Future Direction for Specs.

John D’Angelo
Federal Highway Administration
AMAP 2005

Modified Binders Affect Performance

- Study same mix different binders.

PG 63-22 mod. no rutting

PG 67-22 unmod. 15mm rutting

Binder Properties & Mix Performance

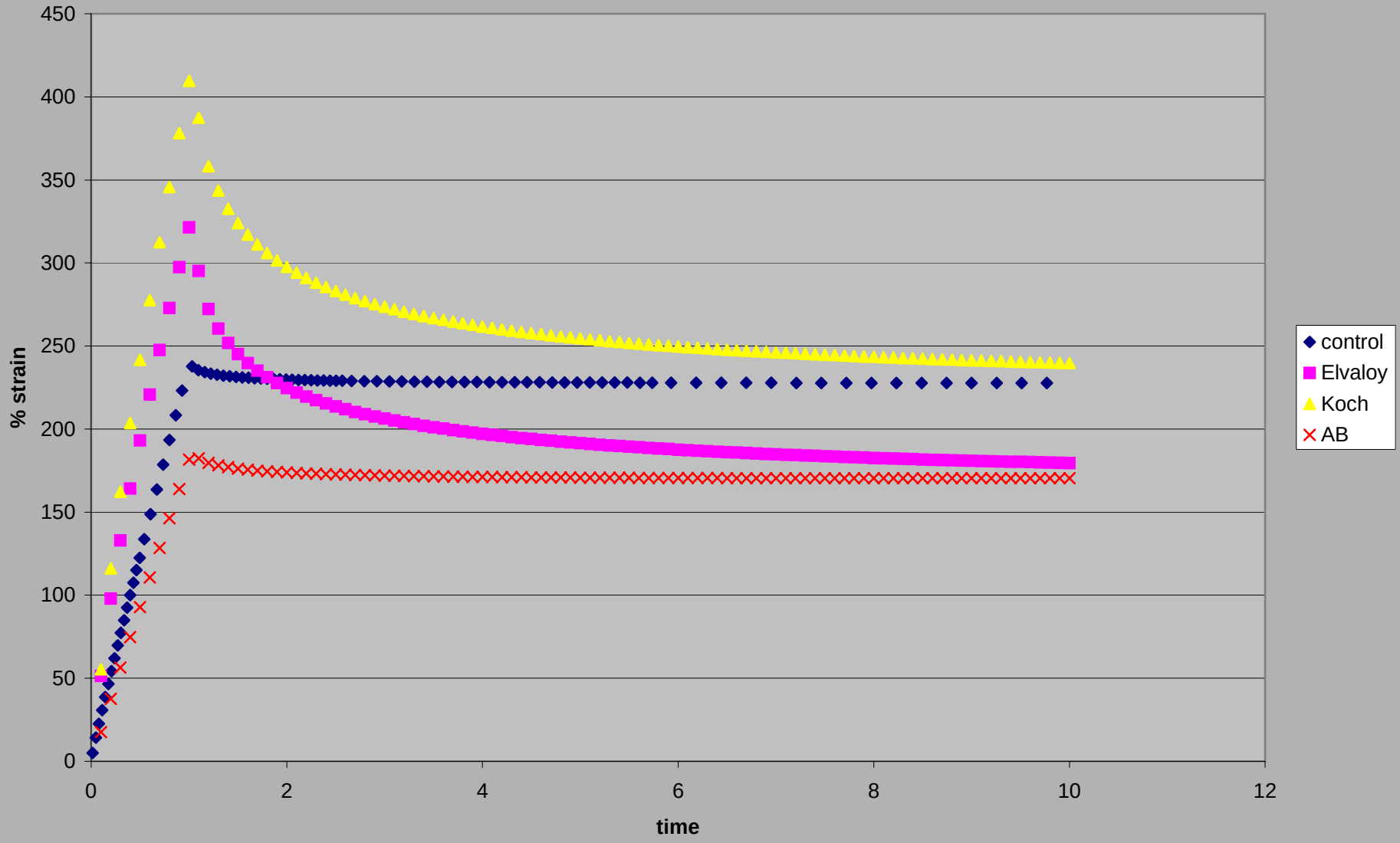
- Do the binder properties reflect mix performance?
  - Evaluate field sites
  - Loaded wheel testers
  - DSR Mix testing

High Temperature Binder Criteria

- New test criteria:
  - Perform creep and recovery tests at multiple stress levels on the same sample at reduced number of cycles.
  - Each cycle is 1 second load with 9 second recovery
  - Stress levels: 25, 50, 100, 200, 400, 800, 1600, and 3200 Pa.
  - Run 10 cycles at each stress level
  - Total cycles per test 80 at 14 min.

