

Warm Mix Asphalt in the United States: From Evolution to Revolution

Matthew Corrigan, P.E.

Mobile Asphalt Testing Trailer Technical Manager
U.S. DOT – Federal Highway Administration

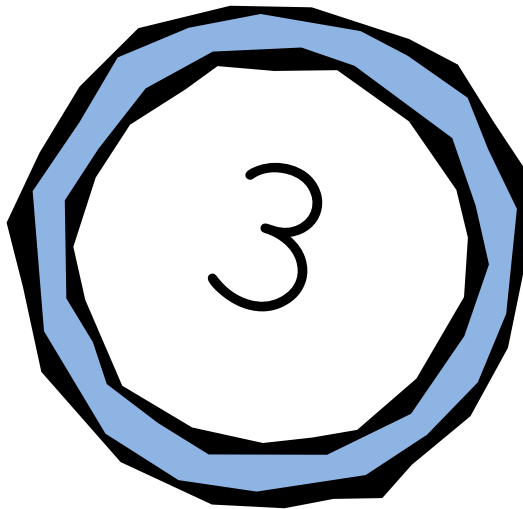
October 31, 2013



Where have we been?

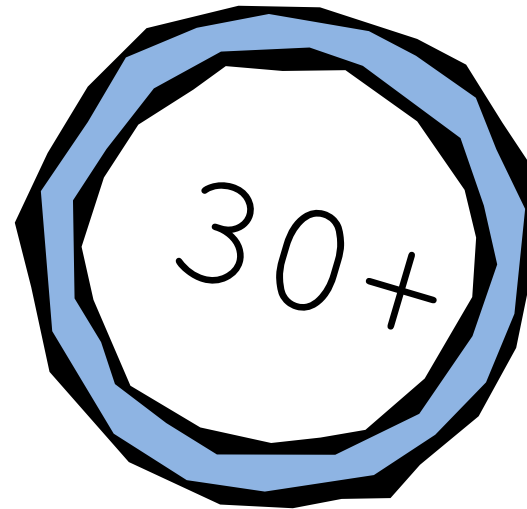
2004-05

Number of named WMA technologies in the U.S.?



2013-14

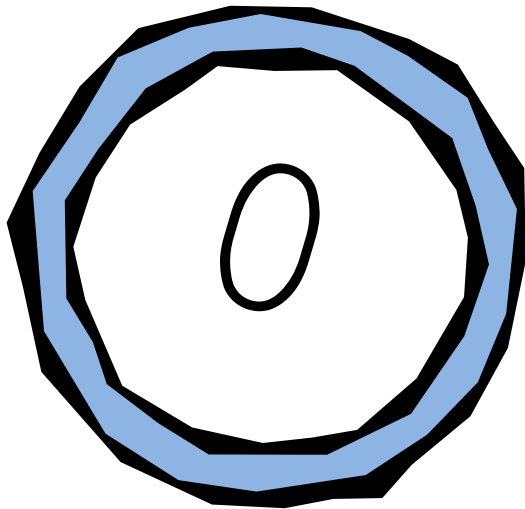
Number of named WMA technologies in the U.S.?



Where have we been?

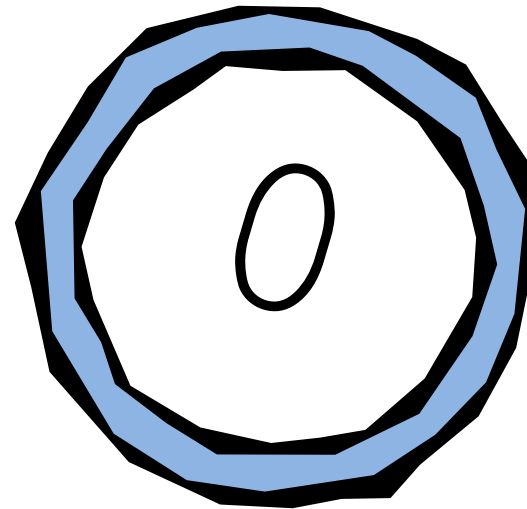
2004-05

No. of WMA Technical Working Groups?



2013-14

No. of WMA Technical Working Groups?



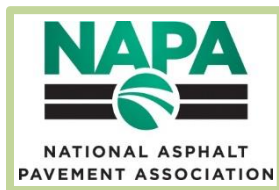
Stakeholder Engagement: WMA Technical Working Group

