

Using Polymer Modified Asphalt Emulsions in Surface Treatments

A Federals Lands Technology Study

Midwestern Pavement Preservation

Partnership Meeting

September 9, 2008, Minneapolis, MN



Presentation Outline

1. Brief Introduction to Federal Lands
2. Purpose & Background of Study
3. Study Findings, Survey, & Recommendations

Brief Introduction of FLH



Golden Gate National Recreation Area

Who We Are

- ◆ FHWA's road-building branch
 - Or what is known as the **Federal Lands Highway Program**



What We Do

- ◆ Engineering and Construction Services & Expertise on Federal Lands
 - Design, Deliver and Construct Projects
 - Safety Studies/Programs
 - Transportation Planning
 - Training & Technology Transfer
- ◆ Annual Design & Construction Budget in excess of \$1 Billion



What We Do

- ◆ ...and now recently, Pavement Preservation



Rocky Mtn Arsenal NWR

FLH Division Offices

Vancouver, WA

WFLHD

Lakewood, CO

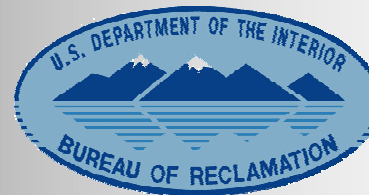
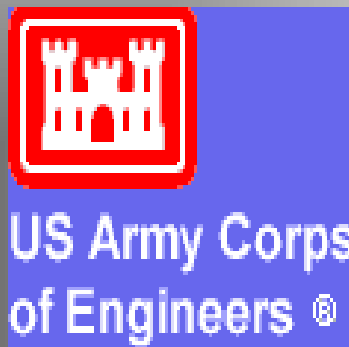
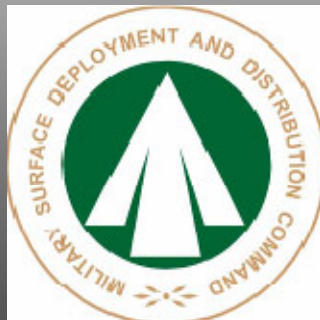
CFLHD

Sterling, VA

EFLHD



Partner Agencies



Road Mileages

- ◆ NPS: 8,127 miles
- ◆ Forest Highways: 29,200 miles
- ◆ NWR: 4,103 miles (mostly gravel)
- ◆ Indian Reservation Roads: 54,700 miles



...On to The Technology Study



The Issues

- ◆ No national standards exist to guide practitioners on the use of polymer modified emulsions
- ◆ The currently measured physical & chemical properties of emulsions do not always correlate with performance.

Product names shown in red text:

- RoadArmor®
- PMCRS
- CHFRS-2P
- LMCRS-2P
- Ralumac®
- PASS®
- CRS-LTP
- MSE®
- CRS-2R
- HFRS-2sP
- CRS-2L
- CRS-2P
- CRS-2HLM
- CQS-1HLM





More Issues

- ◆ High distillation temperatures can alter physical properties of asphalt emulsion residue, including polymer structure
- ◆ Desire from industry/suppliers that any proposed testing methods do not delay shipping & application