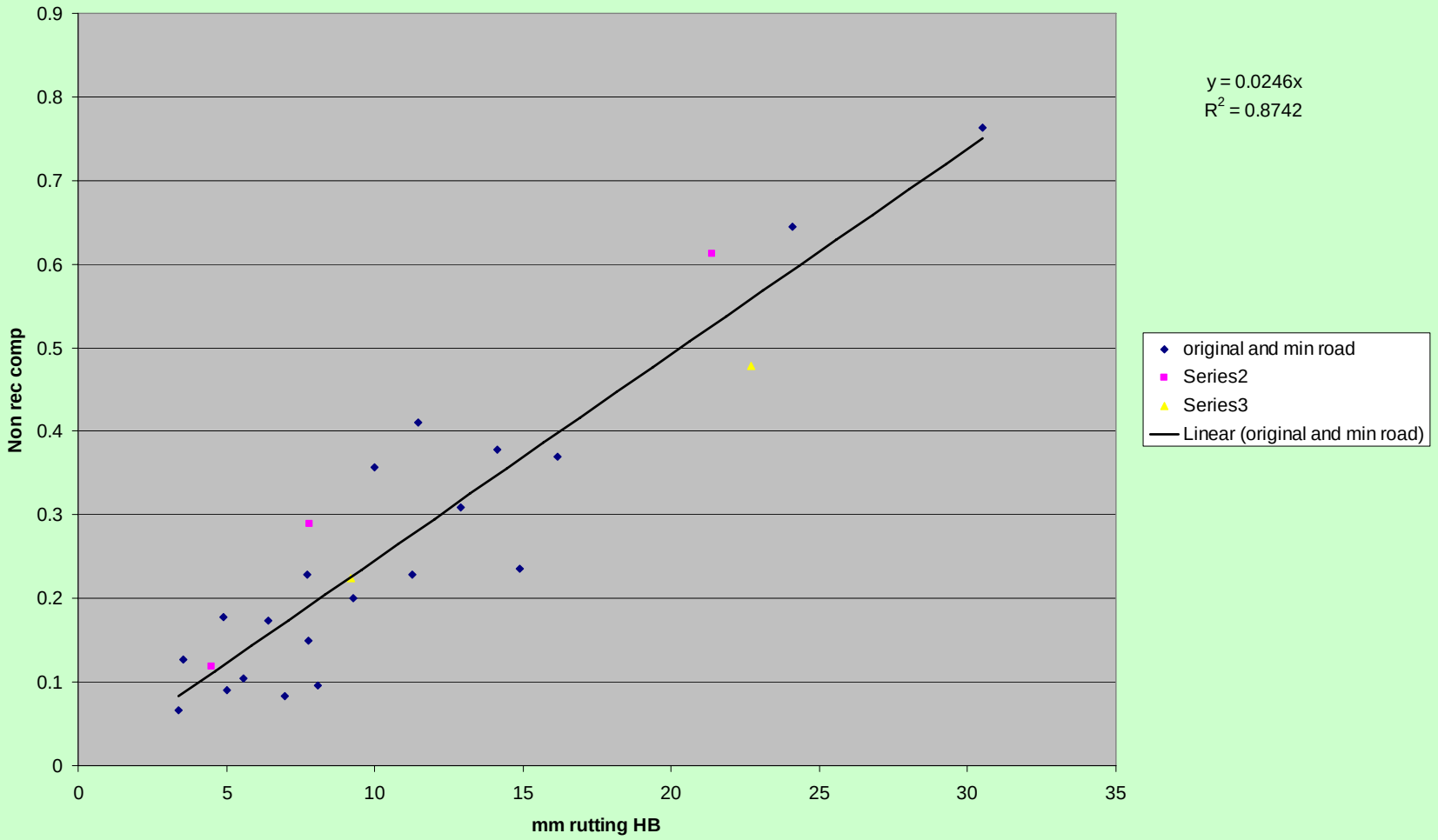
High Temperature Binder Criteria

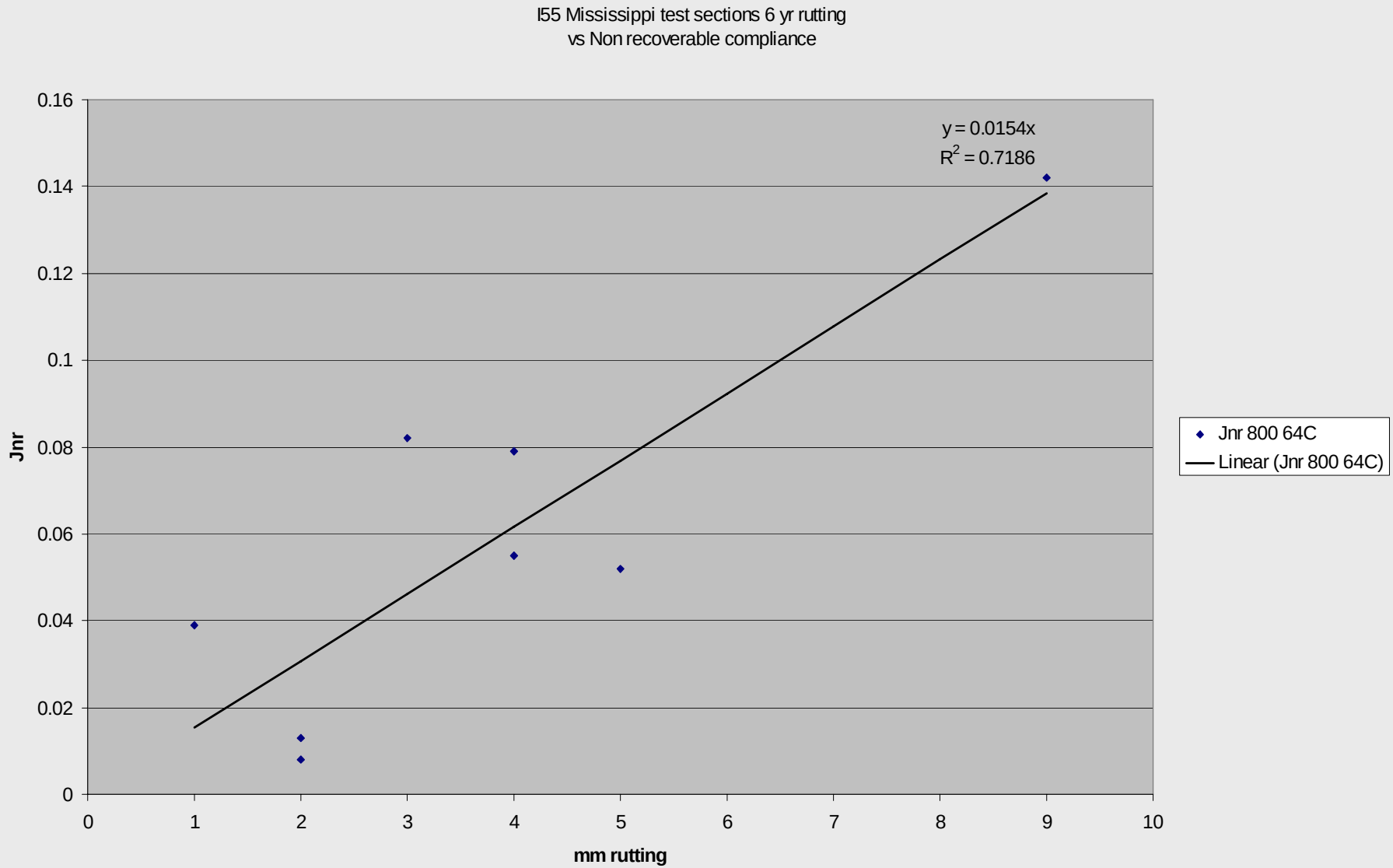
- New test analysis:
  - Nonrecoverable compliance - Jnr
  - Determine the average strain per cycle for each stress level.
  - Divide the average strain by the stress applied at each level.

