



Achieving Sustainability Goals with Warm Mix Asphalt

NEAUPG 2022 – Albany, NY

November 3, 2022



Agenda

Ingevity Overview

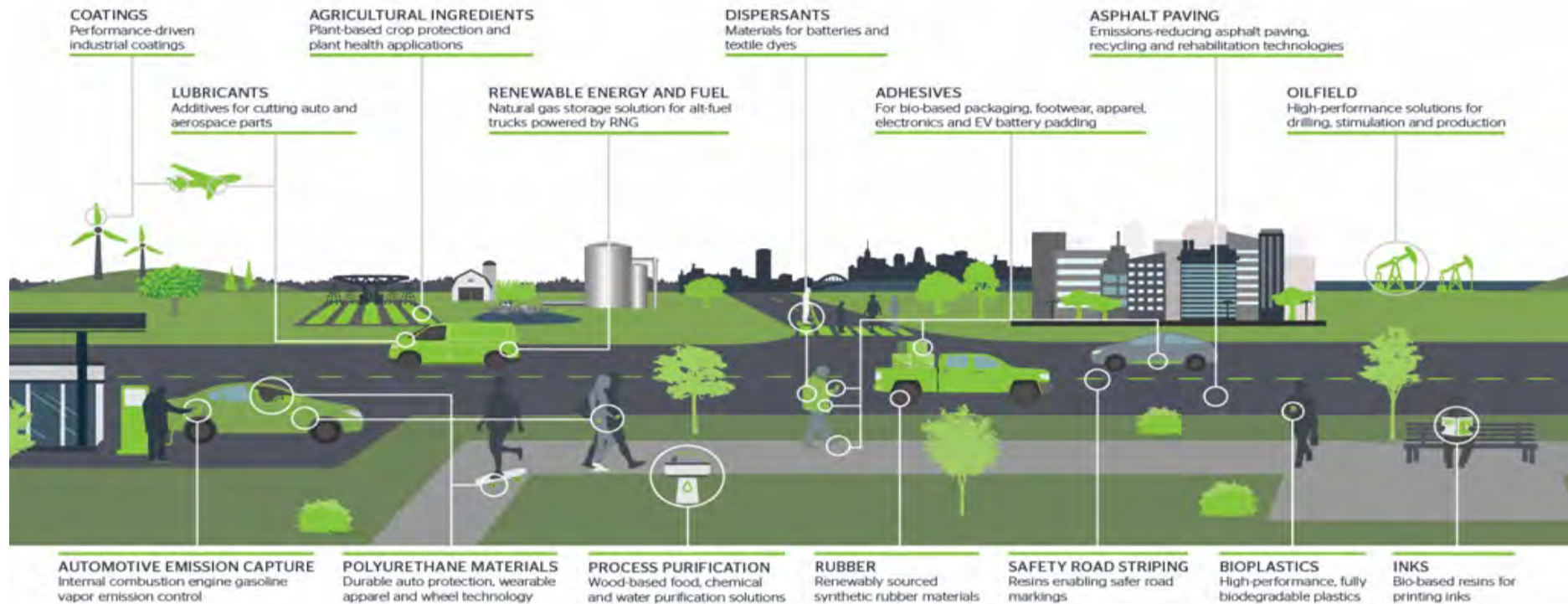
Past & Present Use of Warm Mix Asphalt

Benefits of Lower Production Temps

Meeting Contractor Needs with Data

Path Forward

PURIFYING, PROTECTING AND ENHANCING EVERYDAY LIFE





Brief History of WMA



NAPA Survey on WMA Usage



Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage 2020

Information Series 138

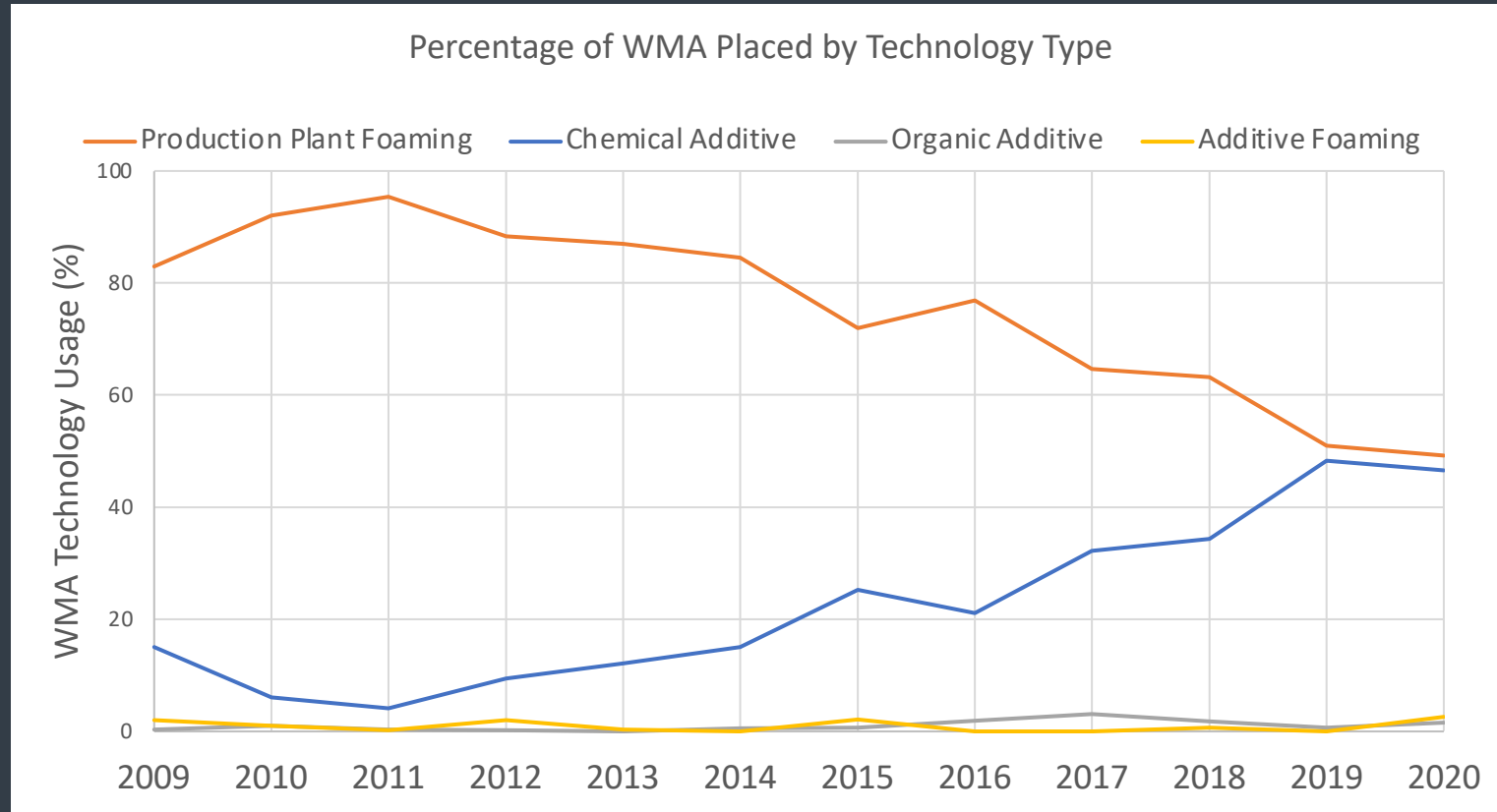


11th Annual Survey

WMA technology is
in $\approx 50\%$ of our
asphalt tonnage.

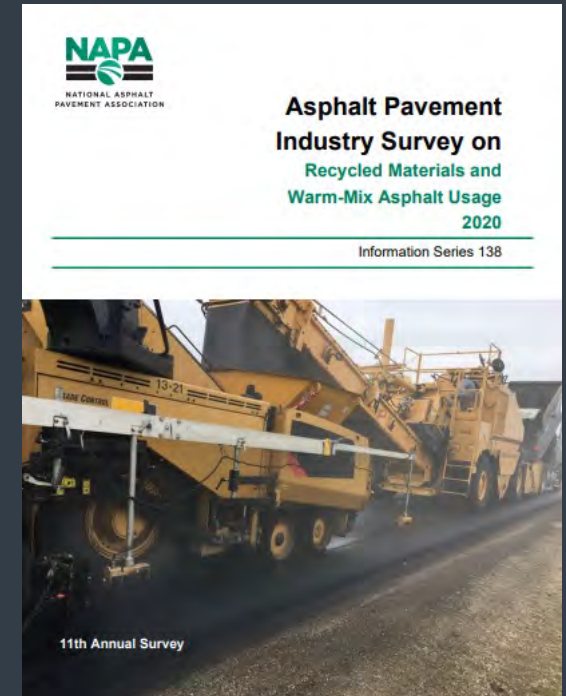
BUT... is it really
WMA if we haven't
reduced temps?

