

Louisiana's Experience With Polymer Modified WMA Mixtures

2010 AMAP Annual Meeting
Savannah, GA

By: Bill King
Asphalt Materials Research Engineer

<http://www.ltrc.lsu.edu>



Benefits of Using WMA

- Reduces Aging of Binders in Plant Production – Extends Binder Life
- Reduced Emissions – Plant and Roadway
- Reduction in Fuel Consumption
- Compaction Efforts Reduced



07-1B Warm Mix Asphalt

Objective

The primary goal of this research project is to quantify the performance of field produced and placed mixtures that utilize Warm Mix Asphalt (WMA) technology and to develop a framework for design, construction, and implementation of this technology in Louisiana.



Changes In Specifications

- **Section 502 Modified:**
 - Minimum mixing temperatures of the mixture shall not be less than 270°F (132 °C) when using the WMA technology. The minimum temperature of the mix going through the paver shall not be less than 230 °F (110 °C).



Completed Projects

Roadway	Location	Date	WMA Process	Mix Properties
WMA Demo	Shreveport	August, 2008	Astec Foamed Asphalt	Rap: 0% and 40% Binder: PG 76-22M
I-220 Crossovers	Caddo Parish	October, 2008	Astec Foamed Asphalt	Rap: 20% Binder: PG 64-22
LA 3191	Natchitoches Parish	November, 2008	Astec Foamed Asphalt	Rap: 15% Binder: PG 70-22M
**LA 3121	Union Parish	March, 2009	Evotherm 3G Additive	Rap: 15% and 30% Binder: PG 70-22M
LA 494	Natchitoches Parish	July, 2009	Astec Foamed Asphalt	Rap: 15% Binder: PG 70-22M
US 171	Caddo	Dec 2009	Astec Foamed Asphalt, Akzol-Nobel Redi-Set	Rap: 15%, 30% Binder: PG 70-22M

**** Complete Factorial Suite of Testing Conducted**

<http://www.ltrc.lsu.edu>



Warm Mix Demo – Shreveport, La.

PG 76-22m

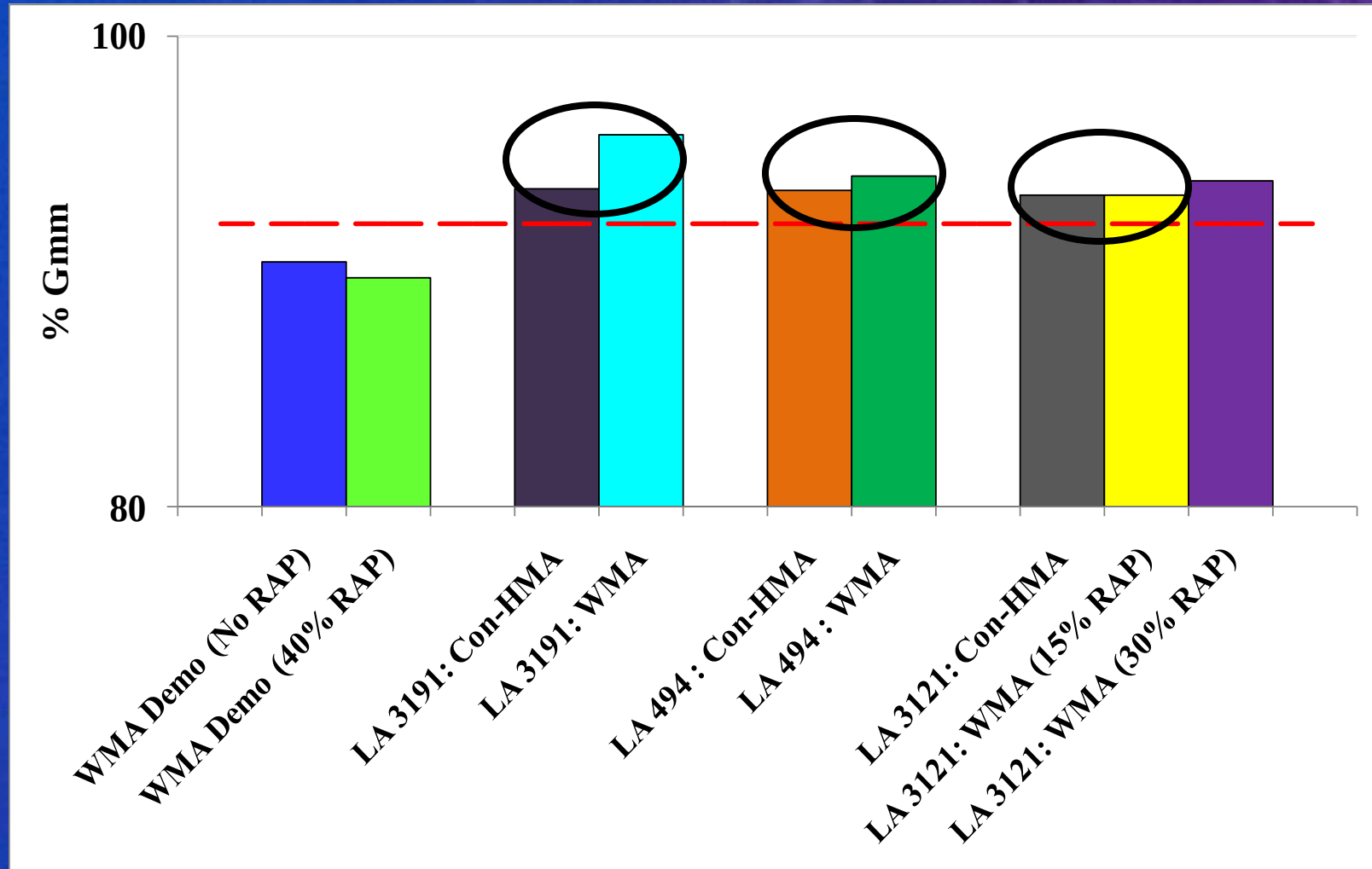


Field Results



<http://www.ltrc.lsu.edu>

Roadway Densities - % Compaction (Gmm)