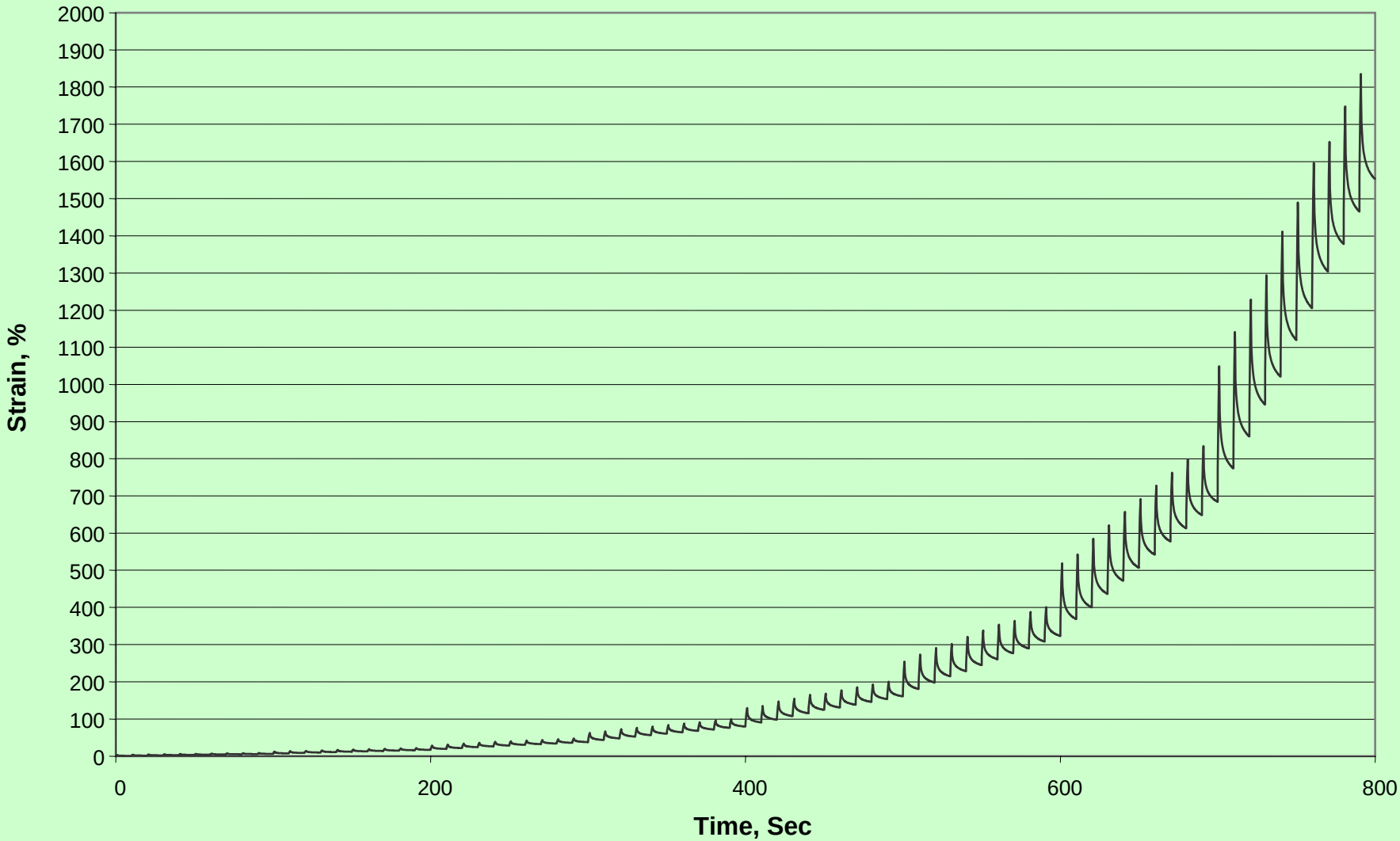

creep 1st cycle 70C 1000 Pa
% strain
time
0
50
100
150
200
250
300
350
400
450
0
2
4
6
8
10
12
control
Elvaloy
Koch
AB

