



# Warm Mix Asphalt

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## The Future of Flexible Pavements

Caltrans  
Warm Mix Asphalt  
Demonstration  
San Luis Obispo  
May 7, 2008

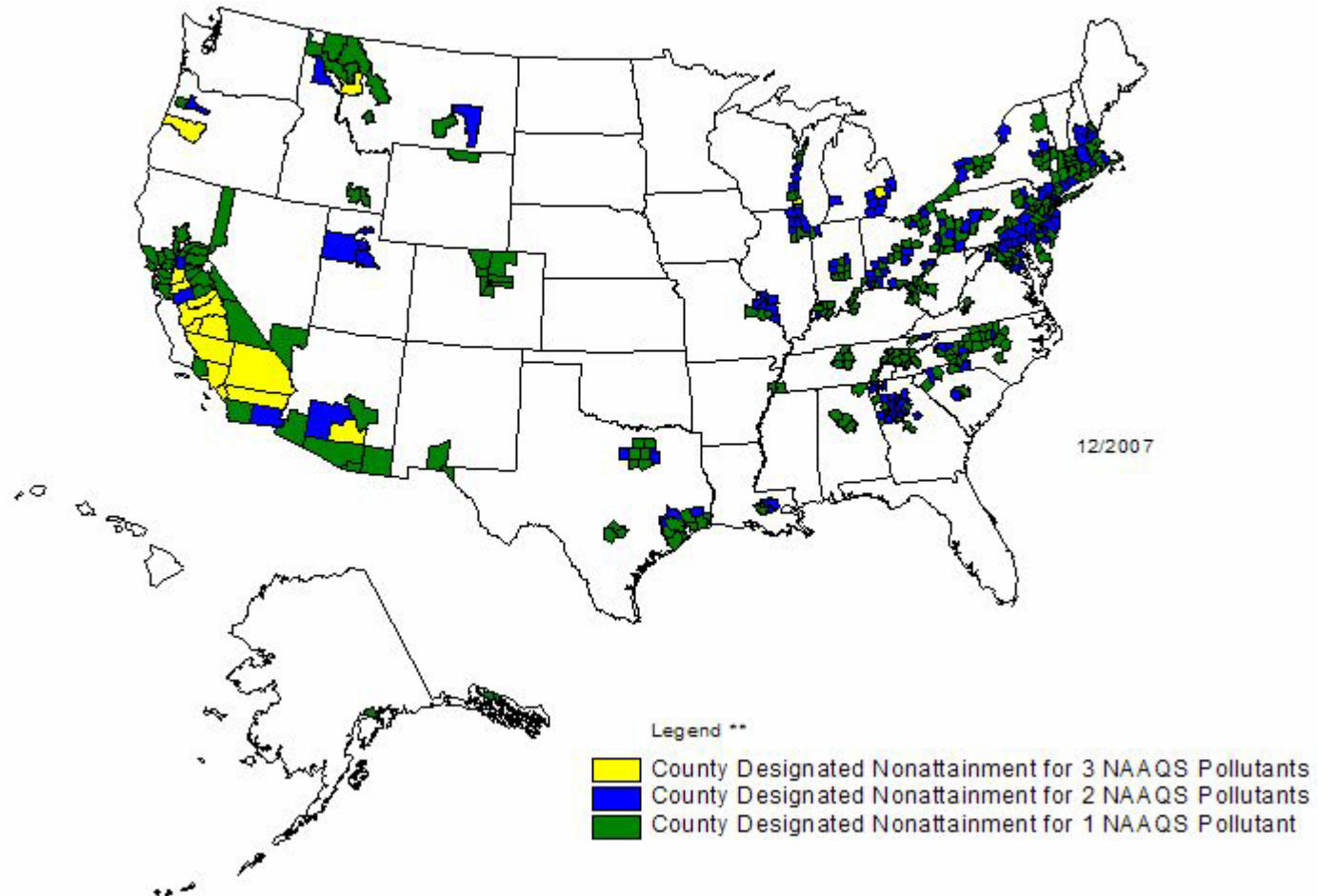
# General Trends

- Regulations
- Activism
- Higher Production Temperatures
- Increasing Energy Costs