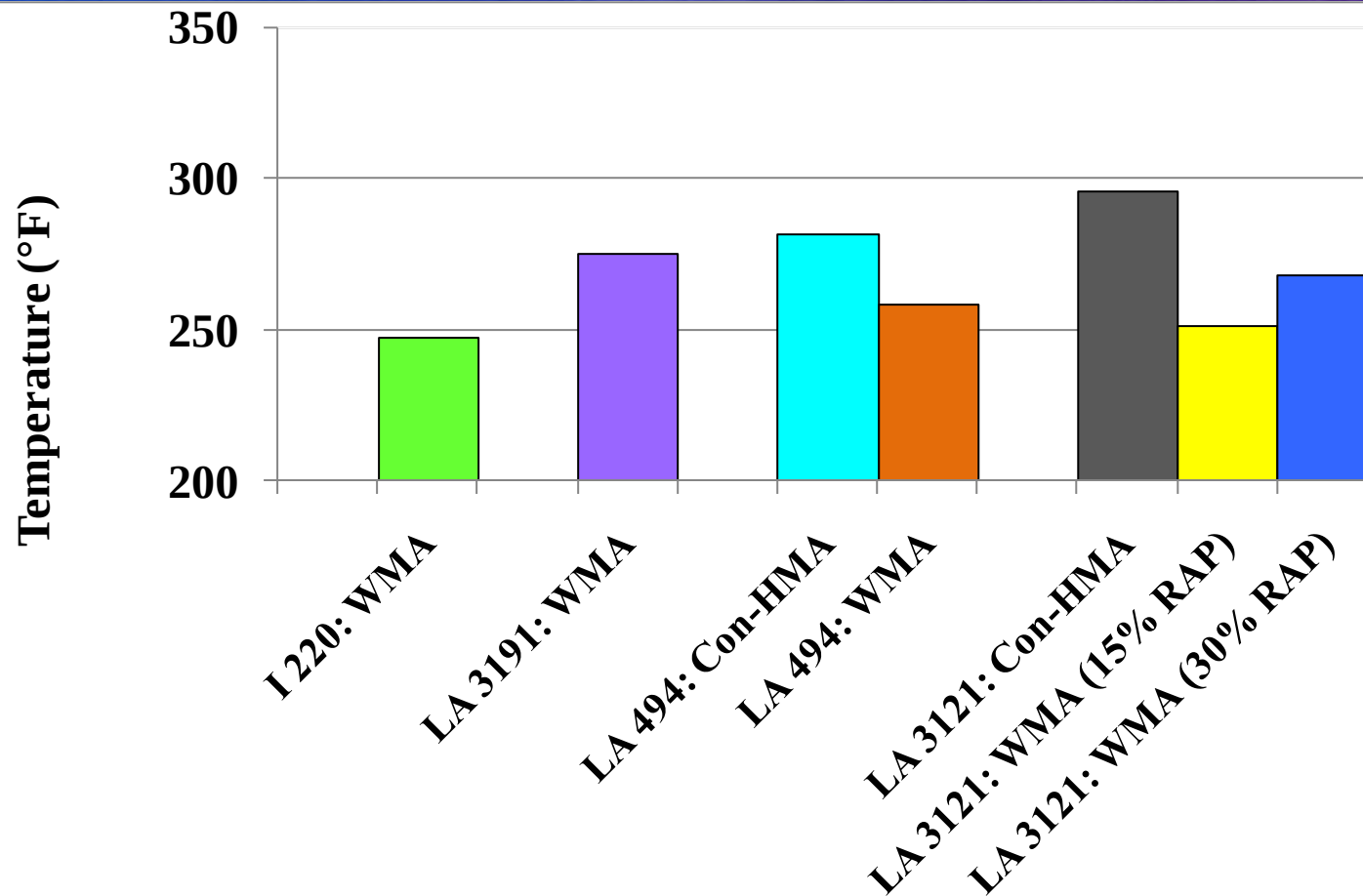


Increase in Density = 1.5%

$$92 \times 1.015 = 93.4$$



Temperature Behind The Paver

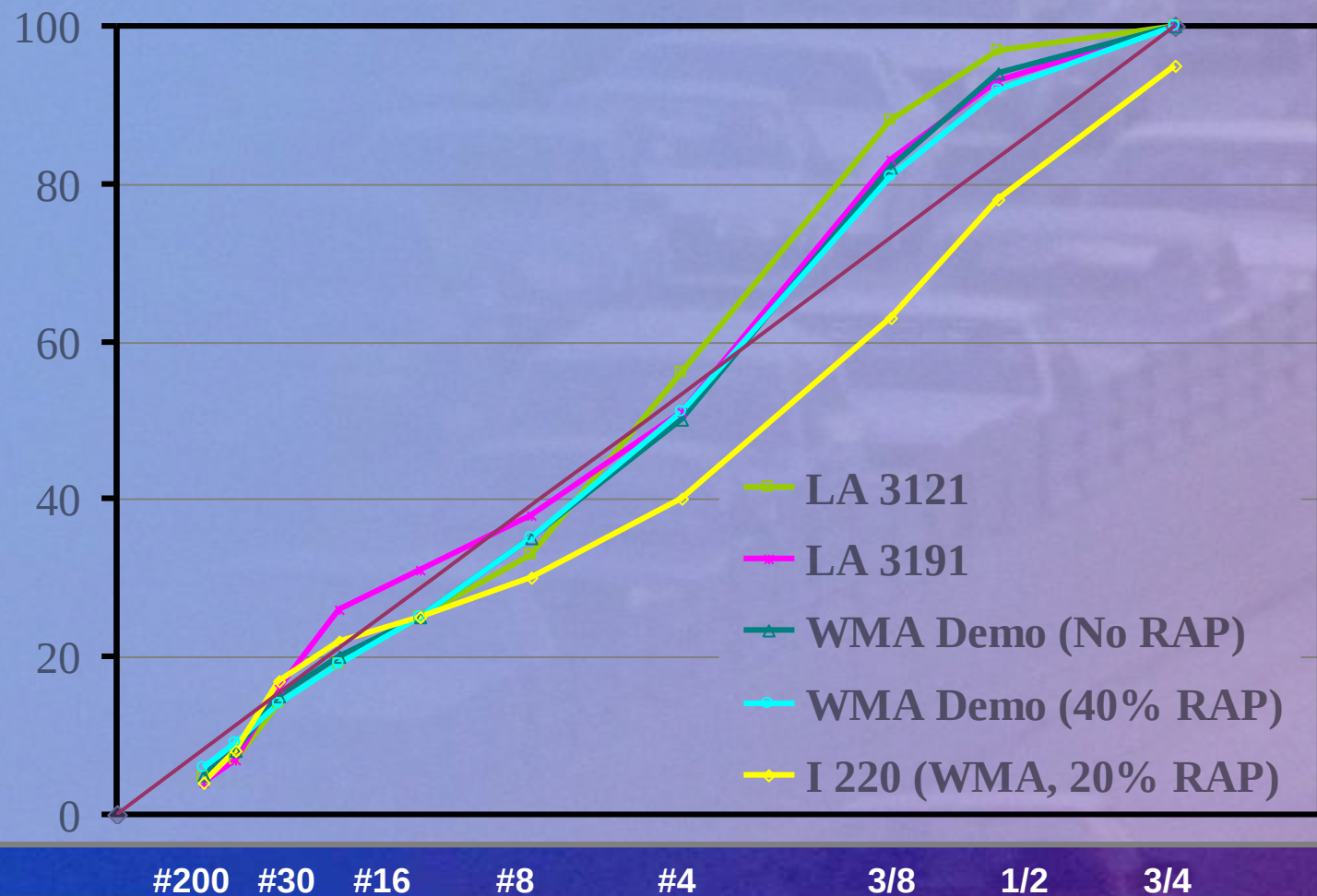




LA 3121, Union Parish

<http://www.ltrc.lsu.edu>

Gradation of Mixtures



Type	Source	%
1"	Ryolite	15
5/8"	Ryolite	20
1/2"	Ryolite	30
RAP		20
Coarse Sands	HANSON	15
A/C	PG 64-22	4.2
Des. Gyr.	75	
GM	2.493	
% Ni	89.5 %	
% Nd	96.5 %	
% Nm	97.5 %	
VMA	13	
VFA	73	
% Voids	3.5	

