP 9-47A *“Engineering Properties, Emissions, and Field Performance”*
- NCHRP 9-49 *“Long Term Field Performance of Warm Mix Asphalt Technologies”*
 - Phase I, Moisture Susceptibility
 - Phase II, Long-Term Performance





<http://www.ct.gov/dot/AASHTO-R35>



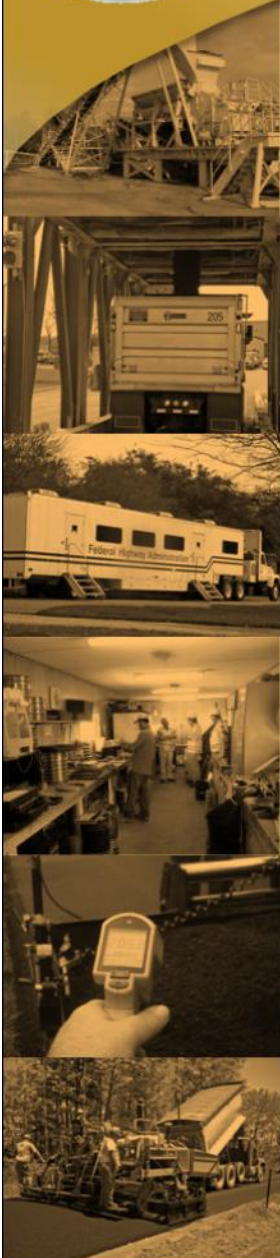
Special Mixture Design Considerations and Methods for Warm Mix Asphalt (WMA)

An Appendix to AASHTO R35 Standard Practice for Superpave Volumetric Design for Hot-Mix Asphalt (HMA)



Ramon Bonaquist, Ph.D., P.E.

