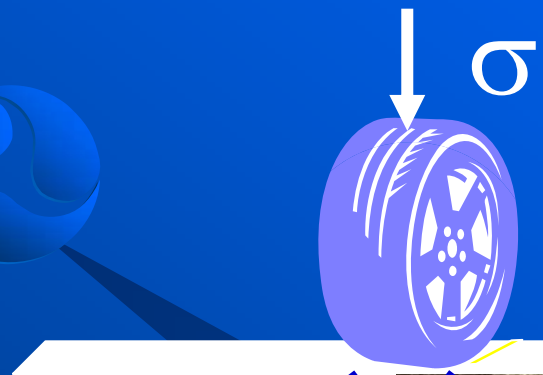
FHWA Pavements program What's Happening

John D'Angelo

Office of Pavement Technology



Pavement Design

tiffness

Mechanistic Analysis

Layered Elastic Analysis

ations at Critical Locations

$E = \sigma/\varepsilon$

Current Status of MEPDG

MEPDG Software Version 0.91

- Downloadable, must be connected to Internet to use
- Updated on NCHRP website: www.trb.org/mepdg

MEPDG Software Version 1.0

- Targeted release: January 2007
- Each State DOT pavement contact will get copy of software (version 1.0)
- **Division Office engineers request version 1.0 cd-rom from DGIT team** (dgit@dot.gov)

FHWA DGIT Workshops

*Webcast available

Upcoming

- Traffic – 3
- PMS Database Inputs - 1

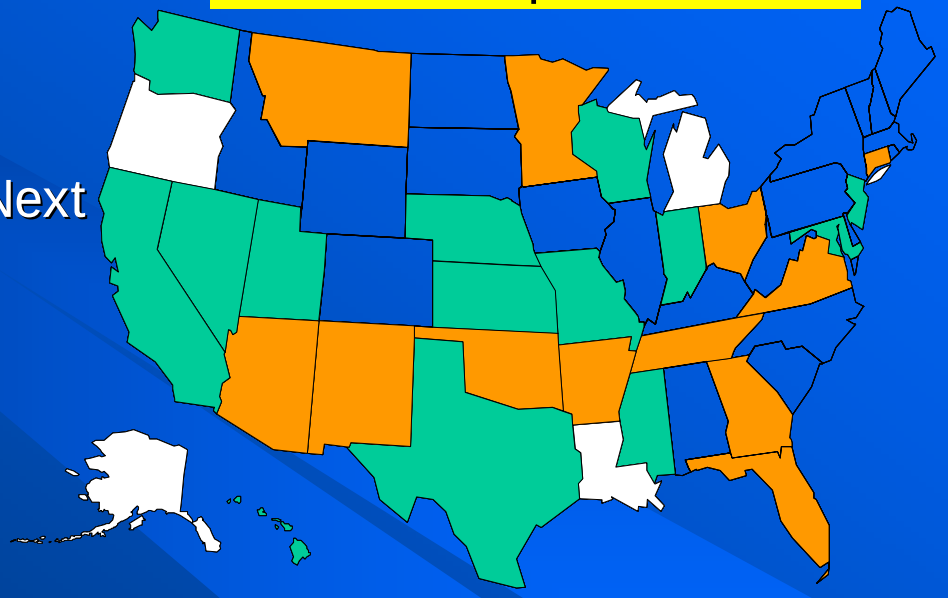
Future

- Local Calibration
- Weighing Impacts of MEPD for Next Generation Traffic Data

Past Workshops

- Introduction to the DG – 8*
- Traffic – 2
- Materials – 11*
- Climatic Inputs – 12*

Workshop Locations



FHWA Other Activities

DGIT & Office of Freight Management / Operations

Contract with Auburn University

- Models in M-E PD that deal with truck size & weight
- Assessing impacts of raising weight limits

FHWA cross-disciplinary cooperation team

- Identify methods to assign cost to infrastructure damaged by increased highway load limits
- Strive for official FHWA position on this topic

Future FHWA Workshops

National Highway Institute
NHI Course #131109
Pilot: April 2007

Analysis of New and Rehabilitated Pavement Performance with Mechanistic-Empirical Pavement Design Software

- Hands-on format with computers loaded with software
- Focus on user, not theory
- Objective is for audience to be capable of performing flexible, rigid, rehab designs

Future FHWA Workshops

- Local Calibration for M-E PDG models
  - Awaiting deliverables from NCHRP 1-40 B
  - Pilot planned for Fall 2007
  - Purpose: discuss Sensitivity of inputs & calibration, educate Pavt Designers & Pavement Managers


Recycling
1476

FHWA Recycling Policy

- Recycled materials should get first consideration in overall materials selection.
- Recycling can offer engineering, economic and environmental benefits.
- Engineering and environmental properties are important.
- Life Cycle Cost benefits assessment is warranted.
- Restrictions prohibiting recycled material that are without technical basis should be removed.

FHWA Plan on Current Status of Pavement Recycling

- Recommendation: Based on current practice, the most impact in pavement recycling can be made through the promotion of reclaimed asphalt pavement (RAP). Other recycling technologies should also be promoted through pavement preservation efforts

FHWA Plan on Current Status of Pavement Recycling

- Purpose: Determine the current status of pavement recycling as far as surveys on quantity, concerns, and potential savings.

FHWA Plan on Current Status of Pavement Recycling

- What work needs to be done
  - The first step is establishment of a RAP Technical Working Group.
  - This group will include government, industry and academia.
  - They will be used to guide the many activities to be accomplished.
  - pavement evaluation

FHWA Plan on Current Status of Pavement Recycling

- What work needs to be done
  - Documentation of design and construction process beginning with establishment of pavement evaluation techniques.

FHWA Plan on Current Status of Pavement Recycling

- **Determination of long term performance Characteristics**
  - **Fatigue Properties**
  - **Low Temp Cracking**
  - **Quality Characteristics**
- **HMA Performance Tester**

FHWA Plan on Current Status of Pavement Recycling

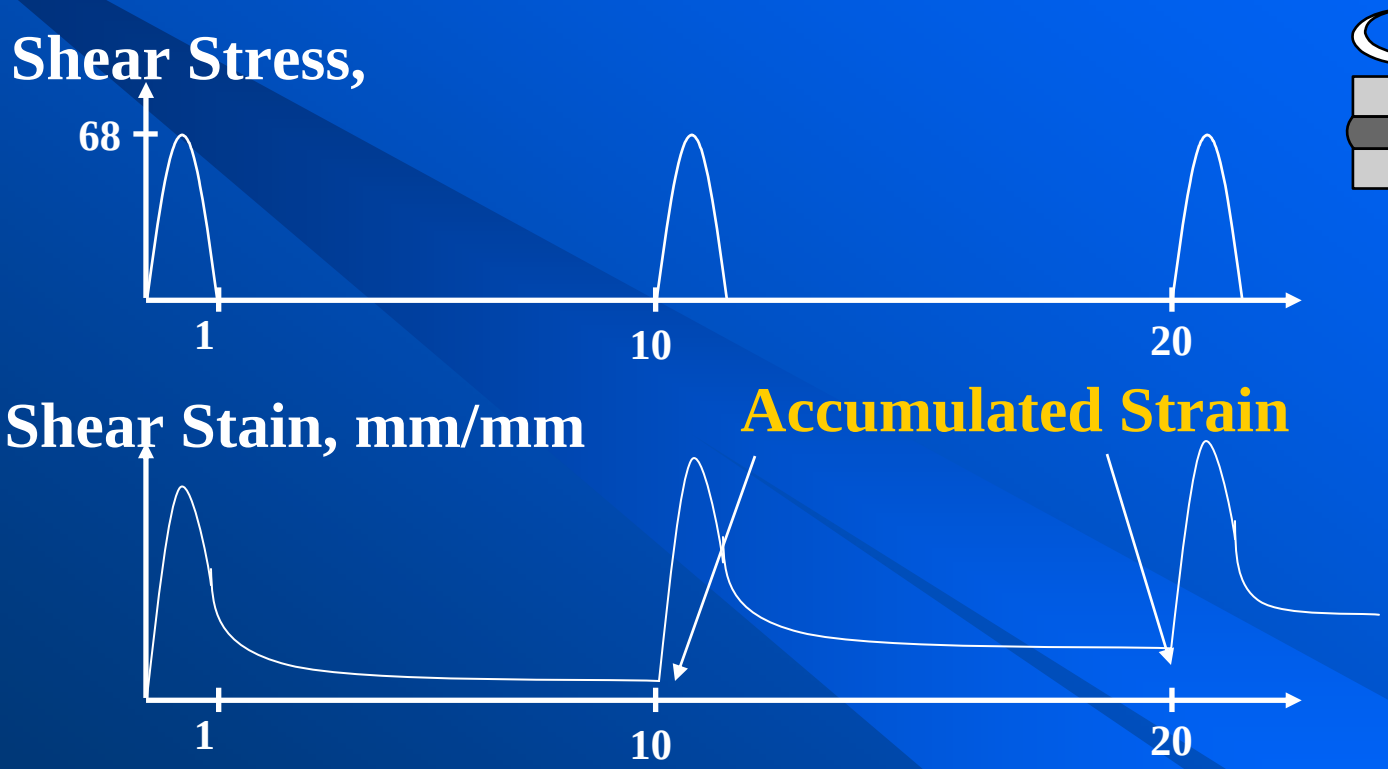
- Work with NAPA on development of updated design recommendations to maximize RAP use.

