


Current & Future Asphalt Binder Expert Task Group

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SAFETEA-LU Funding (2005-2009)

- Research and Technology (Title V)
 - \$411 million/yr
- Innovative Pavement Research & Deployment Program
 - \$23 million/yr
 - Asphalt, Concrete, Aggregate, Alt Materials
- Asphalt Technologies
 - \$4.1 million (minimum)/yr

<http://www.fhwa.dot.gov/safetealu/>

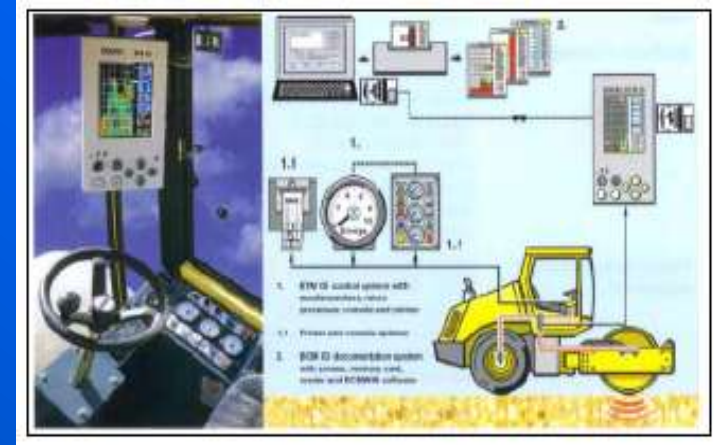
Materials and Construction Technology

- Provide Mobile Asphalt Lab
- Support National Asphalt R&D Programs
- Advance New Design Methods
 - Asphalt Mixture Performance Tester
 - Field validation & mix quality verification
 - Binder Testing Equipment
 - Effects of modified binders on mix
 - Aggregate Imaging System
 - Testing program & implementation



Example Asphalt Initiatives:

- Automated Plant Controls
- Intelligent Compaction
- Warm Mix Asphalt



R&D Accelerated Load Facility

- Specialized research
- Performance prediction





Construction & Materials Quality Assurance

Initiatives:

- Guidance on 23 CFR 637
- Use of Contractor Test Results & Sampling Plans
- State Process Reviews (to date in 28 States)
- Develop Training Materials & Sponsor Workshops
- Develop Analysis Tools
- Promote Advanced Quality Systems
 - Quality Assurance Specs
 - Performance Based Specs
 - Warranty Specs



Environmental Stewardship

Improve sustainability of pavement materials

Initiatives:

- Participate on RAP and WMA Expert Task Groups
- Support AASHTO Recycling Initiatives
- Development of Applications to Reuse Materials
- Develop Publications and Workshops
- Develop Tools (Recycling Took Kit)
- Support Development of Specs
- Support Green Highways Programs





Technology Partnerships

- Expert Task Groups
 - Asphalt Mixture & **Asphalt Binder ETG**
 - Asphalt Modeling
 - Warm Mix Asphalt
 - RAP
- Cooperative Agreements
 - National Center for Asphalt Technology
 - Asphalt Institute
 - National Asphalt Pavement Association



Asphalt Binder ETG

- Objective: To provide a forum for the discussion of ongoing asphalt binder technology and to provide technical input for current and future research, development, specifications.
- Government, Industry, Academia
- Initiated in 1994



Binder ETG - Key Activities

- Low Temperature Task Group
 - ABCD Low Temperature (Sang Soo Kim)
- Fatigue Task Group
 - Binder Yield Energy Test (Bahia)
- High Temperature Task Group
 - MSCR Test Method(D'Angelo/Anderson)
- Polyphosphoric Acid (D'Angelo)
- Other Topics
 - Recovered Motor Oil (Youtcheff)
 - DSR Sample Preparation (VanFrank)
 - Temperature Equilibrium (Anderson)

Advances in Binder Tests

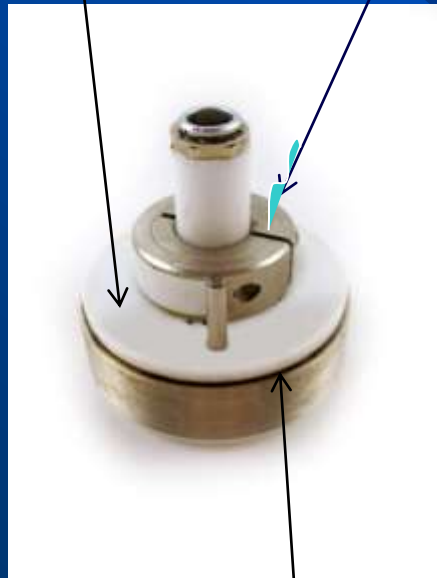
- **Low Temperature Cracking**
 - ABCD Device
 - Sang Soo Kim (Ohio University)
 - Status: Initial Shakedown and Round Robin Underway