Established in 2005
Adjourned in 2012

Co-Chairs:
Matthew Corrigan



Ron White



WMA Technical Working Group

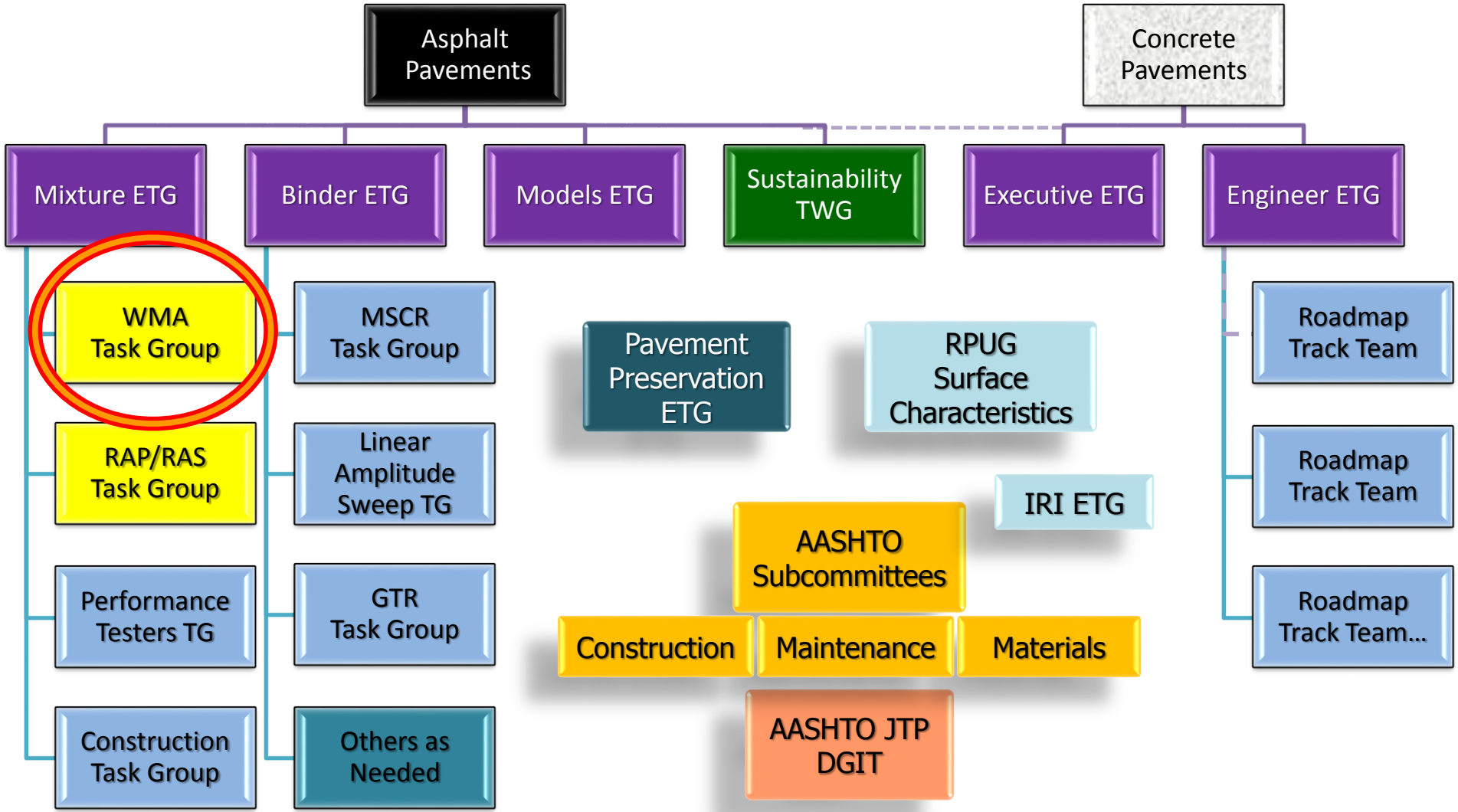
Ron White	Superior Paving
Matthew Corrigan	FHWA
Tom Baker	Washington State DOT
Tom Bennert	Rutgers University
Jack Cowsert	NCDOT
Stacey Diefenderfer	VTRC, VDOT
Jon Epps	Texas A&M University
Danny Gierhart	Asphalt Institute
David Newcomb	NAPA (Liaison)
Keith Platte	AASHTO
Dale Rand	Texas DOT

Ron Sines	Oldcastle Materials
Randy West	NCAT
Harry Bush, Jr.	Vulcan Materials
Howard Marks	NAPA
Jim Melius	NYS Laborers
Brian Prowell	AMS, LLC
Richard Schreck	VA APA
Paul Schulte	NIOSH
Cliff Ursich	Flexible Pvmnts of OH
Rich Wolters	MN APA



THANK
YOU!

FHWA Commitment to Stakeholder Engagement in the Pavement & Materials Program



Where have we been?

2004-05

No. of WMA International Conferences?

0

2013-14

No. of WMA International Conferences?

2



International WMA Conferences

1st Conference on November 11-13, 2008 in
Nashville, TN

Processes, Mix Production & Placement, Energy
consumption, Mix Design, Material Properties

2nd Conference October 11-13, 2011 in St.
Louis, MO

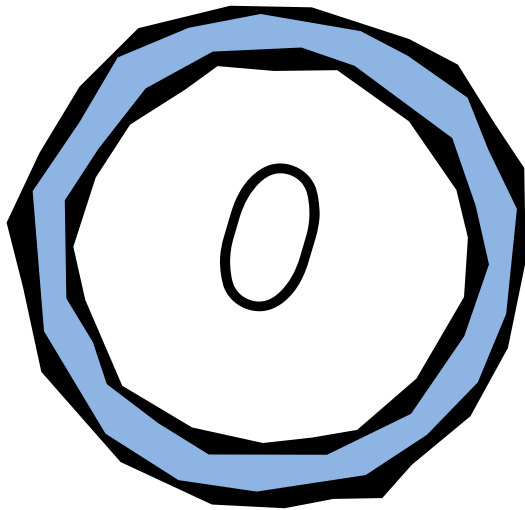
Lab & Field Properties, Design & Performance,
Health & Environment, RAP w/ WMA, Binder &
Mix Properties, Moisture Susceptibility,
Construction, etc.



Where have we been?

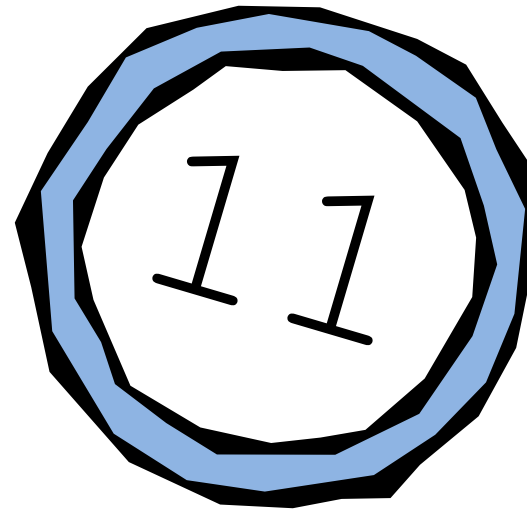
2004-05

Number of WMA NCHRP
Research Projects?



2013-14

Number of WMA NCHRP
Research Projects?