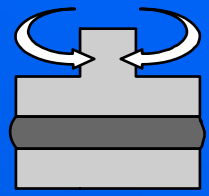

Binders

High Temperature Binder Criteria

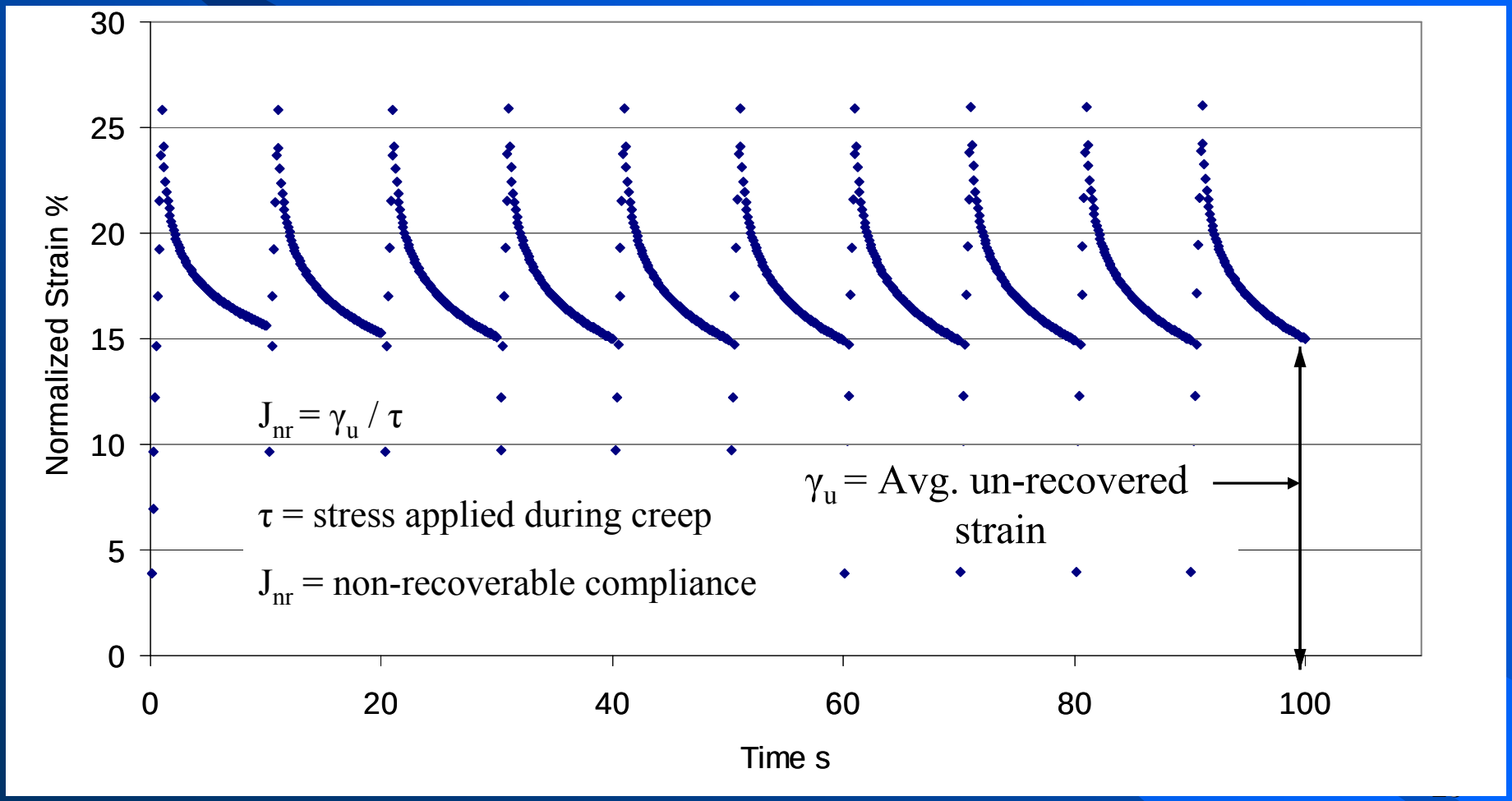
- Study
  - Refine the Multi-Stress Creep and Recovery Test
  - Evaluate multiple binders
  - Evaluate binder and mix properties to develop specification criteria.