Asphalt Binder Cracking Device (ABCD)

RTD &
strain gauge

Invar ring



Asphalt

- Evaluation of low temperature binder properties
- When temperature drops, asphalt shrinks 100 X more than the ABCD invar ring. Asphalt compresses the ring, strain gauge measures this compression.
- Evaluate Polymer Modified Binder
- Draft Specification under review by ETG

Pros and Cons - New Binder Tests

- **Low Temperature Cracking**

- ABCD Device

- Pros: Direct cracking temperature determination,
batch mode operation
 - Cons: No fundamental failure properties,
time consuming, empirical test, duplicates
existing tests?





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- **Intermediate Temperature Task Group**
 - BYE Test Response of PMA (Bahia)
- High Temperature Task Group
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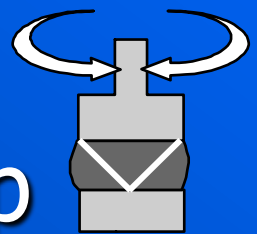


Advances in Binder Tests

- **Intermediate Temperature Fatigue**
 - Binder Yield Energy Test a DSR step strain (Continuum Damage)
 - University of Wisconsin (Dr. Bahia)
 - Status: Under Development

Binder Fatigue Update

- Binder Yield Energy (BYE) Test
- Draft of an AASHTO Procedure
- Multiple labs to test for validation
- Modeling challenges remain
- ETG review by Fatigue Task Group





Advances in Binder Tests

- **Intermediate Temperature Fatigue**
 - Binder Yield Energy (BYE) Test
 - Pros: Based on DSR – easy to use, small sample size, can identify modification and possibly cross-linking
 - Cons: early data is not encouraging, very high strain rates, no fracture involved (damage is assumed with drop in modulus)

Fatigue Testing – another approach



- Fatigue testing on HMA samples in the DSR
- How does polymer modification effect fatigue properties of binders.
- Does the percentage of PM significantly change the fatigue response of binders.

DSR Fatigue Testing

- Fatigue testing on HMA samples in DSR
- Developed and refined by Goodrich and Reese Texas A&M, Reinke
 - Pros: Uses DSR , easier than asphalt mix testing, simulates thin film behavior
 - Cons: Does require special-add-on to secure sample to testing equipment, will require more extensive testing and evaluation





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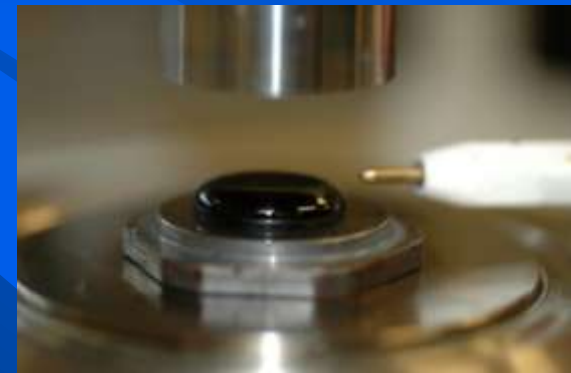


Advances in Binder Tests

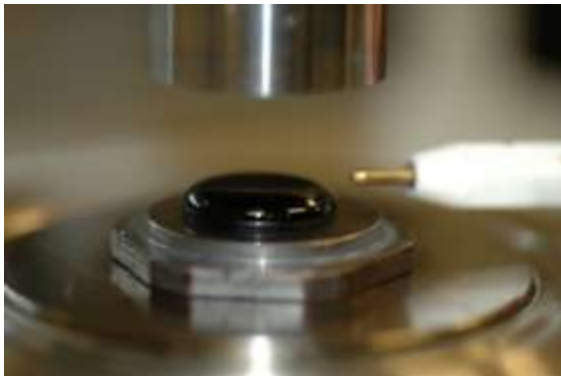
- High Temperature Rutting
 - MSCR Test
 - FHWA (D'Angelo)
 - Status: ASTM D7075-08 and AASHTO standards TP70-08 and M320-09 (table 3)