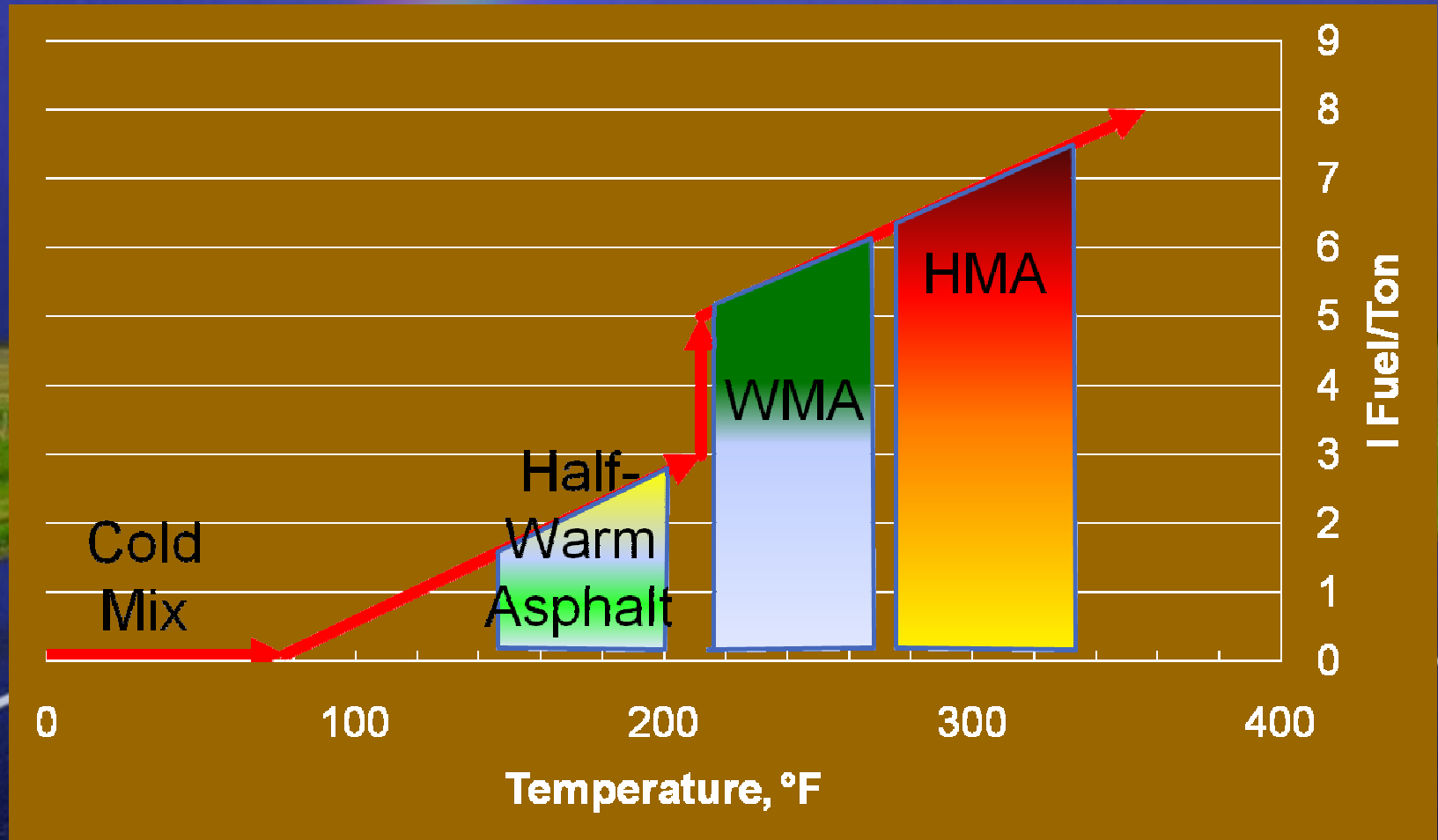
# Current Non-Attainment Areas

## Counties Designated "Nonattainment"

for Clean Air Act's National Ambient Air Quality Standards (NAAQS) \*



# Warm Mix Classifications



# Brief History

- 1997 German Bitumen Forum
- 2000 Second Euroasphalt & Eurobitume Congress (Barcelona)
- NAPA 2002 European Scan Tour
  - Germany and Norway
- NAPA 2003-2008 Annual Meetings
- World of Asphalt 2004
- 2005-2007 – Numerous U.S. Field Trials
- 2007 – FHWA/AASHTO Scan Tour



# Advantages of Lower Temperatures

- Lower fumes and emissions (~30-90%)
- Lower energy consumption (~30%)
- Lower plant wear
- Decreased binder aging
- Early site opening
- Cool weather paving
- Compaction aid for stiff mixes
- Cooler working conditions
- Edge of mat is more vertical, making a better joint
- Eliminates bump at joint when overlaying concrete
- Eliminates the need for fume evacuation equipment on plant and paver

# Warm Mix Asphalt Technical Working Group

- Members: FHWA, NAPA, SAPA, AASHTO, State DOTs, NCAT, Contractors, Labor, NIOSH
- Mission: Evaluate and validate WMA and share information
- Purpose: Guidance for research and implementation of WMA

# NAPA Warm Mix Asphalt Task Force

- Leadership and Communication for
  - Research
  - Development
  - Deployment
- Goals
  - Forum
  - TWG Input and Feedback
  - Identify Technical Gaps
  - Review Educational and Technical Materials



# Technology Providers

## – Foaming Methods

- Advera - PQ
- Aspha-min - Hubbard
- Astec Double-Barrel Green
- Low Emissions Asphalt - McConnaughay
- Terex
- WAM Foam - BP

## – Chemical Modifiers

- Evotherm - MeadWestvaco
- Rediset – Akzo-Nobel
- Revix – Mathy-Ergon
- Sasobit - Sasol

# Applications

- Dense-graded mixes
  - Majority of projects
  - RAP – Wisconsin and Missouri
- SMA
  - Maryland – Washington Beltway
- Open-graded mixes
  - Florida
  - China
- Asphalt-Rubber
  - California

