Asphalt Rubber Thin Overlays

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Outline of Presentation

- Why Asphalt Rubber- (AR)
- AR Properties
- History of AR HMA
- AR Mix Types
- AR Mix Applications
- AR Warm Mix
- Summary

Why Asphalt Rubber?

Rubber contains polymers which…

- **Raises softening point** to above 140º F.
  - Resistance to rutting and shoving
  - Resistance to asphalt migration and drain-down
- **Increases low temperature flexibility** of residue.
  - Resistance to cracking
- **Increases high temperature viscosity**.
  - Thicker film coatings on aggregate particles
  - Higher asphalt content mixes / applications
  - More asphalt = greater resistance to oxidation
  - Increased long term durability
  - Top PG Grading above 80
- Contains no water.

ASTM D6114, Type II (Wet Process)

- **15-20% Crumb Rubber**
  - Typically 30-40 Mesh
  - Processed from Scrap Tires
- **Performance Graded Asphalt**
  - PG58-28 (or) PG 64-22
  - Blend of the two to meet spec requirements
- **On Site blending or at a facility**
- **Reaction process**
  - Elevate Temperature
  - Mix for 1 hour
    - Rubber particles swell, Suspension in Asphalt

Rubberized AC Products

Asphalt-Rubber Binder

Terminal Blend Binder

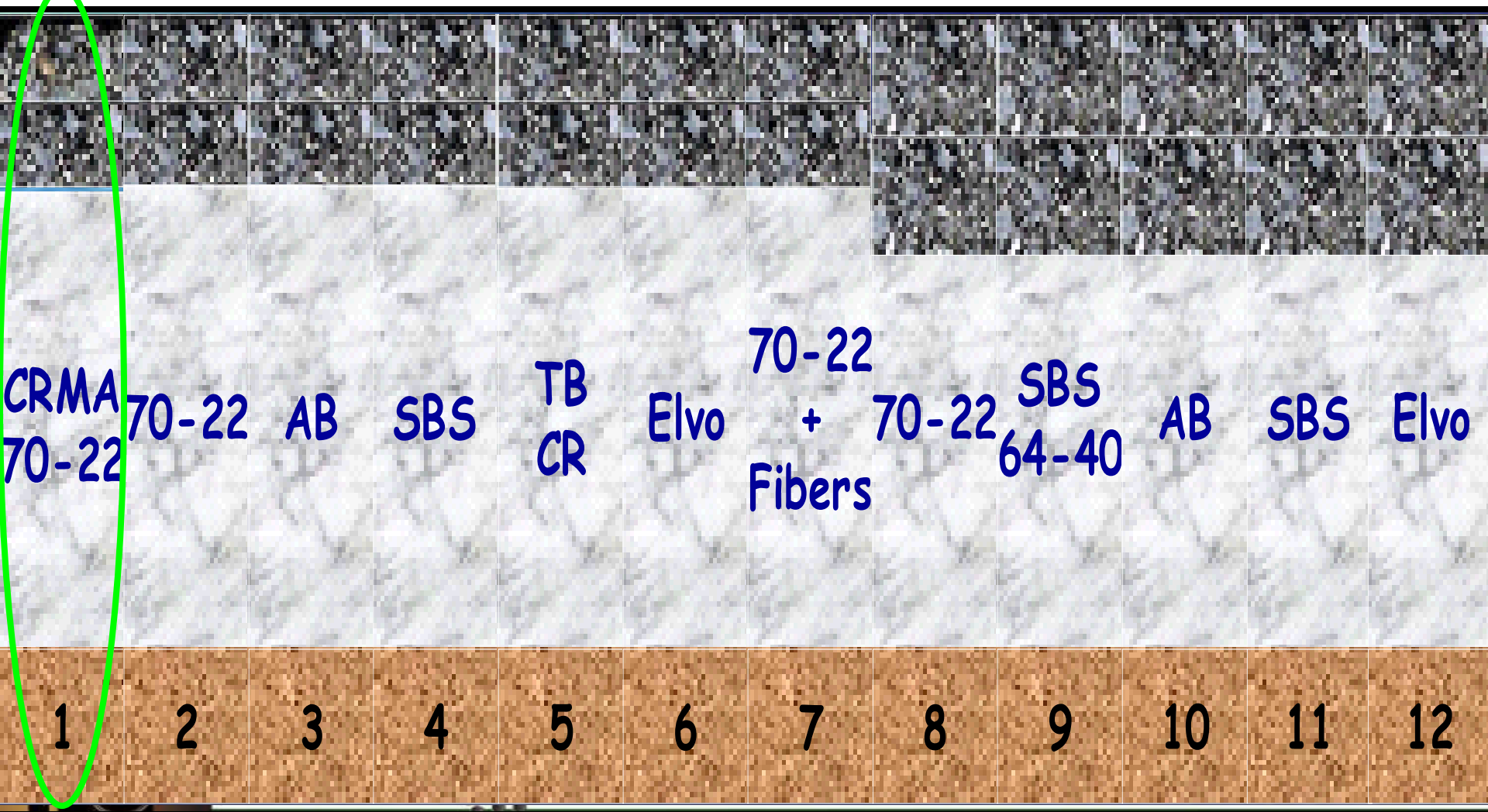
From Shakir Shatnawi

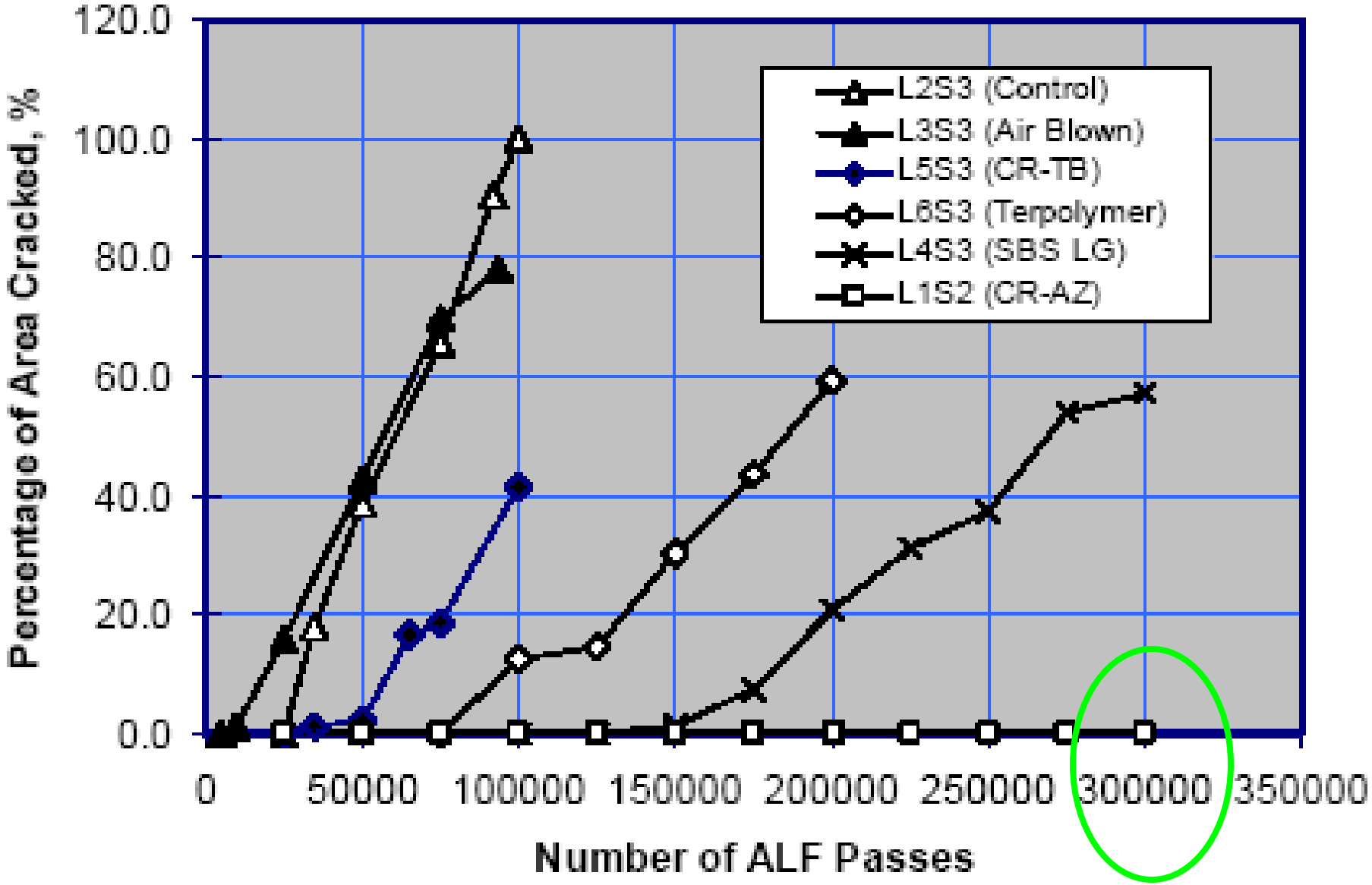
Asphalt Comparisons

Criteria	AR	TB	PG
% Crumb Rubber	15+	3-15 Typically: 5-10	N/A
Specification	ASTM D-6114	Local	AASHTO M320
cP@375 F	1500-5000	500-	100-
Softening Pt. F	140+	130+	115- Typical
ALF Cycles	300,000+	100,000	100,000


Two ALF's with
12 Pavement Lanes Constructed in
the Summer and Fall of 2002

ALF Project Test Sections





Percentage of Area Cracked vs. ALF Wheel Load Passes

Lane 1	Lane 2	Lane 3	Lane 4	Lane 5	Lane 6
CR-AZ	Control	Air Blown	SBS LG	CR-TB	TP
300,000	100,000	100,000	300,000	100,000	200,000

AR Background

- First developed in 1960's
- Initially used in SAM and SAMI's
- Now used in HMA
  - AR OGFC
  - AR Gap Graded
- ASTM D-6114 Binder Specification
- Not Proprietary