NCHRP Projects funded as a result of WMA TWG efforts:

9-43	-Mix Design Practices for WMA	\$522,501	completed
9-47	-Engineering Properties, Emissions, and Field Performance of WMA Technologies	\$79,000	completed
9-47A	-Properties and Performance of WMA Technologies	\$1,121,000	Jun 2013
9-49	-Performance of WMA Technologies: Stage I--Moisture Susceptibility	\$450,000	completed
9-49A	-Performance of WMA Technologies: Stage II--Long-Term Field Performance	\$900,000	Jul 2016
9-52	-Short-Term Laboratory Conditioning of Asphalt Mixtures	\$800,000	Nov 2014
9-53	-Properties of Foamed Asphalt for Warm Mix Asphalt Applications	\$700,000	Dec 2014
9-54	-Long-Term Aging of Asphalt Mixtures for Performance Testing and Prediction	\$800,000	May 2016
9-55	-Recycled Asphalt Shingles in Asphalt Mixtures with WMA Technologies	\$600,000	Sept 2016
9-58	-Effects of Recycling Agents on Asphalt Mixtures w/High RAS & RAP Binder Ratios	\$1,500,000	July 2017 ^{est.}
20-07 (311)	-Development of a WMA Tech. Evaluation Program	\$50,000	completed



NCHRP Projects funded as a result of WMA TWG efforts:

9-43	-Mix Design Practices for WMA	\$522,501	completed
9-47	-Engineering Properties, Emissions, and Field Performance of WMA Technologies	\$750,000	completed
9-47A	-Properties and Performance of WMA Technologies	\$500,000	Jun 2013
9-49	-Performance of WMA Technologies Stage I--Me	\$750,000	completed
9-49A	-Performance of WMA Technologies Stage II--Me	\$900,000	Jul 2016
9-52	-Short-Term Performance and Conditioning of Asphalt Mixtures	\$800,000	Nov 2014
9-53	-Properties of Foamed Asphalt for Warm Mix Asphalt Applications	\$700,000	Dec 2014
9-54	-Long-Term Aging of Asphalt Mixtures for Performance Testing and Prediction	\$800,000	May 2016
9-55	-Recycled Asphalt Shingles in Asphalt Mixtures with WMA Technologies	\$600,000	Sept 2016
9-58	-Effects of Recycling Agents on Asphalt Mixtures w/High RAS & RAP Binder Ratios	\$1,500,000	July 2017 ^{est.}
20-07 (311)	-Development of a WMA Tech. Evaluation Program	\$50,000	completed

Total \$7,522,501

NCHRP Project 09-58 (2014)

Objectives:

- (1) evaluate the effectiveness of recycling agents in HMA and WMA mixtures with high RAS, RAP, or combined RAS/RAP binder ratios through a coordinated program of laboratory and field experiments;
- (2) propose revisions to several relevant AASHTO specifications and test methods;
- (3) develop training and workshop materials and deliver one workshop.



Expansion of NCHRP 9-43 Mix Design Study to Higher Absorption Mixtures

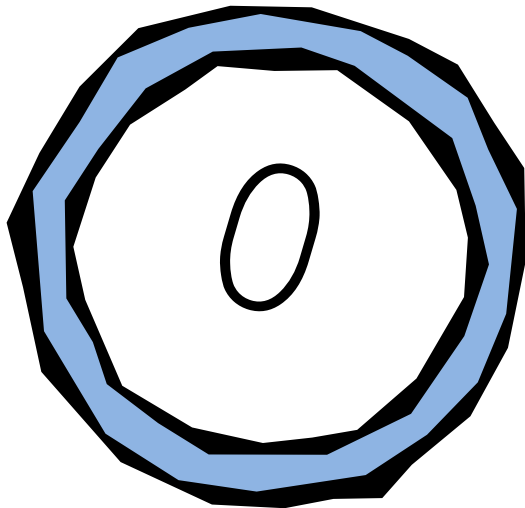
- Original Project 9-43
 - Binder Absorption limited to 0.5 - 1.0 %
- FHWA Mix ETG Work Item: Expansion to Higher Absorption Mixtures $\geq 2.0\%$
 - Includes High Absorption Laboratory Foamed Mixtures
- Dr. Ray Bonaquist, AAT
 - Scheduled for completion Jan – Feb 2014



Where have we been?

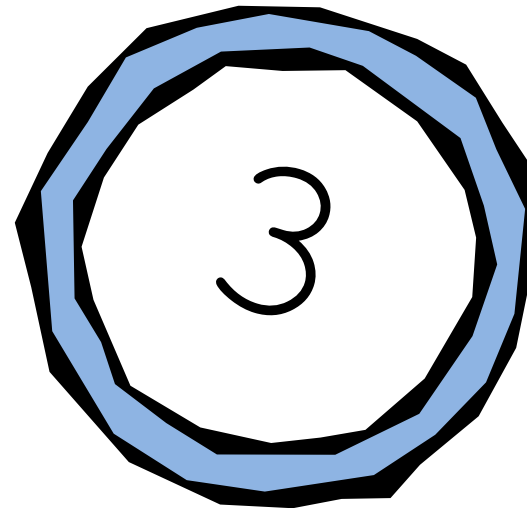
2004-05

Number of WMA Best Practices Publications?



2013-14

Number of WMA Best Practices Publications?