Multi-Stress Creep and Recovery Test Method

- Inadequacy of Superpave high temp $G^*/\sin\delta$ to predict modifier behavior
- Testing is done at actual pavement temperatures
- New MSCR High Temperature Spec (M320 Table 3) correlates to rutting for both neat and polymer modified binders
- Various implementation efforts and specification refinement



- **Standard Test
Procedure developed for
AASHTO TP70-08**



Standard Method of Test for

**Multiple Stress Creep Recovery
(MSCR) Test of Asphalt Binder
Using a Dynamic Shear Rheometer
(DSR)**

AASHTO Designation: TP 70-08



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•Developed as Table 3 for ASSHTO M 320-09

Original					
DSR G*/sinδ Min 1.0	64				
RTFOT					
64 Standard MSCR3.2 <4.0	[[MSCR3.2 – MSCR 0.1]/ MSCR 0.1] < .75	64			
64 Heavy MSCR 3.2<2.0		64			
64 Very heavy MSCR3.2 <1.0		64			
PAV					
S grade DSR G* sinδ Max 5000	28	25	22	19	16
H & V grade DSR G* sinδ Max 6000	28	25	22	19	16

Standard Specification for Performance-Graded Asphalt Binder

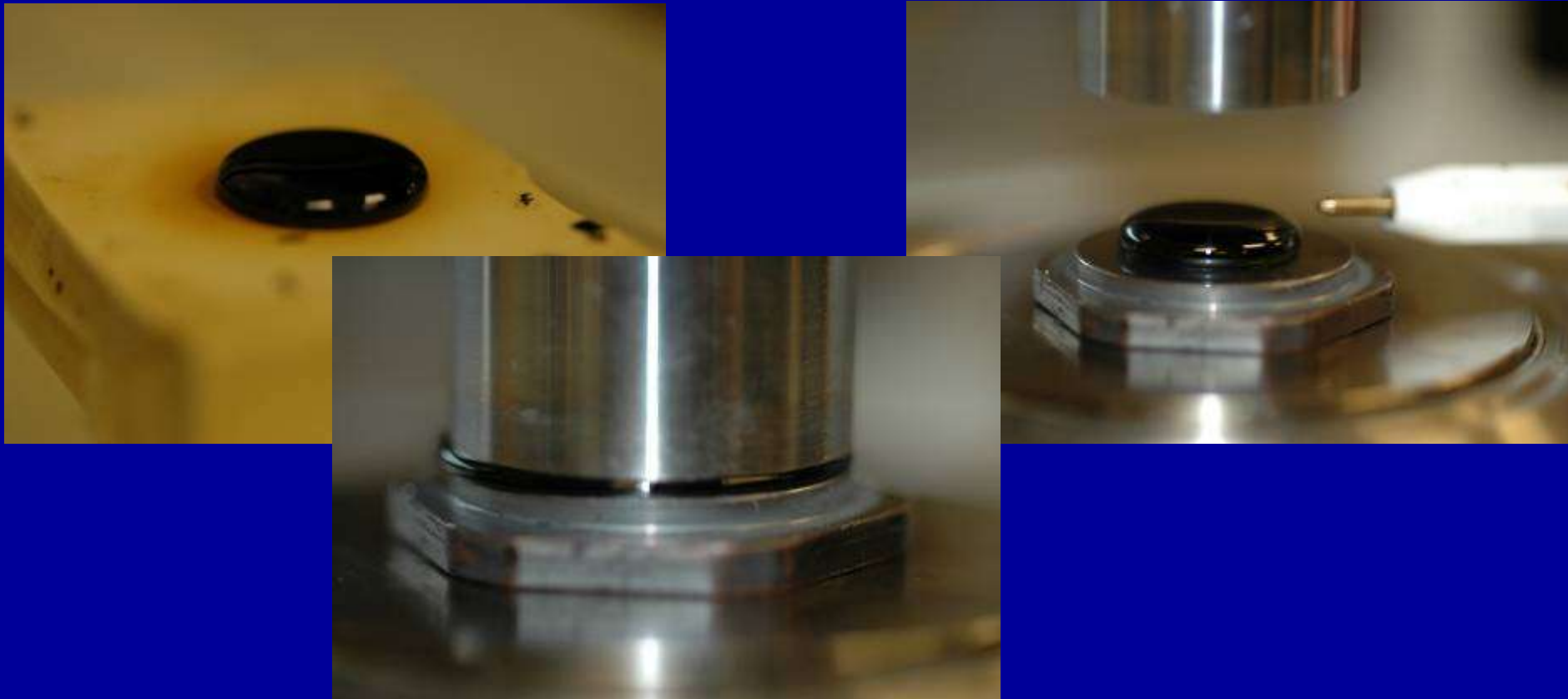
AASHTO Designation: M 320-09



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Multi Stress Creep and Recovery

- Sample prep is exactly the same as the existing rolling thin film oven test and dynamic shear rheometer (RTFOT DSR).