More Issues

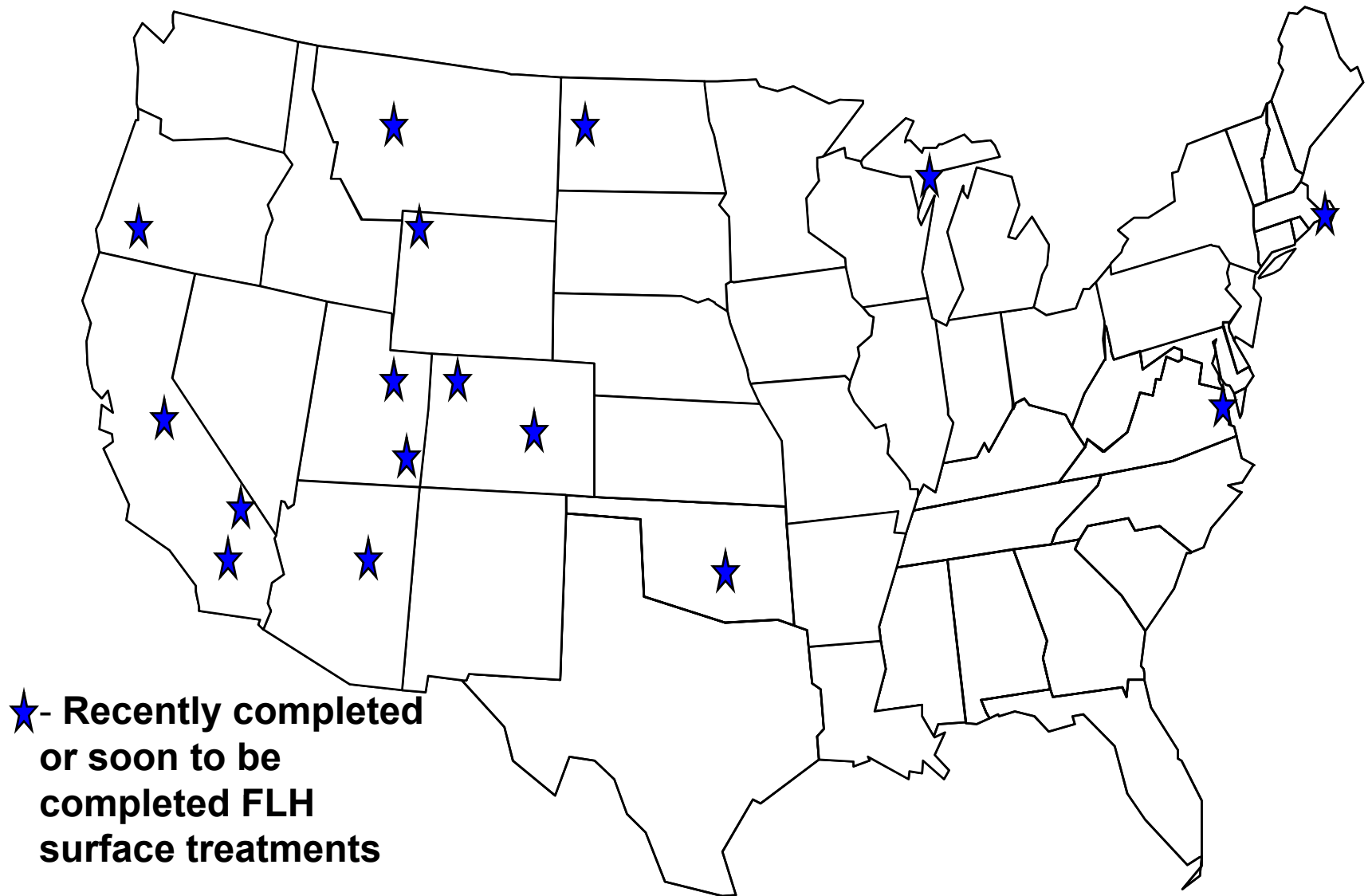
- ◆ Simple adoption of Superpave PG specs not possible
 - The failure mechanisms of emulsion applications would not be addressed
- ◆ Is use of polymer worth the additional costs?



Death Valley N.P.



Information Gap – No climatic grading system or guidance for emulsions





Why was this study undertaken?

- ◆ In short, to provide guidance on when, where, and how to use polymers in chip seals & slurry seals
 - Current Best Practice
 - Framework for Developing Performance-Related Specifications
 - Benefits vs. Costs

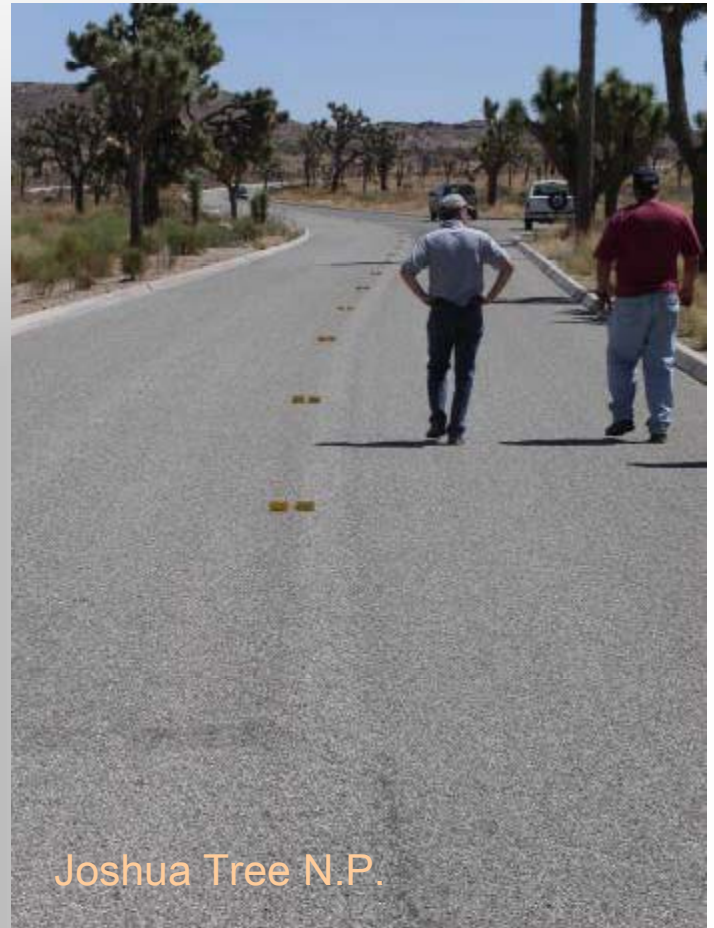


Products of Study

- ◆ A Guidance Report that Includes:
 - Current Best Practice
 - “Strawman” Performance-related Specification (generic; not technology specific)
 - Benefits vs. Costs of Polymer Use; Climatic Issues; and Traffic levels
- ◆ Laboratory Evaluation of “Strawman” Specification