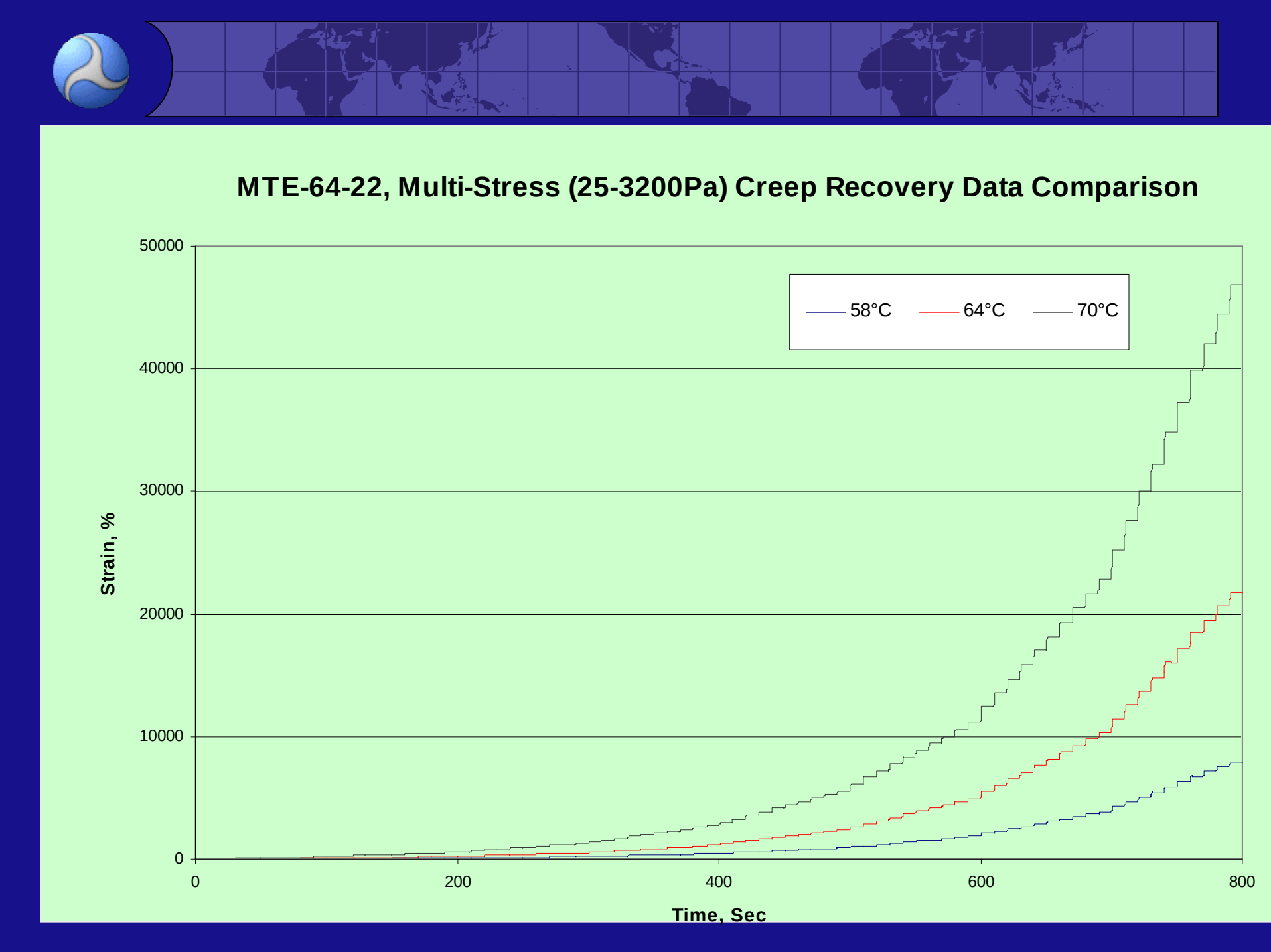

Non Rec Compliance 70C
0.400
0.300
0.200
0.100
Compliance
0
200
400
600
800
1000
1200
Stress
control
Elvaloy
Koch
AB
Power (Elvaloy)
Power (Koch)
Power (AB)
Power (control)