# Chattanooga - Loadout

Astec Double Barrel Green  
Control WMA  
Temp = 320°F Temp = 270°F



# Yellowstone Paving

Control  
Temp = 320°F



Warm Mix  
Temp = 245°F

# Production and Paving Notes

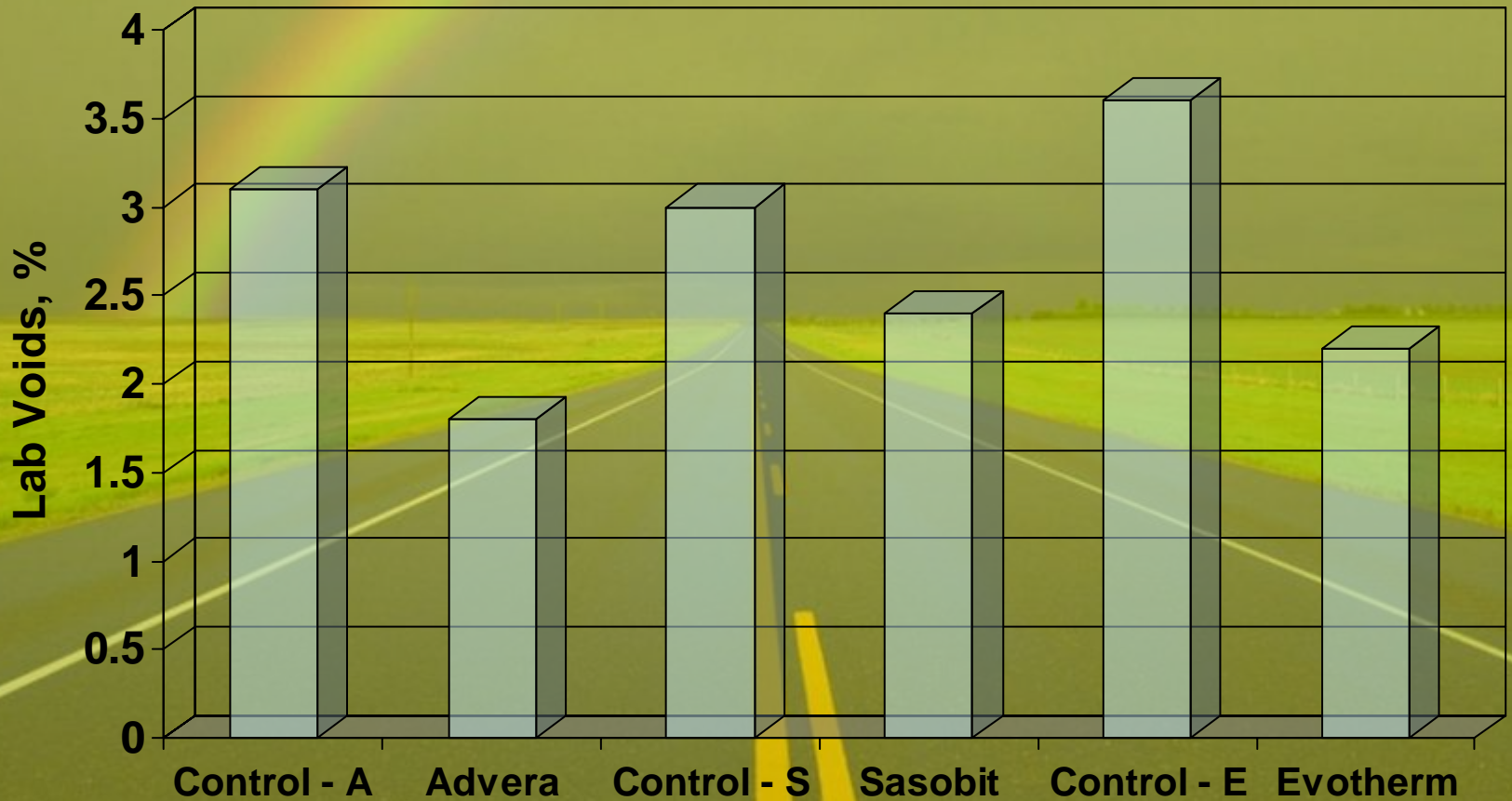
- Work to minimize aggregate moisture.
- Make sure the burner is tuned for the temperature.
- Keep baghouse temperature above condensation point.
- Consider superheating aggregate ahead of RAP.
- Follow normal placement practices.