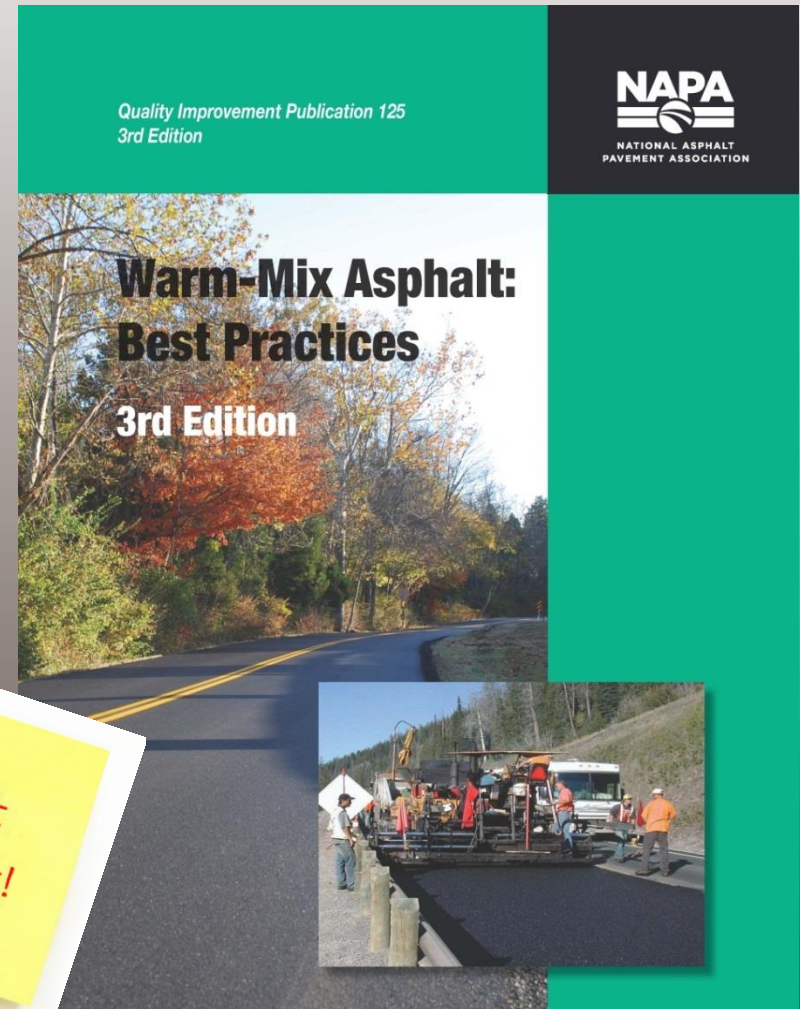


Quality Improvement Series 125

3rd Edition

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

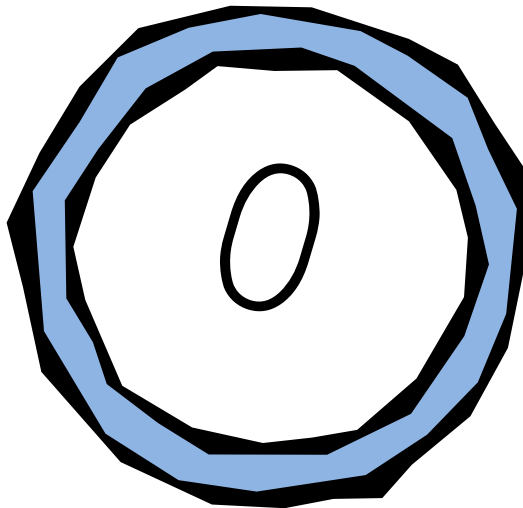
Don't forget!



Where have we been?

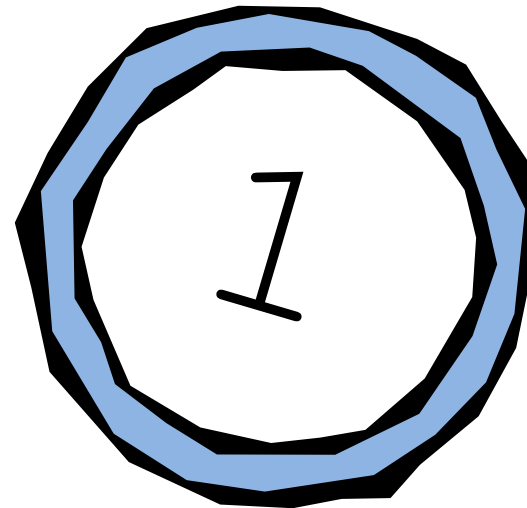
2004-05

Number of AASHTO
Standards on WMA?



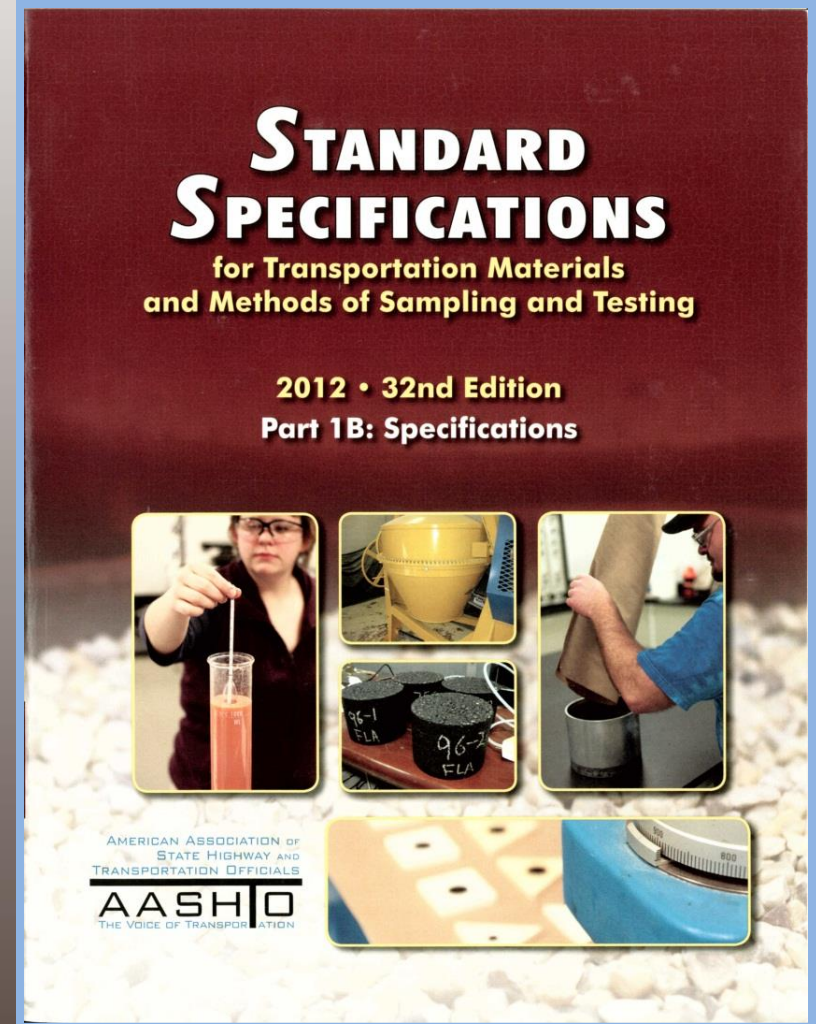
2013-14

Number of AASHTO
Standards on WMA?