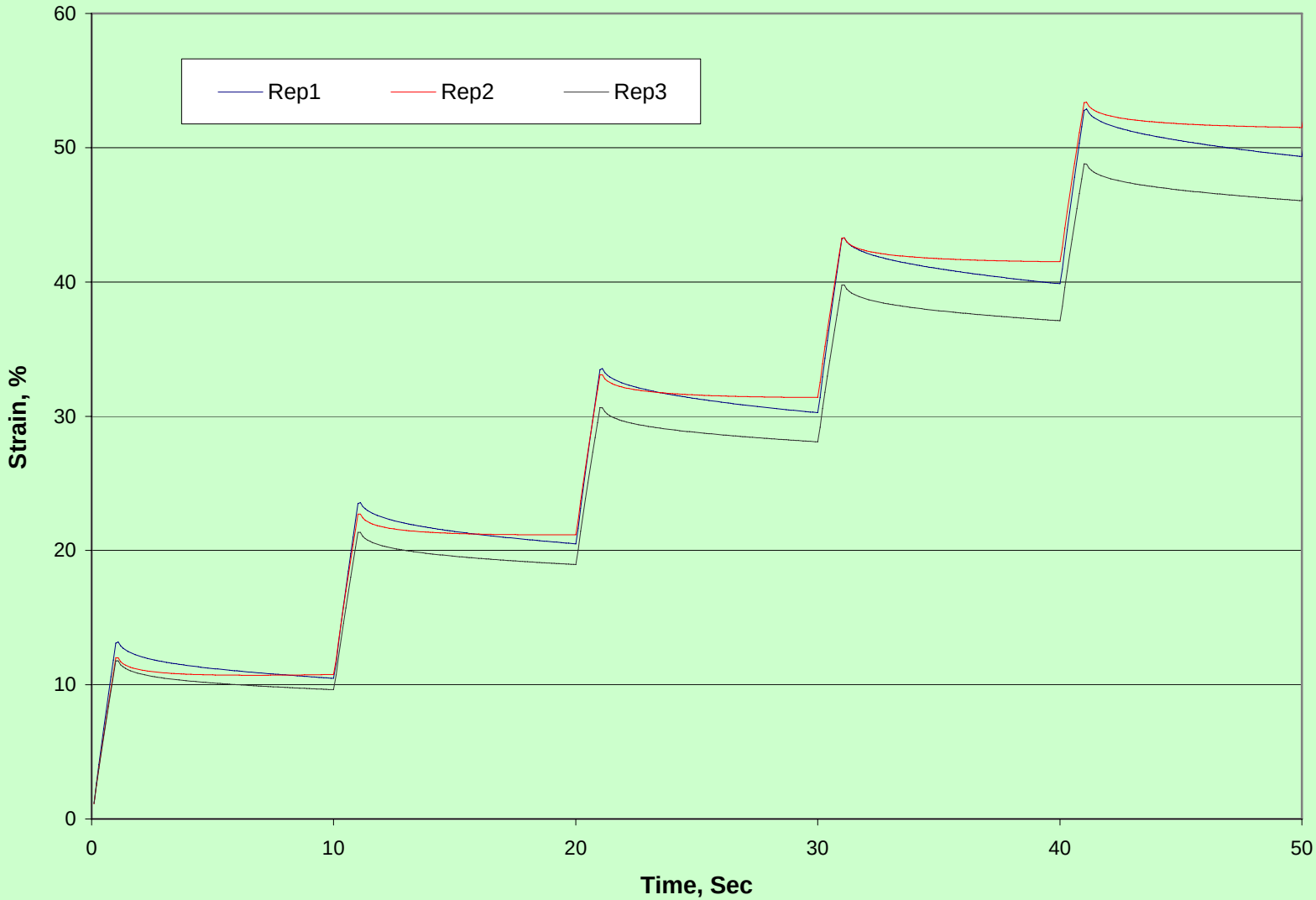
Mix testing multiple studies

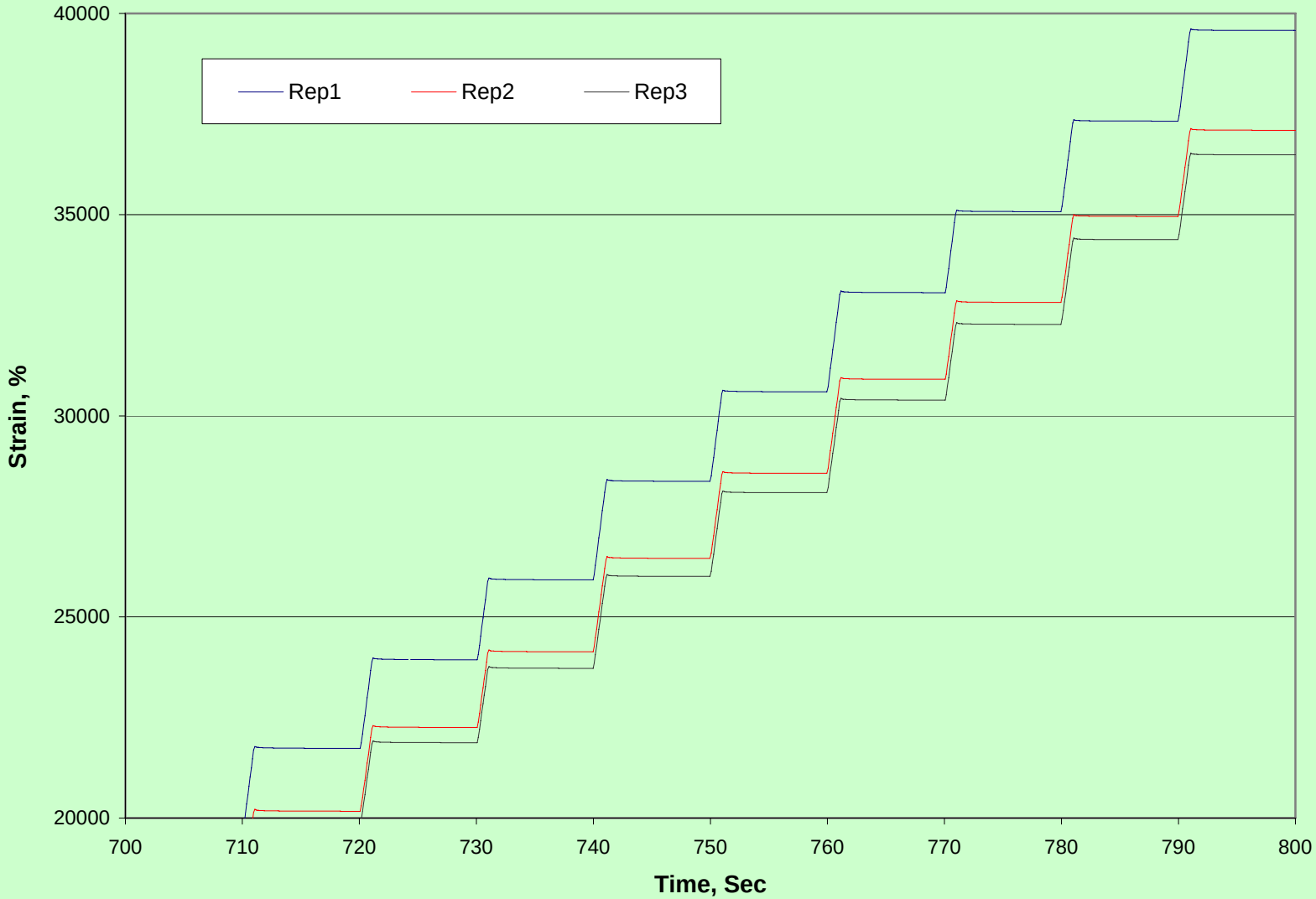



I55 Mississippi test sections 6 yr rutting
vs Non recoverable compliance
y = 0.0154x
R2 = 0.7186
Jnr
mm rutting
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
1
2
3
4
5
6
7
8
9
10
Jnr 800 64C
Linear (Jnr 800 64C)