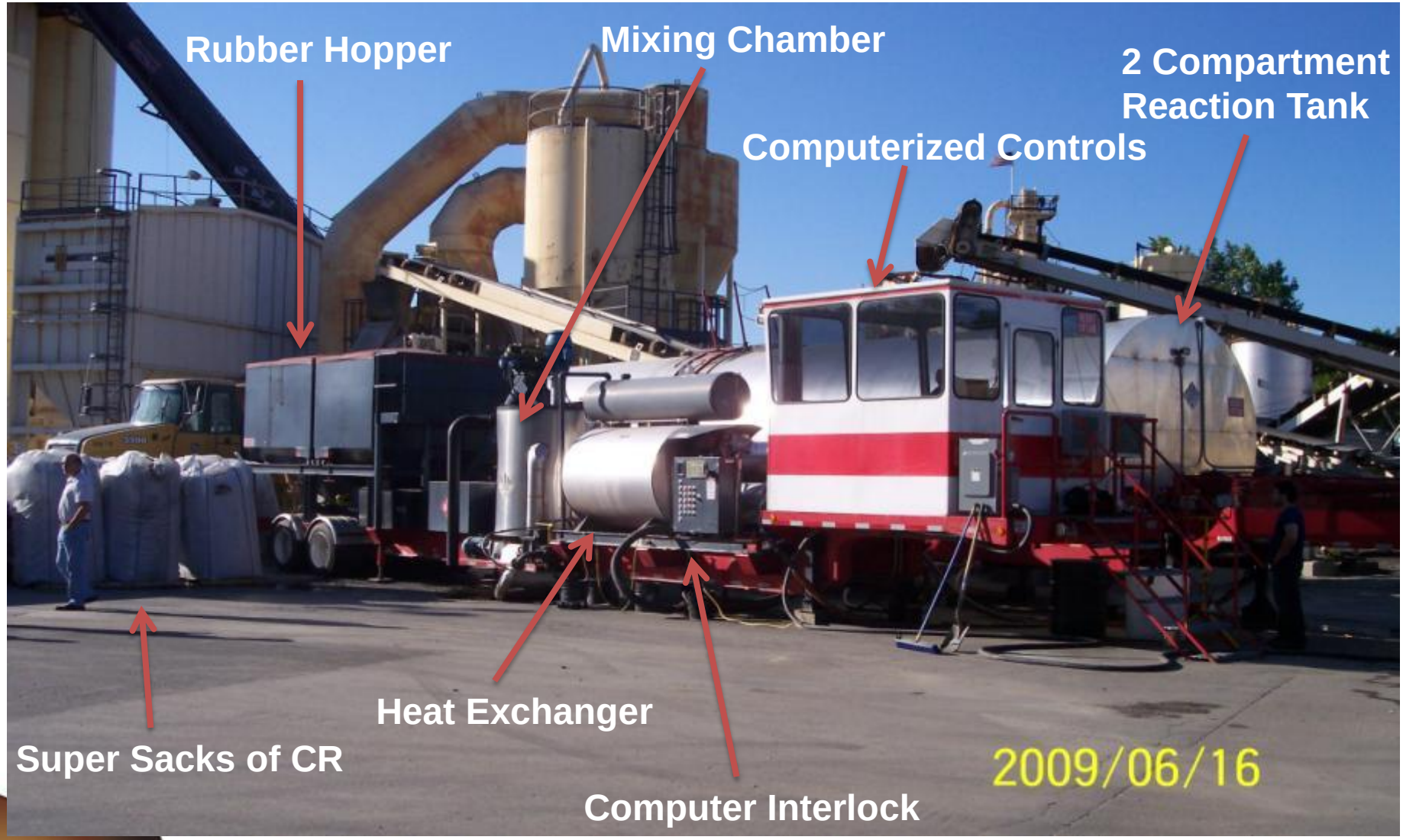
History of AR HMA Usage

- **National uses**
  - Arizona, California
  - Florida, South Carolina
  - Texas
- **ASMG Experience**
  - MassDOT
    - Several AR Gap Graded Projects (2008 – 2011)
  - NJ projects
    - 2009 – NJDOT I-78 AR OGFC
    - 2010 – NJTA, Garden State Parkway AR OGFC
  - NH DOT
    - 2011 – AR Gap Graded Project
  - Local Agencies

Why AR Mixes?

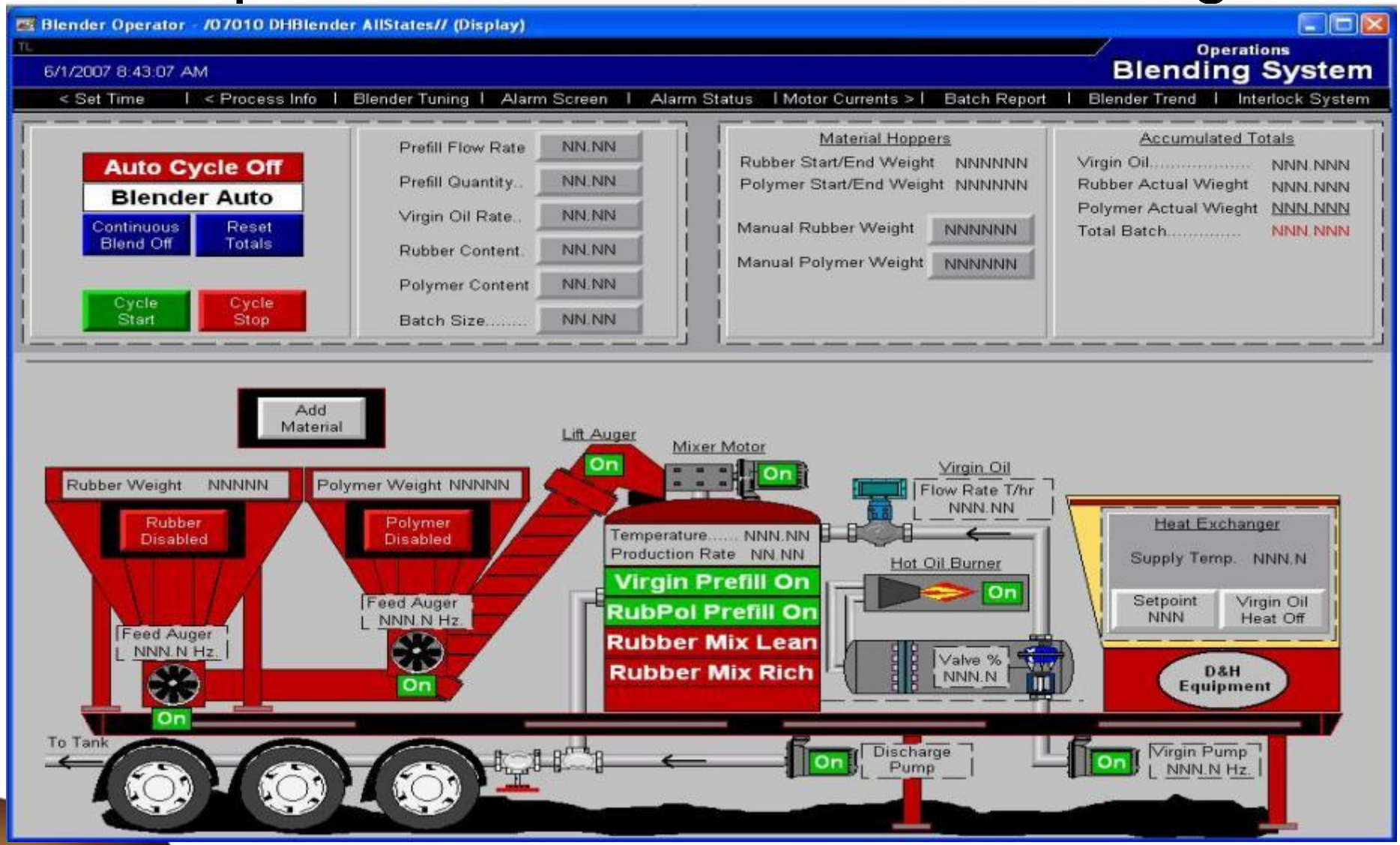
- **Benefits**
  - **Longer Pavement Life**
    - Reduced Rutting
      - AR = Higher Softening Point of PG Binder
    - Reduced Oxidation
      - Thicker Film Coatings = More Binder in Mix
    - Reduced Cracking
      - AR Properties = Greater Flexibility at Cold Temperatures
    - Increased Long Term Durability
    - Reduced Thickness
  - **Noise Reduction**
    - AR Properties Absorb Tire Noise
    - Economic Alternative to Sound Barriers
  - ***"Green" Process – Reuses Scrap Tires***