# CDOT WMA Project I-70

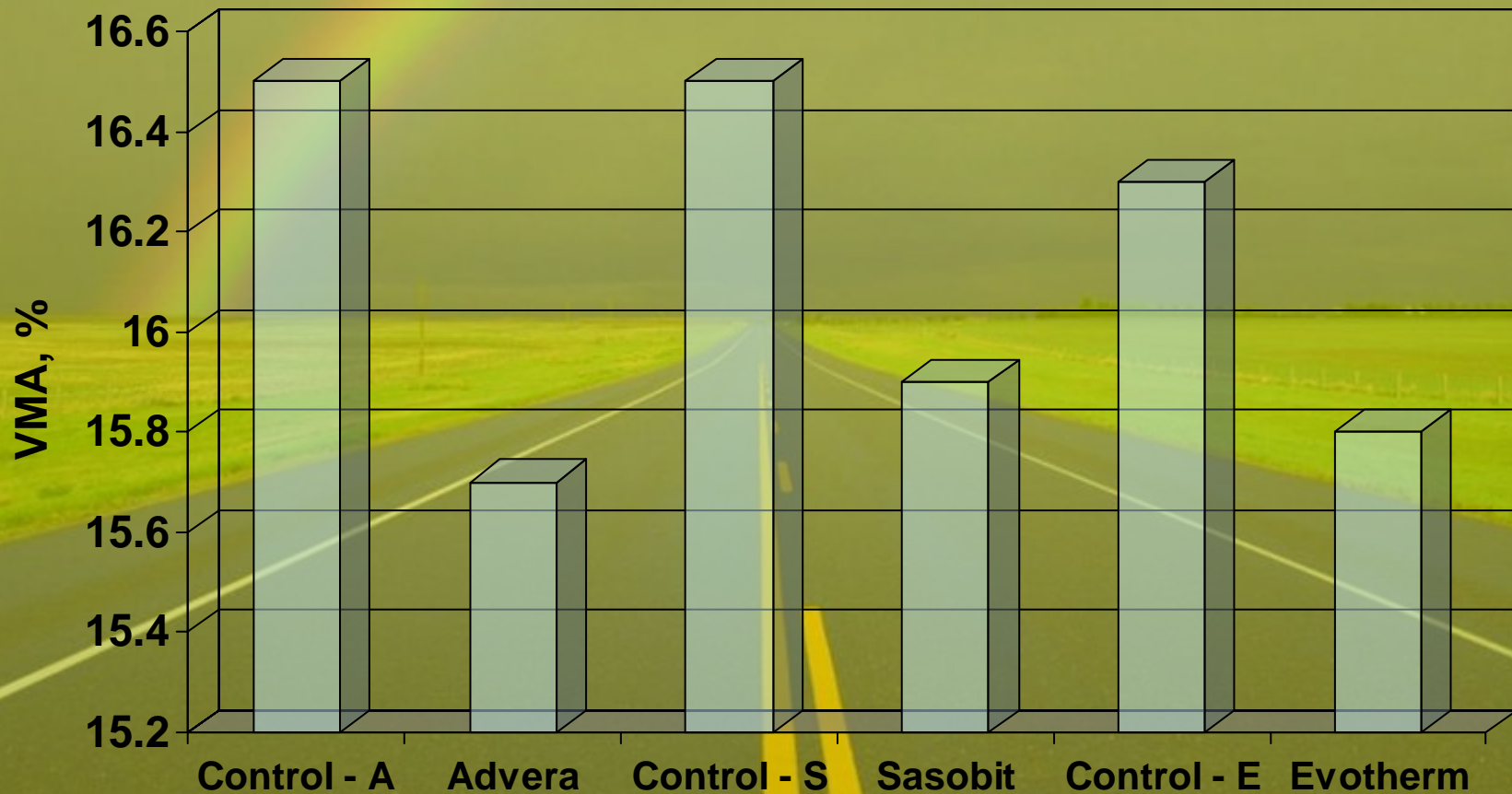


## Performance

# Performance Colorado I-70

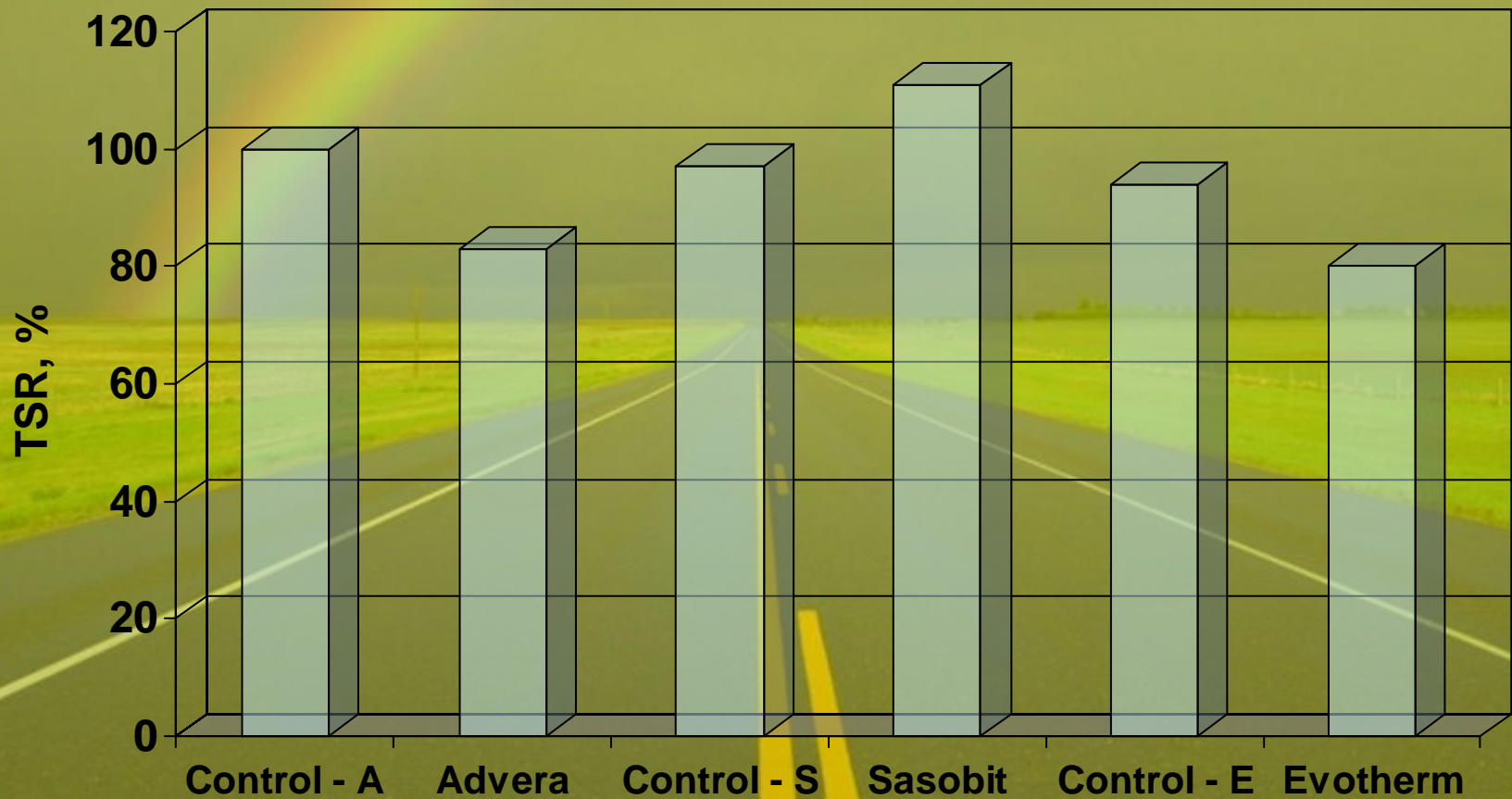


# Performance Colorado I-70

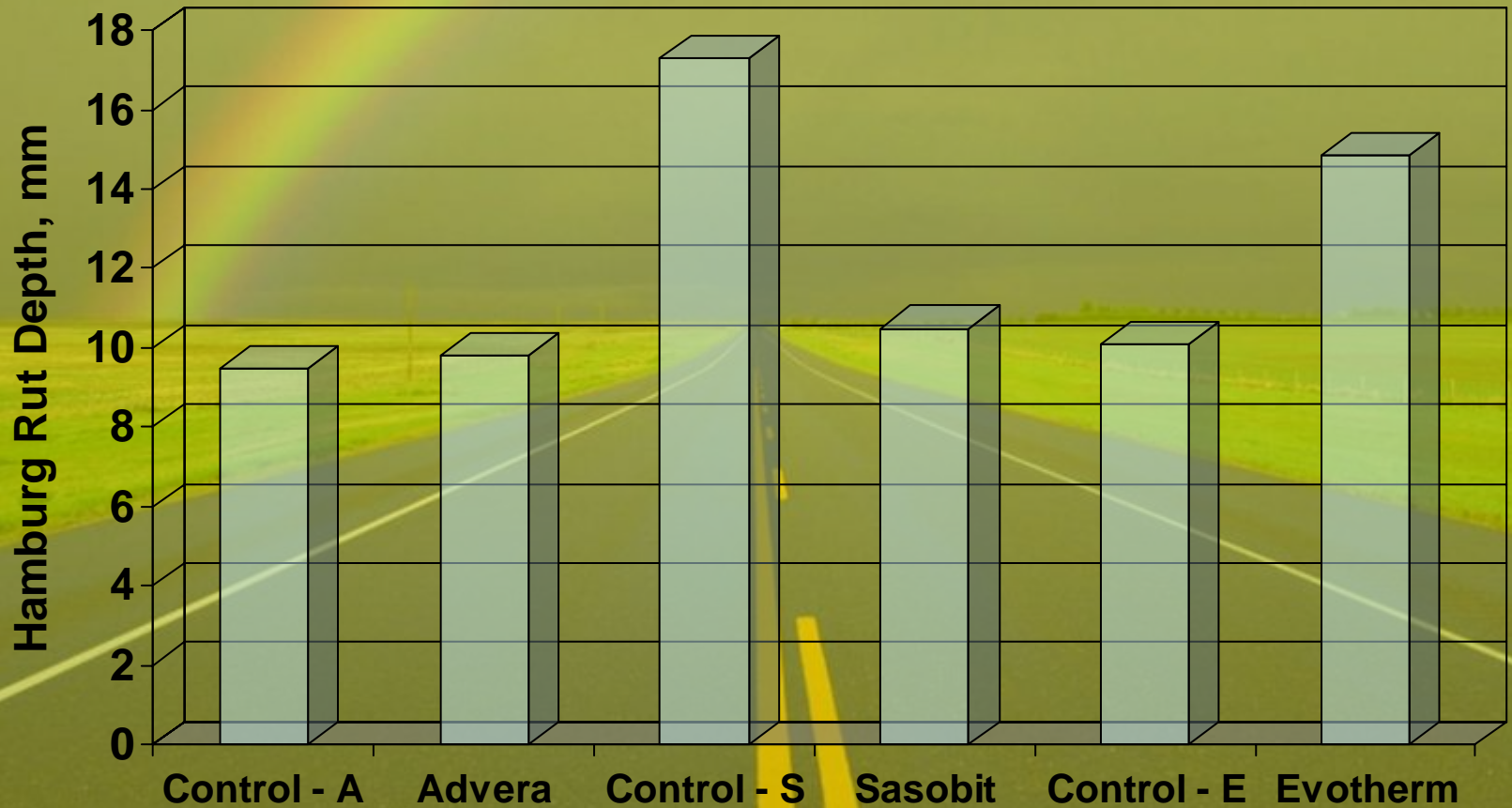




# Performance Colorado I-70



# Performance Colorado I-70



# LEA Field Density

Mix	Avg. Gmb	Avg. %Gmm	SD
HMA control – Rt. 96B	2.278	94.1	1.43
LEA control – Rt. 96B	2.298	95.6	0.51

# Reduced Emissions

Data provided by suppliers.

- Aspha-min – North Carolina – 265°F
  - 17.6% decrease in SO<sub>2</sub>
  - 3.2% decrease in CO<sub>2</sub>
  - 35.3% decrease in total hydrocarbons
  - 6.1% decrease in NO<sub>x</sub>
- Evotherm – Canada – 140°F
  - 45.8% decrease in CO<sub>2</sub>
  - 63.1% decrease in CO
  - 41.2% decrease in SO<sub>2</sub>
  - 58% decrease in NO<sub>x</sub>
- Direct comparisons are discouraged – different plants, different weather, different temperatures

# Why we need Warm Mix

- Better air quality
- Better energy efficiency
- Better performance
- Better compaction
- Better working conditions

# Conclusions

- Warm Mix is the Future of Asphalt Mixtures.
- Technology providers coming forward.
- Industry and agencies must work together to make it happen.
- Advantages outweigh concerns.
- Will add to versatility of the material.