NCHRP 9-10 Rutting Test
Repeated Creep Recovery Test



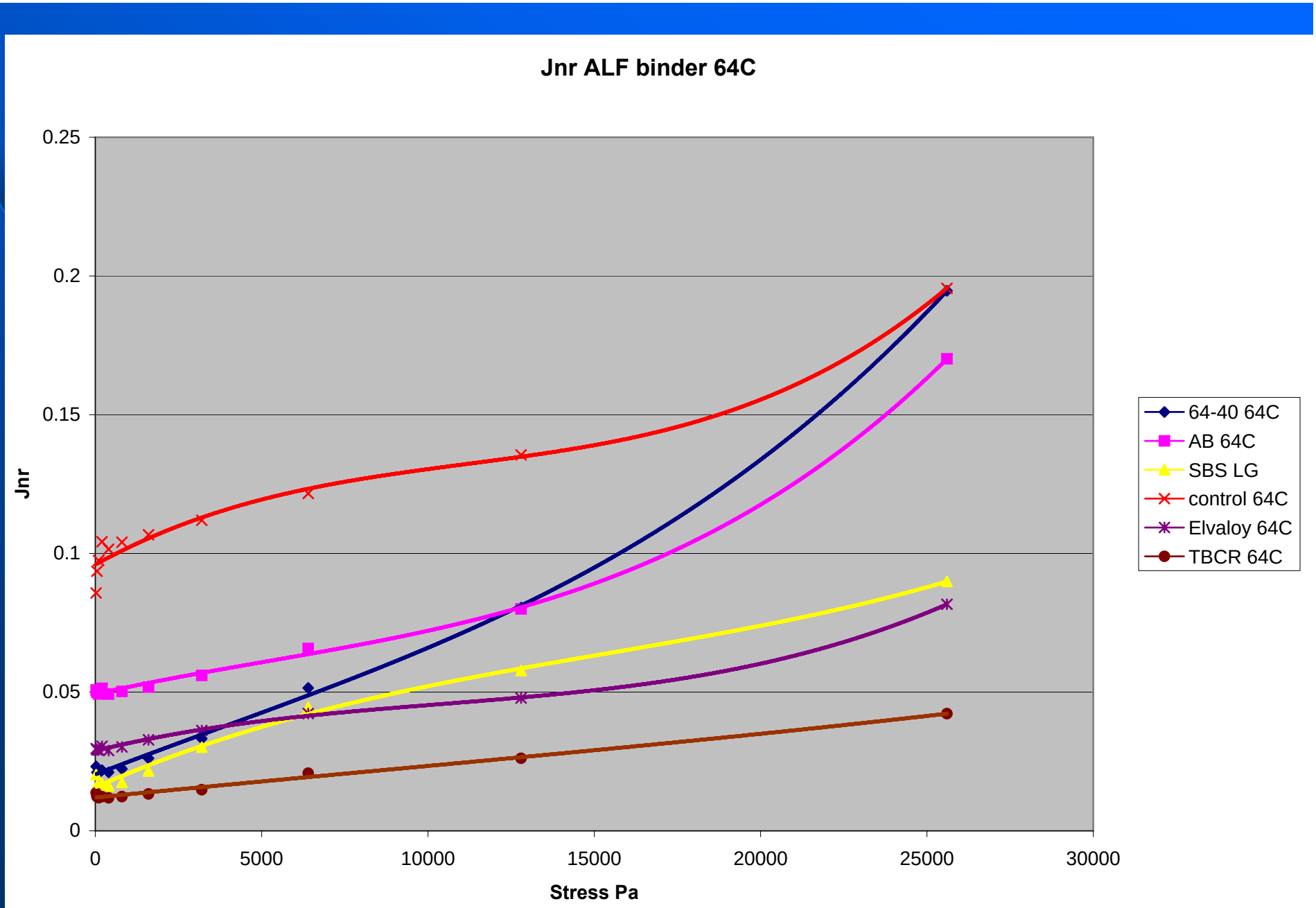


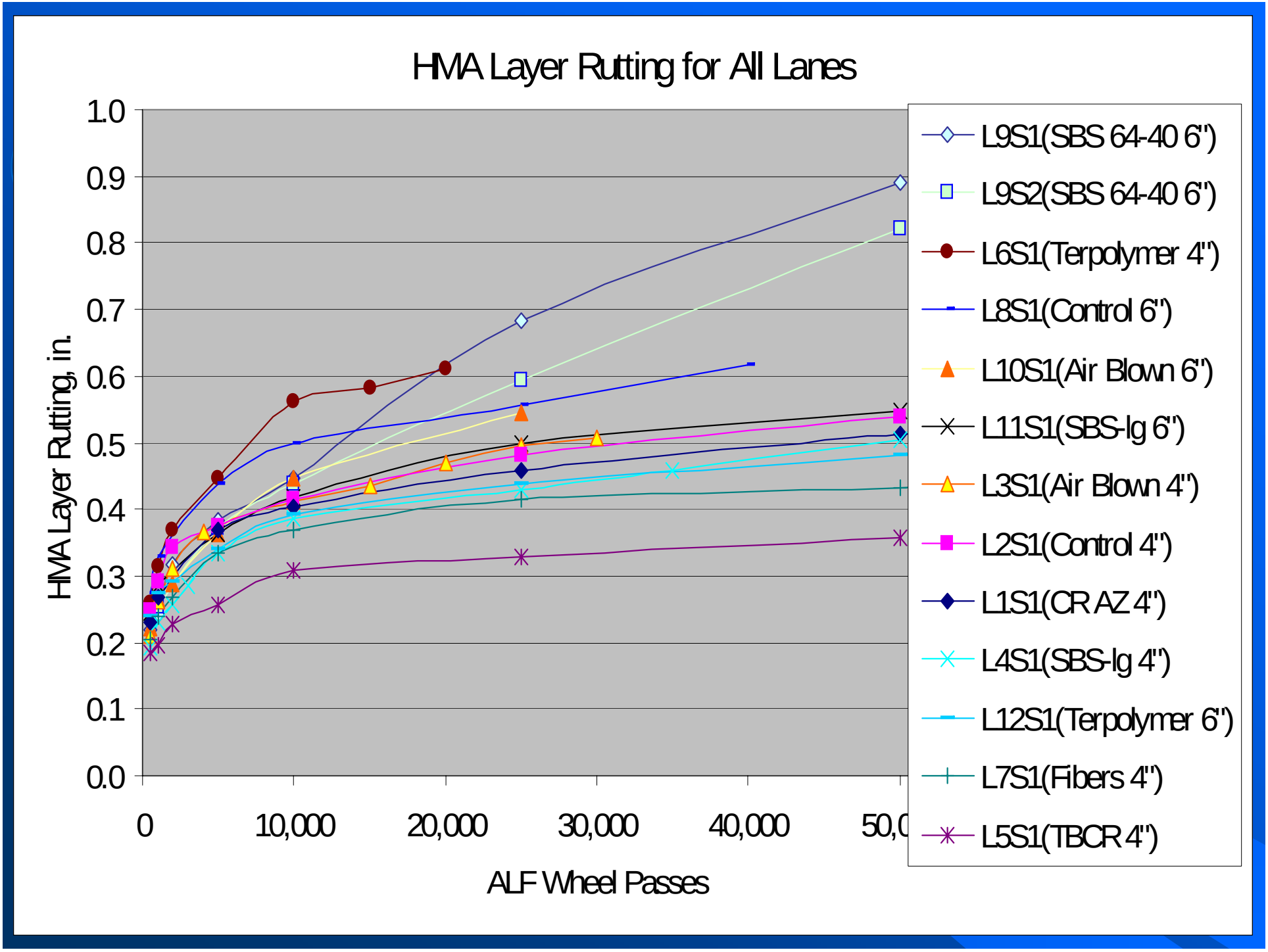
New High Temp Criteria Jnr

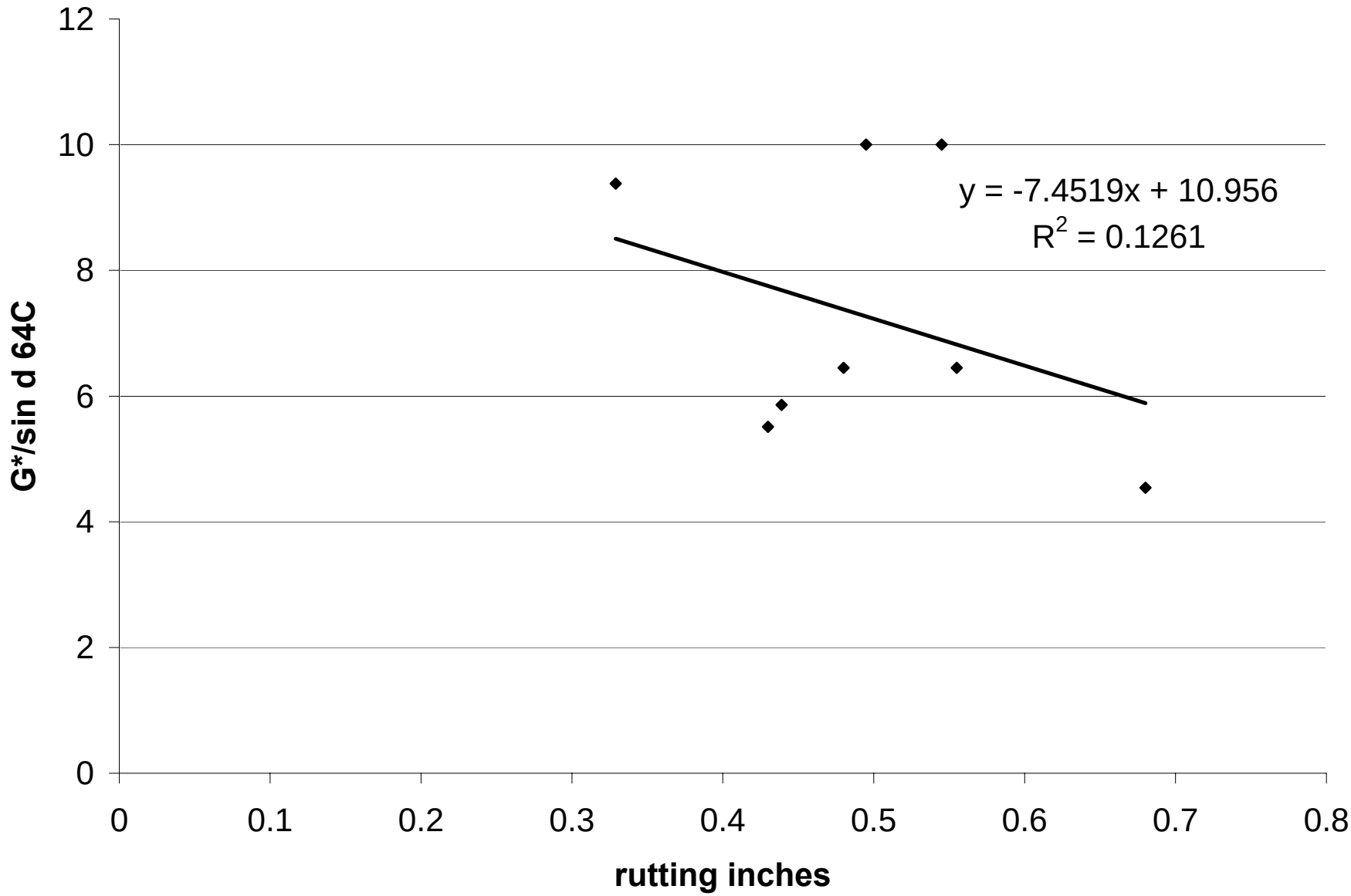


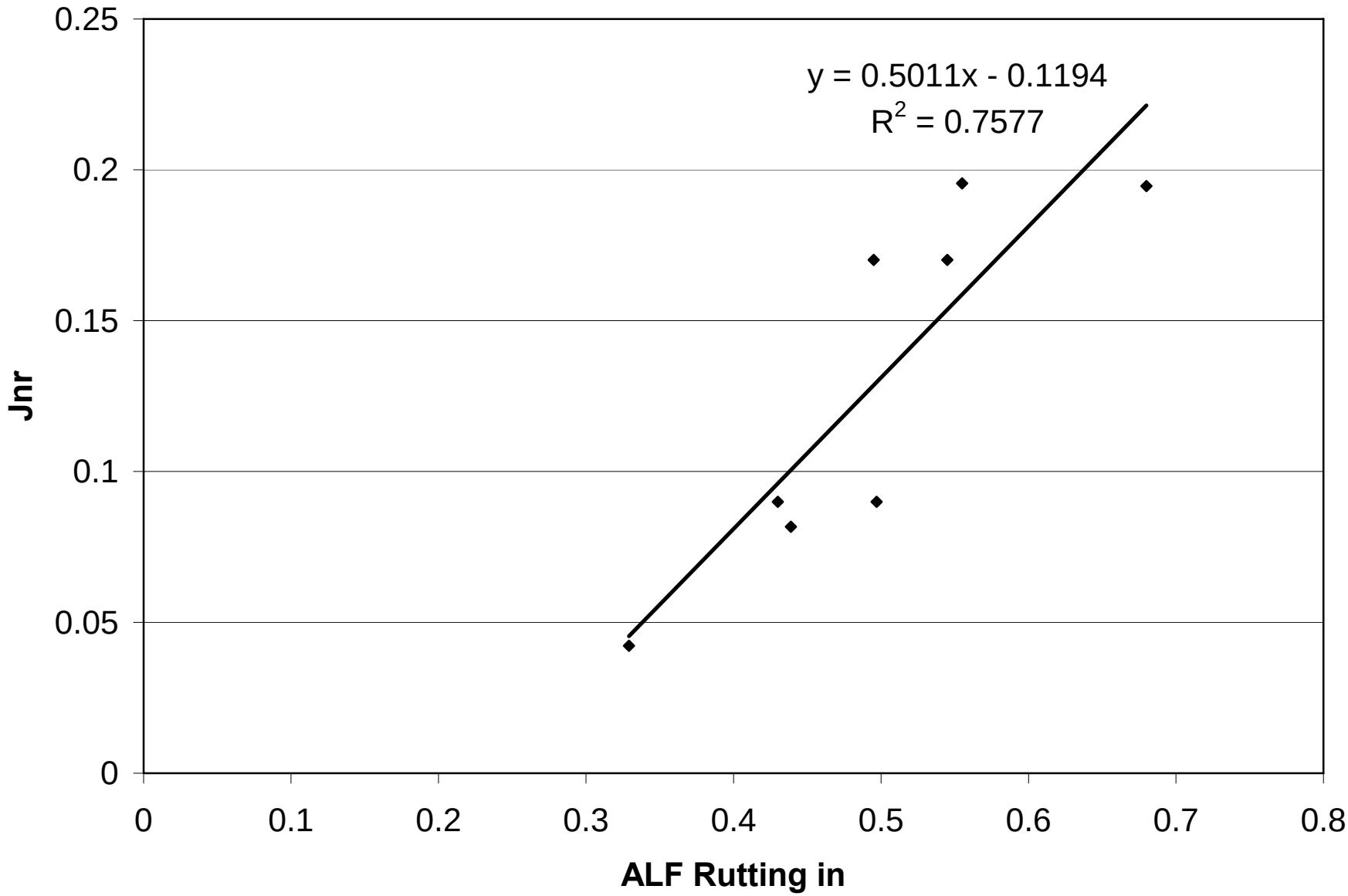
As-Built Pavement Lanes

CR-AZ ---- 70-22	PG 70-22 Control	Air Blown	SBS LG	CR-TB	TP	PG 70-22 + Fibers	PG 70-22	SBS 64-40	Air Blown	SBS LG	TP
1	2	3	4	5	6	7	8	9	10	11	12

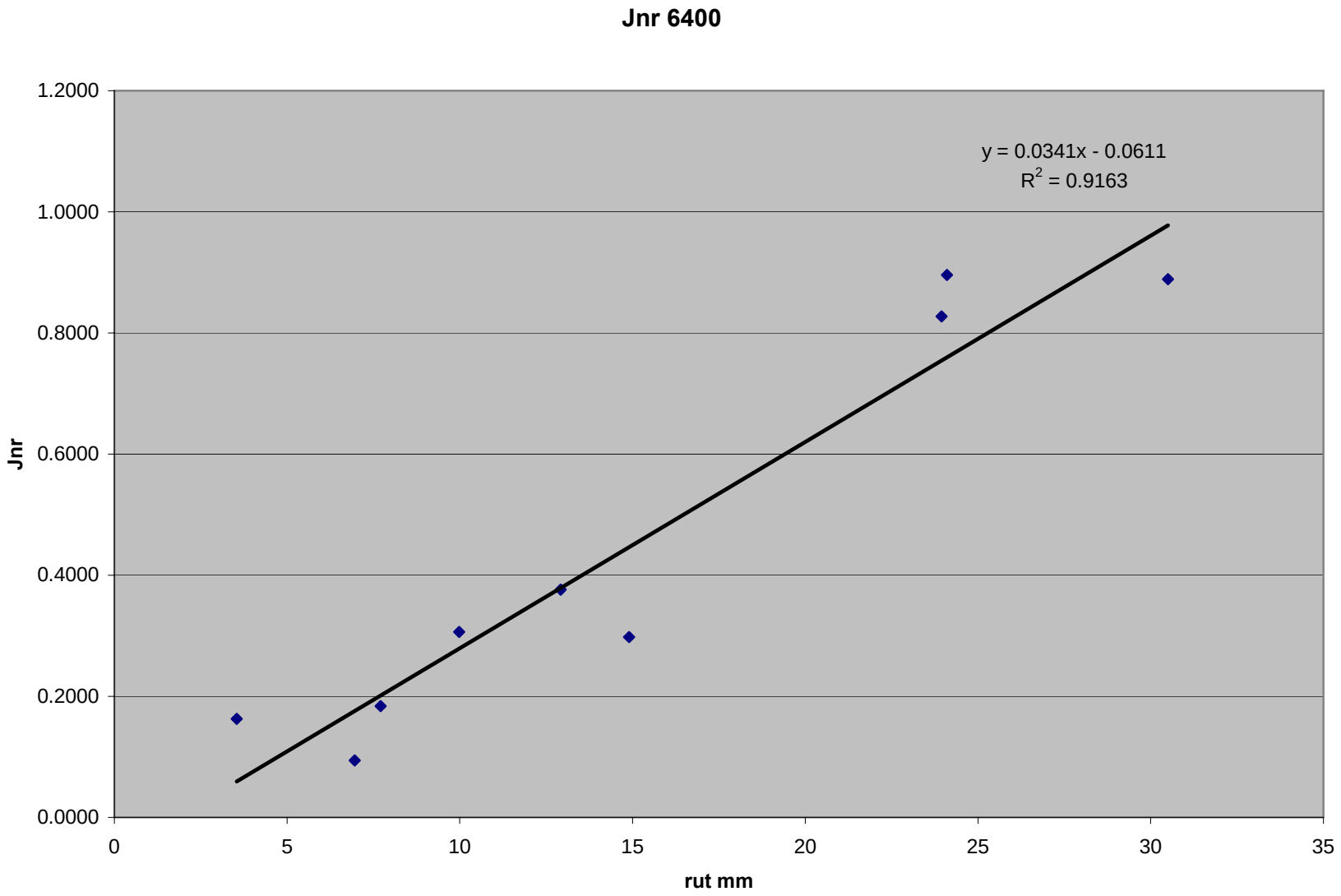

Jnr ALF binder 64C
0.25
0.2
0.15
0.1
0.05
0
Jnr
0
5000
10000
15000
20000
25000
30000
Stress Pa
64-40 64C
AB 64C
SBS LG
control 64C
Elvaloy 64C
TBCR 64C


HMA Layer Rutting for All Lanes
HMA Layer Rutting, in.
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
10,000
20,000
30,000
40,000
50,0
ALF Wheel Passes
L9S1(SBS 64-40 6")
L9S2(SBS 64-40 6")
L6S1(Terpolymer 4")
L8S1(Control 6")
L10S1(Air Blown 6")
L11S1(SBS-lg 6")
L3S1(Air Blown 4")
L2S1(Control 4")
L1S1(CR AZ 4")
L4S1(SBS-lg 4")
L12S1(Terpolymer 6")
L7S1(Fibers 4")
L5S1(TBCR 4")


12
10
8
6
4
2
0
G*/sin d 64C
y = -7.4519x + 10.956
R2 = 0.1261
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
rutting inches


y = 0.5011x - 0.1194
R2 = 0.7577
Jnr
ALF Rutting in
0.25
0.2
0.15
0.1
0.05
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8