Asphalt Rubber Binder – Blending



Asphalt Rubber – Processed Tire

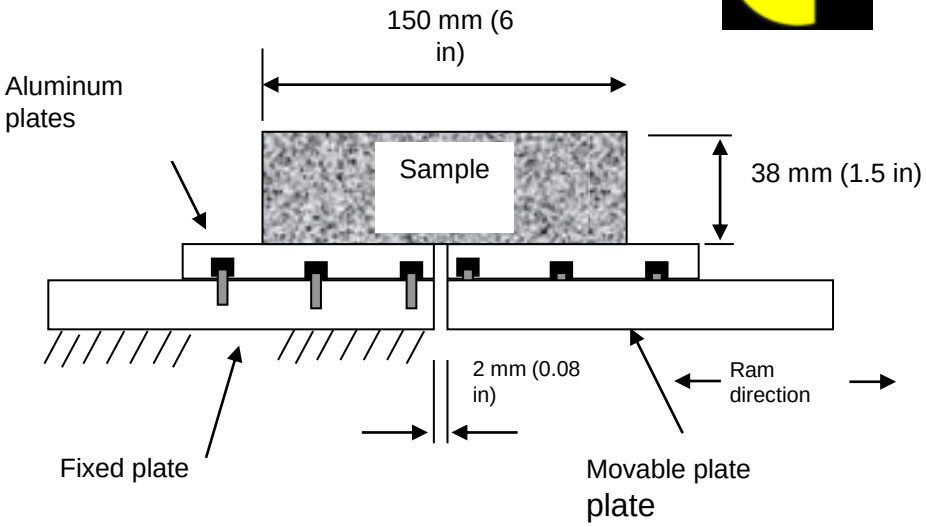
Asphalt Rubber Binder – Blending

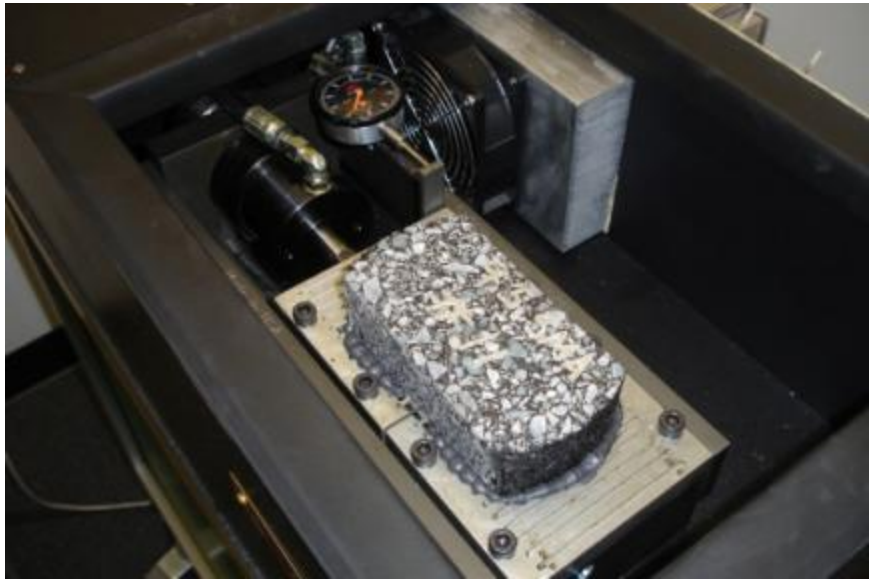


I-78 NJ – AR OGFC

I-78 NJ – AR OGFC (June, 2012)

Overlay Tester



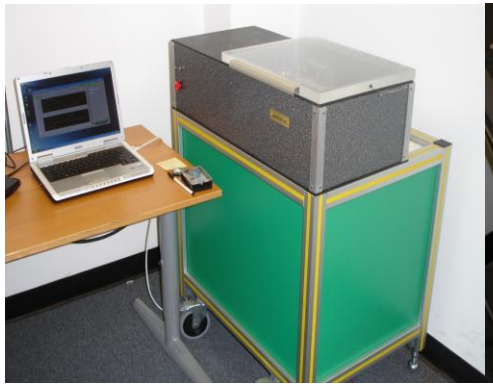


- Sample size: 6’’ long by 3’’ wide by 1.5’’ high
- Loading: Continuously triangular displacement 5 sec loading and 5 sec unloading
- Definition of failure
  - Discontinuity in Load vs Displacement curve