NAPA Survey on WMA Usage



Data taken from NAPA's "Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage: 2019"

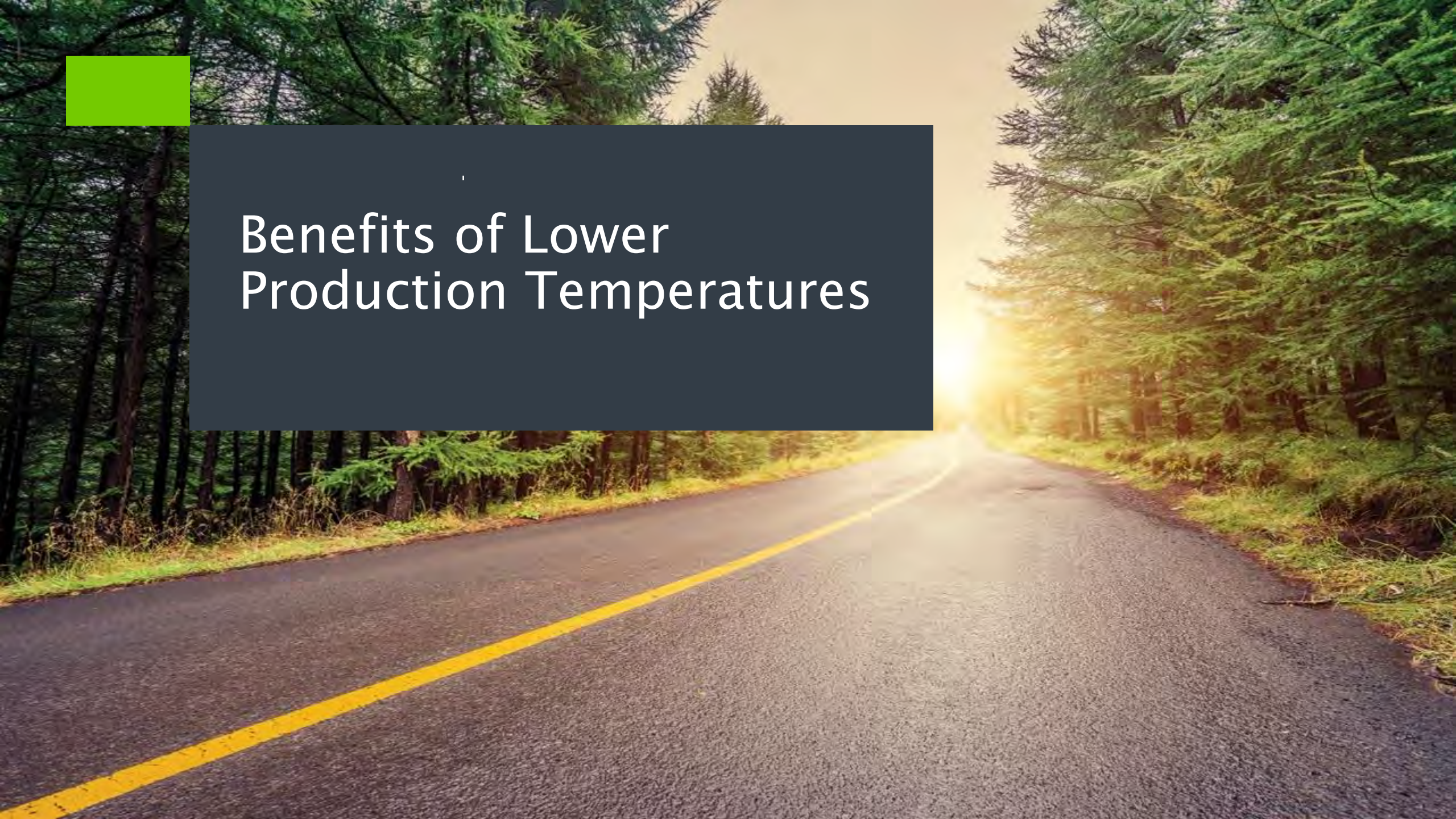
WMA Technology	% Production											
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Production Plant Foaming	83	92	95.4	88.3	87	84.5	72	76.9	64.7	63.2	51	49.2
Additive Foaming	2	1	0.2	2	0.3	0	2.1	0	0	0.7	0	2.6
Chemical Additive	15	6	4.1	9.4	12.1	15	25.2	21.1	32.2	34.3	48.3	46.6
Organic Additive	0.3	1	0.3	0.2	0	0.5	0.7	1.9	3.1	1.8	0.7	1.6



Current Use of WMA

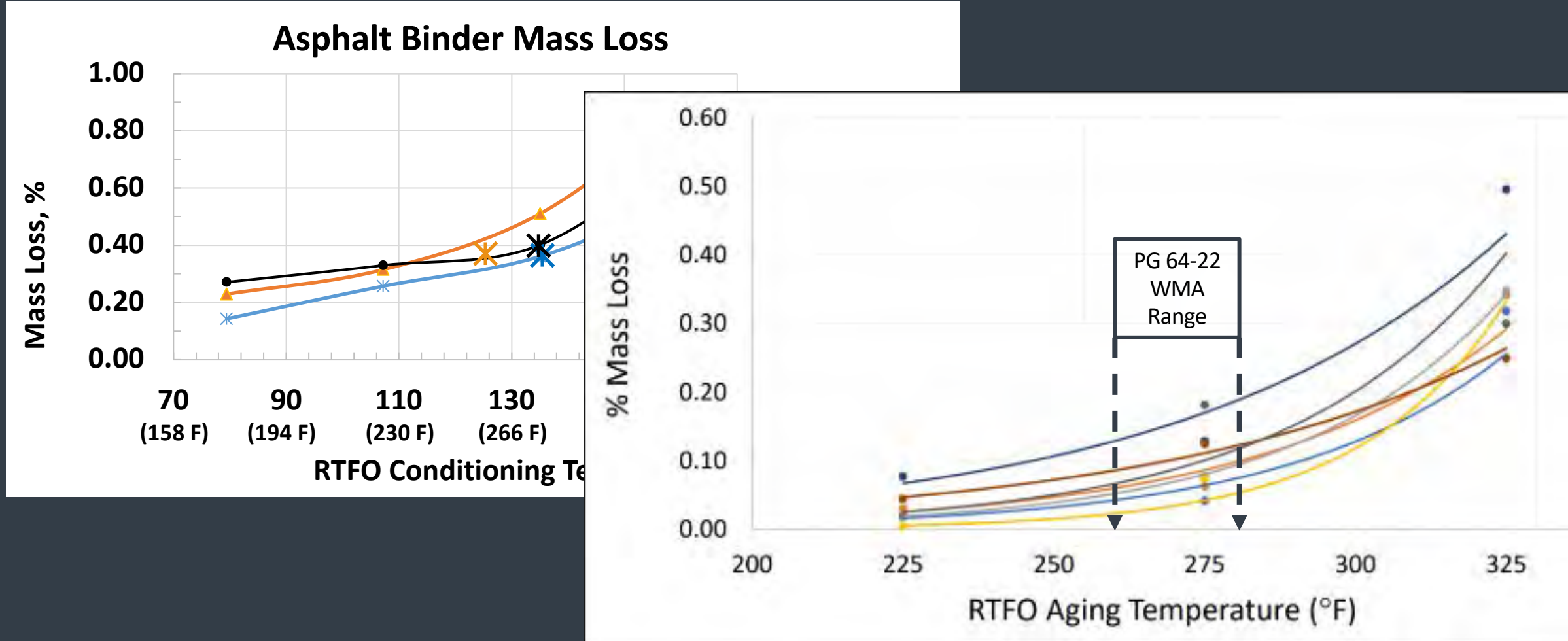
- Cheap Insurance
- Improved compaction
 - Density bonus
 - Reduce rollers
- Cold Weather Paving
 - Start earlier – pave longer
- Long Haul – Better Silo Storage
- Reduced Absorption – Lower AC Content
- Liquid Anti-Strip and Lime replacement
- Increased recycle usage – improved workability
- Decrease mix temperature
 - Reduced thermal segregation
 - Longer binder life
 - Reduced fuel consumption
 - Reduced emissions
 - BMD





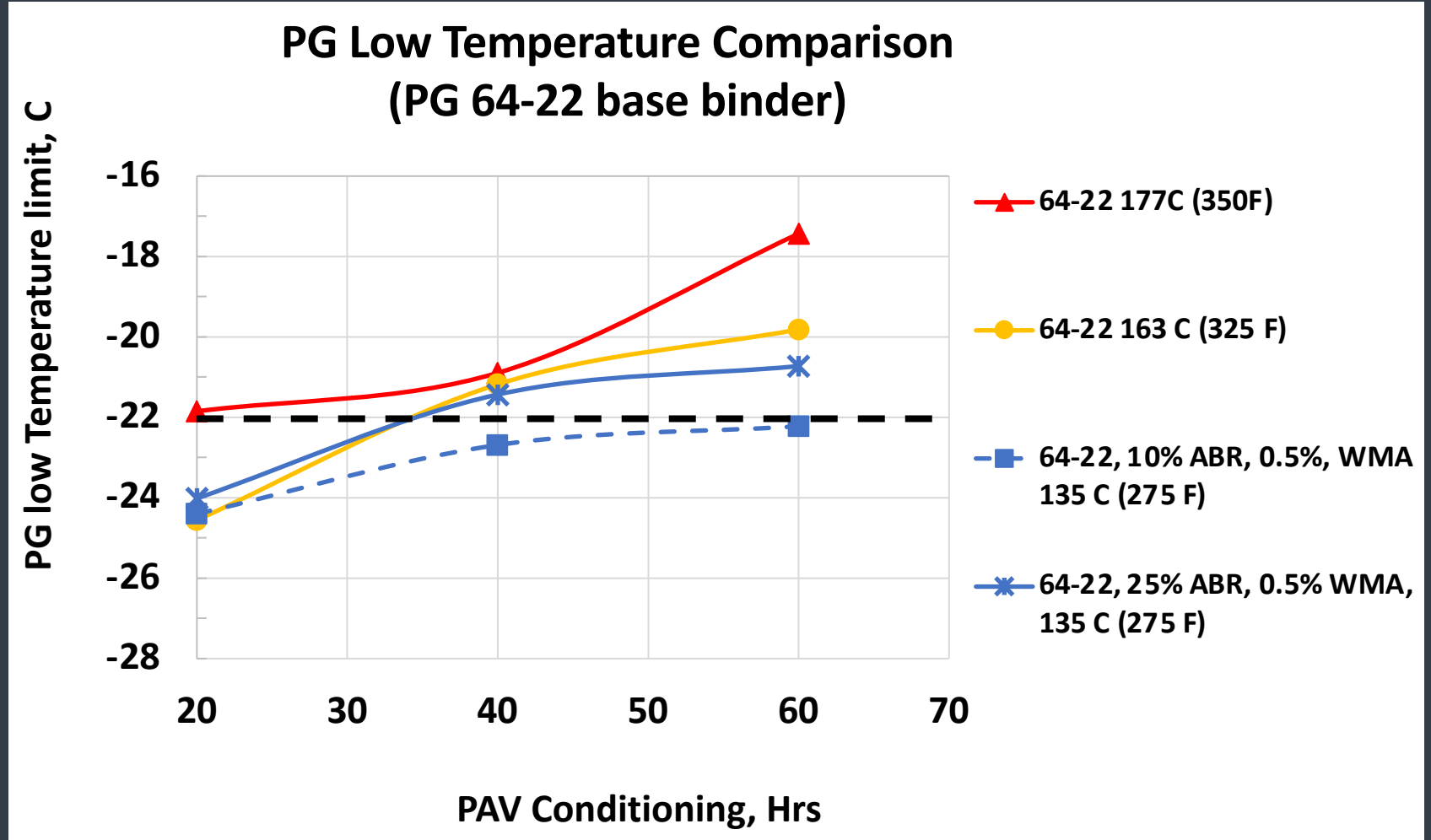
Benefits of Lower Production Temperatures