Special Mixture Design Considerations and Methods for WMA







PTi – THE FOAMER



D&H Equipment – Hydro Foamer

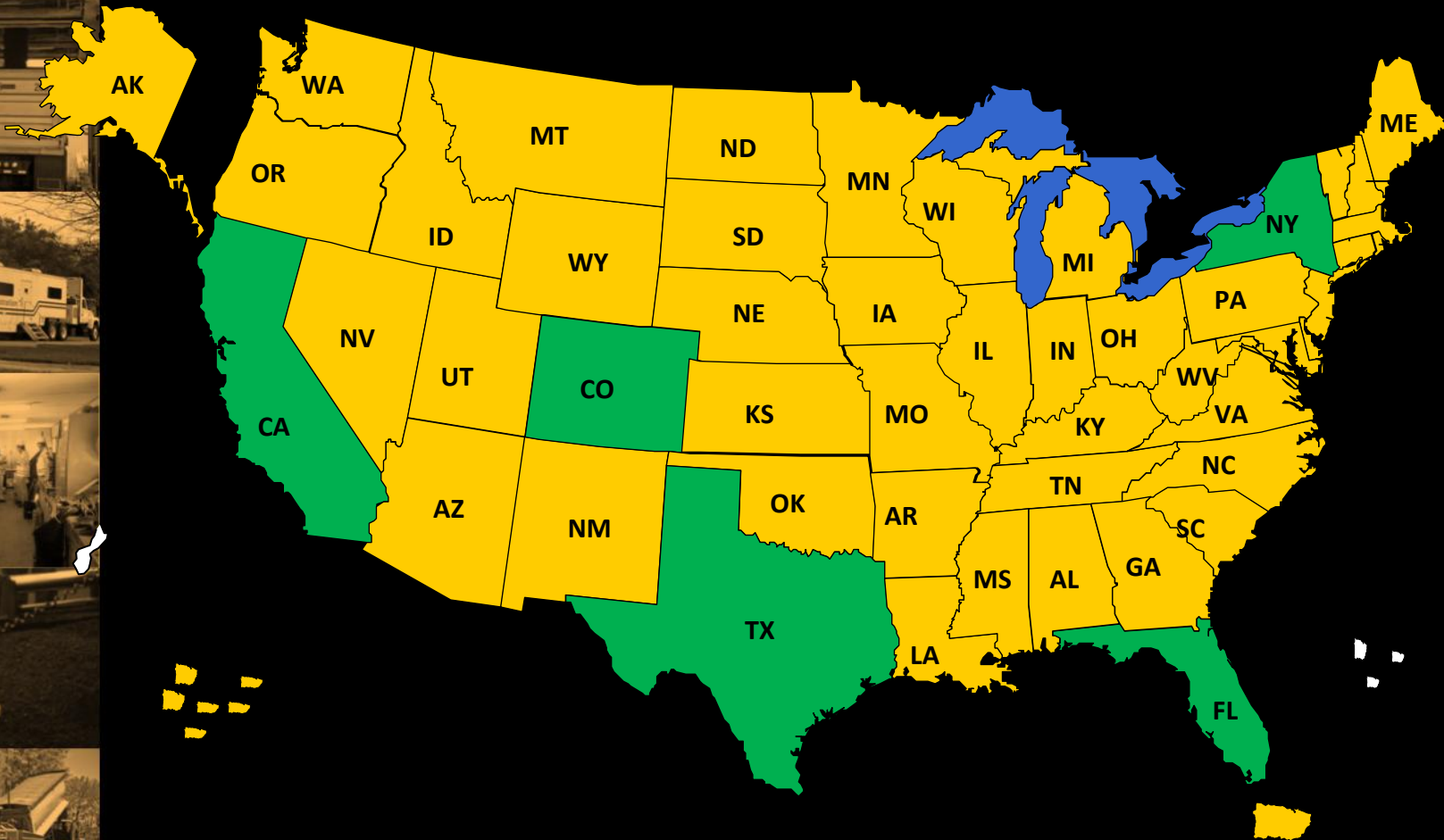


Wirtgen, WLB 10 S





Qualified/Approved Product Lists





- Gain experience
- Ensure performance with unknown or new WMA technologies
- Ensure compatibility/performance when used with local/regional materials
- Technology Marketplace...



- Meet with NY DOT
- Submit material and additive samples
- Required testing (includes Hamburg LWT)
- Production, testing, and compaction data





NEAUPG Accepted Technologies (as of 2011)





“The collective efforts from highway agencies and industry partners to advance warm mix asphalt technologies as a standard practice has been tremendous.”



-, FHWA

“[We] support the development and implementation of warm-mix asphalt ... this will inevitably become the standard practice for asphalt mixture production.”



“WMA is the future of flexible pavements in the U.S. ... lowering our production and paving temperatures promises improved energy consumption, operations, and quality.”

-Mike Acott, President,



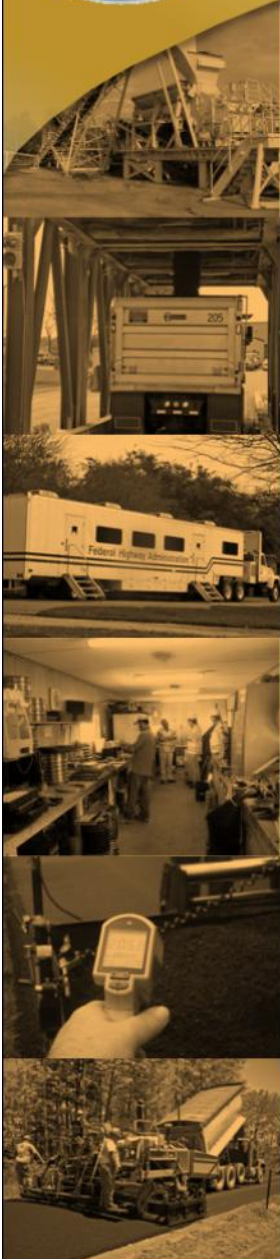
“WMA technology provides an important tool to the pavement engineer ... designers and contractors alike now have a great opportunity to learn more about this promising practice which is revolutionizing the paving industry in North America.”

-Pete Grass, President,





Keep Moving Forward





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