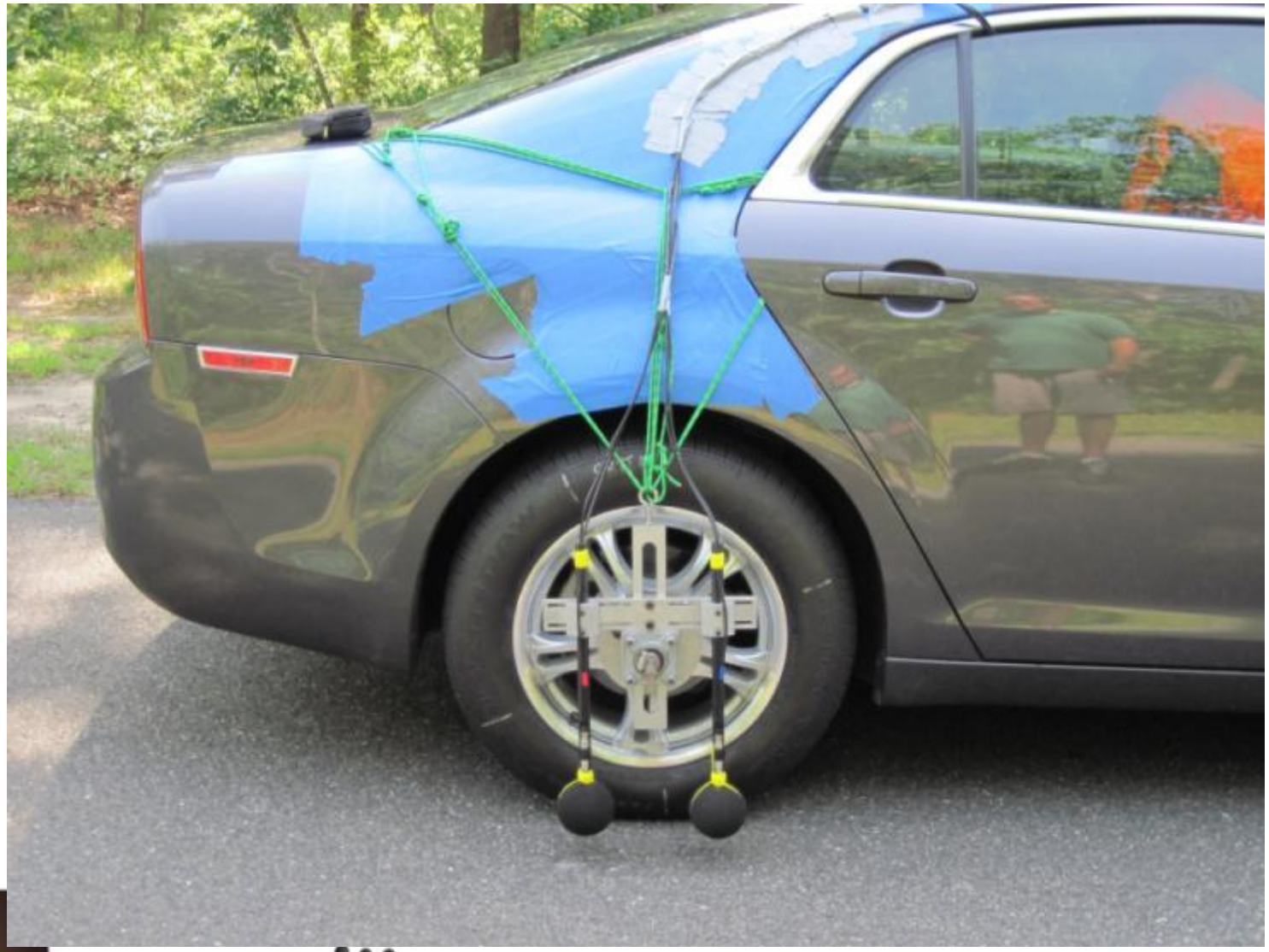
Typical Preservation Overlay Mixes

Surface Course Mixes

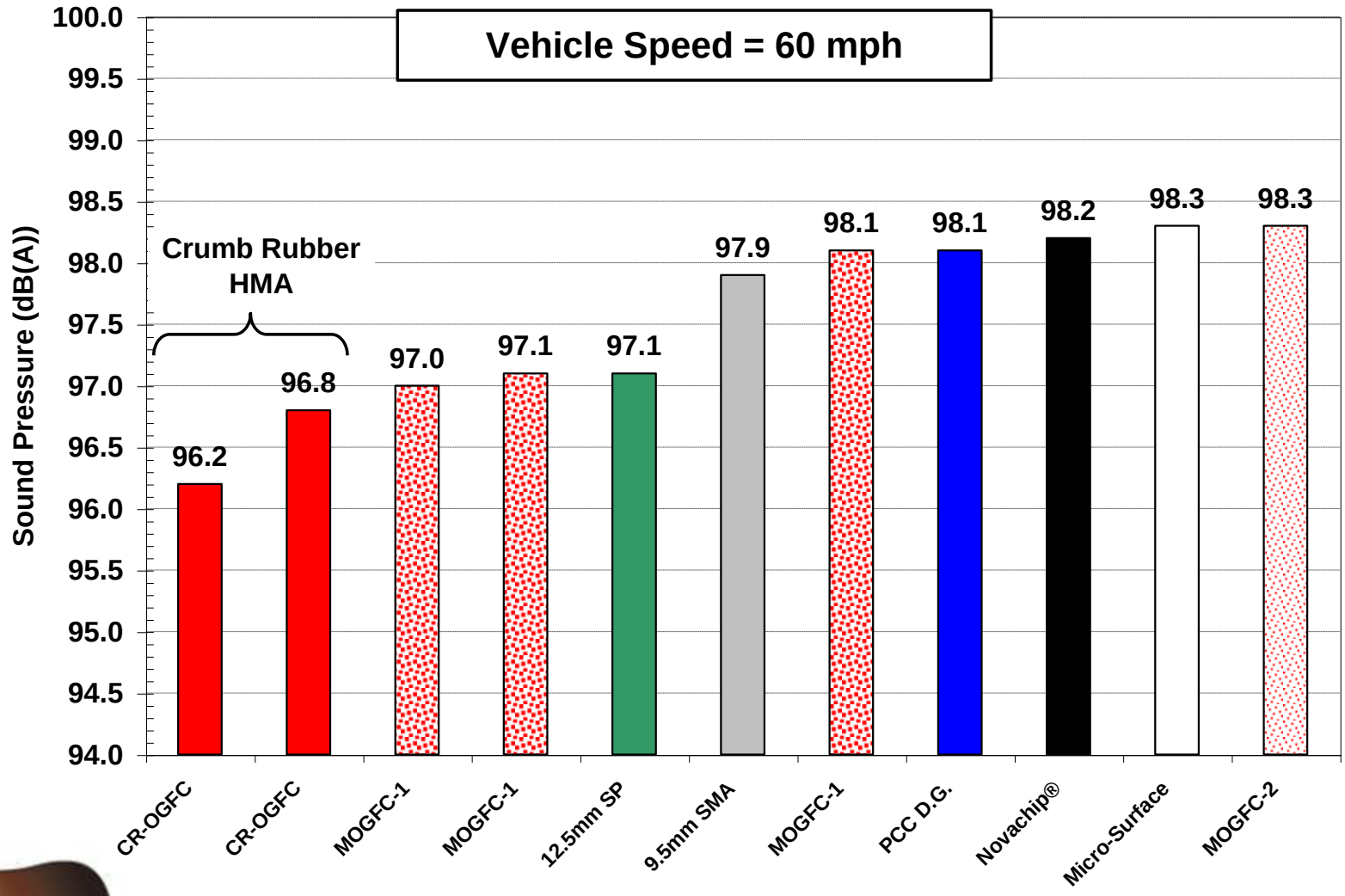
59ºF, 0.025" Horizontal Deflection



ON-BOARD SOUND INTENSITY (OBSI) EVALUATION



NJDOT -10 Quietest Pavements Tested



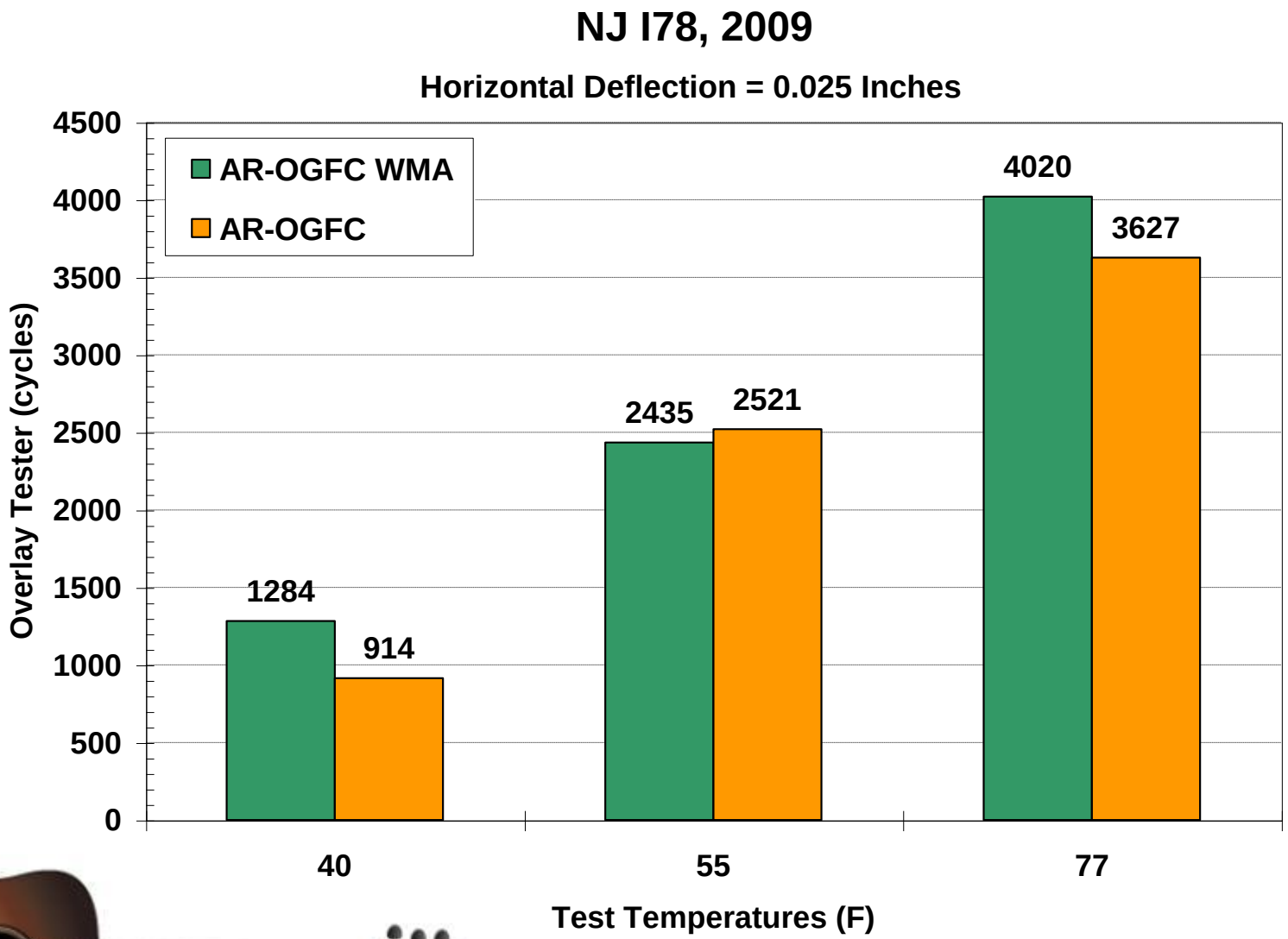
What is Warm-Mix Asphalt (WMA)?

- Asphalt Mix **produced at 40-100ºF less than conventional HMA**
  - Various technologies and additives
    - Chemical Additive (Surfactants)
    - Organic Additives (Waxes – long chain hydrocarbons)
    - Foaming Processes
- Typically Produced @ 212-280ºF vs. 320ºF
- Produced and placed with conventional HMA equipment
- Can be used as **Workability/Compaction aide**

Why Use WMA?

- Environmentally Sound
- Reduces green house gas emissions
- Reduces energy use
- Reduces opacity and odor
- Improves workability
- Reduces binder aging
- Reduces paving temperatures
- Offers the potential to increase the % of RAP used in mix
- Offer the potential to extend the paving season