Binder Mass Loss vs RTFO Temperatures



PG Low Temp After Extended Aging

- 20 Hr PAV is common aging limit for PG specifications
- PG 64-22 RTFO 350F is out of spec after 20 Hr PAV
- Reducing RTFO 50F still meets spec after 60 Hrs

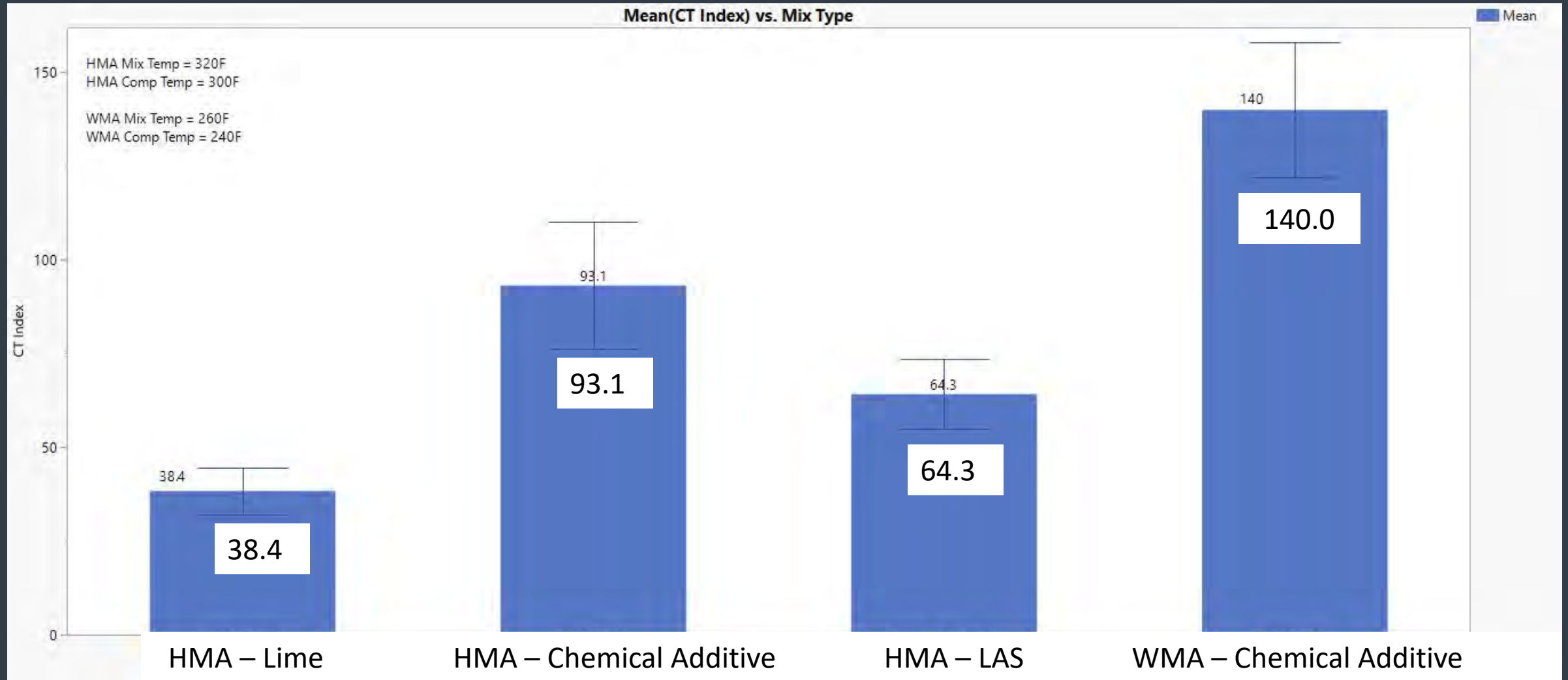


5yrs

10yrs

15yrs

IdealCT Results – SC

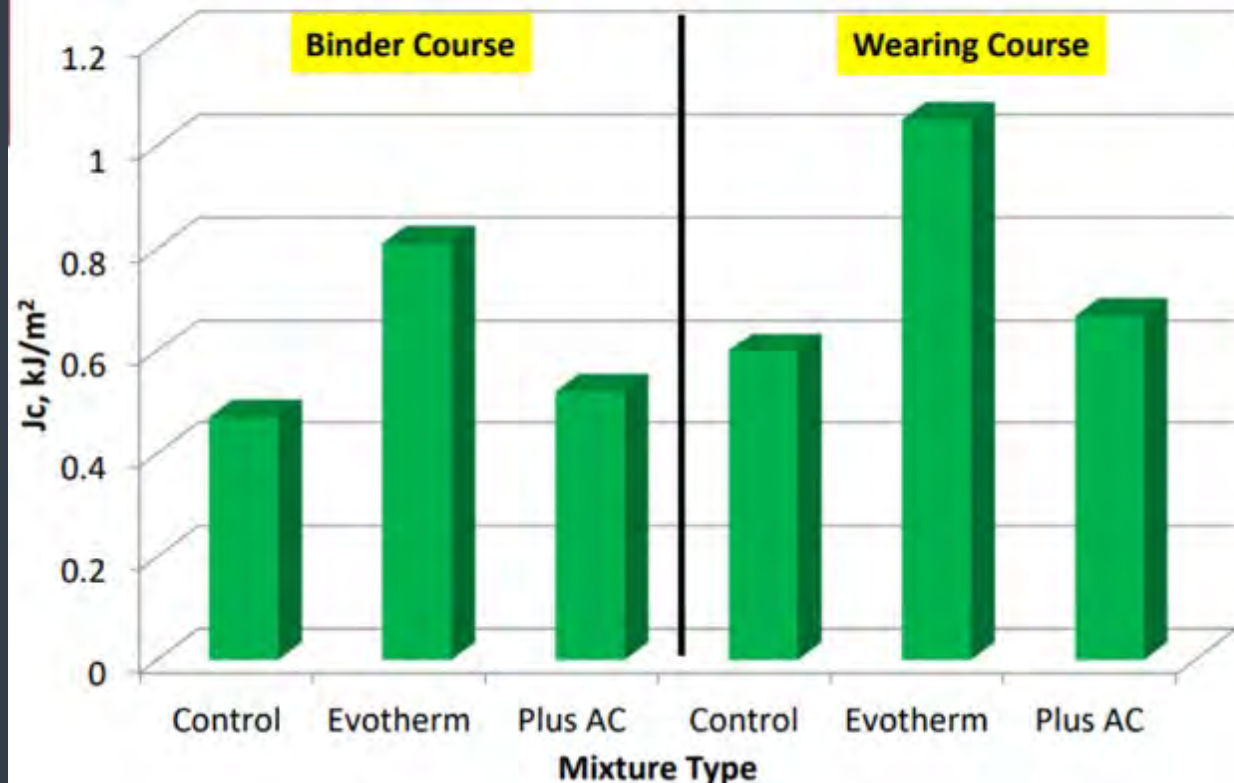