Laboratory – Material Characterization



<http://www.ltrc.lsu.edu>

Materials Characterization

Rutting Performance of Mixtures

- Loaded Wheel Tester (LWT – Hamburg)
- Dynamic Modulus Test [$E^*/\sin \square$]
- Flow Number (F_N) Test

Fatigue Performance

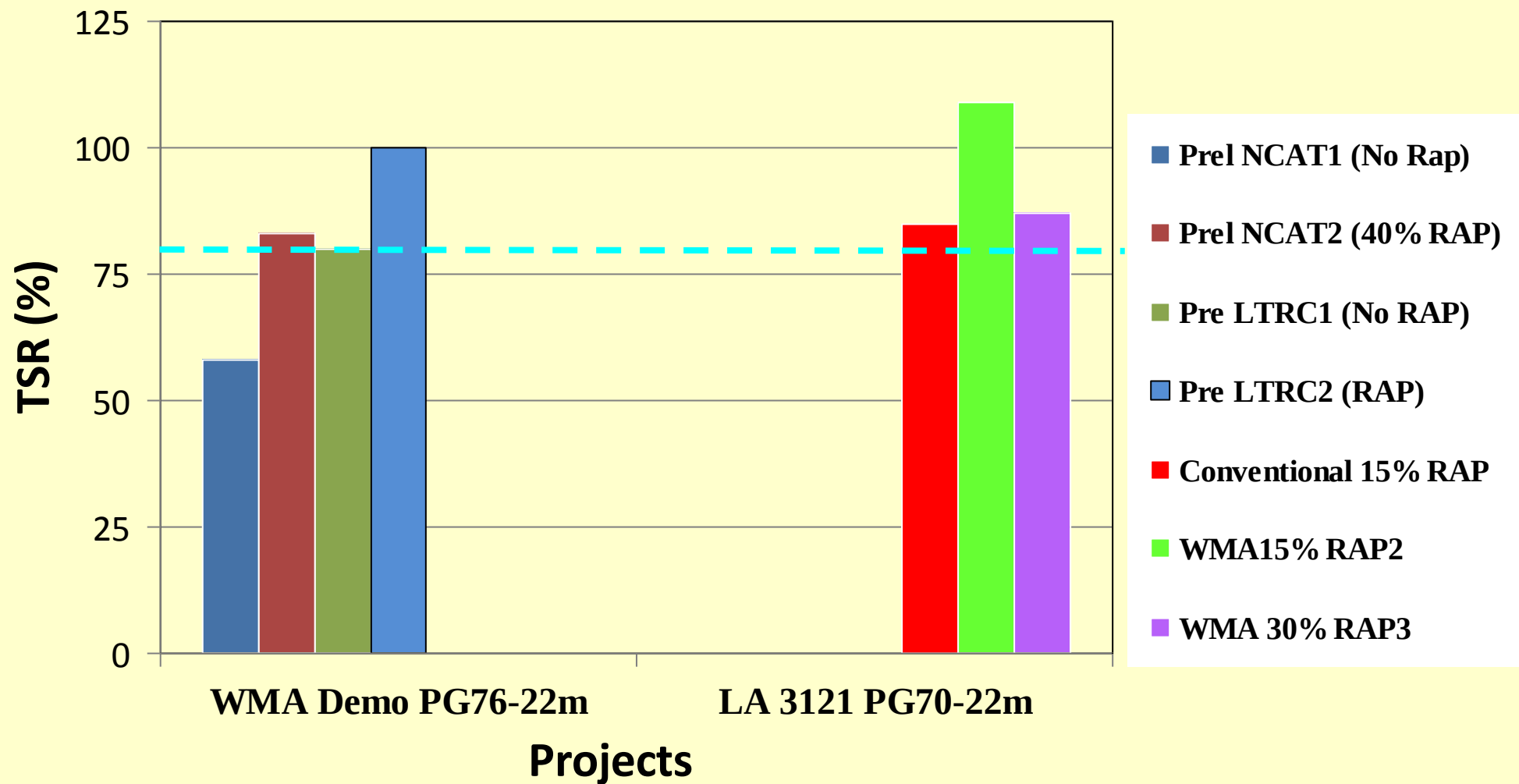
- Indirect Tensile Creep Test
- Dynamic Modulus Test [$E^* \sin \square, 25C$]