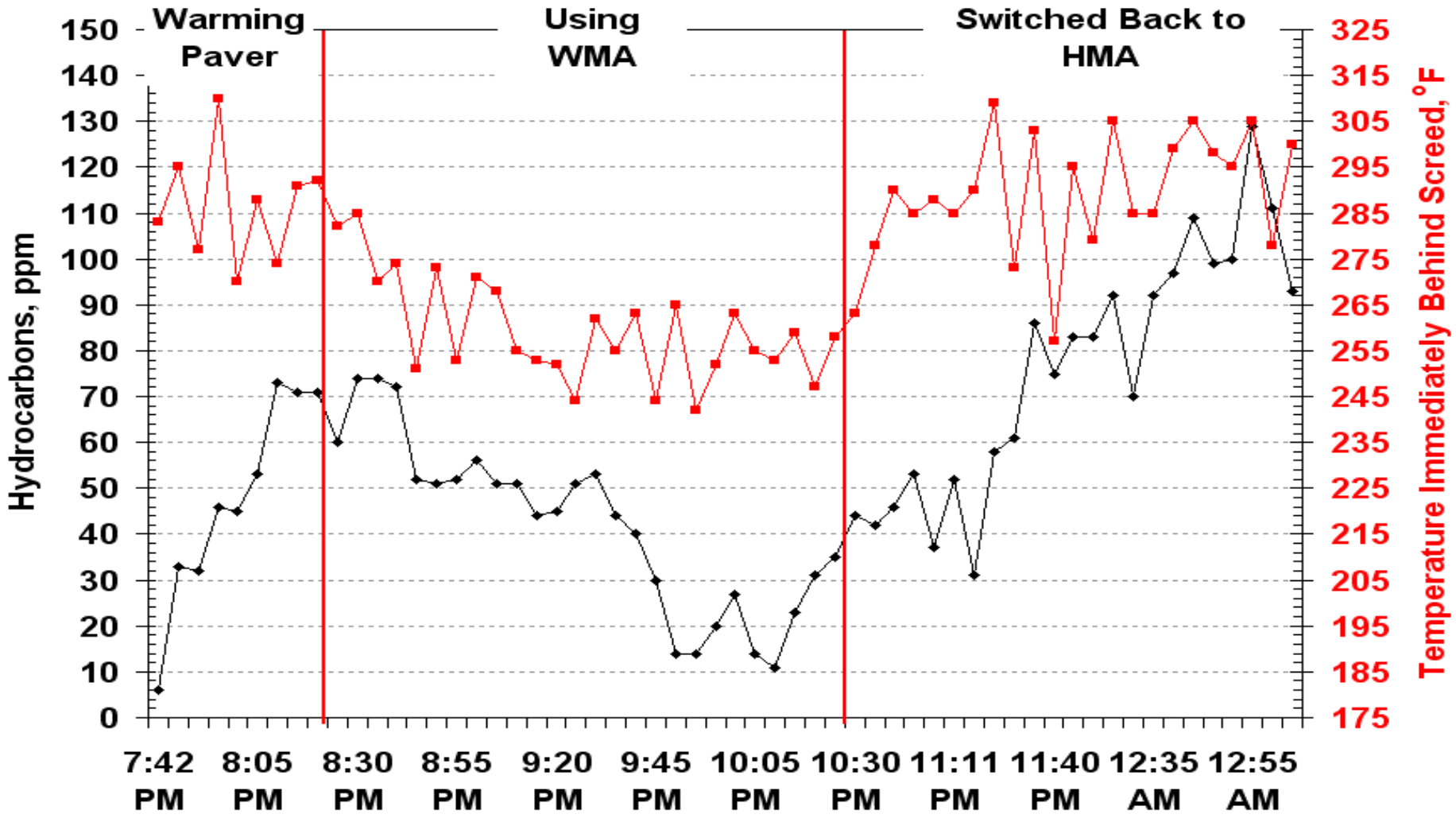
Overlay Tester Cracking Results



Emissions Testing

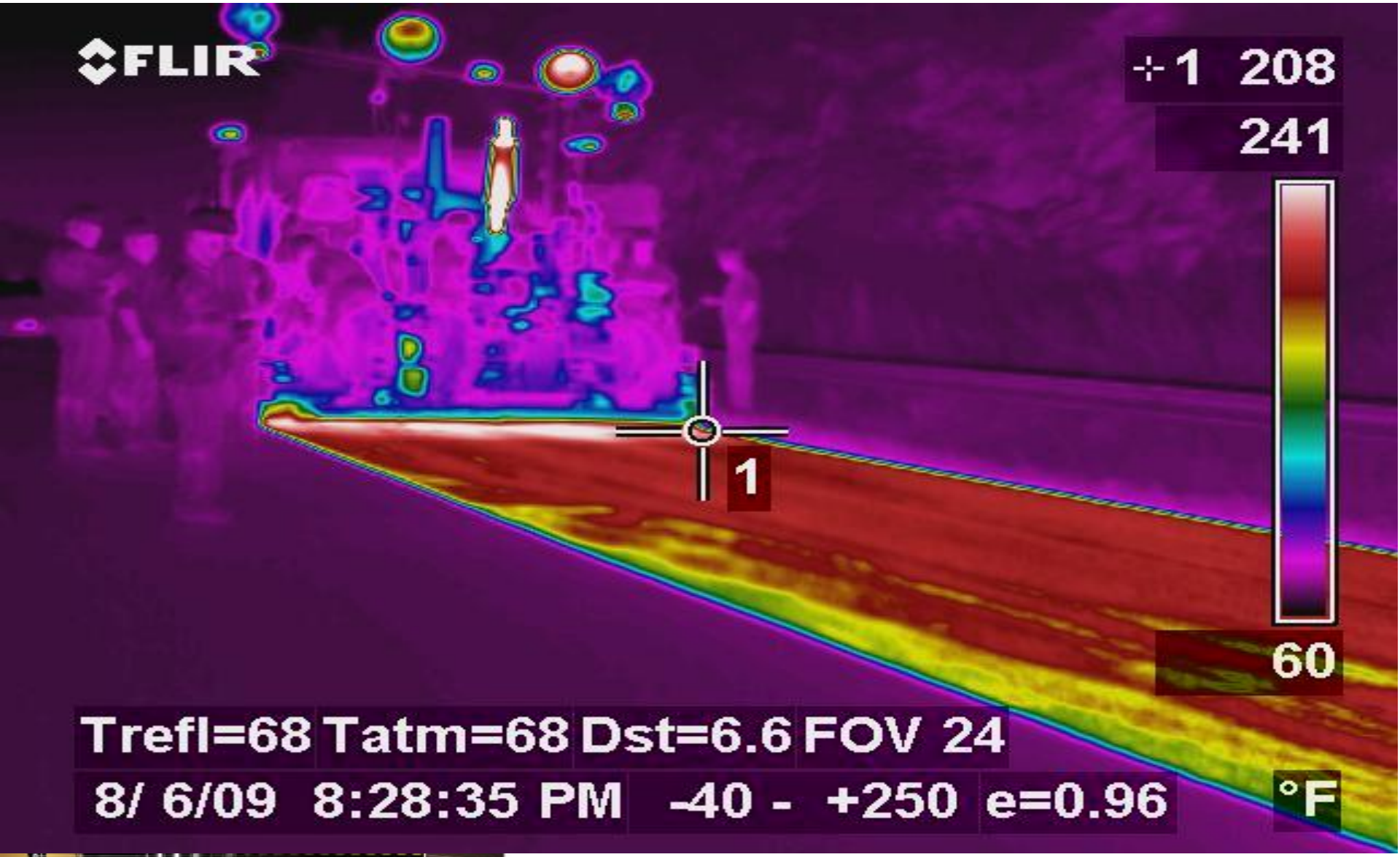
- Looked at quantifying emission reduction at paver with and without WMA
- Used portable emissions tester mounted to railing on back of paver (where workers would stand)