Sample B6280, Multi-Stress (25-3200Pa) Creep Recovery Data at 70°C
Strain, %
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0
200
400
600
800
Time, Sec


MTE-64-22, Multi-Stress (25-3200Pa) Creep Recovery Data Comparison
58°C
64°C
70°C
Strain, %
50000
40000
30000
20000
10000
0
0
200
400
600
800
Time, Sec

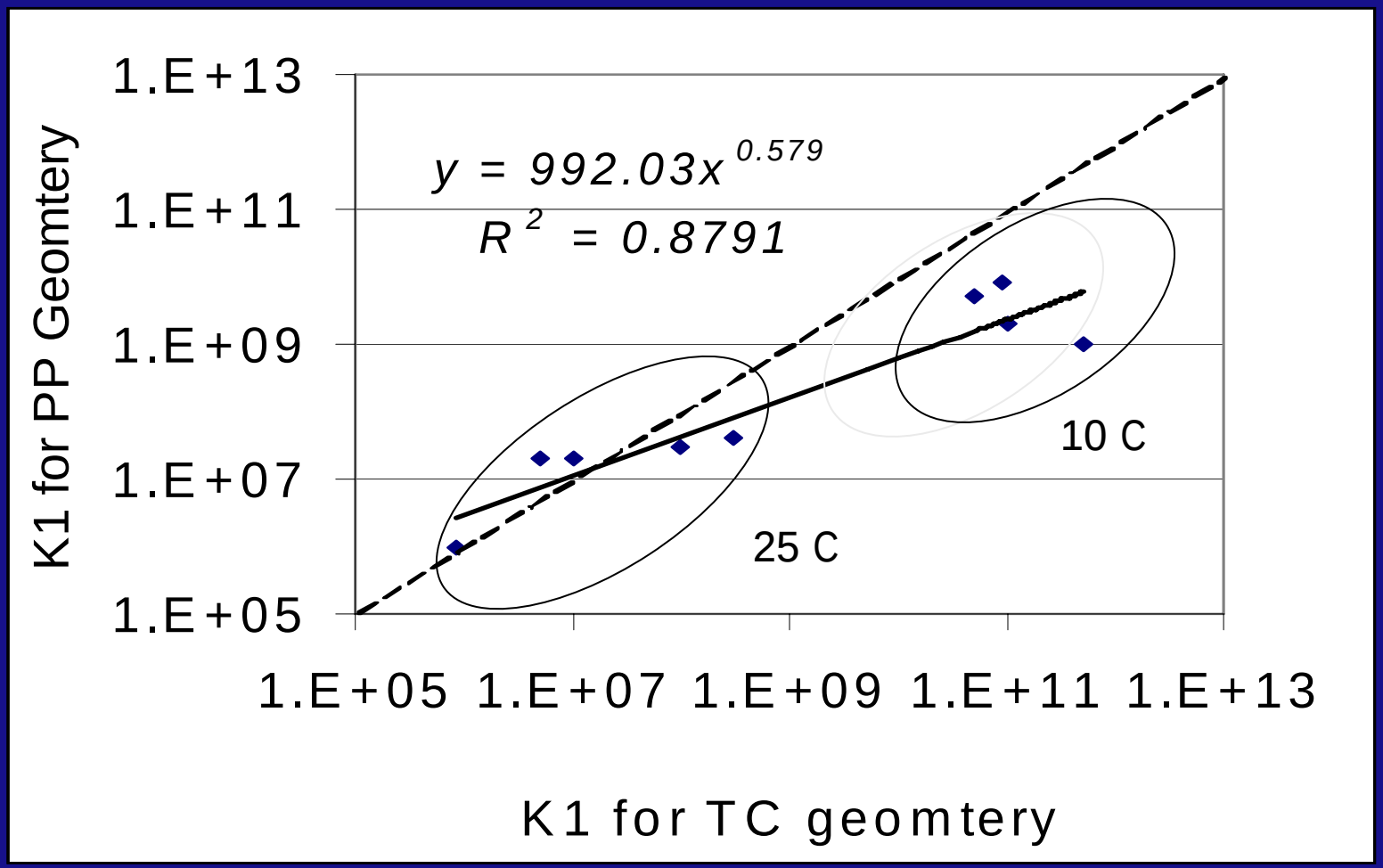

SBS Linear (B6230), MS (25-3200Pa) Creep Recovery Data at 76°C
Rep1
Rep2
Rep3
Strain, %
Time, Sec
0
10
20
30
40
50
60


SBS Linear (B6230), MS (25-3200Pa) Creep Recovery Data at 76°C
Rep1
Rep2
Rep3
Strain, %
40000
35000
30000
25000
20000
700
710
720
730
740
750
760
770
780
790
800
Time, Sec