Hamburg Rut testing MINN Road mixes



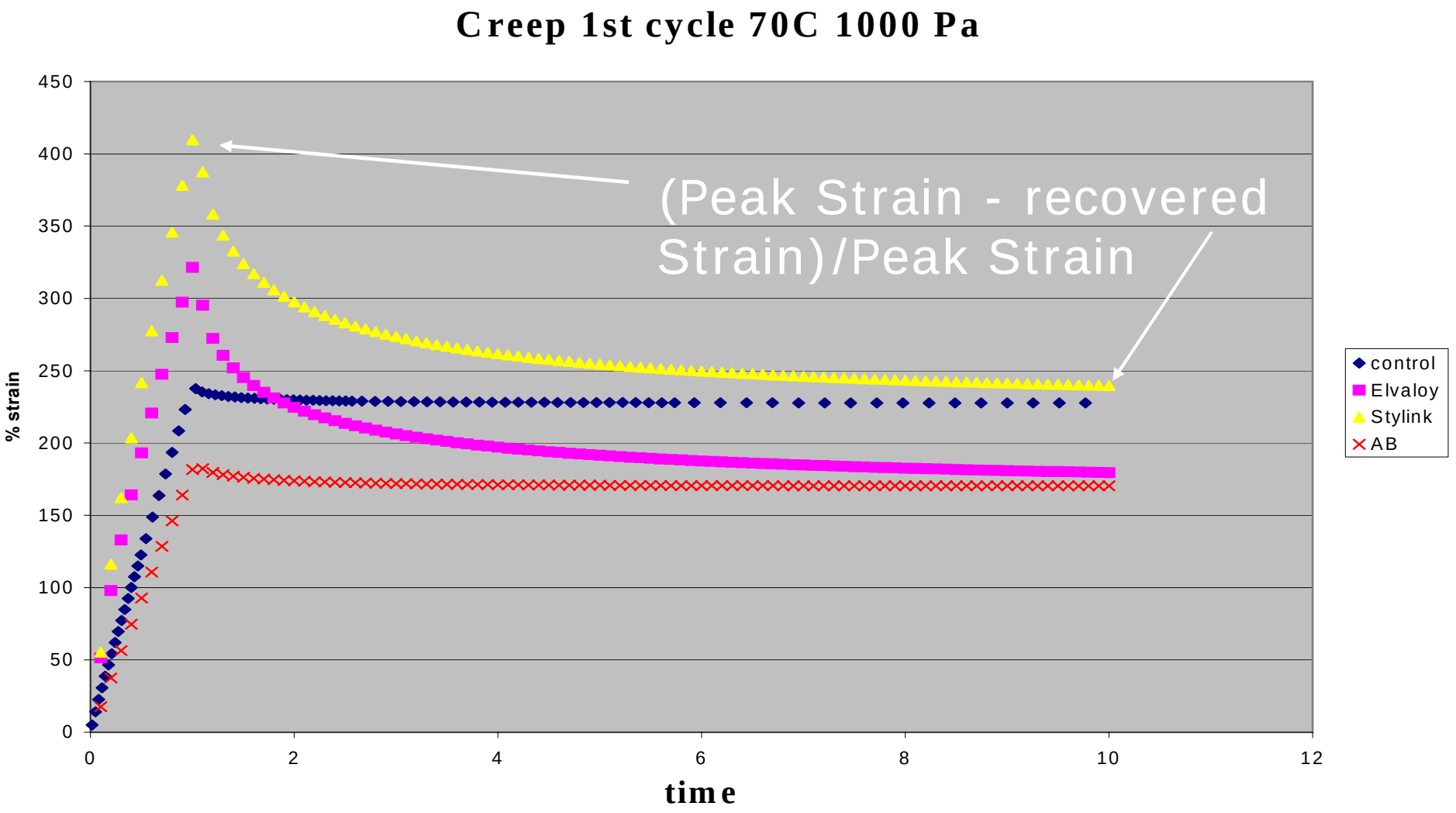
Ongoing work

- Define Jnr based on neat binders.
- Evaluate SPT creep and recovery testing to relate stress level in binder to mix.
- Evaluate test sections with know performance.

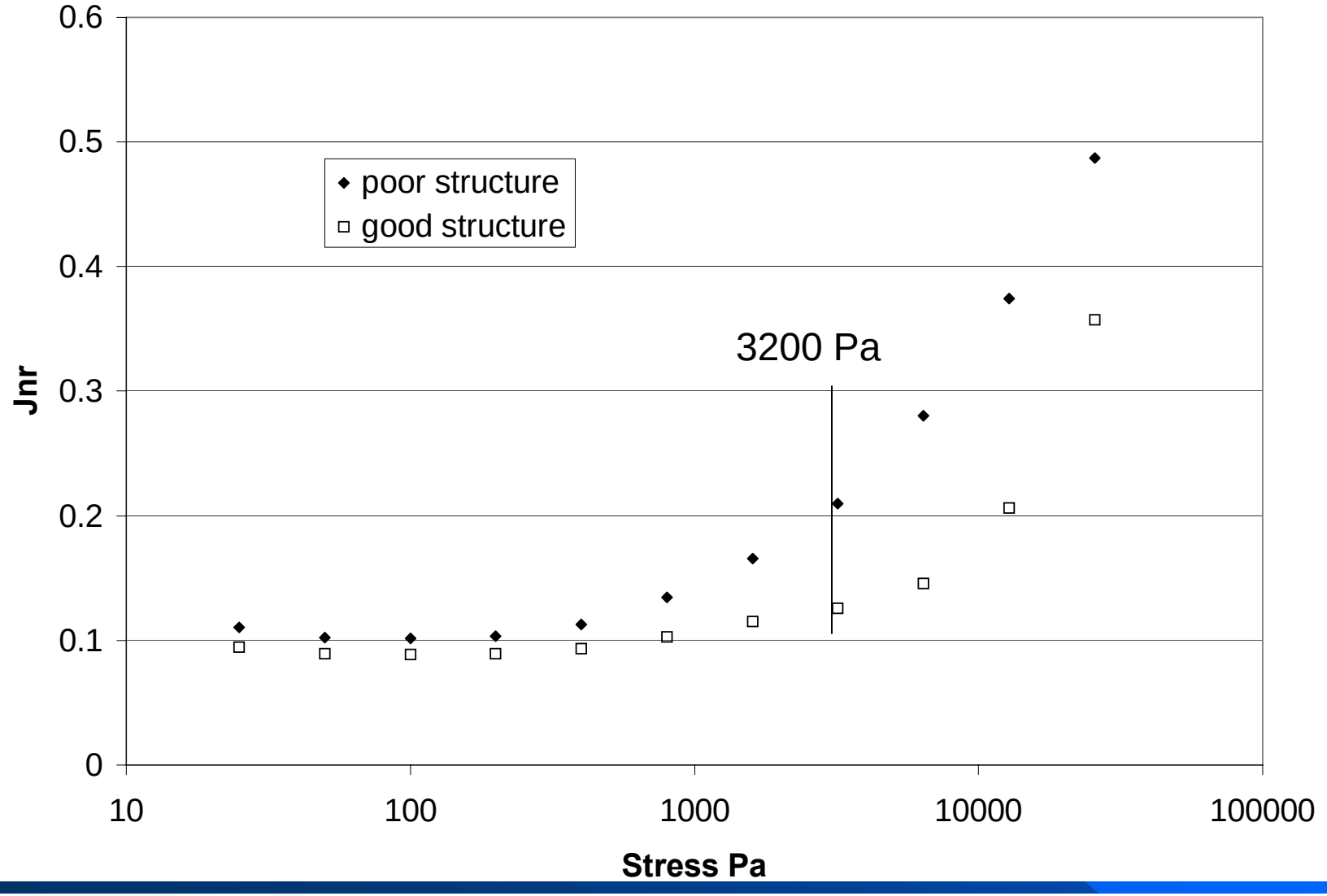
How do we identify Polymers? Use DSR Approach

- Use DSR
  - Muti Stress Creep Recovery Test
    - Two creep stress levels
    - Ten cycles per stress level
    - For Elastomeric modifiers Specify:
      - % strain recovery 3200 Pa > 15% or 20%
      - Overall change between stress levels 100-3200 Pa < 75%
    - Run on the RTFOT
    - Run on the same sample as RTFOT grading