I-78 AR OGFC – Emissions at Paver

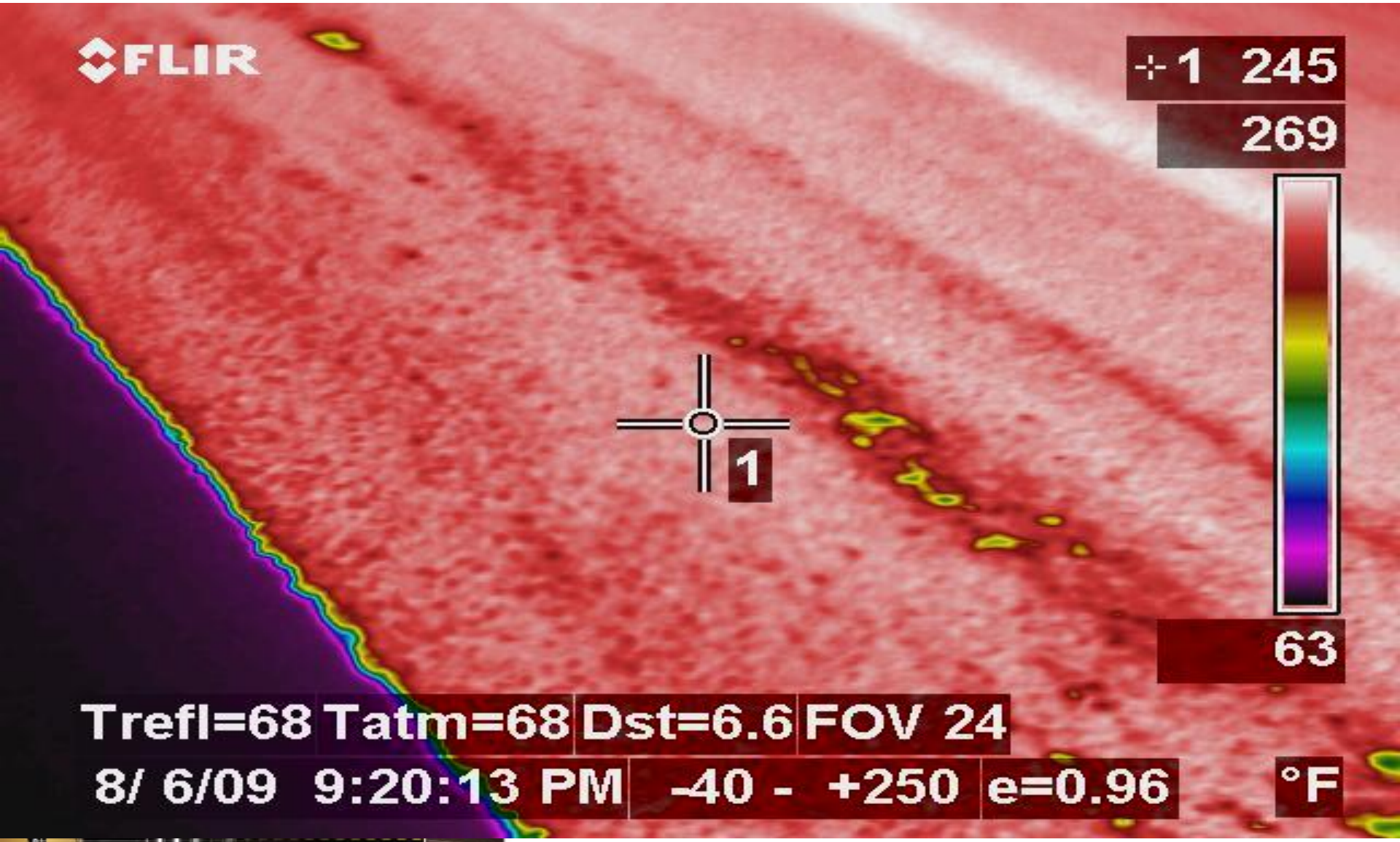


I-78 AR OGFC with Evotherm

I-78 AR OGFC with Evotherm



I-78 AR OGFC with Evotherm



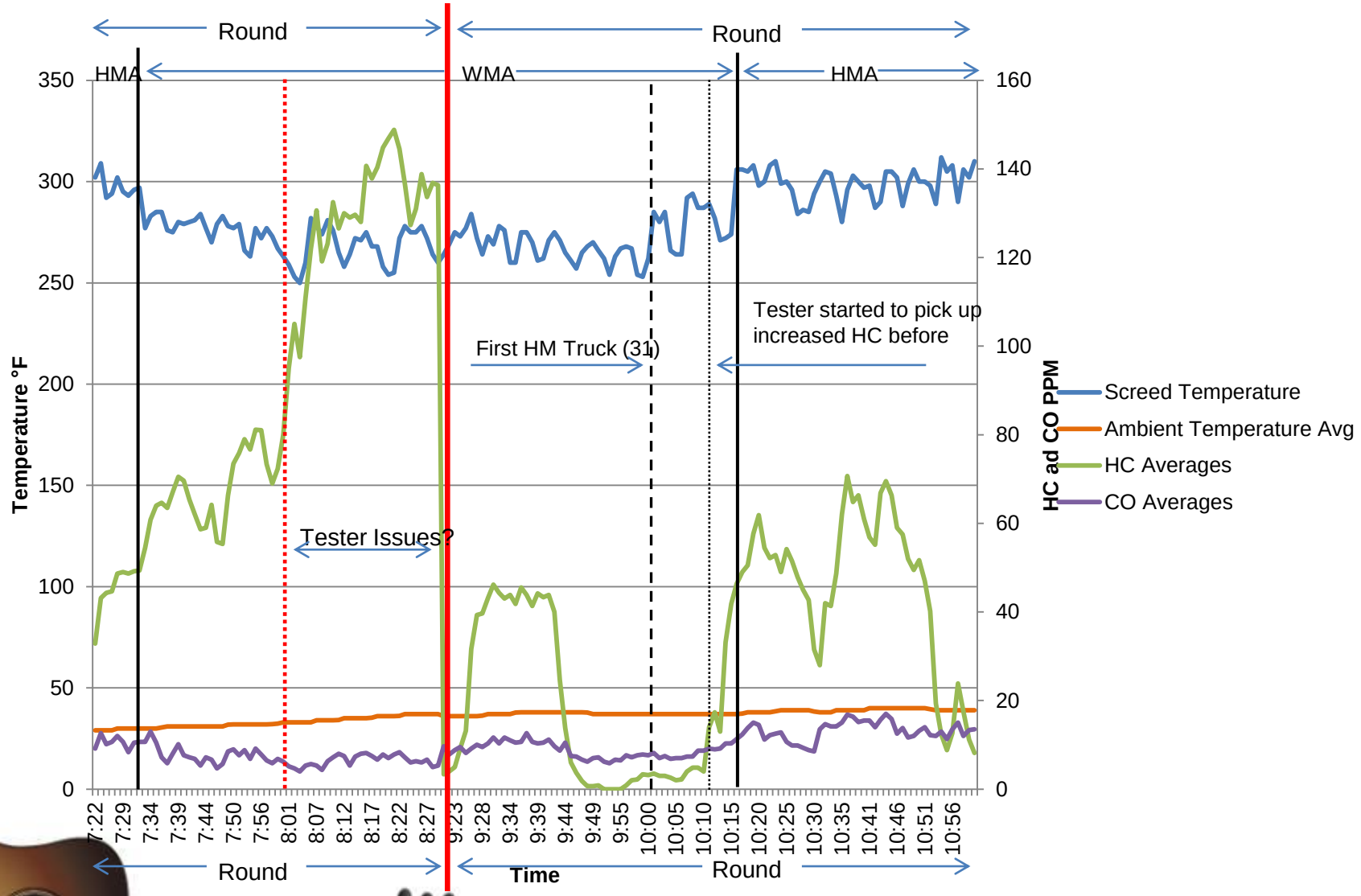
NJTA Garden State Parkway

Amherst, MA- AR GG

Amherst, MA – AR GG ECOBIT™ with SonneWarmix™ WMA

Amherst, MA- AR GG WMA

Amherst- ARGG WMA Air Data

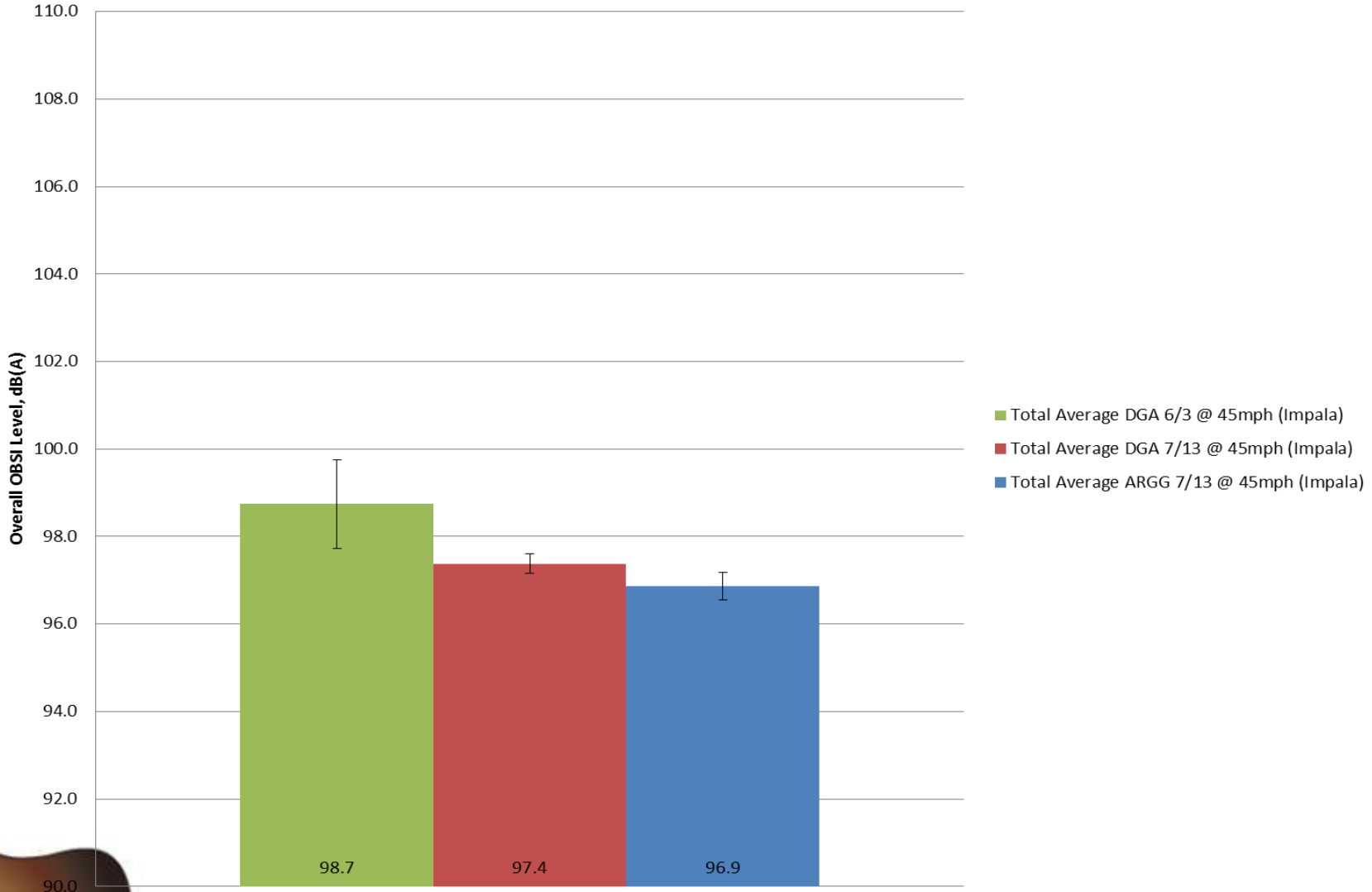



NORTH TO
38
INTERSTATE
93

NHDOT Data

- AR GG mix
- 12.5 mm Conventional mix control section
- Evaluating noise, crack resistance and durability over time
- Article about project in **Pavement Preservation Journal**, Summer 2012 issue