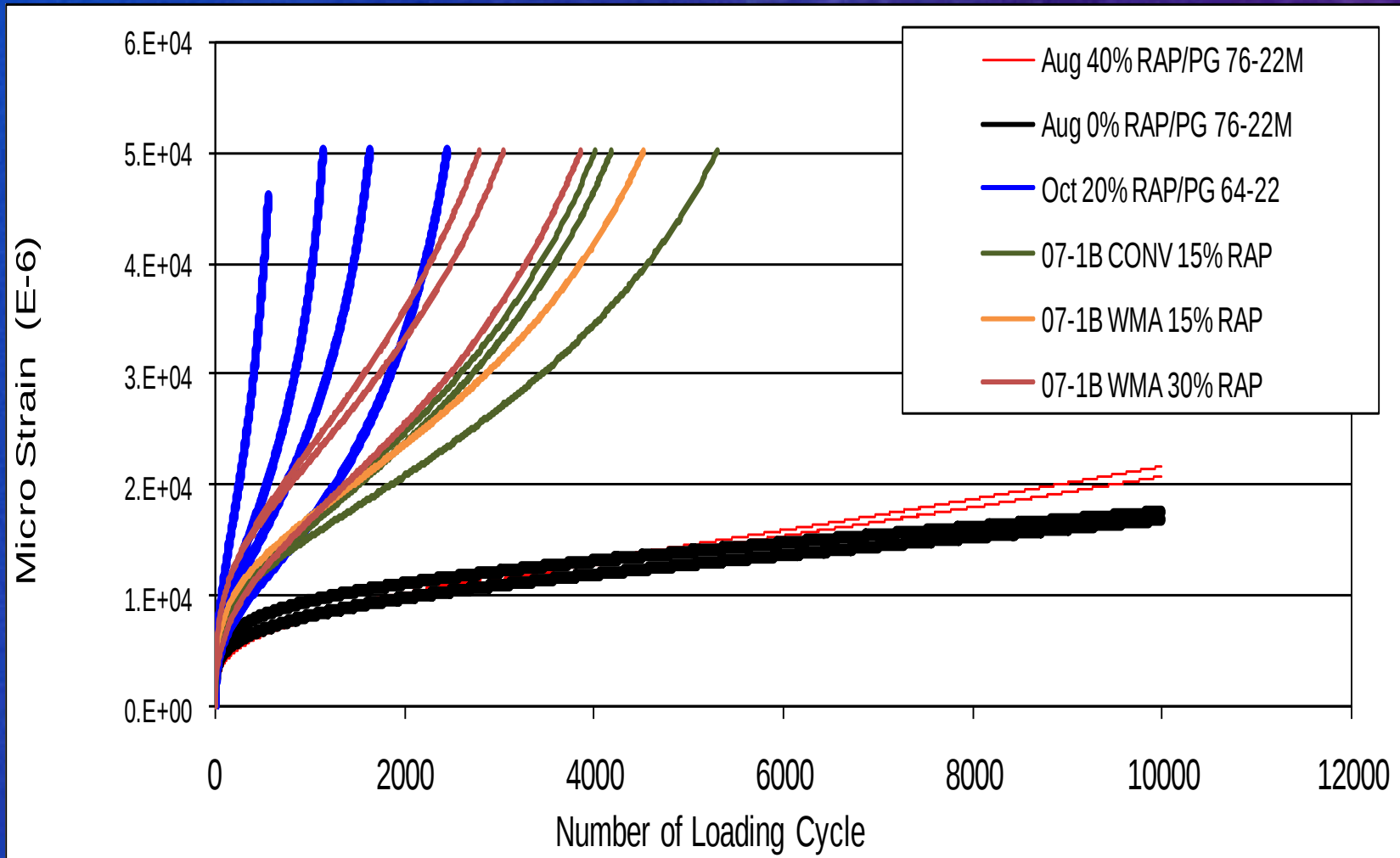
Loaded Wheel Test Results

Project	Sample Type	Air Voids (%)	Rut Depth (mm)
Warm Mix Demo	Plant LTRC1 (No Rap)	12.3	8.65
	Plant LTRC2 (40% Rap)	9.5	4.3
	Core Samples (No Rap)	9.6	3.9
	Core Samples (40% Rap)	10.3	5.2
I-220 Crossovers	WMA, PG 64-22	6.5	2.5
	WMA, PG 64-22	10.5	>20.0
LA 3121	Conv-HMA, 15% RAP	5.05	4.85
	WMA, 15% RAP	4.4	5.65
	WMA, 30% RAP	4.4	5.7