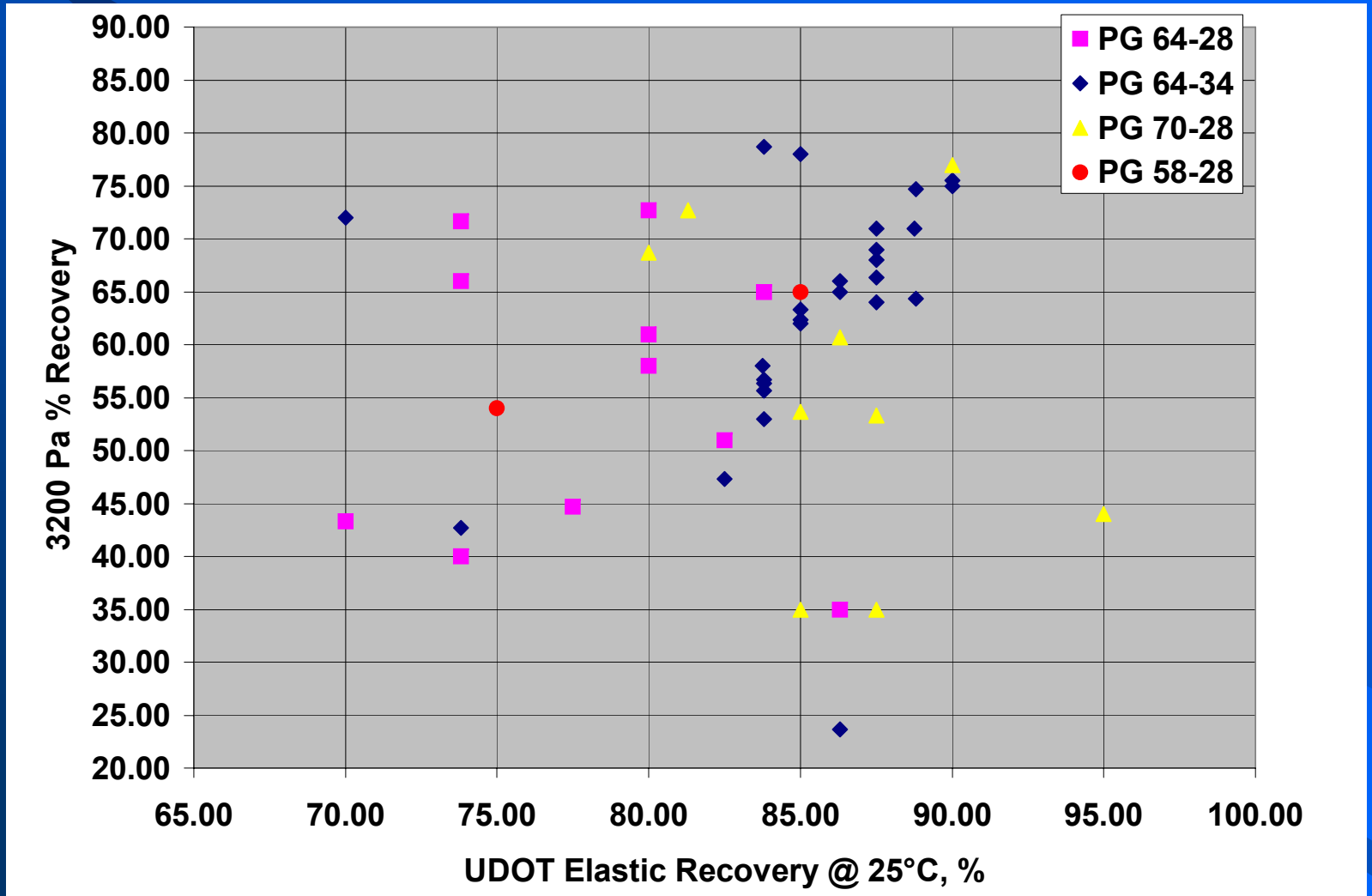
What criteria? % recovered strain



MSCR selection of stress levels



General relationship between ER and MSCR

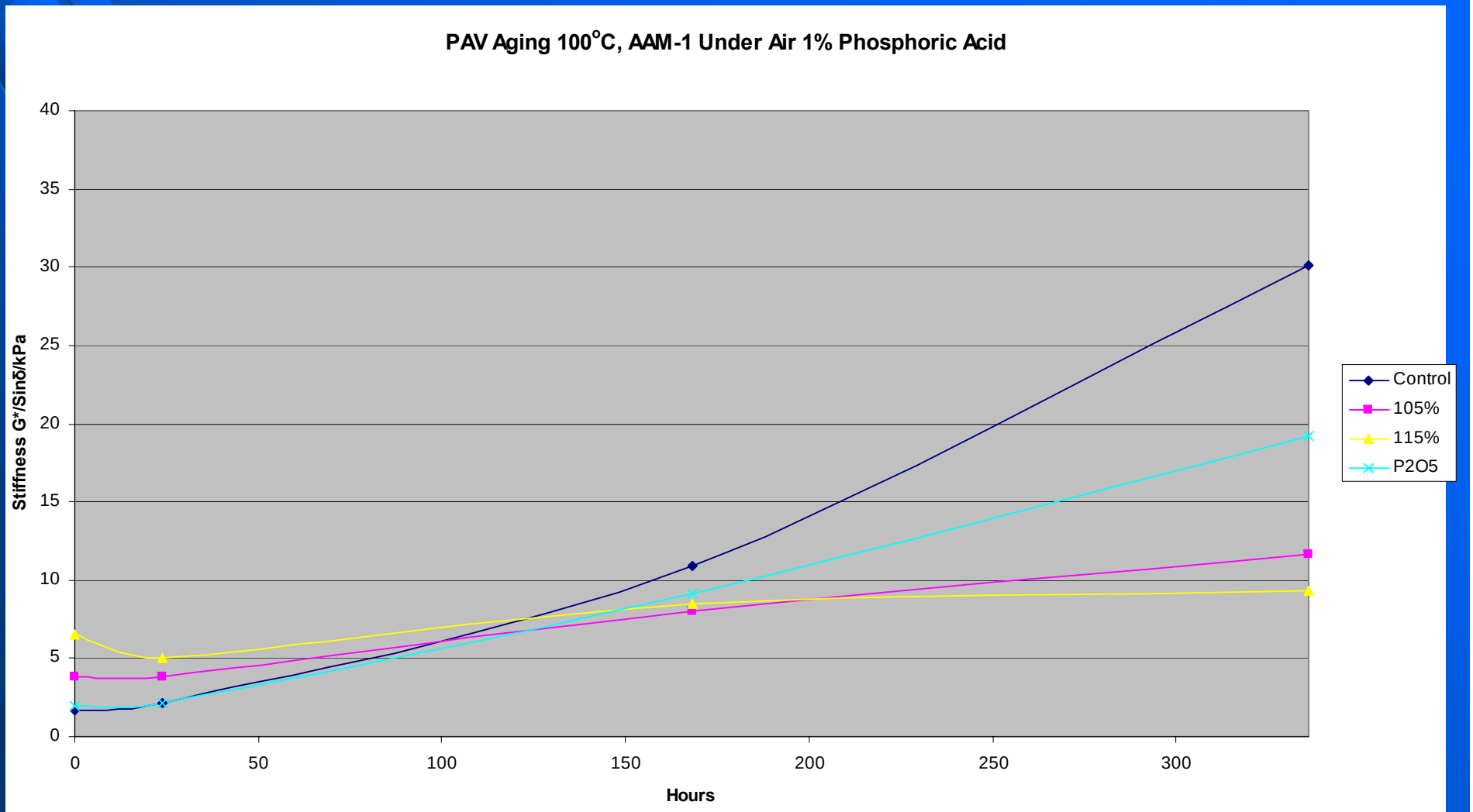


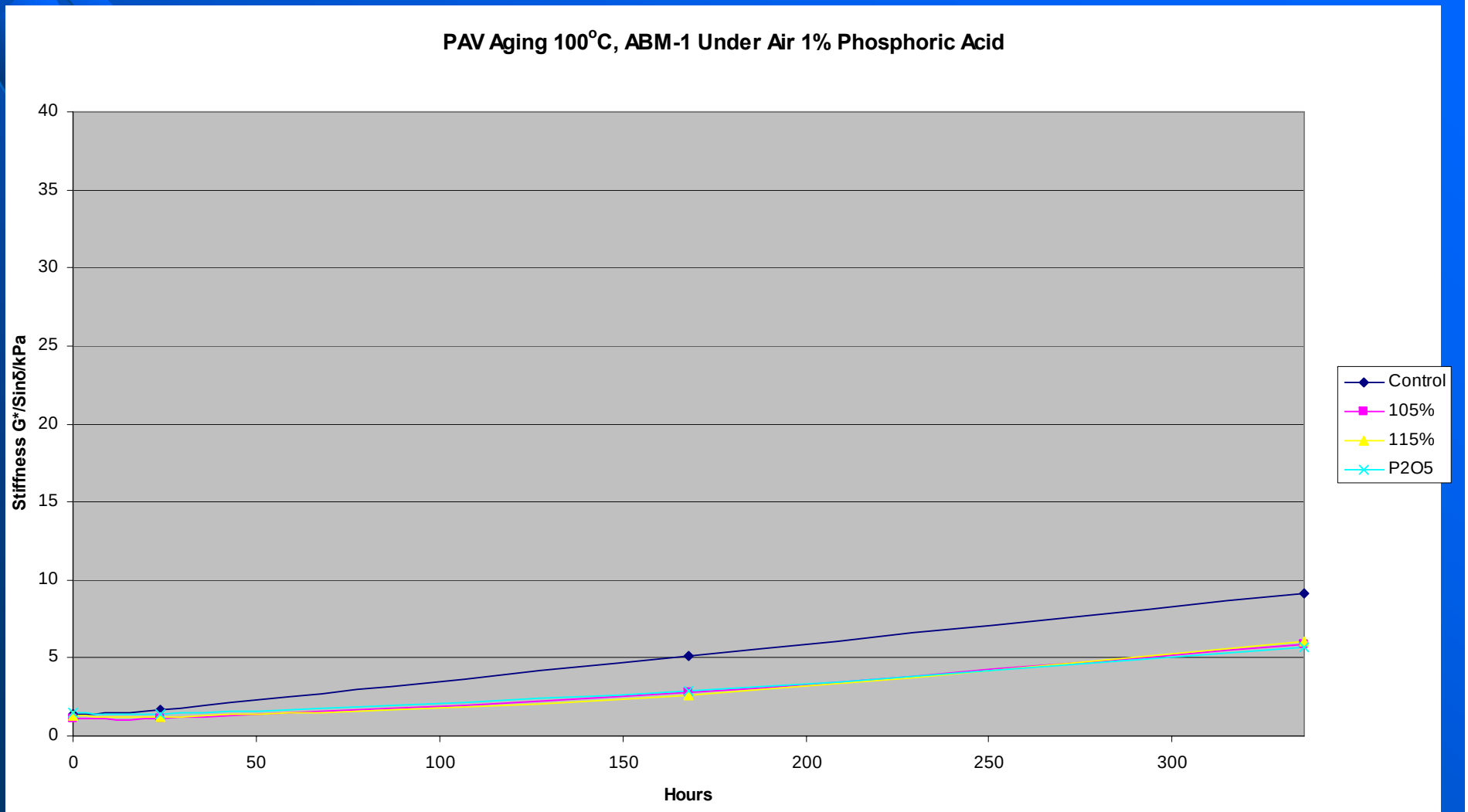
Phosphoric Acid Modified Asphalt

FHWA Study

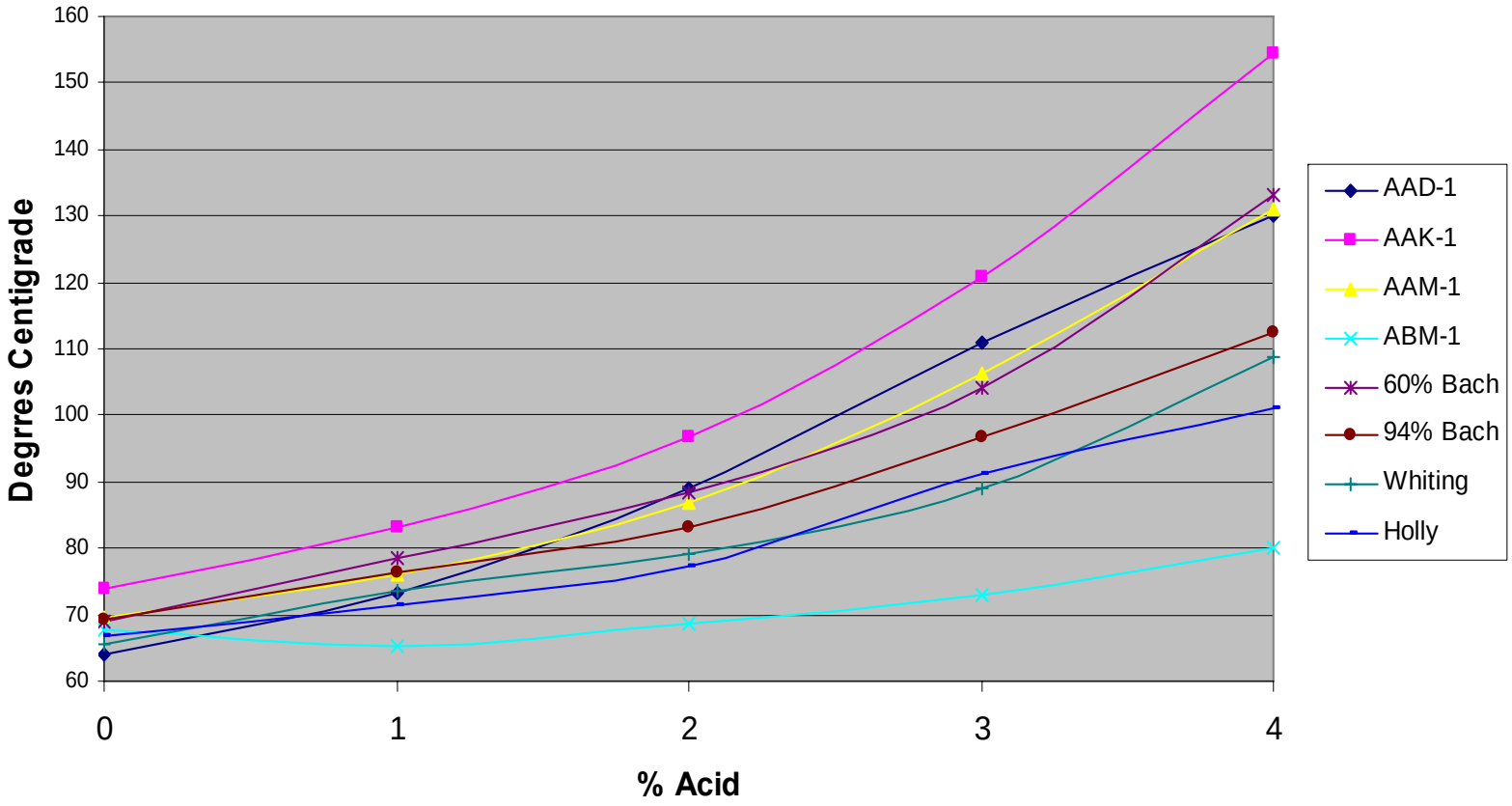
Four SHRP Asphalts

	Origin	Grade	Asphaltene %	Polar Aromatics	Napthenic Aromatics	Saturates
AAD-1	CA Coastal	PG 58-28	20.5	41.3	25.1	8.6
AAK-1	Boscan	PG 64-22	20.1	41.8	30.0	5.1
AAM-1	West TX Int.	PG64-16	4.0	50.3	41.9	1.9
ABM-1	CA Valley	PG 58-10	7.1	52.4	29.6	9.0


PAV Aging 100°C, AAM-1 Under Air 1% Phosphoric Acid
Stiffness G*/Sinδ/kPa
40
35
30
25
20
15
10
5
0
0
50
100
150
200
250
300
Hours
Control
105%
115%
P2O5


PAV Aging 100°C, ABM-1 Under Air 1% Phosphoric Acid
Stiffness G*/Sinδ/kPa
40
35
30
25
20
15
10
5
0
0
50
100
150
200
250
300
Hours
Control
105%
115%
P2O5

Effect of 115% PPA Acid Modification on Original PG Grade



Conclusion – Based on 24 Hour Stiffness

- Any of the Phosphoric Acid Grades can be used
- Acids Containing Water Cause Foaming
- Green Acid is Likely to Cause Corrosion
- Stiffness is Asphalt Dependant
- AAK-1 (Boscan) is the Most Responsive
- ABM-1 (CA Valley) Showed No Stiffness Increase

Effect of Water on Gyratory Cores - ALF Mix no lime

Conclusion Effect of Water on Gyratory Cores

- PPA does not seem to be leaching out.

Proposed Work Plan

- Three binders with different sensitivities to PPA
- Two aggregates, non stripping and stripping;
- Amine anti- strip additives and lime
- Four stripping tests
- Effect of Polymer Modification with SBS