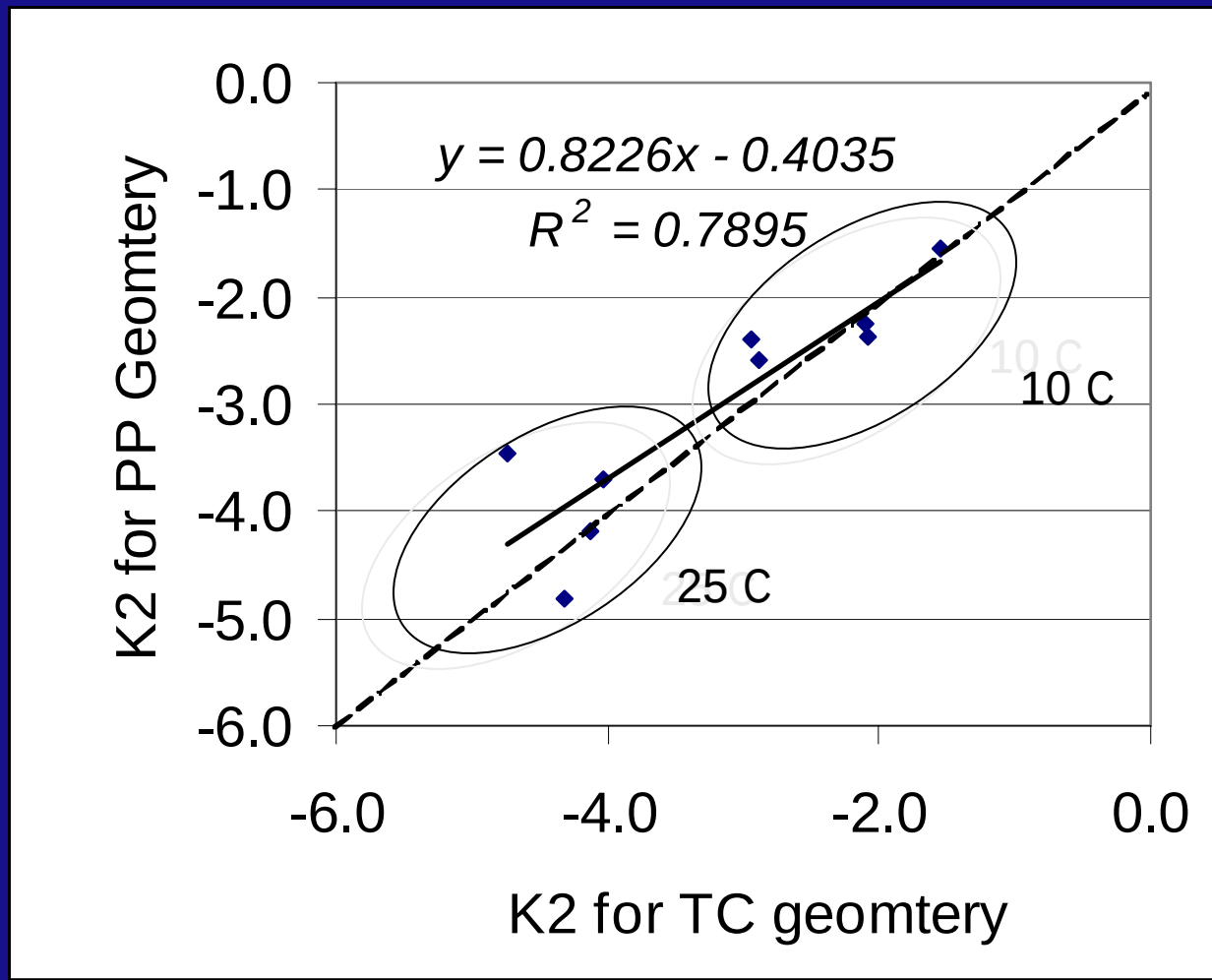
Torsion Cylinder: Testing

- Stress-controlled Testing
- 100 kPa to 575 kPa
- Height used in test varies within a narrow range ± 0.5 mm

Correlation of K1



Correlation for K2



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

Technology Overview

- Materials Processing
  - Two Component Asphalt Binder
    - WAM-Foam®
- Mix additives
  - Mineral
    - Aspha-Min®
  - Organic
    - Sasobit®
    - Asphaltan B®

U.S. Department of Transportation
Federal Highway Administration

WAM-Foam®

- Product of a Joint Venture
  - Shell International Petroleum (UK) and Kolo Veidekke a.s. (Norway)
- Two separate components
  - Soft Asphalt
  - Hard Asphalt in Foam Form

Aspha-Min®

- Product of
  - Eurovia Services GmbH (Germany)
- Manufactured Synthetic Zeolite
  - Sodium Aluminum Silicate
  - Hydro thermally crystallized
- Available in
  - 25 or 30 kg bags
  - Bulk for Silos

U.S. Department of Transportation
Federal Highway Administration

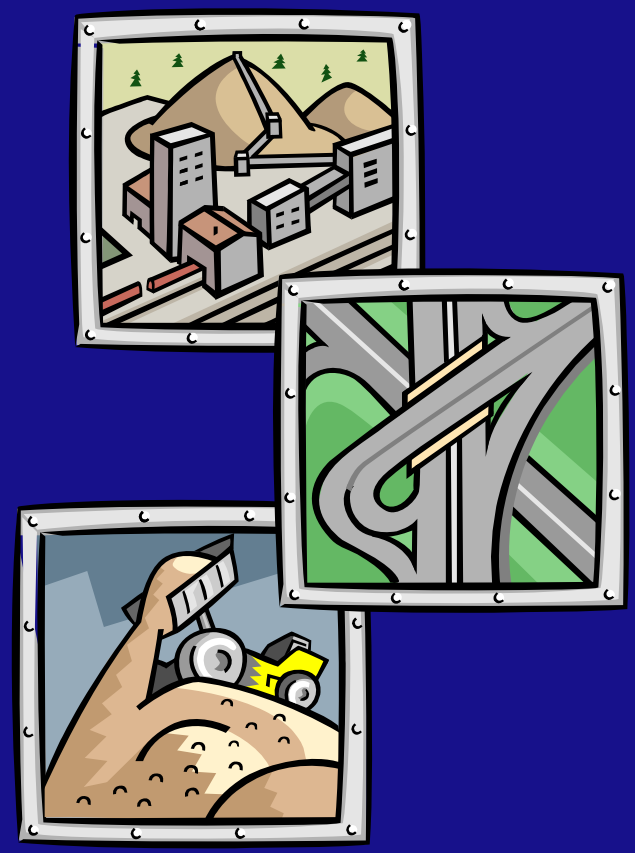
Sasobit®

- Product of
  - Sasol Wax GmbH (Germany)
- Fischer-Tropsch parrafin wax
  - Fine crystalline long chain aliphatic hydrocarbon
  - Produced from coal gasification
- Available in
  - Flakes or powdered form
  - 2, 5, 20, and 600 kg bags