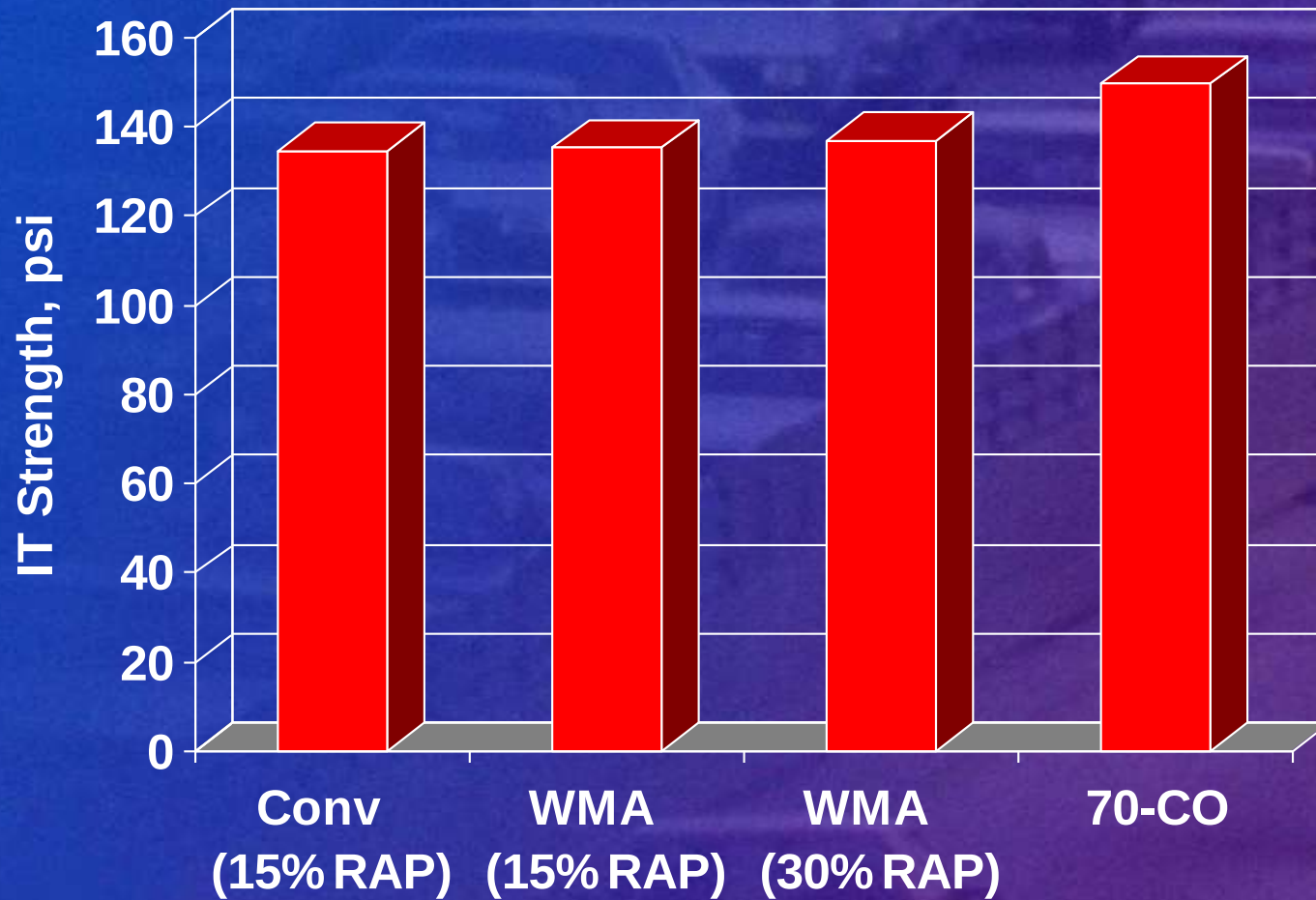
Lottman Test



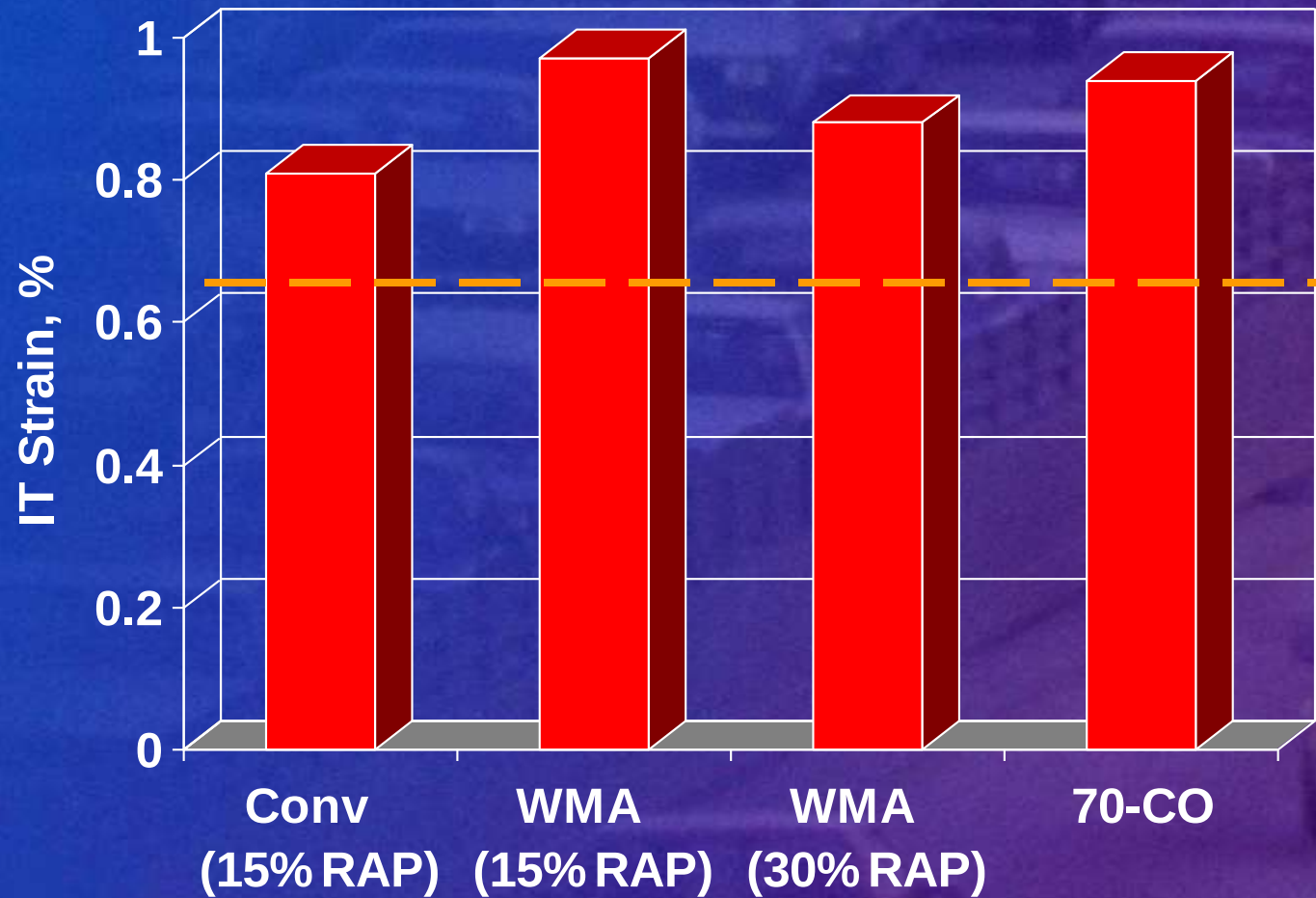
Flow Number Test Results - 54°C



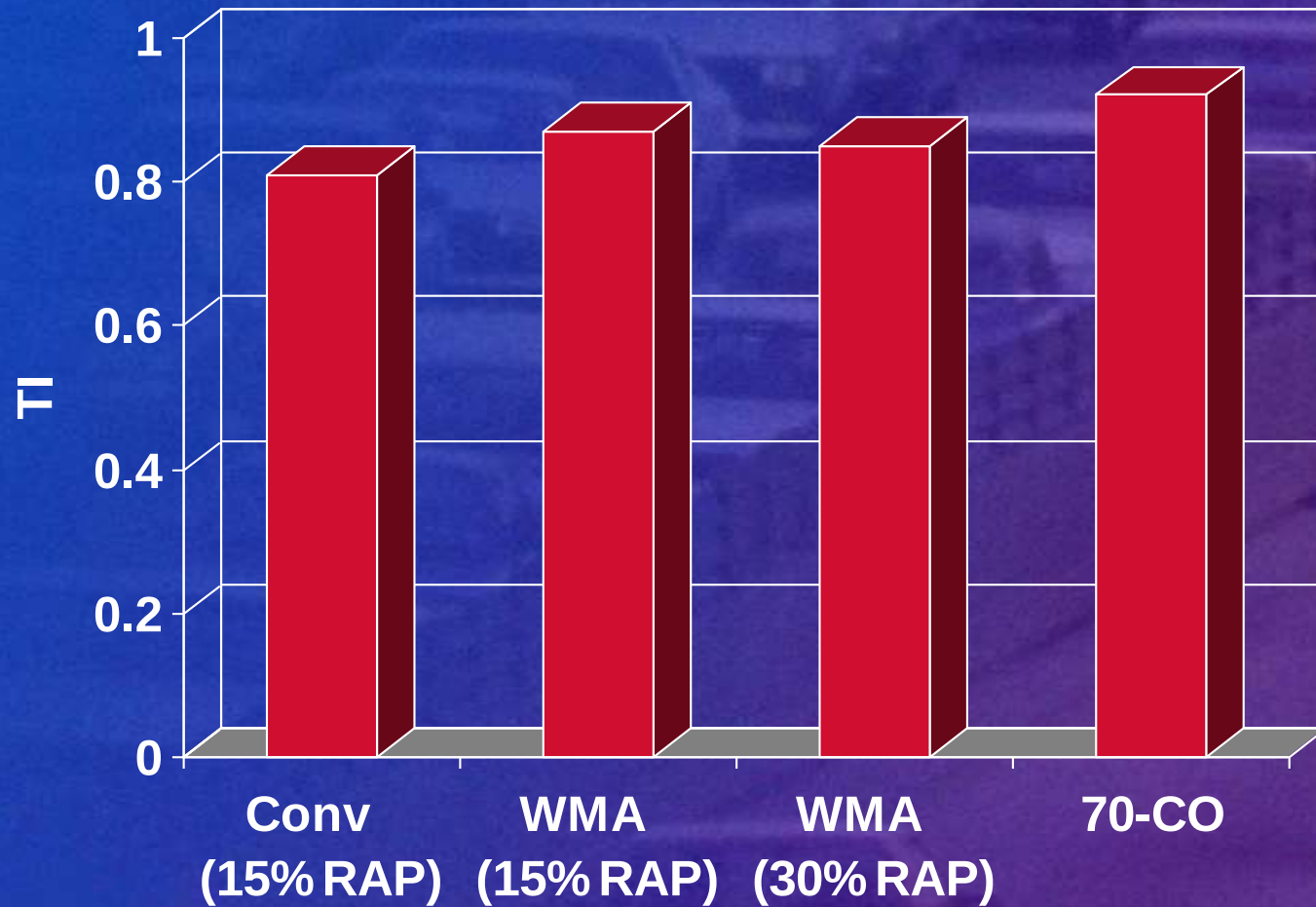
Indirect Strength Test Results



Indirect Strength Test Results

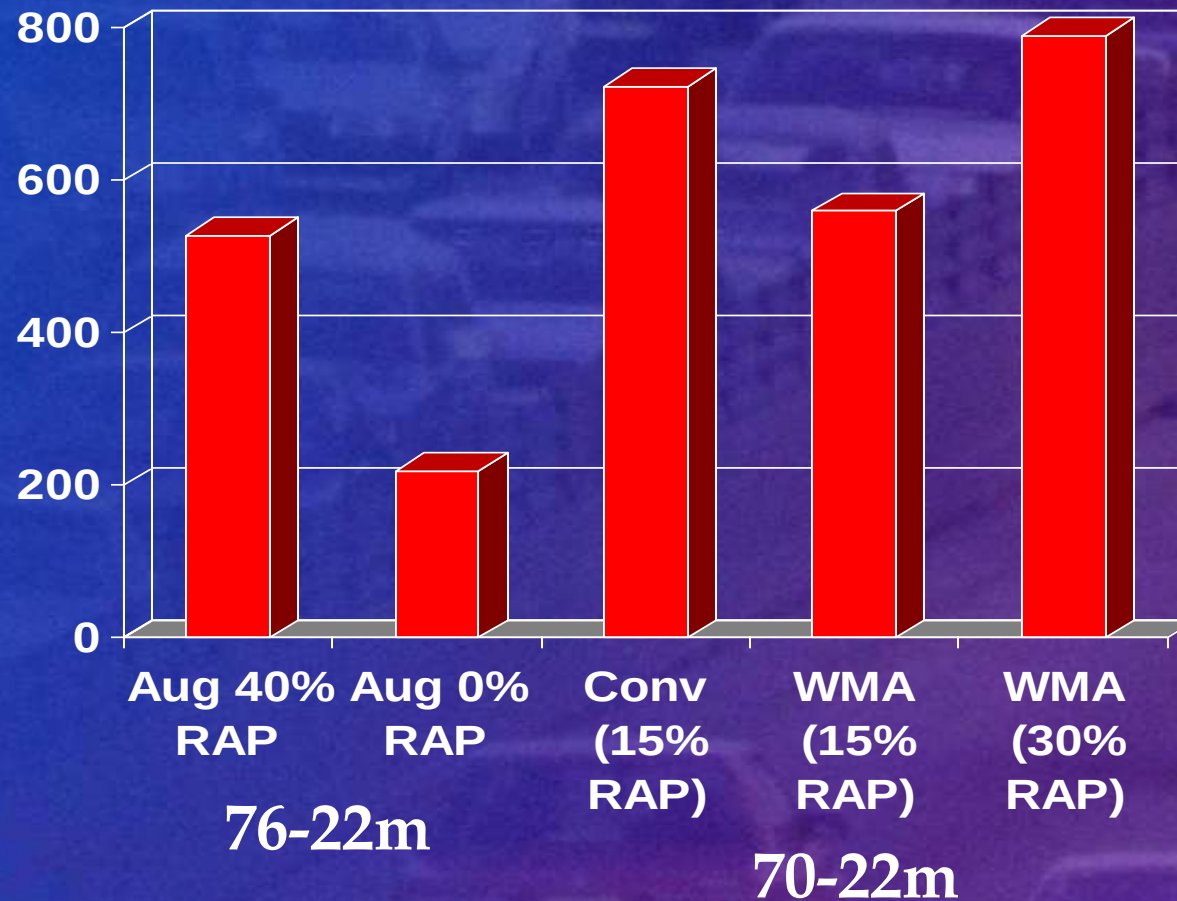


Indirect Strength Test Results