What about identifying polymers?

- MSCR J_{nr} addresses the high temperature rutting for both neat and modified binders, but many highway agencies require polymers for cracking and durability.
- The MSCR % Recovery measurement can identify and quantify the extent of polymer processing and how the polymer network, processing and the binder effect performance.

Superpave Plus Specifications

- PG+ Tests
 - Commonly used by many agencies in addition to AASHTO M320 specification
 - Ensure polymer modification of “premium” asphalt binders
 - Elastic Recovery **24 States**
 - Force Ductility **3 States**
 - Phase Angle **7 States**
 - Toughness and Tenacity **6 States**




Pros and Cons - New Binder Tests

- **High Temperature Rutting**

- MSCR Test

- Pros: Sensitive to Polymer structure and quality of modification, No grade bumping required, testing done at climate temperature, very easy to use
- Cons: Not widely accepted yet by AASHTO, Not yet fully understood by State DOTs

Status

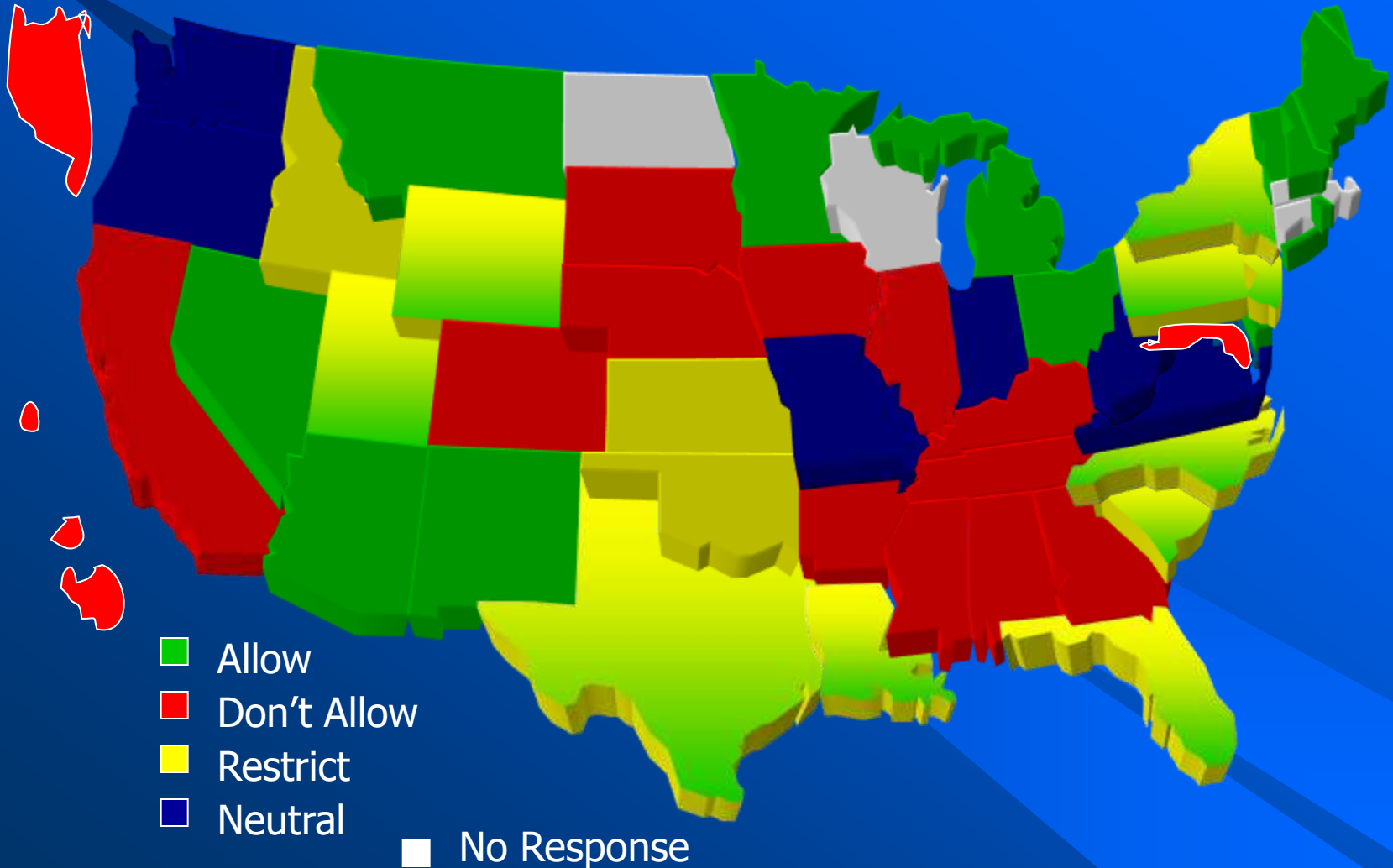
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- Currently Table 3, SOM balloting as stand alone
 - Regional workshops Asphalt Institute and FHWA
 - Asphalt Institute and FHWA efforts on testing Precision and Bias
 - Developing user literature
 - User Producer Groups “round robin” repeatability testing
 - Provide users with alternatives to the empirical Superpave Plus tests