Appendix to AASHTO R35 with commentary “Special Mixture Design Considerations and Methods for WMA”

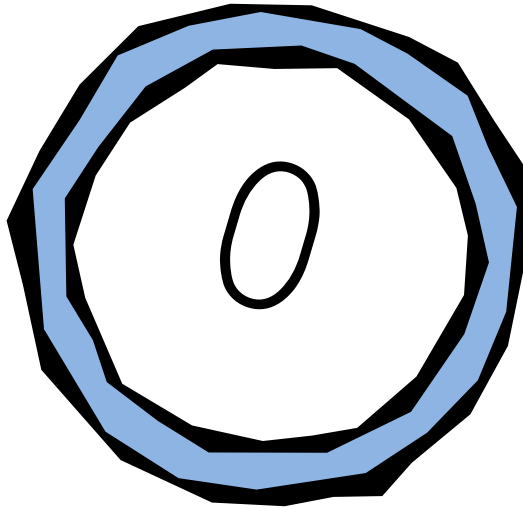
Approved by AASHTO Subcommittee on Materials and published: *Standard Specifications for Transportation Materials and Methods of Sampling and Testing* (32nd Edition, 2012)



Where have we been?

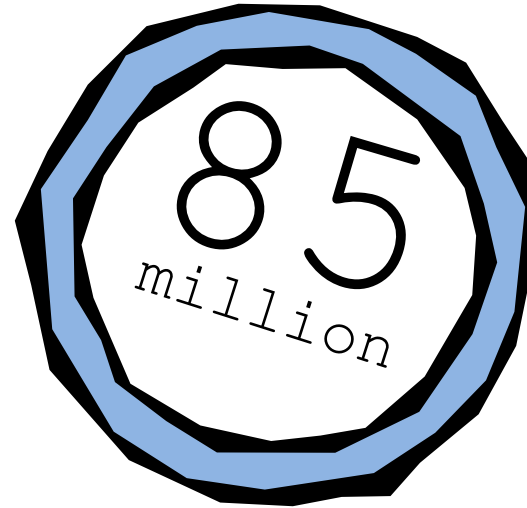
2004-05

Number of WMA tons
produced annually?



2013-14

Number of WMA tons
produced annually?



Information Series 138

2nd Annual Asphalt Pavement Industry Survey on Reclaimed Asphalt Pavement, Reclaimed Asphalt Shingles, and Warm-Mix Asphalt Usage: 2009–2011

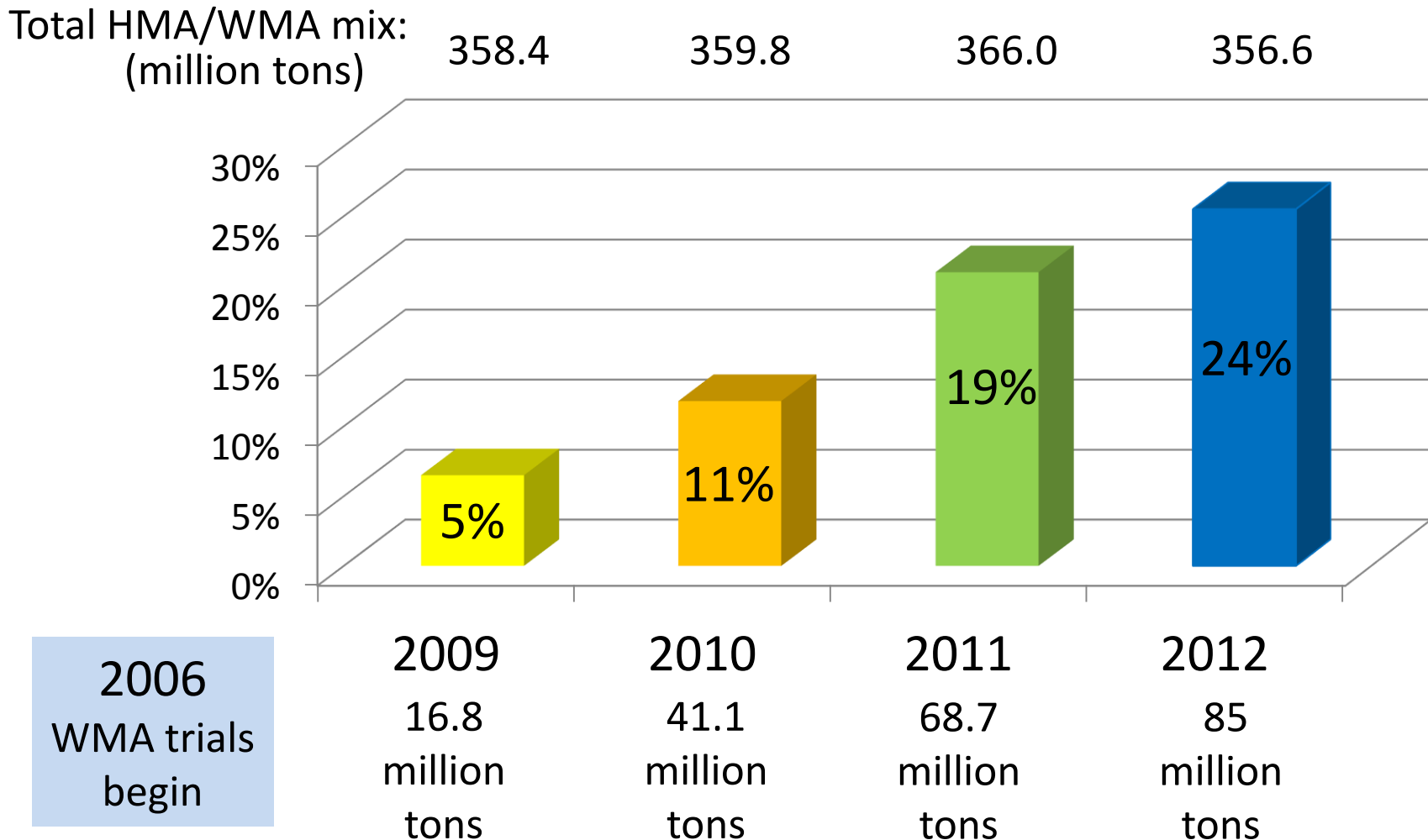
Information Series 138

2nd Annual Asphalt Pavement Industry Survey on Reclaimed Asphalt Pavement, Reclaimed Asphalt Shingles, and Warm-Mix Asphalt Usage: 2009–2011