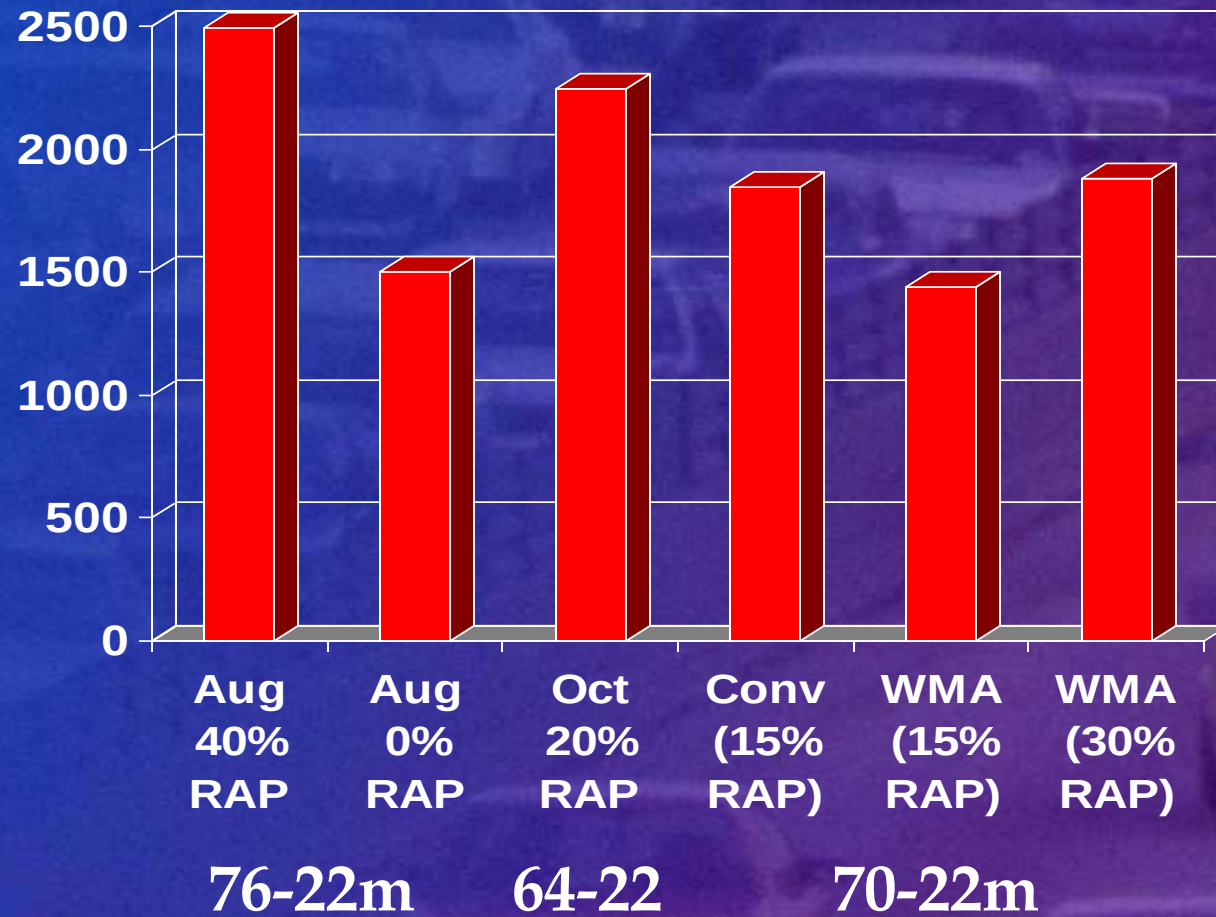
Dynamic Modulus Test Results

$E^*/\sin(\delta)$ (54°C, 5Hz)



Dynamic Modulus Test Results

$E^* \times \sin(\delta)$ (25°C, 5Hz)



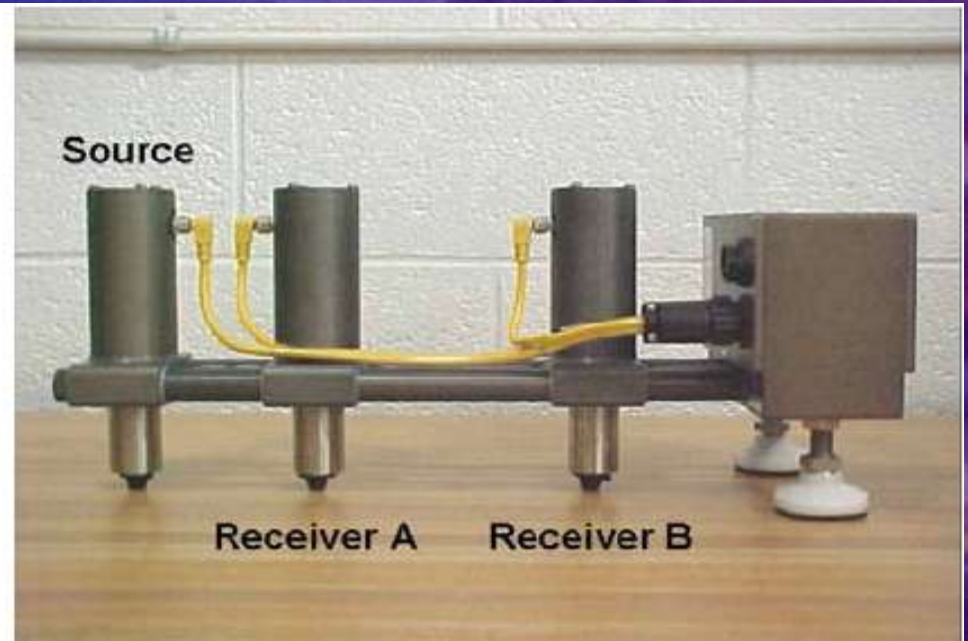
Non Destructive In-Situ Testing



<http://www.ltrc.lsu.edu>

Portable Seismic Pavement Analyzer (PSPA)