Field Data – Louisiana Field Density Study

Field Density – Cores

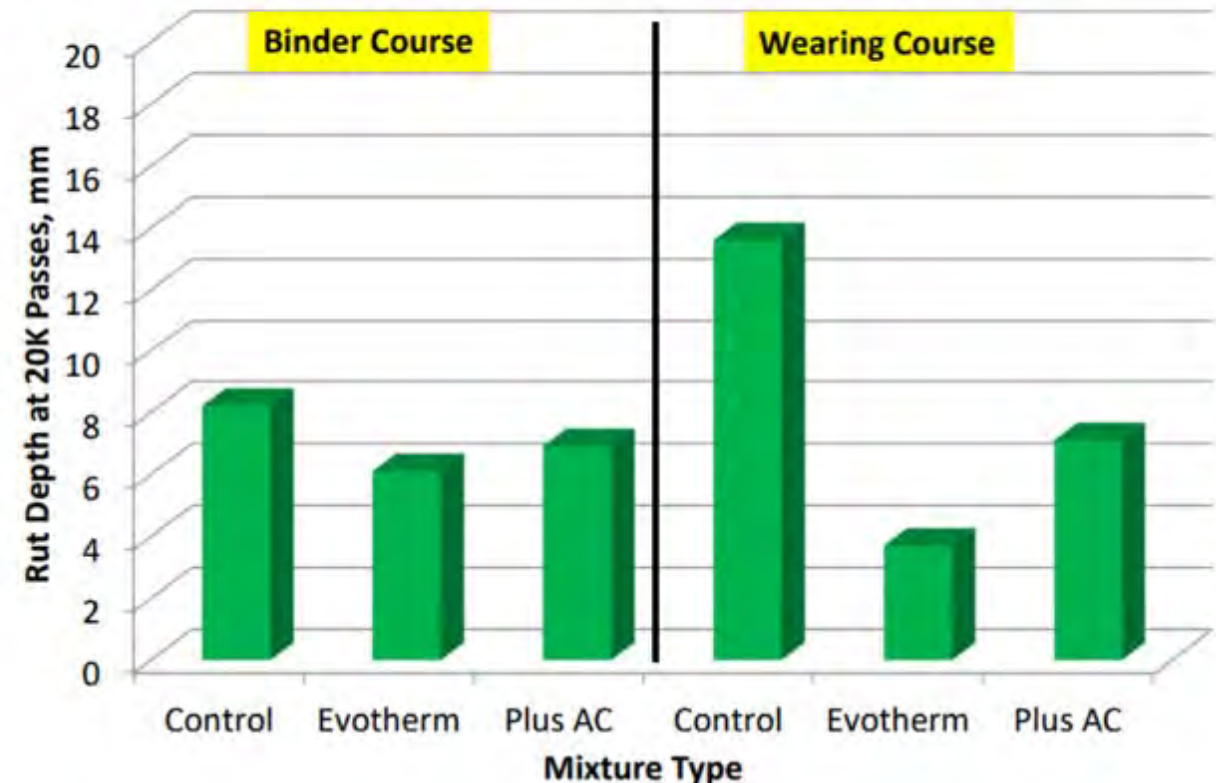
Semi-Circular Bend Test Results, 25°C

ASTM D8044 – Field Cores

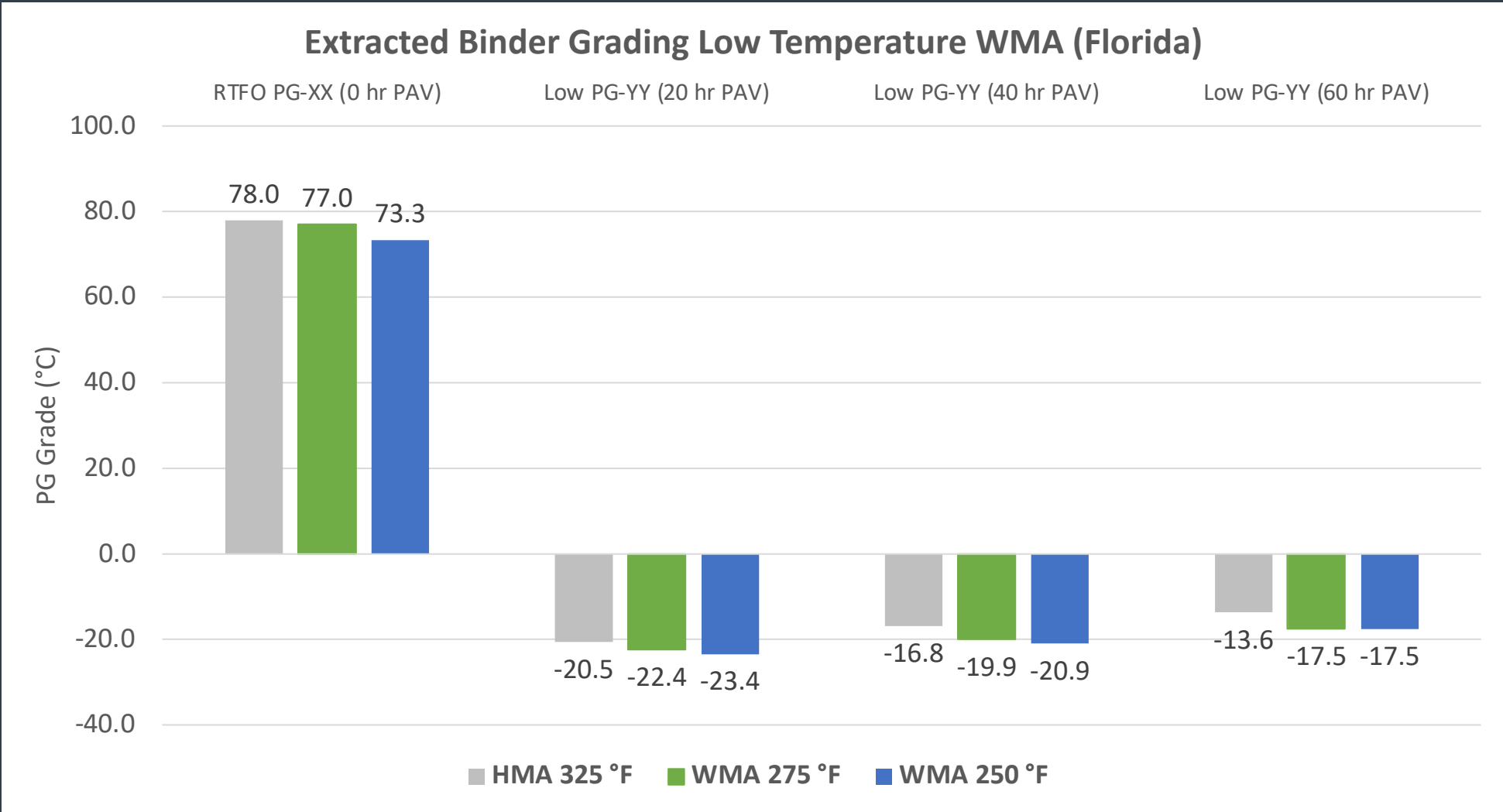


LWT Test Results, 50°C

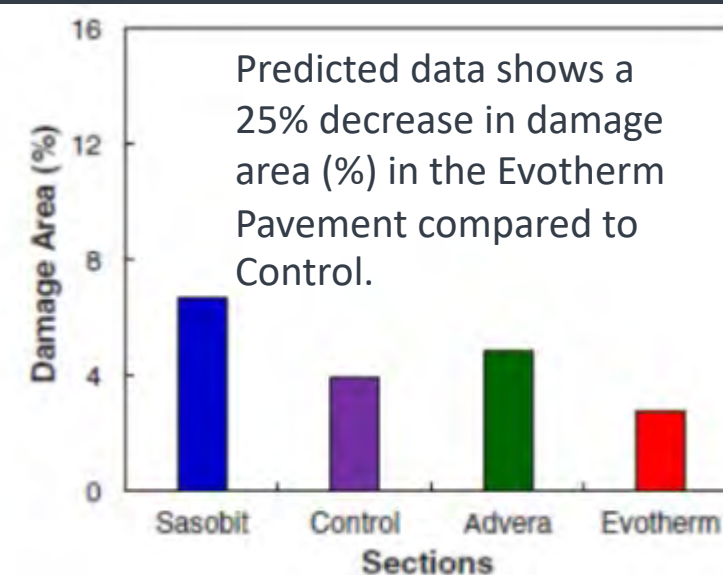
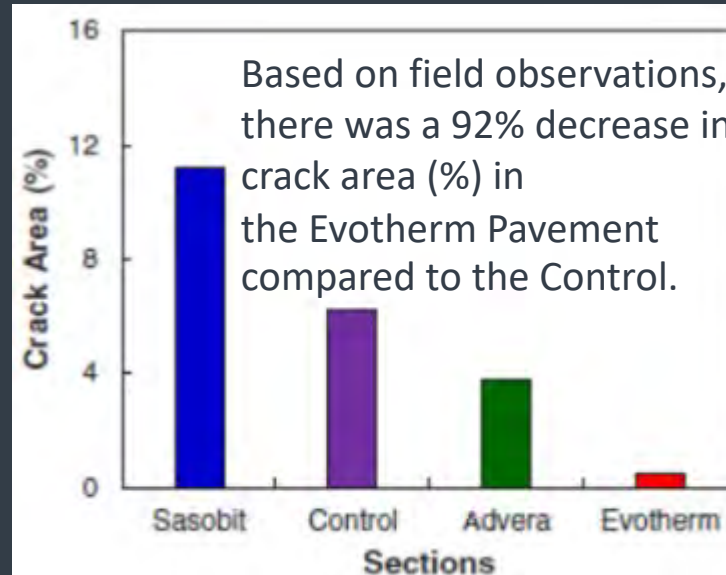
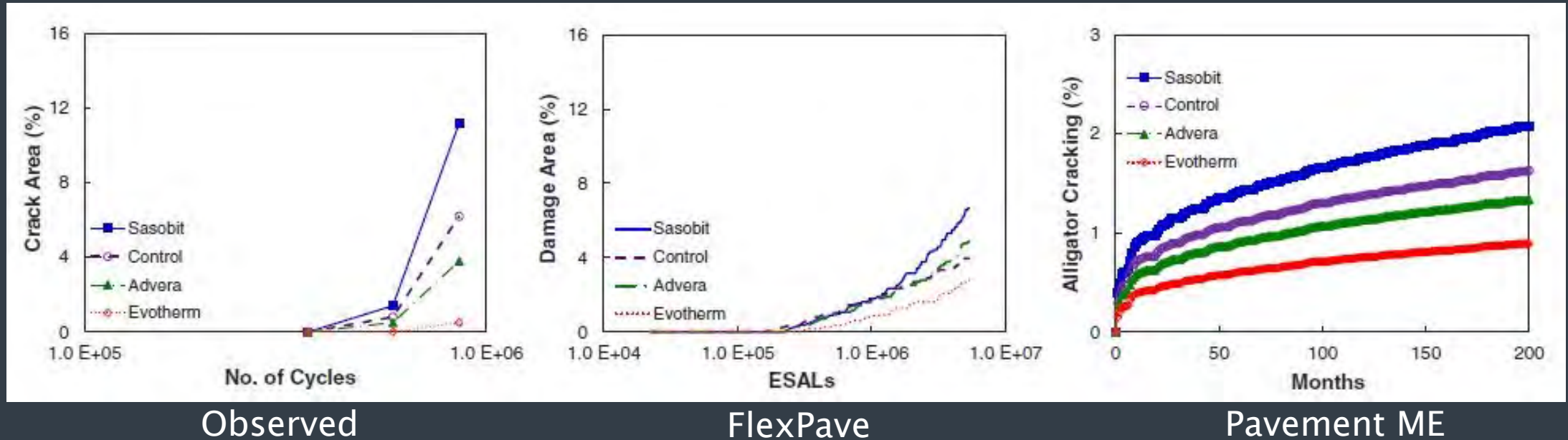
AASHTO T 324