WMA Usage in HMA/WMA

Percentage of Total Mix Production in USA



StateDOT WMA Usage in HMA/WMA

Percentage of State Mix Production in USA

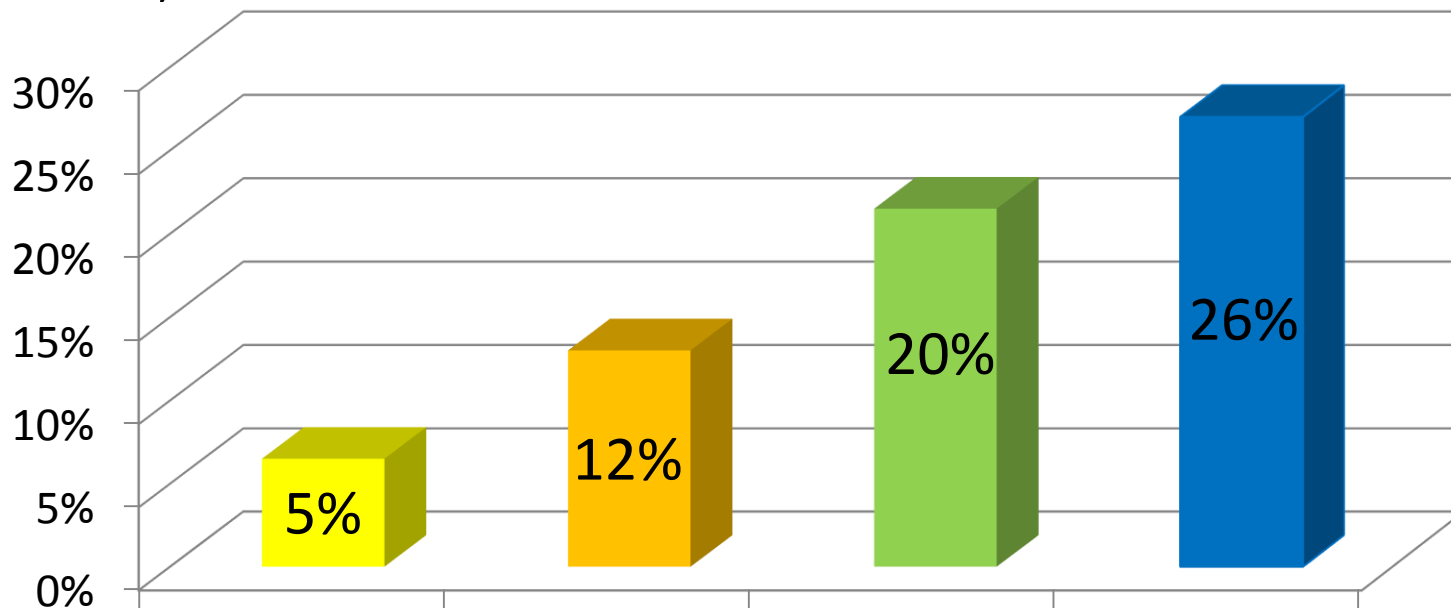
Total DOT HMA/WMA mix (million tons):