Asphaltan B®

- Product of
  - Romonta GmbH (Germany)
- Combination of
  - Montan wax constituents
  - Higher molecular weight hydrocarbons
- Available in
  - Granular form
  - 25 kg bags

Research Needs



- Compatibility with US?
  - Mix designs
  - Equipment
  - Climate conditions
  - Work practices
- Success in Europe = Success in US?
- Performance

National Cooperative Highway Research Program

9-29: Simple Performance Tester for Superpave Mix Design

- Evaluation of 1st-article SPTs from Shedworks/IPC and Interlaken complete.
- Single-replicate measurement COV: dynamic modulus 13%, flow time 33%.

Advanced Asphalt Technologies (November 2005)

9-27: Relationships of HMA In-Place Air Voids, Lift Thickness and Permeability

Determine in-place air voids and minimum lift thicknesses needed to achieve durable, impermeable HMA pavements.

NCAT ***(April 2004)***

Factors Affecting In-Place Air Voids

- **Recommended thickness/NMAS ratios for adequate in-place density:**
  - **≥ 3 for fine-graded mixes**
  - **≥ 4 for coarse-graded mixes**
- **Lower ratios will require more field compactive effort to achieve adequate density.**

Factors Affecting HMA Permeability

- **No significant difference in lab permeability between fine- and coarse-graded mixes.**
- **Satisfactory permeability at 7±1% AVC at t/NMAS = 2, 3, or 4.**
- **Permeability increases as air voids and coarse aggregate ratio increase, decreases as VMA increases.**

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

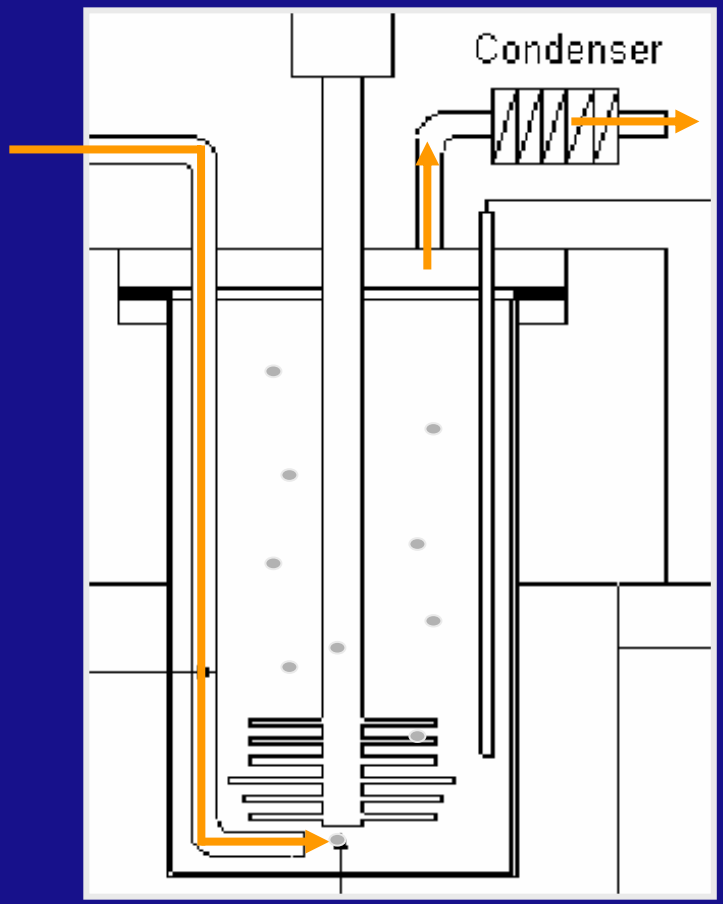
- Update method in AI Manual SP-02:
- Simple performance test(s).
- As-delivered M-E design guide performance models and software.
- New volumetric criteria.
- Framework for integrated mix and structural design.
  - Advanced Asphalt Technologies, LLC (August 2006)

9-36: Improved Procedure for Laboratory Aging of Asphalt Binders in Pavements

- Improved procedure for short-term laboratory aging usable in a purchase specification such as AASHTO M320.
  - Apply to neat and modified binders.
  - Quantify binder volatility.
  - Extend to long-term aging.
  - Mimic PP2 mix aging.
- Advanced Asphalt Technologies (August 2005)

SAFT

Apparatus



Aging Conditions: 30 min at 163°C

9-39: Determining the Mixing and Compaction Temperatures of Superpave Asphalt Binders in HMA

- Reliable, user-friendly method.
- Equally applicable to modified and unmodified binders.
- Simple and quick to use.
- Suitable for routine specification use.
- (RFP anticipated December 2004)

1-40:Facilitating the Implementation of the Guide for the Design of New and Rehabilitated Pavement Structures

- Conduct a thorough review of the Guide
- Organize and convene workshops
- Develop a concise user’s guide
- Provide technical support

Thanks Questions