Recovered Binder Data (Florida)



Observed vs Predicted WMA Field Performance



A yellow CAT roller is paving a road in a forest. The roller is moving from left to right, leaving a smooth, dark surface behind it. The road is bordered by a rocky embankment on the left and tall pine trees on the right. The sky is blue with scattered white clouds. A semi-transparent dark grey rectangle is overlaid on the upper left portion of the image, containing the title text. A small, solid green square is located in the top left corner of the image.

Meeting Industry Goals with Data

Our Industry Needs Leaders...



Improved Air Quality with WMA

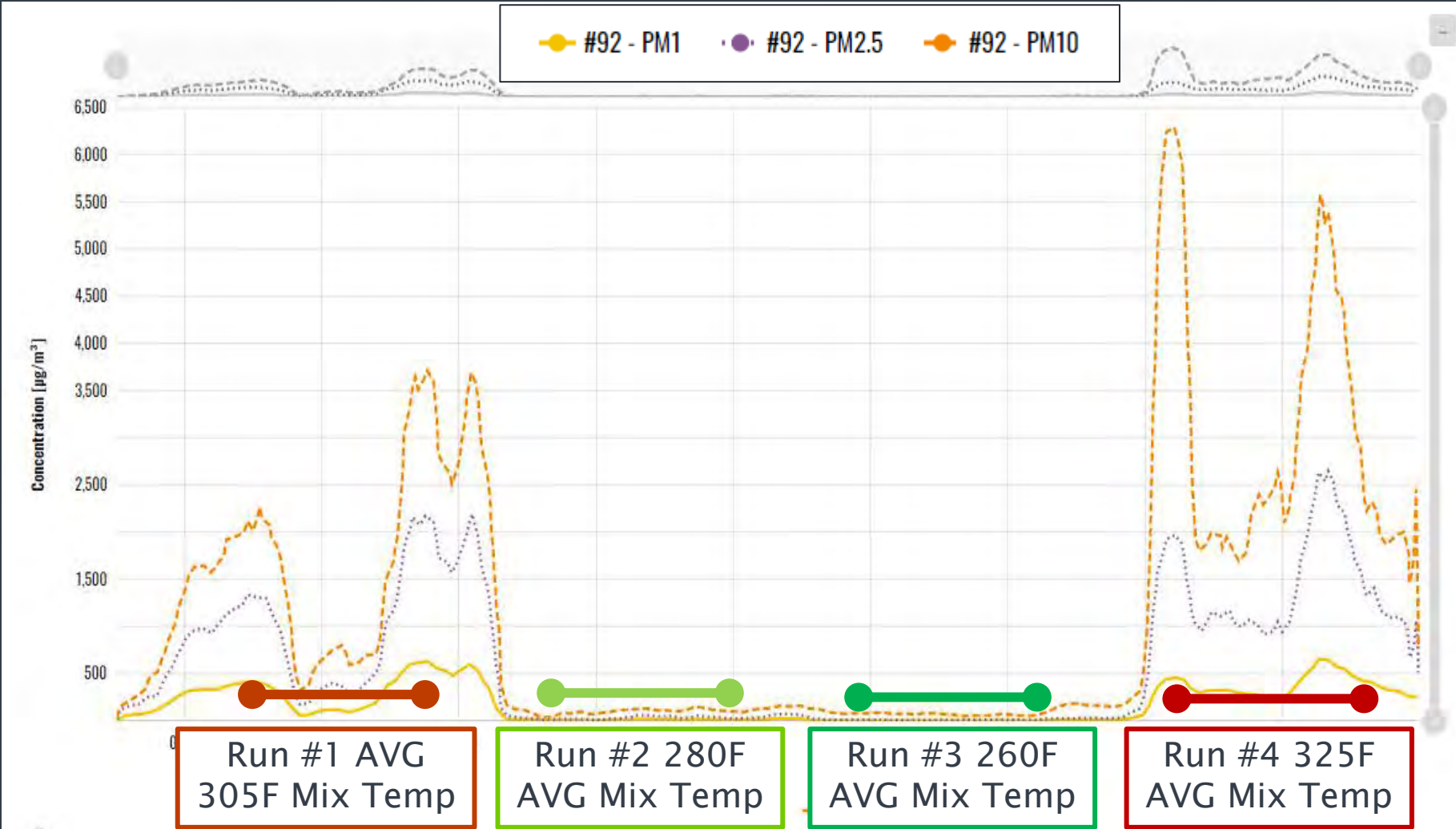
325° HMA



275° HMA



Quantifying Emissions Reductions with True WMA



**APT
Device**

Evotherm WMA Plant Fugitive Emissions Data

2022 Project details from Contractor (Utah)

- 360 Tons/hr run rate
- Gencor Counter Flow Drum
- 15% RAP Content

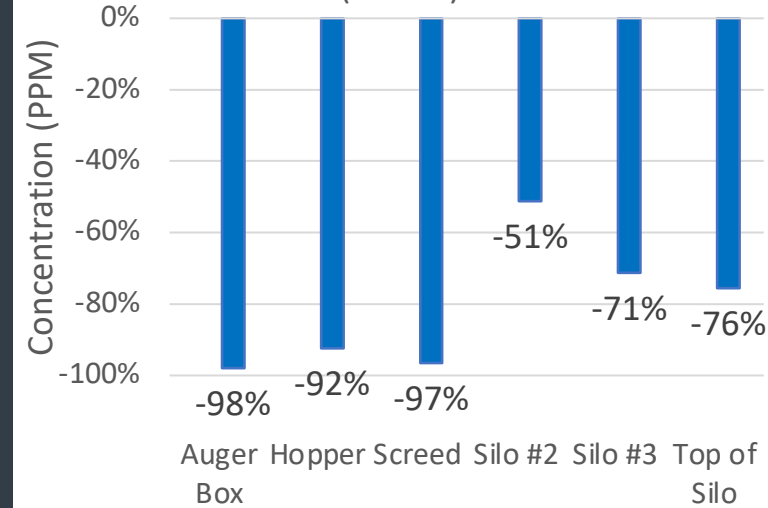
Project Details from Contractor (Florida)

- 200 Tons/hr run rate
- Astec Double Barrel Green
- 40% RAP Content

Project Details from Contractor (Virginia)

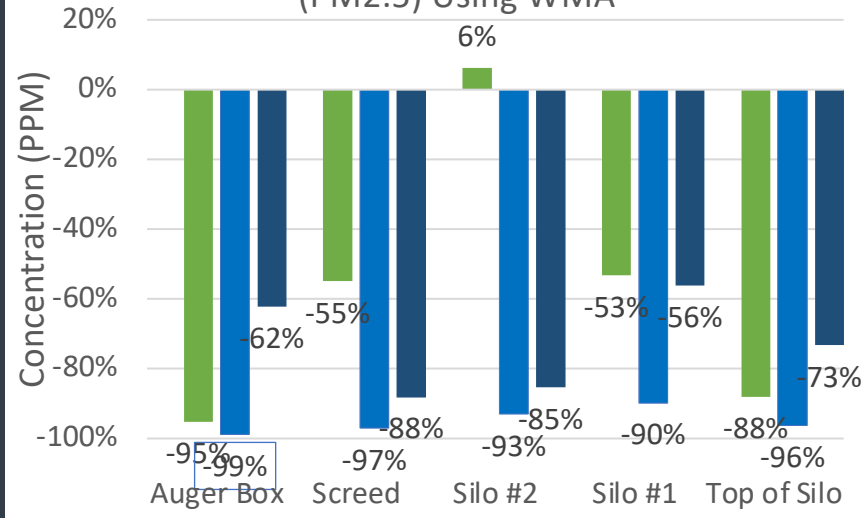
- 290 Tons/hr run rate
- Astec Double Barrel Green
- 30% RAP Content