169.2

172.5

175.3

177.3



2009
8.6
million
tons

2010
20
million
tons

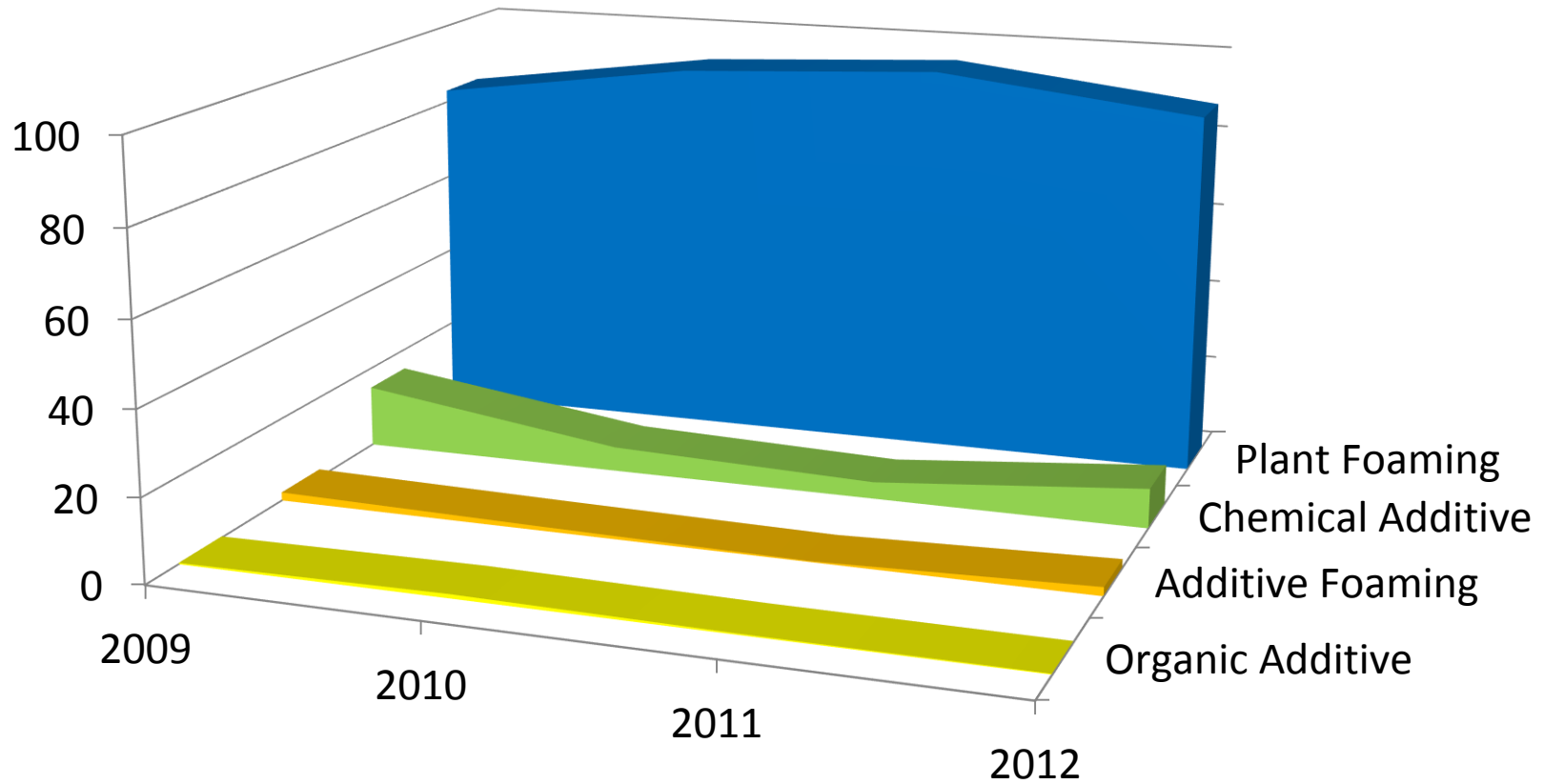
2011
34.6
million
tons

2012
45.6
million
tons

2006
WMA trials
begin

WMA Usage by Technology

Percent of market for WMA production in USA



... additional WMA products getting press

- Road Science™ division of ArrMaz
 - AD-here® with CECABASE™ RT 945*
- Engineered Additives LLC
 - BituTech RAP, BituTech PER, BituTech WA1, BituTech VPW (products also listed as recycling/rejuvenating agents)
- GreenMantra Technologies**
 - Synthetic wax derived from recycled plastics

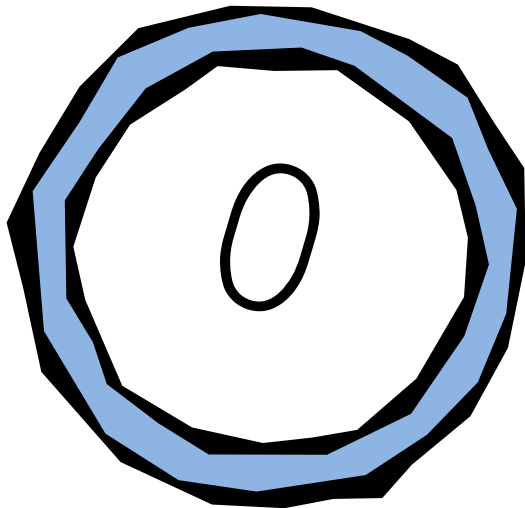
*CECA, a subsidiary of the Arkema Group in France, through its affiliate, Arkema Inc., and Road Science, a division of ArrMaz, Inc., announced they have signed a distribution agreement in which Road Science will be the exclusive USA distributor of CECA's warm mix asphalt additive, CECABASE™ RT.

**GreenMantra Technologies announced that Paul Veillette, former President & CEO of Sasol Wax Americas, has joined GreenMantra as Vice President of Sales.

Where have we been?

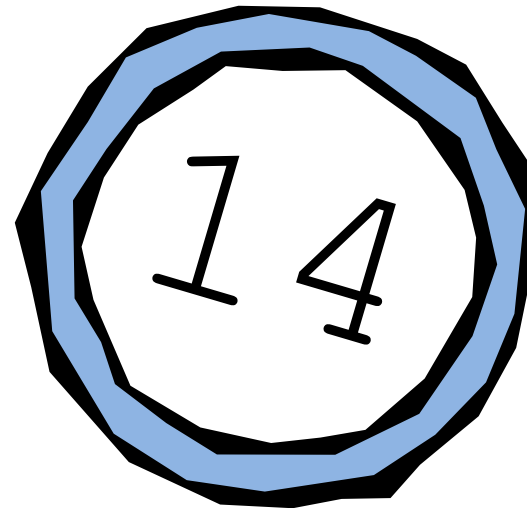
2004-05

Number of WMA projects
evaluated by FHWA?



2013-14

Number of WMA projects
evaluated by FHWA?