Study Sponsors

- ◆ FHWA's HIAM
- ◆ FLH Technology Deployment
- ◆ FLH Pavements
- ◆ Industry (material suppliers & associations)





Principle Investigators

- ◆ National Center for Pavement Preservation (NCPPE), Larry Galehouse and John Johnston
- ◆ GHK, Inc. is a sub-consultant (Gayle and Helen King)

GHK, Inc.





Technical Panel & Contributors

- ◆ Technical Panel Includes: AEMA, FHWA, & Suppliers representatives
- ◆ Contributors include: Academia, ETGs, Industry, Suppliers

Asphalt Research Consortium

BASF



Ergon Asphalt & Emulsions, Inc.
a company that works





Remaining Study Schedule

- ◆ Evaluation of Performance-Related Specifications – Summer/Fall 2008
- ◆ Final Report Completion – December 2008

Study Funding ~ \$142,000*

***Not including industry support**



Major Study Tasks

1. Literature Review (completed)
2. Recommendations (nearly complete)
3. Laboratory Verification (underway)
4. Final Guidance Report (draft completed)

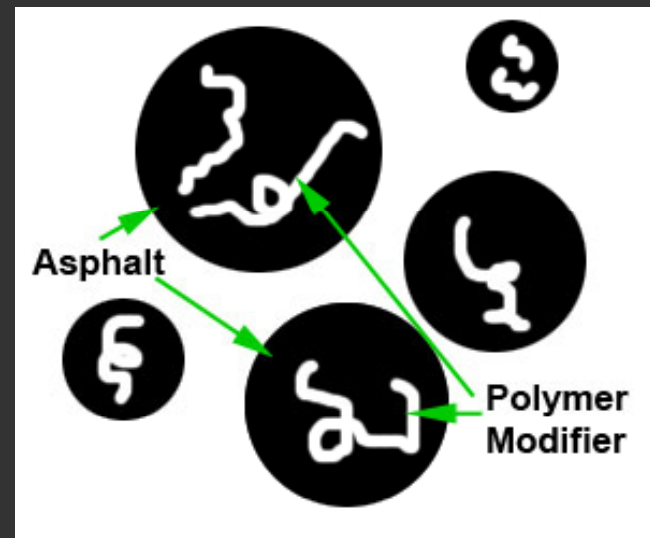
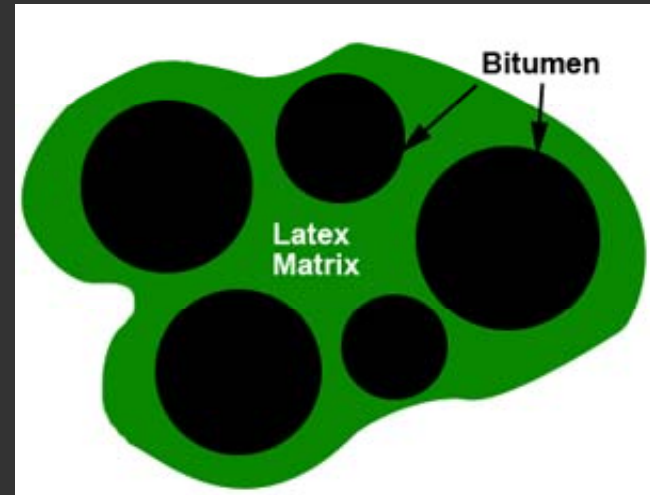


Literature Review Findings

- ◆ Four primary modification methods:
 - Pre-blending
 - Co-milling
 - Pre-batching with “soap”
 - Post-modification
- ◆ Dosage rates for polymers of 2.5% to 5% (by weight of residual asphalt content) are generally advisable (but there is not consensus).

Literature Review Findings

- ◆ Evidence indicates that polymers are most effective when their concentration and the method of modification is sufficient to promote the formation of a continuous polymer network that surround asphalt particles.





Literature Review Findings

- ◆ SBS and SBR are the most commonly used polymers, and they generally yield the best performance
- ◆ Polymers can dramatically improve the performance of emulsions when used properly
- ◆ Recommended to use polymer modified emulsions with chip seals for all classes of roads.