- ◆ Modulus of Surface Layer
- ◆ Uses Stress Waves



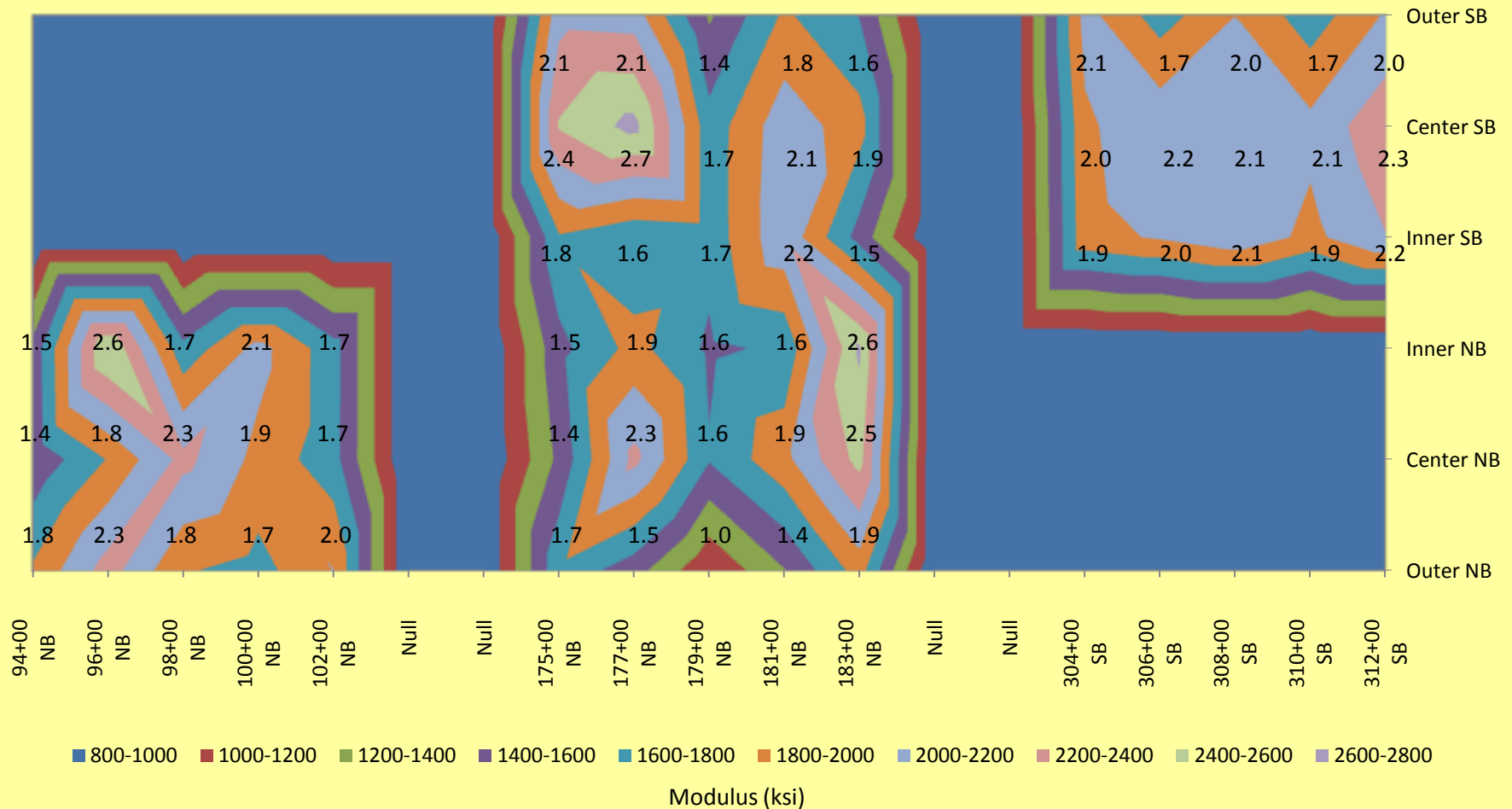
Light Weight Deflectometer (LWD)