Percent Reduction in Fugitive Emissions (PM2.5)



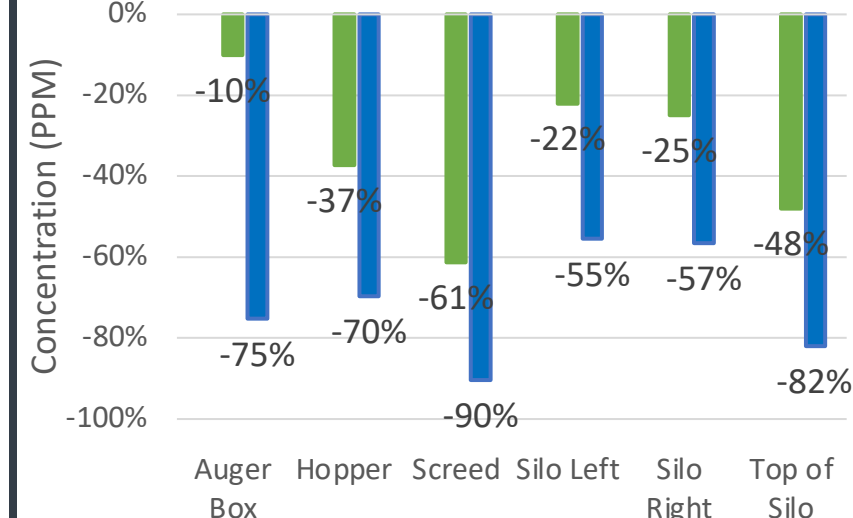
315°F -> **260°F**

Percent Reduction in Fugitive Emissions (PM2.5) Using WMA



325°F -> **275°F** -> **265°F** -> **250°F**

Percent Reduction in Fugitive Emissions (PM2.5) Using WMA



310°F -> **285°F** -> **260°F**

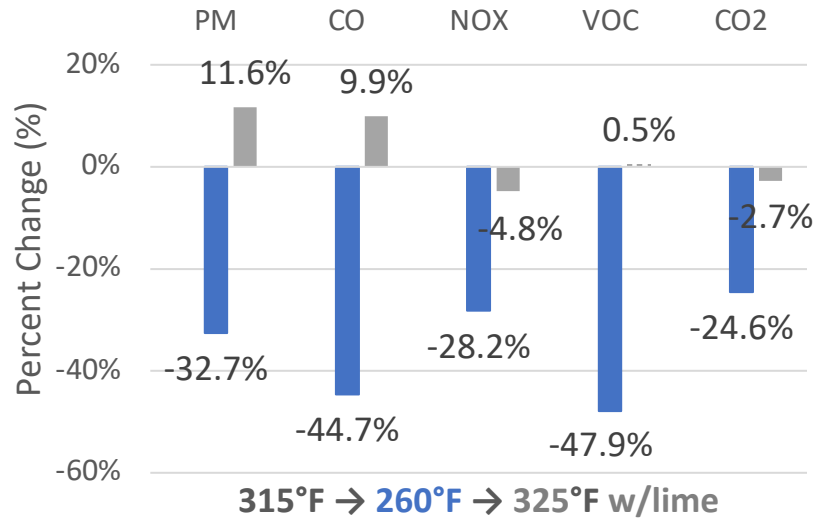


Evotherm WMA Plant Stack Emissions Data

Input Data from Contractor (Utah)

- 360 Tons/hr run rate
- Gencor Counter Flow Drum
- 15% RAP Content

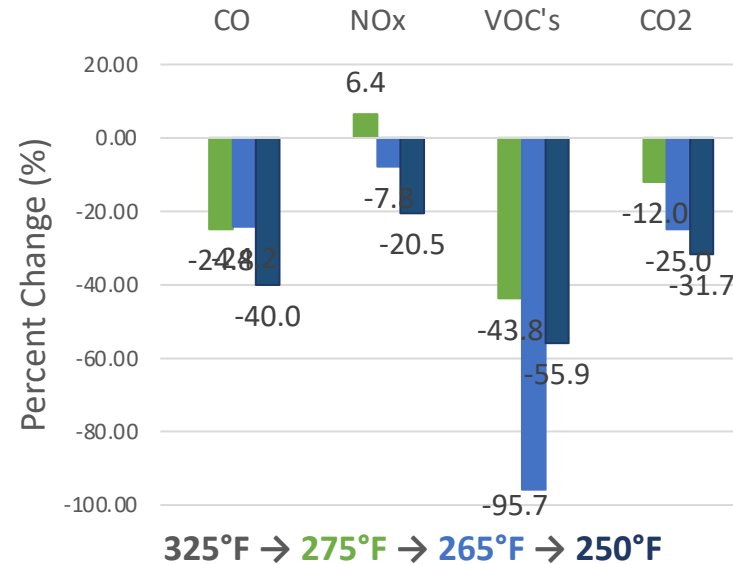
Stack Emissions (Utah)



Input Data from Contractor (Florida)

- 200 Tons/hr run rate
- Astec Double Barrel Green
- 40% RAP Content

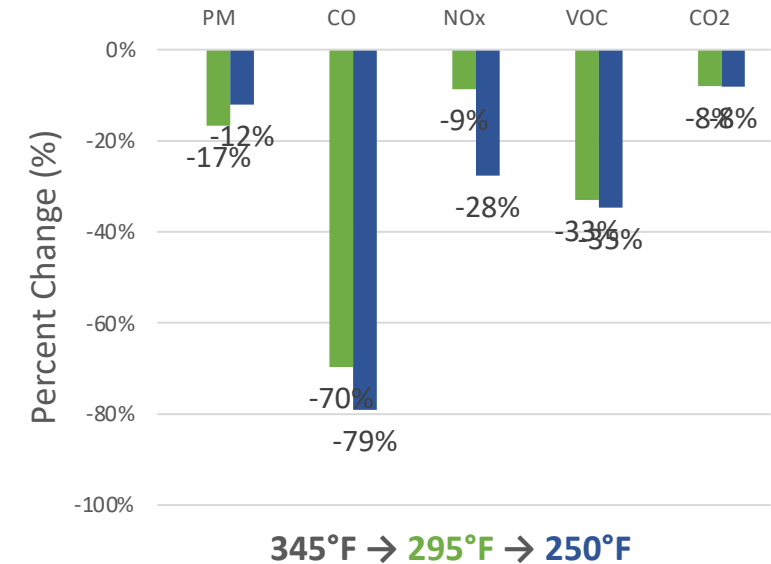
Stack Emissions (Florida)



Input Data from Contractor (Ohio)

- 240 Tons/hr run rate
- Astec Double Barrel
- 20% RAP Content

Stack Emissions (Ohio)





Blue Smoke Mitigation:

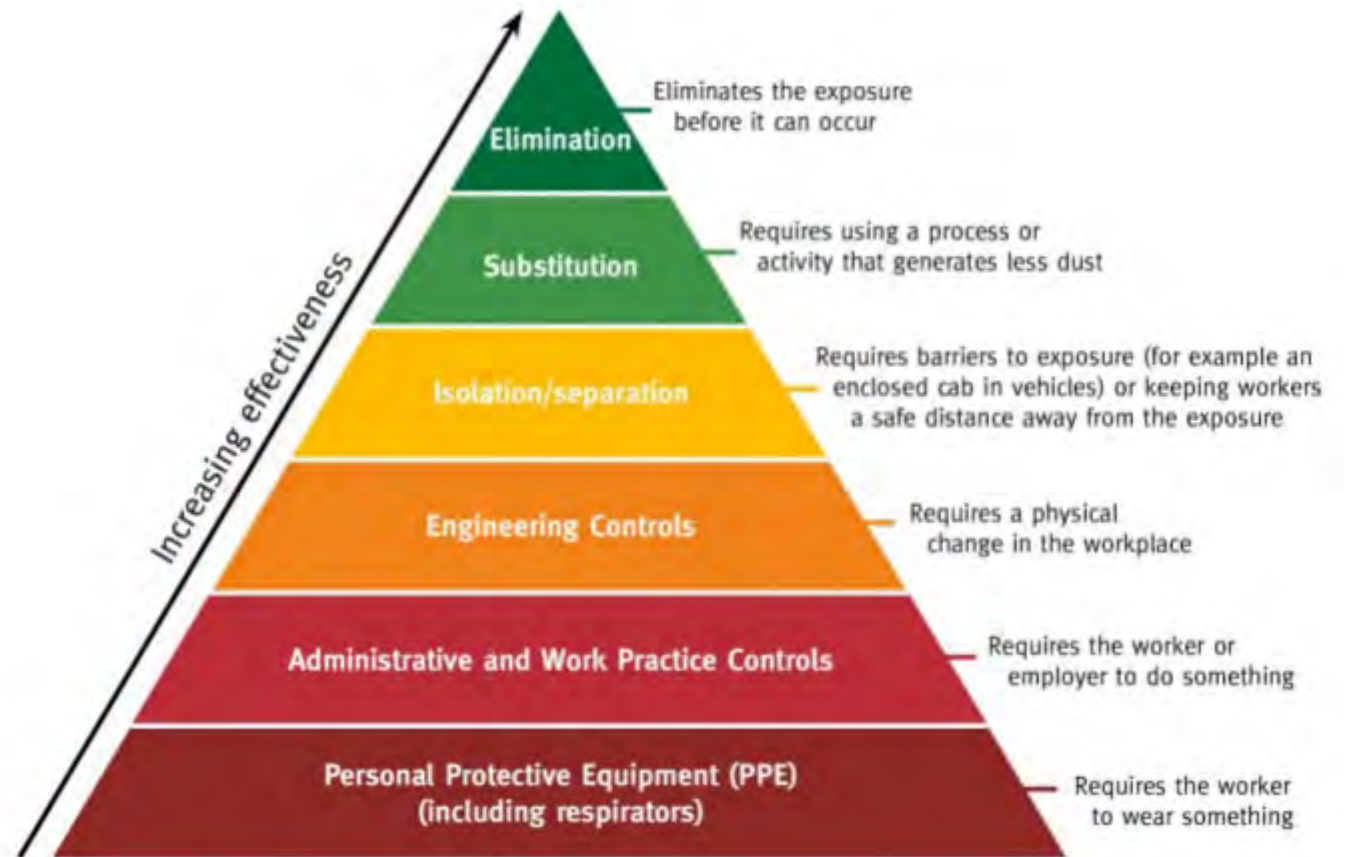
Costs:

Blue Smoke Recovery Systems: \$750,000-\$2M for the system per mix plant and approximately \$30 - \$50K/year in parts, labor and energy costs.