Overview of Tested Pavements



MassDOT- AR-GG, I-295, August 2008

MassDOT- AR-GG, I-295, June, 2012

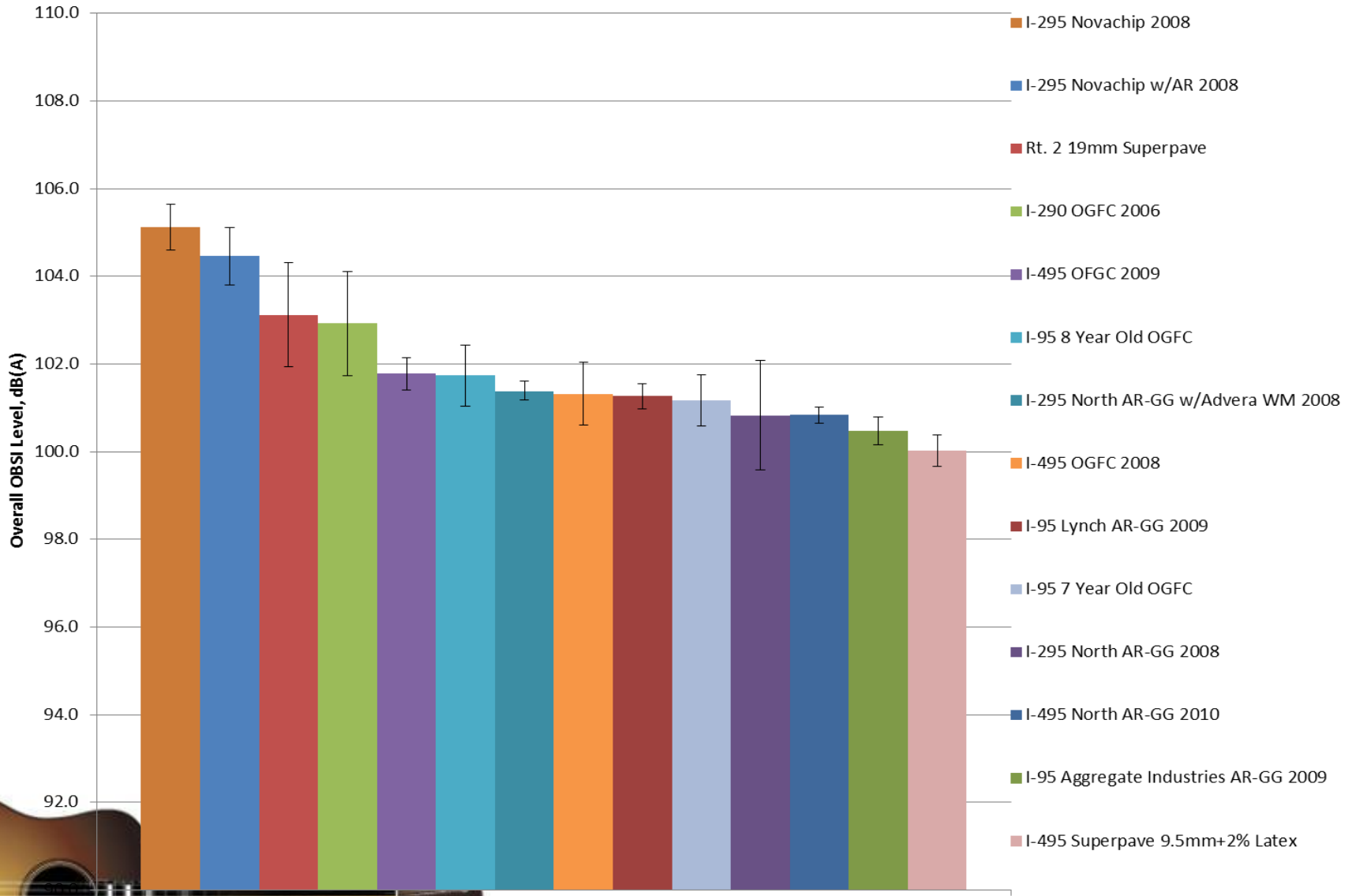
MassDOT- AR-BWC, I-295, June, 2012

MassDOT AR-GG

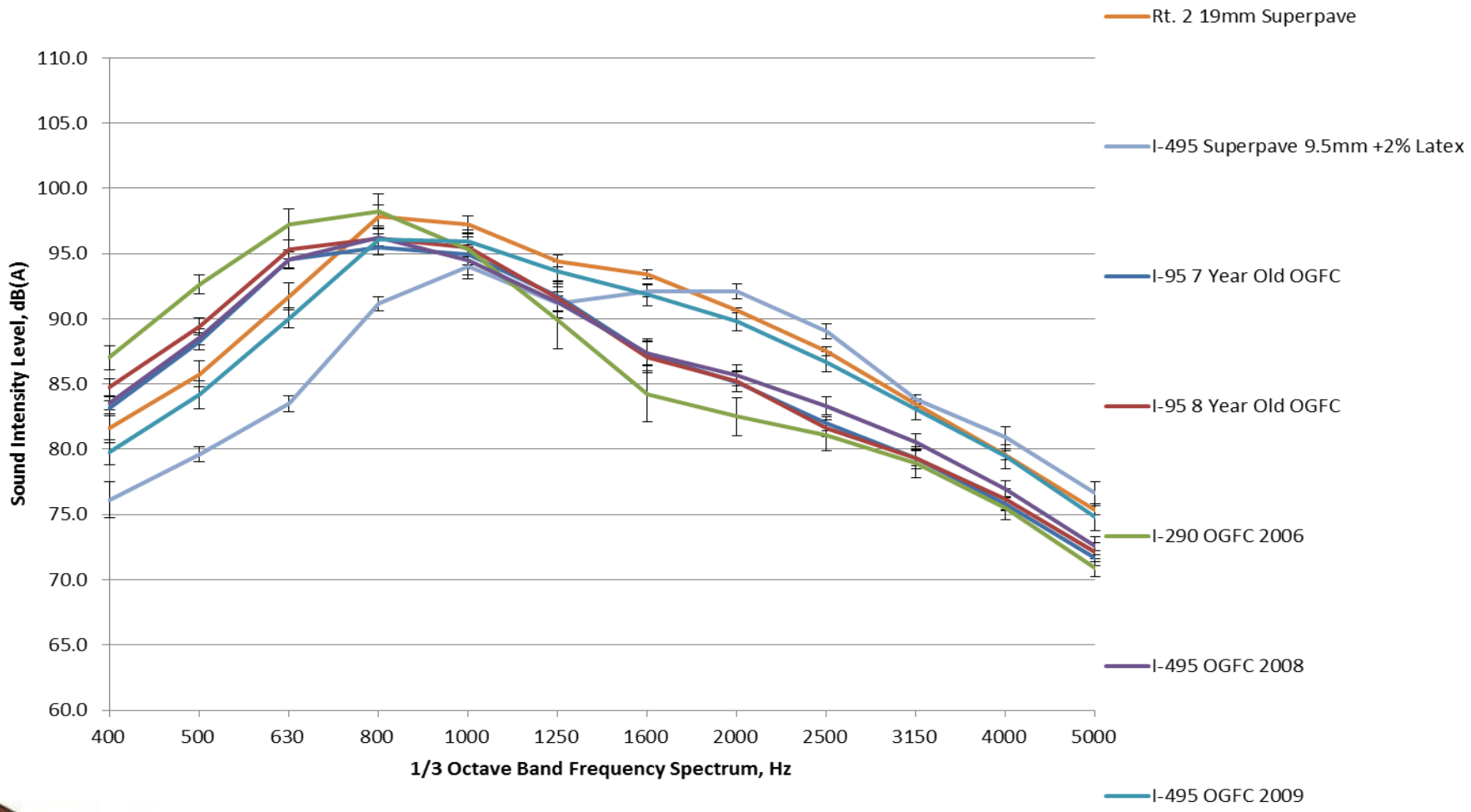
MassDOT Data

- Several projects on high volume roads
- AR GG Mix
- Over 400,000 tons bid or placed to date
- Consumed over 1 million tires
- Requires warm mix additive in all AR mixes
- Plan to do AR OGFC project
- Evaluating noise and performance

Overview of Tested Materials in MA



OGFC vs DGA

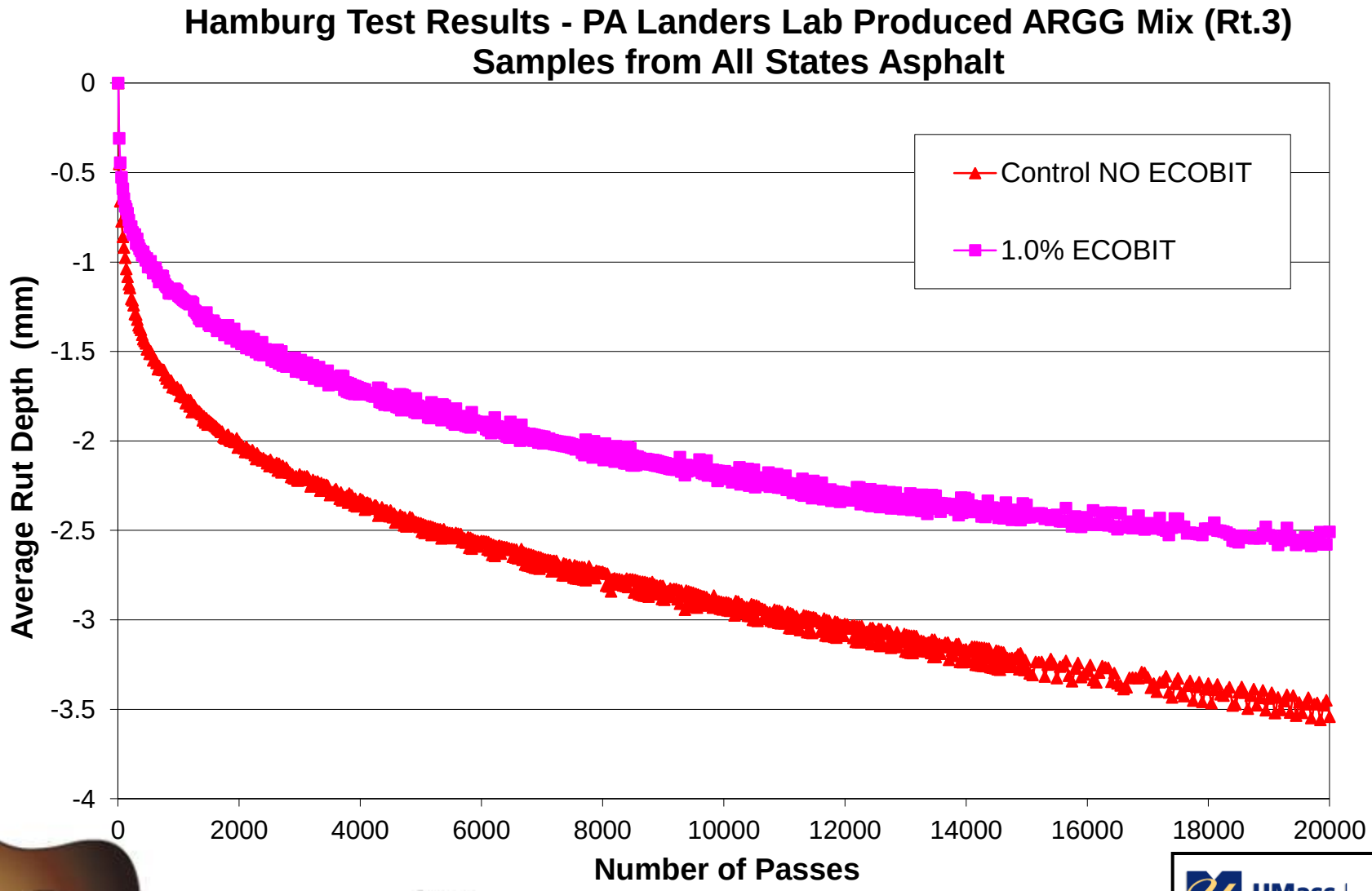

Rt. 2 19mm Superpave
I-495 Superpave 9.5mm +2% Latex
I-95 7 Year Old OGFC
I-95 8 Year Old OGFC
I-290 OGFC 2006
I-495 OGFC 2008
I-495 OGFC 2009
Sound Intensity Level, dB(A)
110.0
105.0
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
1/3 Octave Band Frequency Spectrum, Hz