- ◆ Modulus of Multiple Pavement Layers
- ◆ Uses Impact Loads and Deflections



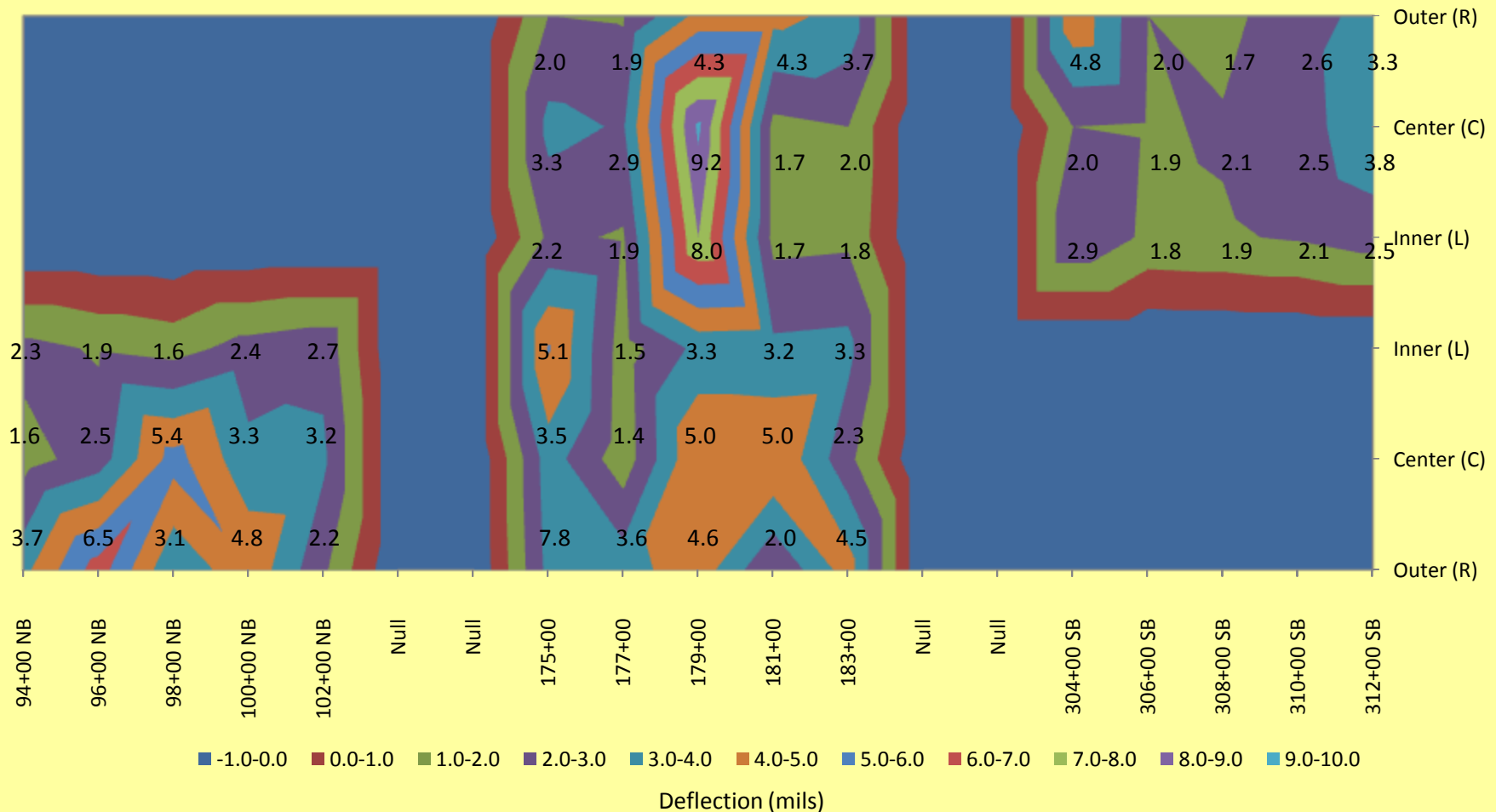
In Situ Results – LA 3121

PSPA Temp Corrected Modulus Contour



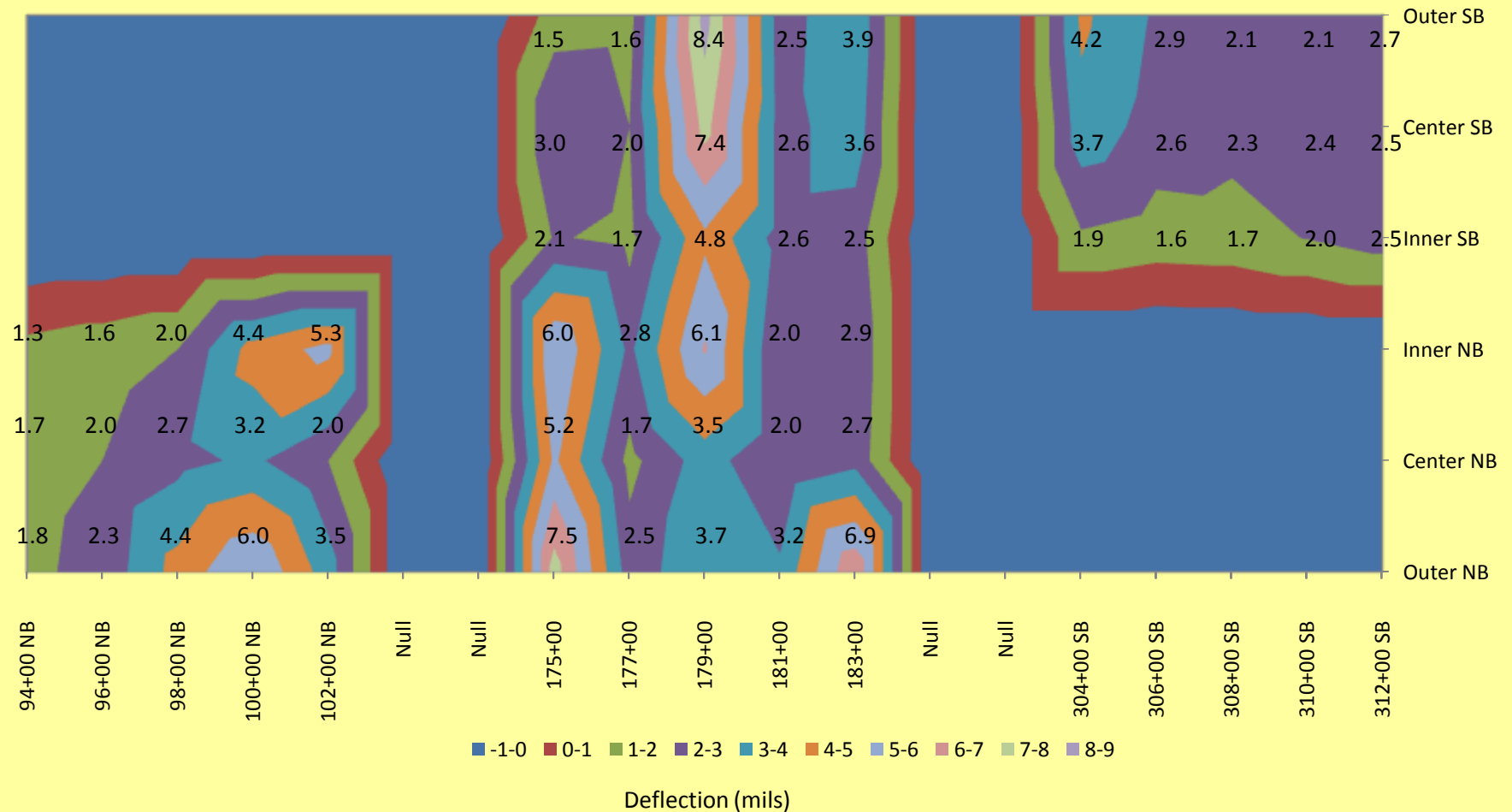
In Situ Results – LA 3121

LWD - Soil Cement Deflections



In Situ Results – LA 3121

LWD - Asphalt Deflections Contour



Energy Savings

- **LA 3121**
 - D & J Construction – HMA Plant
 - Conventional HMA (15%RAP) vs WMA (15% RAP)
 - **13.2% Fuel Usage Savings Reported**
- **US 171 – Recently Completed**
 - Madden Contracting – HMA Plant
 - Conventional HMA (15%RAP) vs WMA (15% RAP)
 - **14% Fuel Usage Savings Reported**



What We Have Learned So Far - Summary

- Density and Compaction results of Polymer Modified HMA mixtures using the WMA technology have proven to be as effective if not better than conventional mixtures.
- Temperatures can be reduced 50 - 75 F below normal mix temperatures.
- Using WMA Technologies can Save in Fuel Cost
- Plans are being made to evaluate additional field projects using this WMA Technologies



What's Next

- **New Projects are currently Underway**
 - US 171 Near Keithville, La. – Construction Recently Completed
 - LA 115 Near Alexandria, La. – Latex Modified
 - LA 3127 Near New Orleans - Sassobit
- **Complete the Materials Characterization for these projects.**
- **Incoporate Specifications and Implement the use of WMA Technologies in Louisiana.**



Troops Having a Little Fun



<http://www.ltrc.lsu.edu>



The New F-16 Fighters



<http://www.ltrc.lsu.edu>



The New M1A1 Tank





The Buddy System



<http://www.ltrc.lsu.edu>



Any Questions?



Thank You!