Mixture Issues

Superpave Gyratory Compactor Calibration

Making Superpave Mixtures Consistent

AASHTO Designation: T 312-03 Preparing ... Specimens by ... SGC

4.1

Superpave Gyratory Compactor – ... an average internal angle of 1.16° ± 0.02°

.....

(only internal angle with simulated mix measurement)

Specification Recommendations

- Drop procedures related to use of HMA
  - drop reference in T312; eliminate TP48
- Implement new TP for simulated loading
  - add reference in T312
  - Precision: Troxler 4140 NOT INCLUDED
  - Refer to “manufacturers’ recommendations”
    - Applies to specific procedures for using various devices
    - Applies to hot-versus-cold question(s).
  - Inform users that RAM ~ DAV2/HMS
- Angle tolerance: move to +/- 0.03 deg

TP-62 Determination of Dynamic Modulus

- 9-29: Superpave Performance Tester for dynamic modulus
- TP 62 **Dynamic Modulus E***
  - Accommodate Superpave Performance Tester
  - Separate Std for sample preparation
  - Separate Std. for master curve

Fine Aggregate Specific Gravity Issues

Task Group Objectives:

- Identify problems/issues with current standard AASHTO T 84
- Evaluate alternate methods
- Make recommendations regarding changes and/or new methods
- Additional scope -- Mixture gravity determination issues T 209

9-33: *A Mix Design Manual for Hot Mix Asphalt*

Final draft end of 2006 will modify build upon Superpave method to Asphalt Institute Manual SP-02:

- New volumetric criteria.
- N-design
- Simple performance test(s).
- Criteria developed with M-E design guide performance models and software.
- Framework for integrated mix and structural design.