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Polyphosphoric Acid Modification Specification Survey





PPA Summary

- PPA is a valuable tool to binder suppliers necessary to provide binders that meet current specifications and provide performance desired.
- It is the suppliers responsibility to investigate performance characteristics
- Effect of PPA on moisture damage is asphalt and aggregate dependant and is treatable with both lime and liquid anti-strips.
- Task group to draft a "Best Practices Manual for Using Polyphosphoric Acid"



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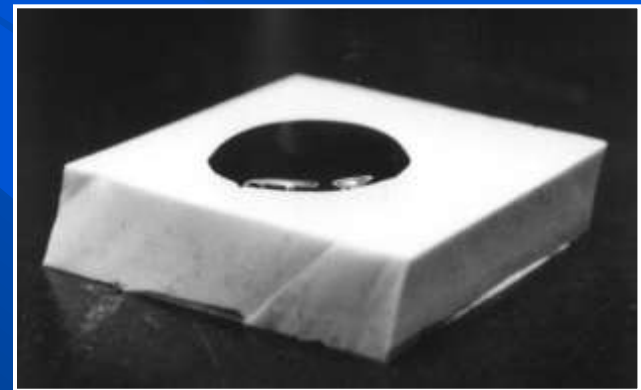


Detection of PPA and Trace Metals in Asphalt Binders

- Phosphoric Acid content of asphalt binders can be readily measured using XRF Spectroscopy.
- Presence of recycled Engine Oil Bottoms can be detected by measuring trace metals Cu, Mo, Ba, Ca, Pb and Zn levels.
- ETG will prepare a “research needs statement” on the use of reclaimed/recycled motor oils and effects on mix performance.

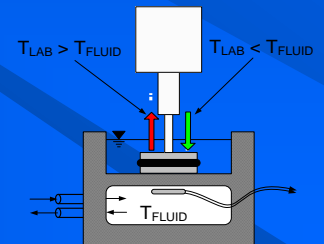
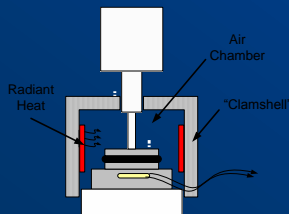
DSR Specimens

- T 315-08 maximum 2 hours time for specimen to held in molds
- AASHTO SOM tech section 2b requested ETG evaluation
- Asphalt Institute/FHWA to evaluate storage time, report at ETG



Thermal Equilibrium in the DSR

- How long does it take to reach thermal equilibrium in the DSR and is the current test method adequate?
- Anecdotal evidence suggests that current specification may not be adequate
 - Comments by field personnel
 - Casual evaluation of systems
 - Precision and accuracy statement





Study objectives

- Determine equilibrium time for rheometers of various design
- Compare measured equilibrium time with the 10 minutes as specified in the test method
- If needed , recommend procedure for determining equilibrium time
- Conclusion: No single equilibrium time



What's Next with Program Funding??

- Various authorization proposals & SAFTEA-LU extension
- Currently “Jobs for Main Street” – “Surface Transportation Extension Act of 2010” would extend funding until end of FY2010
- Continue Existing Programs
- Identify New Initiatives
 - Sustainable Pavement Technologies
 - Accelerated Construction and Innovation Implementation
 - Longer Lasting Materials
 - Innovative Quality Assurance



Asphalt Binder Expert Task Group

Next Meeting

February 22 & 23, 2010

Irvine, California

Asphalt Binder Expert Task Group

Thank You!

<http://www.fhwa.dot.gov/pavement>

Download ETG Presentations at:

<ftp://fhwaftp.fhwa.dot.gov>

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