Evotherm at Low Temps:

Approx. \$1.00-\$1.25 per mix ton (before value of fuel savings and other economic benefits)

Hazard Mitigation



OSHA Hazard Mitigation "Hierarchy of Control"

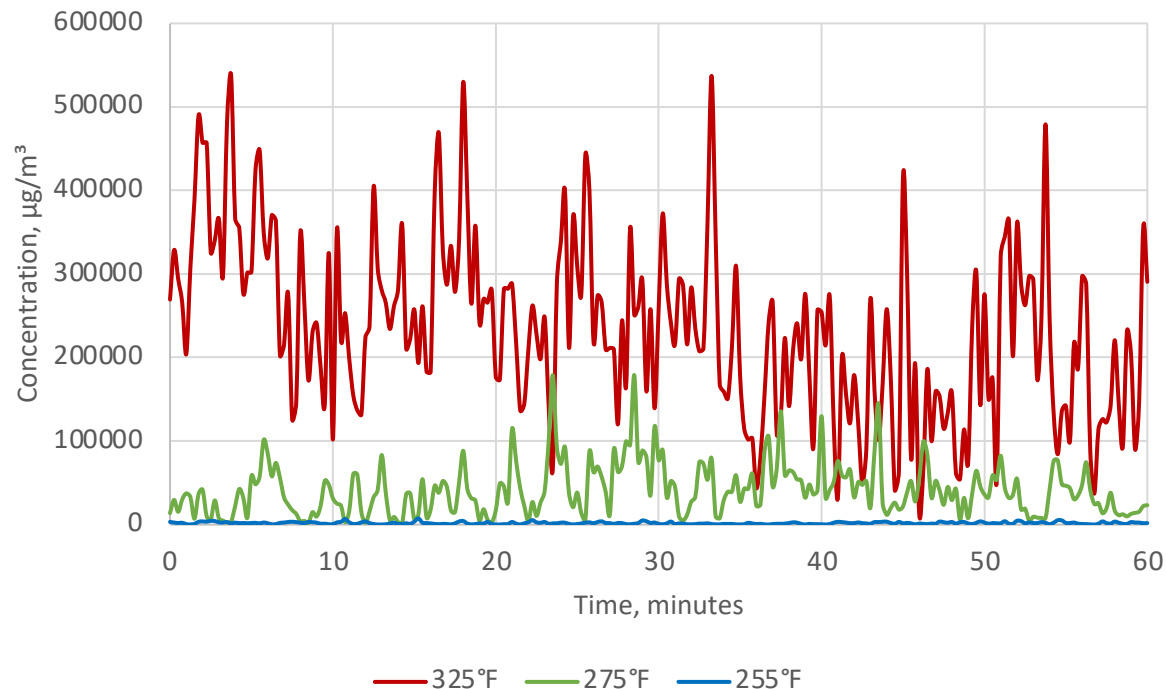
Evotherm WMA Plant Fugitive Emissions Data 2022

Project details from Contractor (New York)

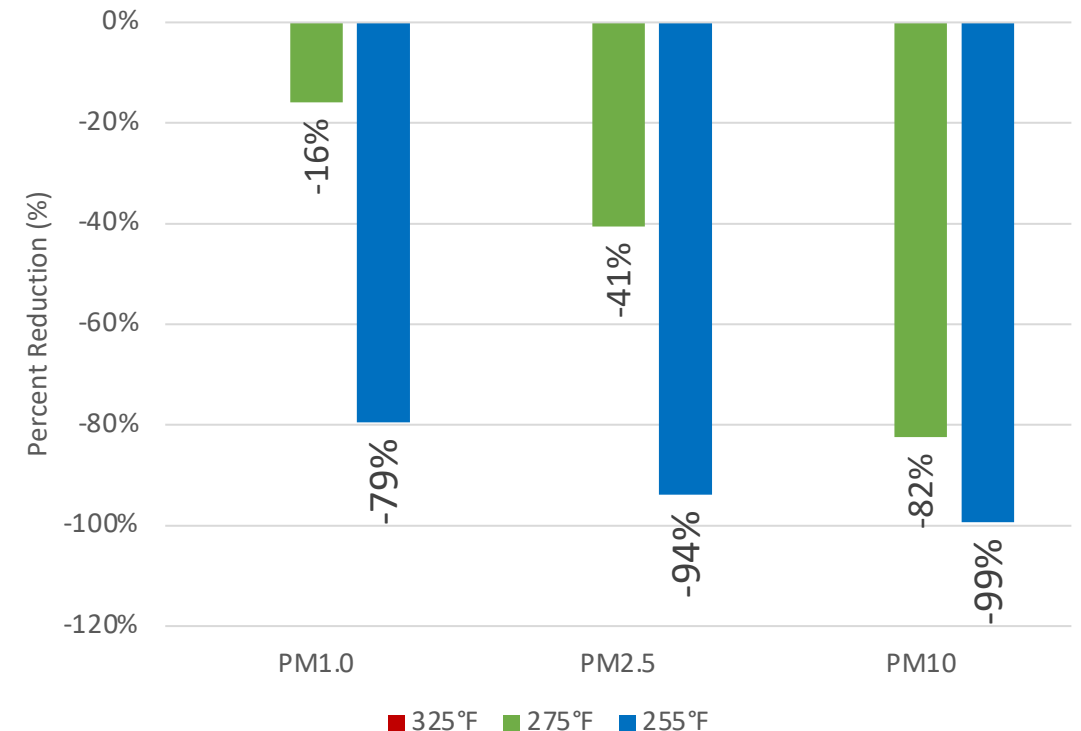
- 225 Tons/hr run rate
- Astec Double Barrel
- 20% RAP Content



Comparison of HMA and WMA Particulate Matter (PM10) Emissions for 1-Hour Run at Top of Silo



Percent Reduction Fugitive Emissions from HMA - Top of Silo



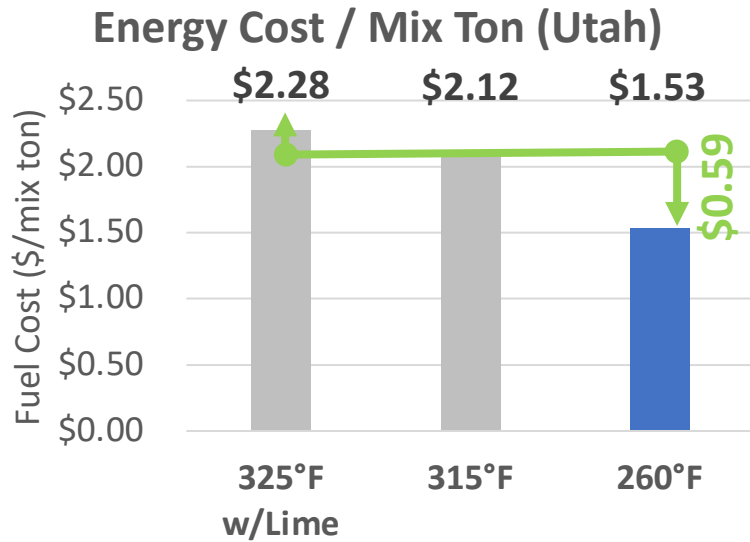
Evotherm WMA Plant Fuel Consumption Data

Note: Natural gas fuel \$9.00/MMBtu assumption

2022

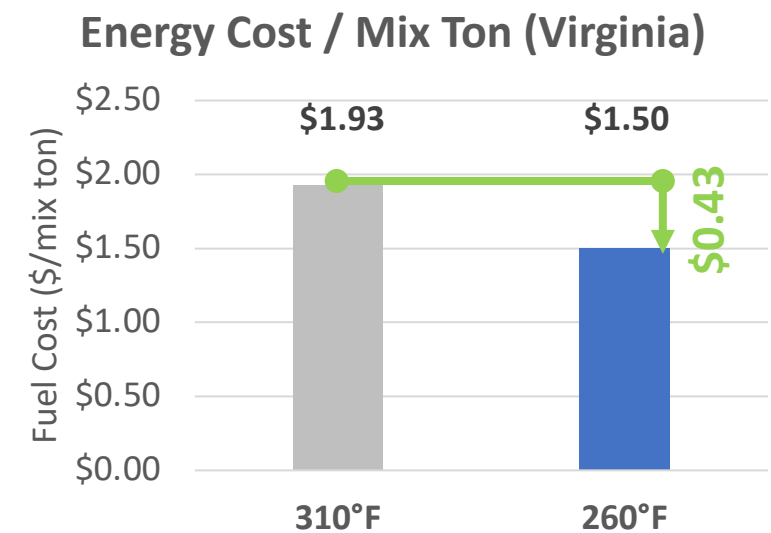
Utah Contractor

- 360 Tons/hr
- Gencor Counter Flow
- 15% RAP
- 250k Mix Tons/yr
- **\$147.5k Savings (single plant)** running at 260°F