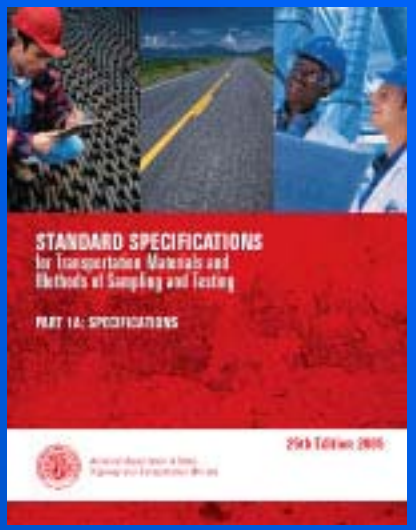
Advanced Asphalt Technologies (August 2006)

Other NCHRP Projects

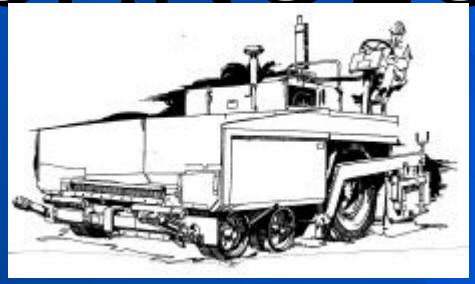
- 9-34: Improved Conditioning Procedure for Moisture Susceptibility
- 9-38: Endurance Limit of HMA Mixtures to Prevent Fatigue Cracking
- 9-39: Determining Mixing and Compaction Temperatures of PG Binders in HMA
- 9-45: Development of Specification Criteria for Mineral Fines Used in HMA

AASHTO M 323 Design Guidance

- Combined New and RAP Aggregates
  - Gradation
  - Angularity
  - Flat and Elongated
  - Other Tests ??
- Binder Grade Changes ??
  - < 15 % RAP, no grade change
  - 15 -25 % RAP, use one grade softer
  - > 25 % RAP, use blending chart



WARM MIX ASPHALT TECHNOLOGY



44th Annual Idaho Asphalt Conference

October 21, 2004

Moscow, Idaho

U.S. Department of Transportation
Federal Highway Administration

What is WMA?

- Appears to allow a reduction in the temperatures at which asphalt mixes are produced and placed
  - Reduced viscosity at lower temps
    - Complete aggregate coating

Why WMA?

- Potential Advantages
  - Energy Savings
  - Decreased Emissions
    - Visible
    - Non-Visible
  - Decreased Fumes
  - Decreased Oxidation Hardening
  - Decreased Plant Wear

Warm Mix Asphalt

- Ongoing Technical Working Group
- European Scan May 2007
- Continued field trials


Construction

Intelligent Compaction

GPS antenna

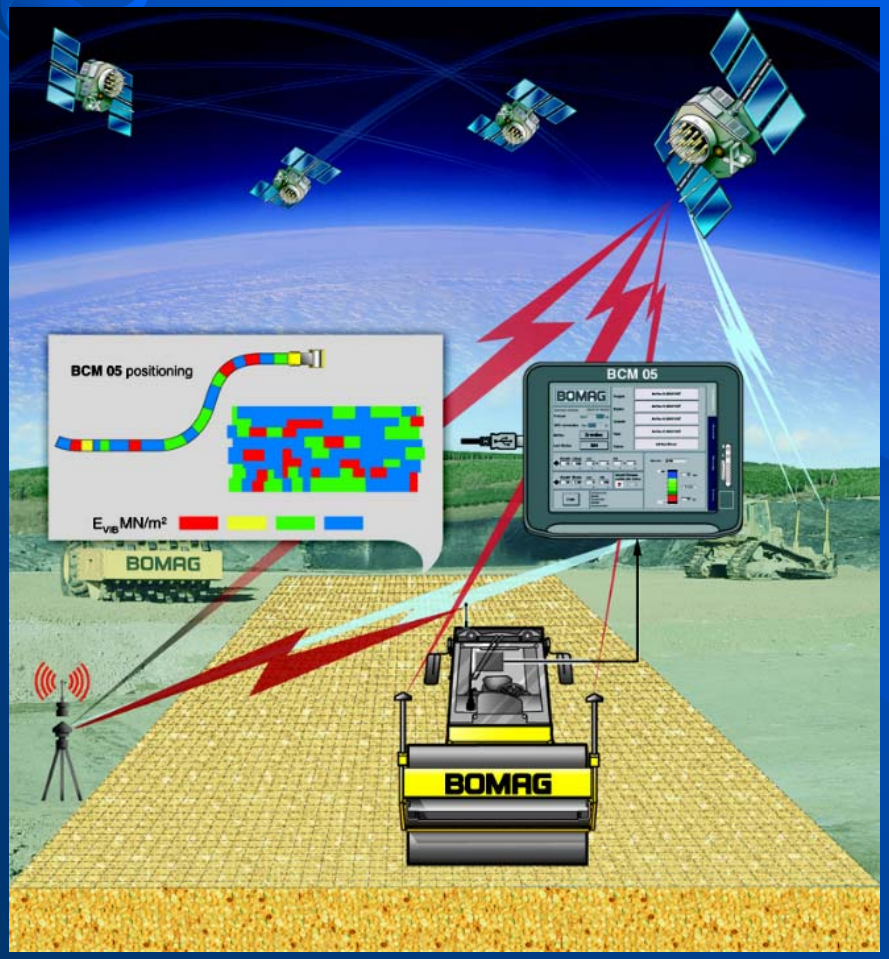
GPS reference station (Trimble)

BW 174 Asphalt Manager equipped with BCM05 and GPS

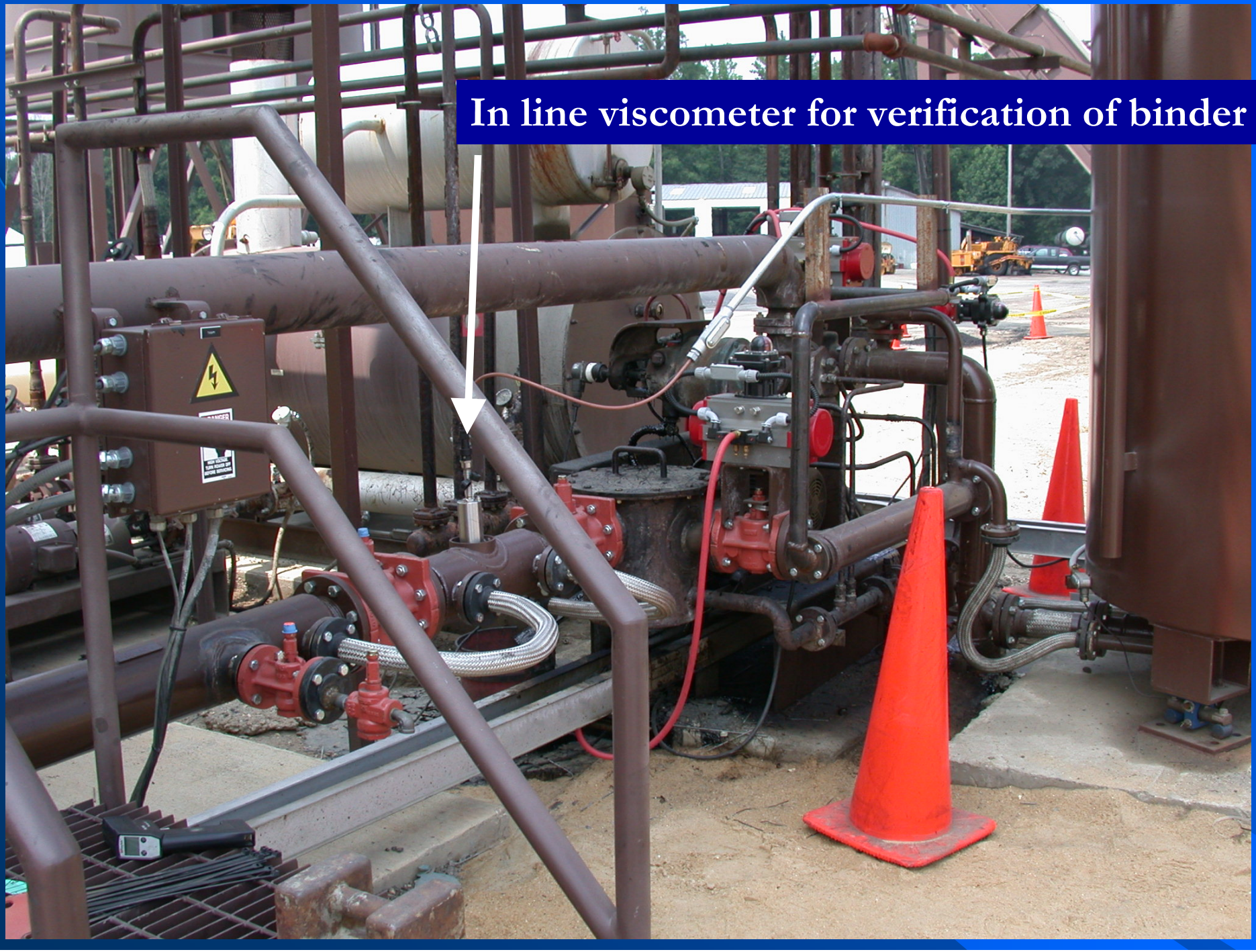
What is intelligent compaction?

- Automatic adjustable compaction equipment
- Usage of Continuous Compaction Control, CCC
- Selection of the most suitable equipment

GPS / positioning with reference station



At the mix plant are there other process that can be part of a QA program?


In line viscometer for verification of binder

Computer recordation

QA of the Future

- The QA will all be tied to Internet.
  - Direct down load of info to the owner.
  - Posting of data immediately to all parties.
  - Faster review and resolution of discrepancies.

Thank You.....

http://www.fhwa.dot.gov/pavements