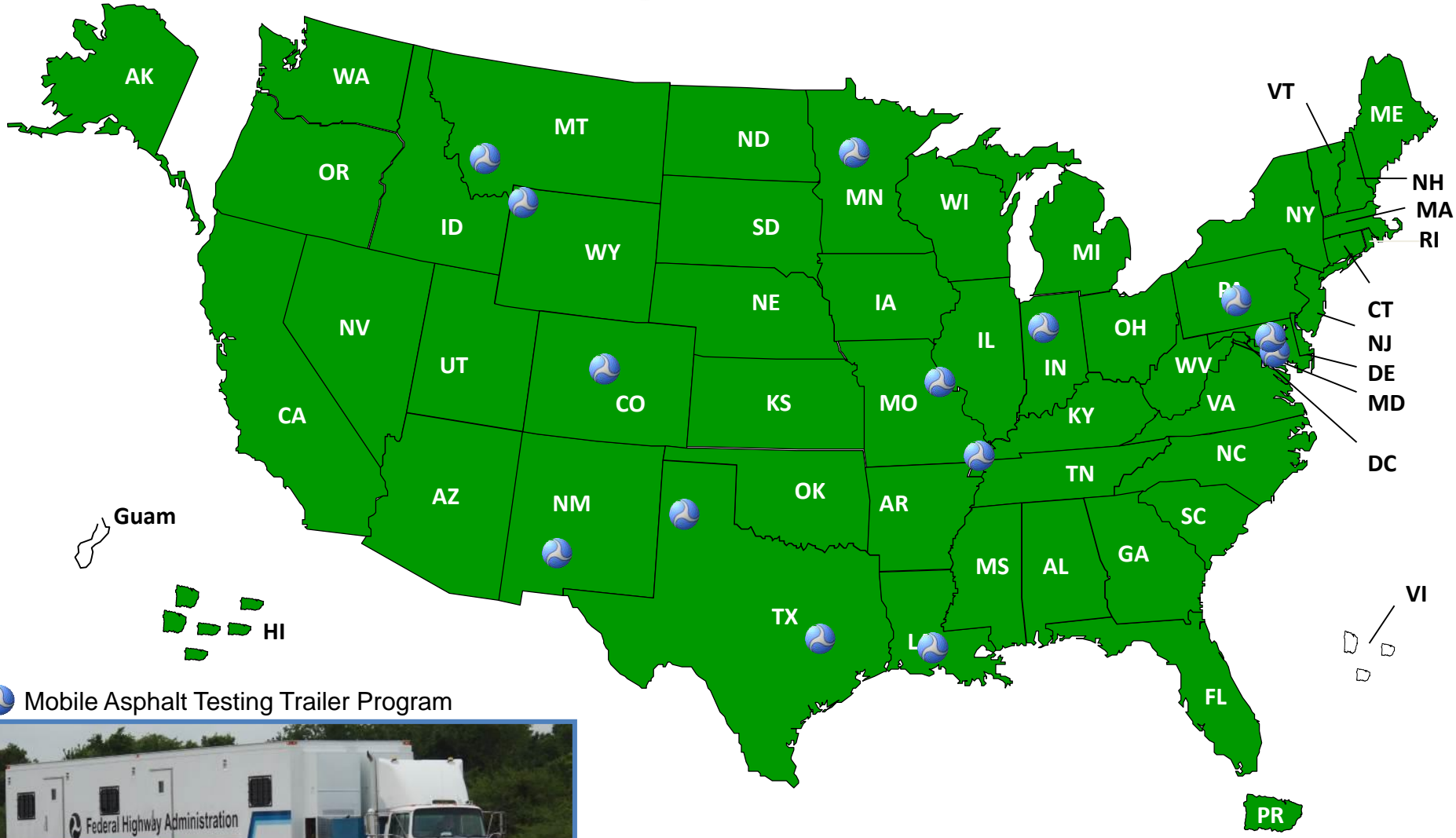


FHWA Field Support Mobile Asphalt Testing Trailer (MATT)

- Mobile Asphalt Pavement Materials Lab
 - Site Visit
 - Field Data/Testing
 - Use/Demo Emerging Test Devices
 - POC: Matthew Corrigan, P.E.



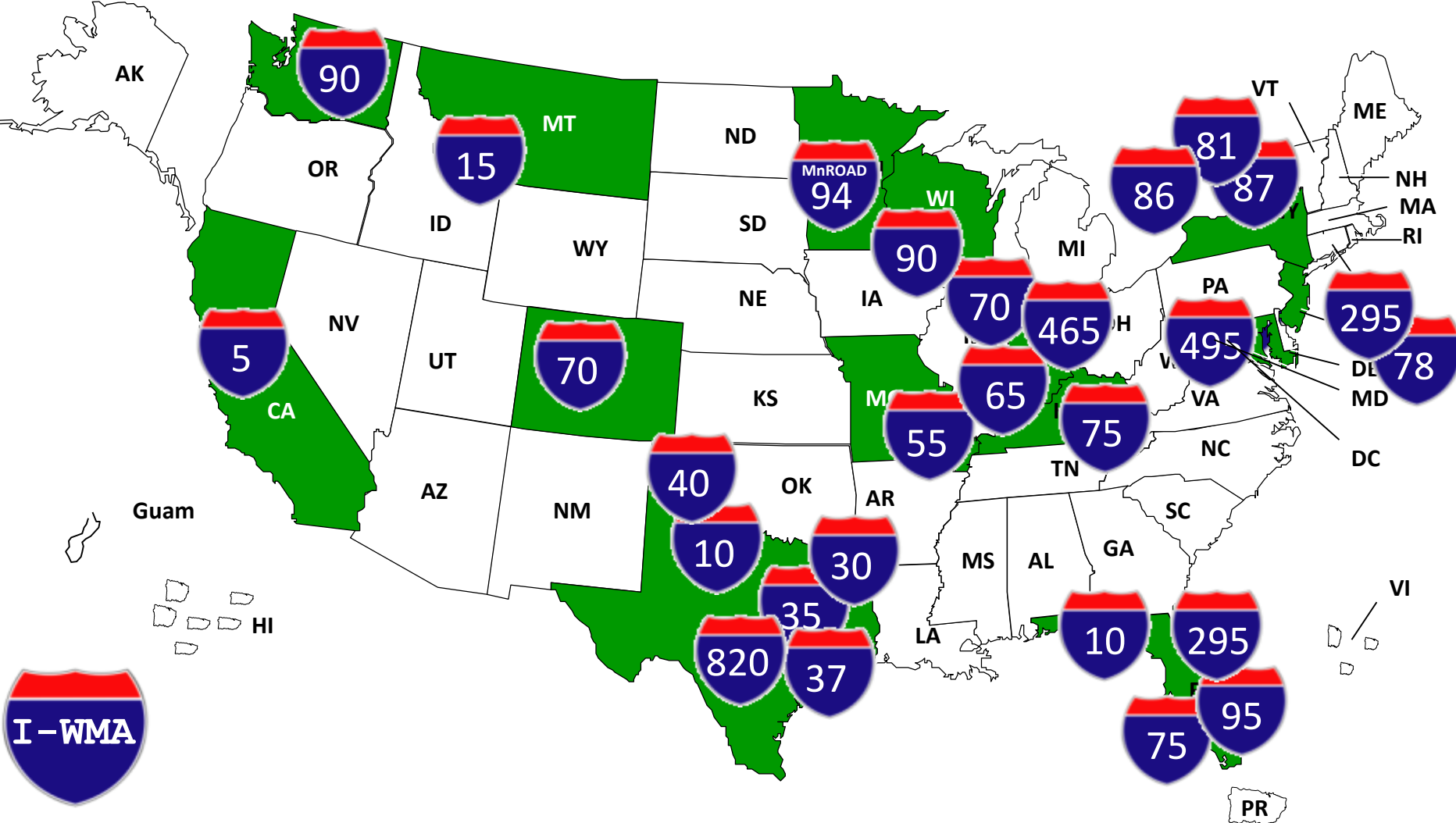
WMA Project Locations



 Mobile Asphalt Testing Trailer Program



Interstate Highway WMA Usage











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

-Office of Pavement Technology, FHWA

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

- Global Asphalt Pavement Alliance

**Global
Asphalt
Pavement
Alliance**



“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, NAPA

“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, Asphalt Institute

232.03806
90
2-8-18-32-18-10-2

Thank

88.90585
39
2-8-18-9-2

You

Discussion / Comments / Questions



FHWA's Mobile Asphalt Testing Trailer – “the MATT”