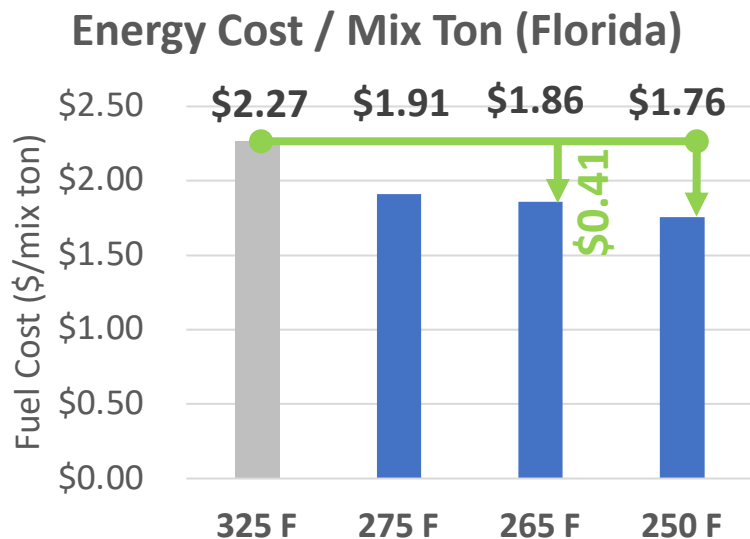
Virginia Contractor

- 290 Tons/hr
- Astec Double Barrel
- 30% RAP Content
- 250k Mix Tons/yr
- **\$107.5k Savings (single plant)** running at 260°F



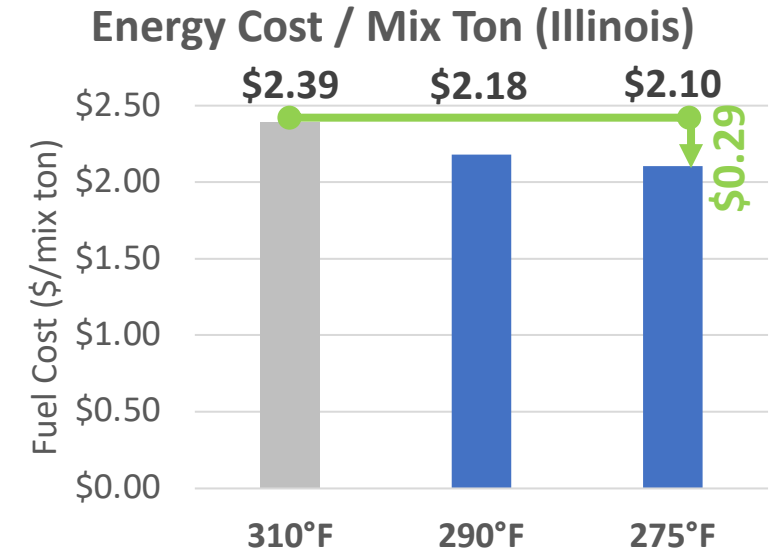
Florida Contractor

- 200 Tons/hr
- Astec Double Barrel
- 40% RAP
- 150k Mix Tons/yr
- **\$61.5k Savings (single plant)** running at 265°F



Illinois Contractor

- 300 Tons/hr
- Gencor Counter Flow
- 40% RAP Content
- 350k Mix Tons/yr
- **\$101.5k Savings (single plant)** running at 275°F





What's the Path Forward

Ingevity EPDs for Chemical WMA Additives

Environmental Product Declaration

Ingevity

Warm Mix Asphalt Additive, Warm Mix Asphalt Chemical Additive, Warm Mix Asphalt Chemical Package, Liquid Anti-Strip, Compaction Aid

Product

Evotherm P25

Self-declared core EPD based on the EN15804:2012 + A2

Issue Date 7/11/2022
Valid until 7/10/2027
Collection period 2021

Company

Ingevity Corporation
5255 Virginia Avenue
North Charleston, SC 29406 U.S.A.
www.ingevity.com
+1 800-458-4034

DEMONSTRATION OF VERIFICATION

EN15804:2012+A2 serves as core PCR
Third party verification of the declaration, according to ISO 14025

- ☒ Internal Third party verifier
- ☒ External The Right Environmental Ltd.

Environmental Product Declaration

Ingevity

Warm Mix Asphalt Additive, Warm Mix Asphalt Chemical Additive, Warm Mix Asphalt Chemical Package, Liquid Anti-Strip, Compaction Aid

Product

Evotherm M1

Self-declared core EPD based on the EN15804:2012 + A2

Issue Date 12/2/2021
Valid until 12/1/2026
Collection period 2020

Company

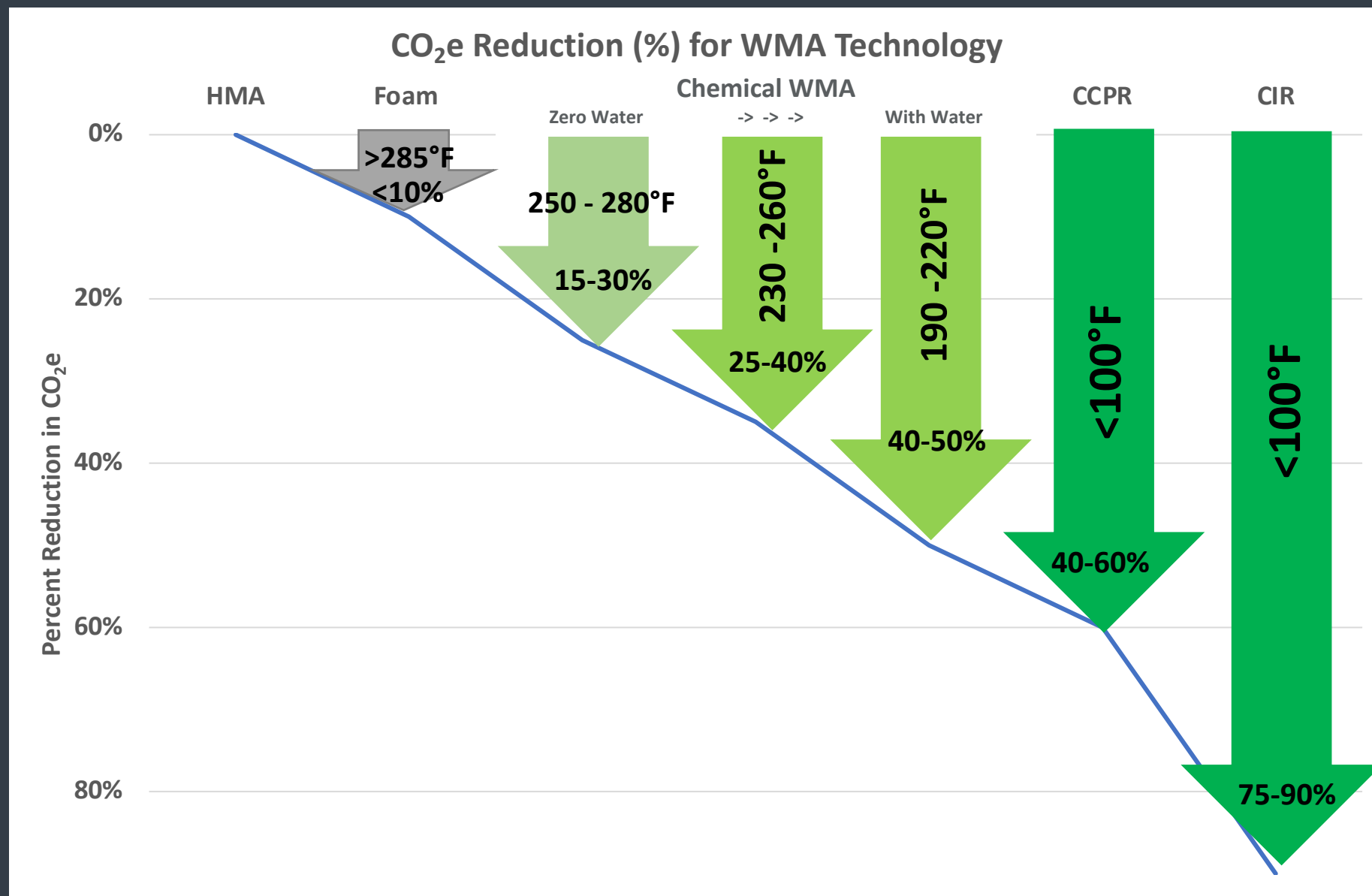
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CO2 Reduction – Path to Zero



Agency Options

Incentive Specifications

\$1 /ton Bonus < 290°
Production Temperature

\$2/ton Bonus < 270°
Production Temperature

WMA Temperature Specifications

Road Owner Specifies Max
Production Temperature

Line Item Pay

DOT pays for WMA as a
separate line item.

Similar model to asphalt
binder in SC or LAS in TN



True WMA Is Good For Our...

- People 
- Planet 
- Performance 
- Profitability 

Thank you!

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