Plymouth, MA Rt. 3

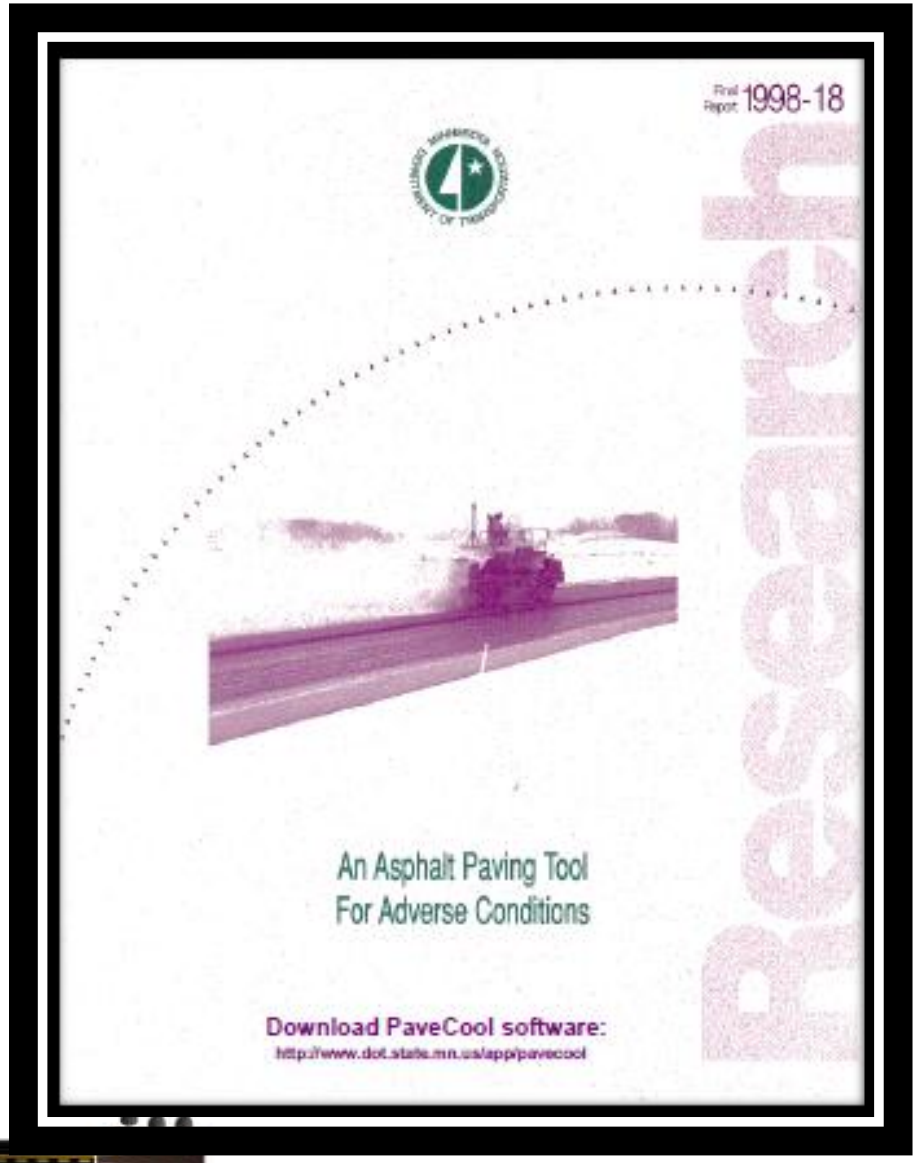
- AR GG mix – 1/2 ‘’ nominal maximum size
- 7.5% ASTM D-6114 AR Binder
- 1 ¼’’ compacted over micro-milled surface
- 20,000 tons
- Current spec requires 55F pavement temperature
- With ECOBIT™ with SonneWarmix™ MassDOT pavement temperature was reduced to 45F for last 5,000 tons
- Night Paving
- Resulted in reducing spec to 45 F

massDOT
Massachusetts Department of Transportation

Plymouth, MA Rt. 3



PaveCool (Minnesota DOT program)



Plymouth, MA Rt. 3

PaveCool 2.4 - Simulation Results

Input File: PaveCool

Project: PA Landers Asphalt Rubber Gap Graded + 1% ECOBIT

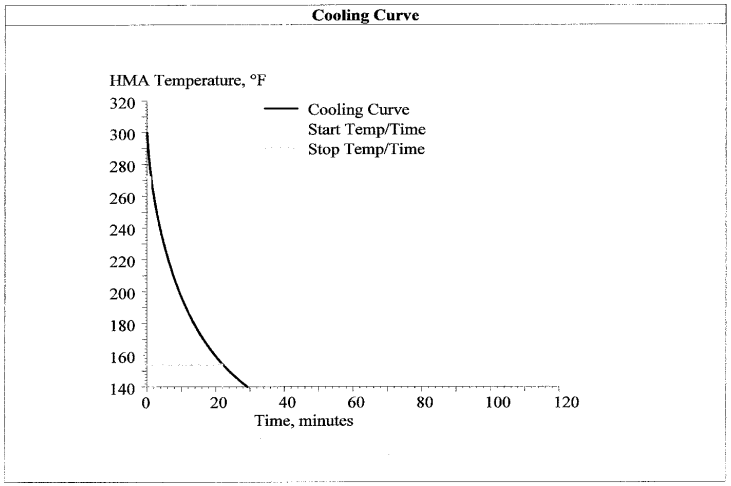
Project Date & Time	Start Rolling*	Stop Rolling*
09/02/09 12:10 PM	1 min. (272 °F)	22 min. (154 °F)

HMA Mix Type	Binder Grade	Thickness	Delivery Temp.
Coarse/SMA	PG 82-28	1.50 in.	300 °F
Air Temp.	**Wind Speed**	**Sky**	**Latitude**
35.0 °F	10 mph	Clear & Dry	42.0 ° North
Existing Surface	**Moisture**	**State**	**Surface Temp.**
AC	N/A	MA	35.0 °F

* Some asphalt mixtures will require compaction start and stop times different from those recommended by this program. As always, good judgement must be exercised in order to ensure a properly compacted surface. Special considerations should be made for polymer modified asphalt binders. In this case, manufacturer guidelines should supersede recommendations made by this program. Consult the Help file for further details. In no event will the Minnesota Department of Transportation, the University of Minnesota or their suppliers be liable for damages or expenses arising out of the use of this program.

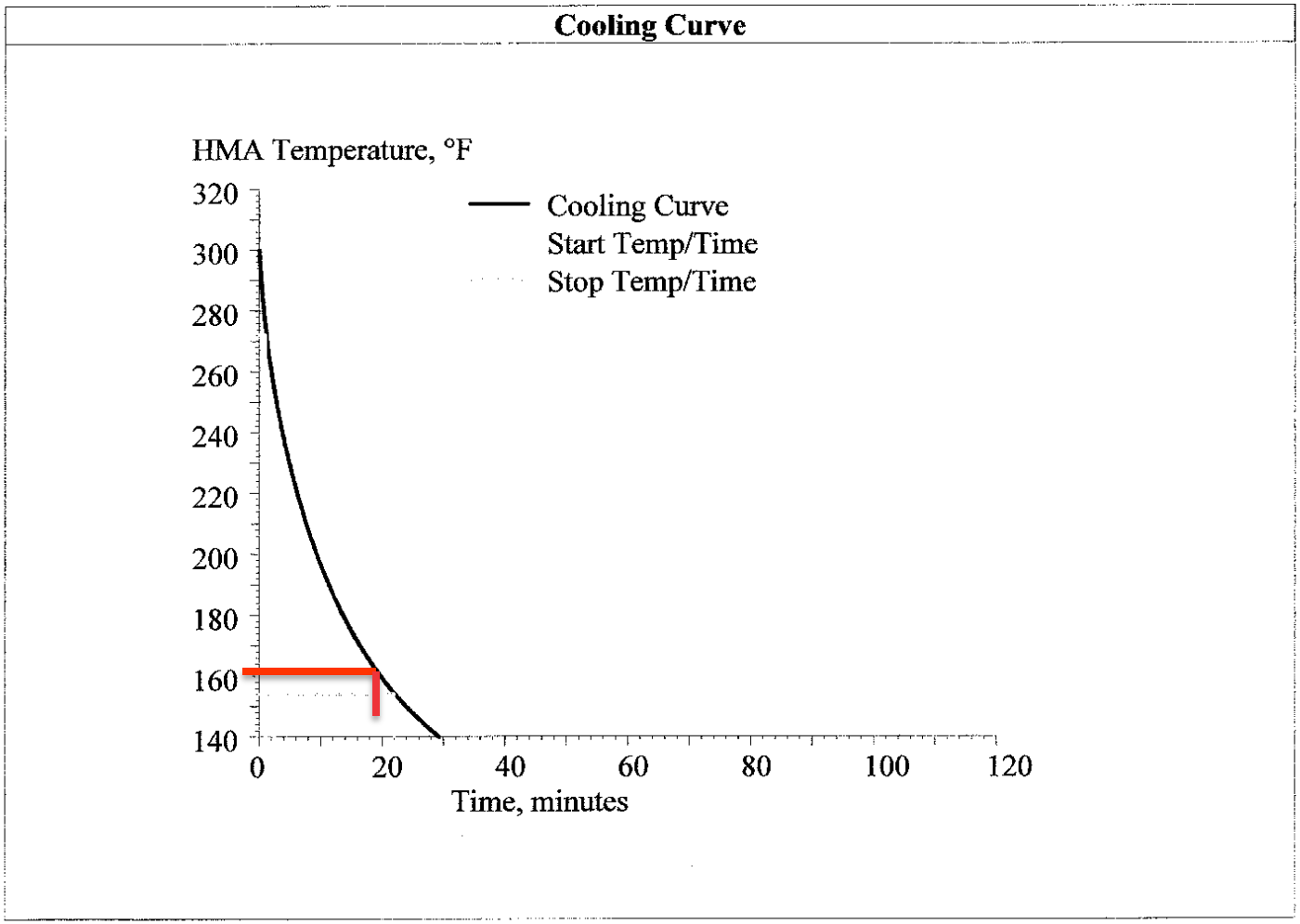
Simulation Time: 09/02/09 2:51 PM

Cooling Curve



Plymouth, MA Rt. 3

Simulation Time: 09/02/09 2:51 PM



Summary – Asphalt Rubber Mixes

- AR and Terminal Blend have completely different properties
- AR Binder enhances the performance of mixes by stiffening the binder, increasing elasticity (crack resistance), and are resistant to migration
- AR mixes typically have 20% higher binder contents
- AR OGFC and ARGG mixes have been used successfully in many states and climates with great success
- AR mixes reduce rutting, oxidation, cracking and pavement noise and provide smooth surfaces

Summary – continued

- Utilizing best practices, AR mixes are user friendly
- AR mixes can easily be adapted to warm mix applications reducing mix temperatures, emissions and binder aging
- ***AR mixes consume old tires and are environmentally friendly***

THANK YOU

All States Materials Group®

Products & Services

- ECOBIT™ with SonneWarmix™ WMA Binder
- CRMB for HMA
- PG Graded Binders
- Asphalt Rubber SAM & SAMI
- FiberMat® SAM & SAMI
- Bonded Pavements
- Chip Seals
- Liquid Calcium/Magnesium Chloride
- Full Depth Reclamation
- Hot & Cold Mix Asphalt

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