Key Data Gaps

- ◆ Lack of consensus on what types of testing is representative and most reproducible
 - Residue extraction
 - Performance testing
- ◆ Cost-Benefit analysis of using polymers
- ◆ Climate considerations



Potential National Implications

- ◆ Study will be marketed to State and Local agencies in hopes that it will lead to new AASHTO / ASTM standards.
- ◆ Catalyst for additional research in performance testing (Phase II)
- ◆ Demonstrate the need for more research on test methods, cost/benefit studies, and climate considerations.

The Outreach Survey

- ◆ Completed in February, 2008



Goal of the Survey

1. Solicit industry input to **develop performance-related specifications**
 - Polymer-modified Chip Seals
 - Polymer-modified Slurry/Micro



The Outreach Survey

- ◆ On-line / web-accessible
- ◆ Consists of six (6) primary sections which cover various technical areas related to the use of polymer modifiers in asphalt emulsions
- ◆ Testing methods, acceptance criteria, certification, etc.





Survey Topics

- ◆ Approved Supplier Certification Program
- ◆ Residue Recovery Methods
- ◆ Emulsion Specification Tests
- ◆ Emulsion Residue Specifications
- ◆ Application-Specific Performance Specifications
- ◆ Construction/Acceptance

Use of Survey

- ◆ Results Reported To:
 - Study Tech Panel – February 14th
 - AEMA/ARRA/ISSA – February 22nd
 - Binder Expert Task Group – February 27th
 - Emulsion Expert Task Group – April 7th
- ◆ Basis for a Detailed Testing Plan
 - In coordination with Binder & Emulsion ETG's, the ARC (Bahia/Sebaaly), the Fugro micro-surfacing study
- ◆ Solicit supplier support for lab testing
- ◆ Support for Research Proposals (PP Research Roadmap, TRB, etc)



19 Responses

Affiliation

- ☐ 1 Contractor
- ☐ 1 Trade Association
- ☐ 2 Academics
- ☐ 3 Consultants
- ☐ 4 Government
- ☐ 8 Material suppliers

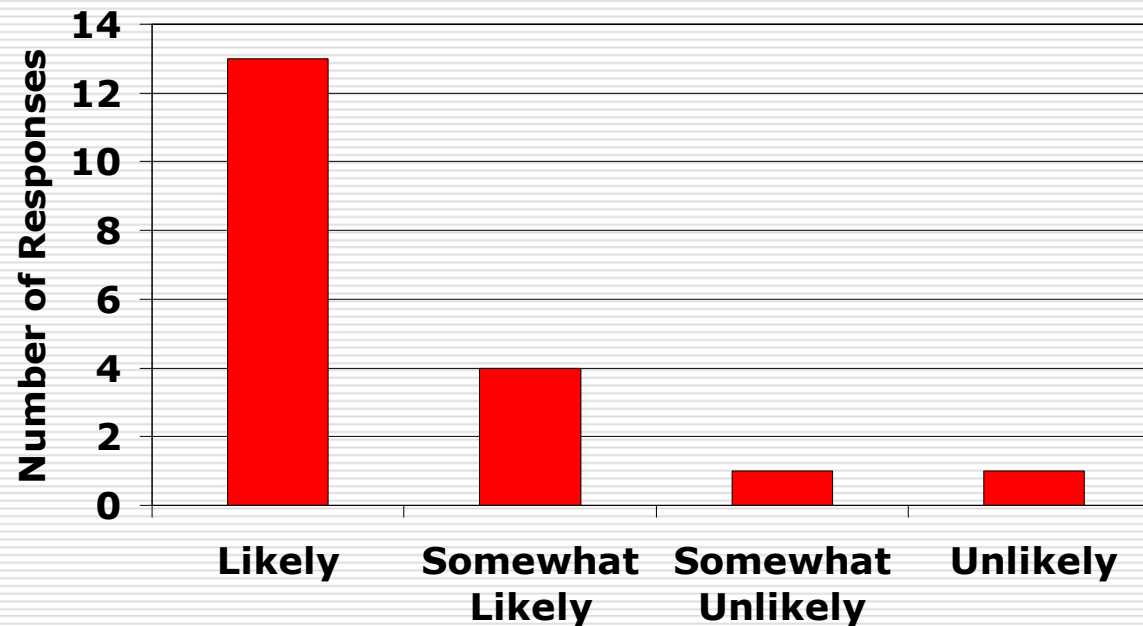
Job Function

- ☐ 1 Sales/Marketing
- ☐ 2 Managerial
- ☐ 4 Regulatory
- ☐ 12 Technical

Disclaimer: some representative comments have been included, but following graphs do not include some excellent comments and qualifiers.

See report for more detail.

How likely are you to support a **low temperature residue recovery method?**



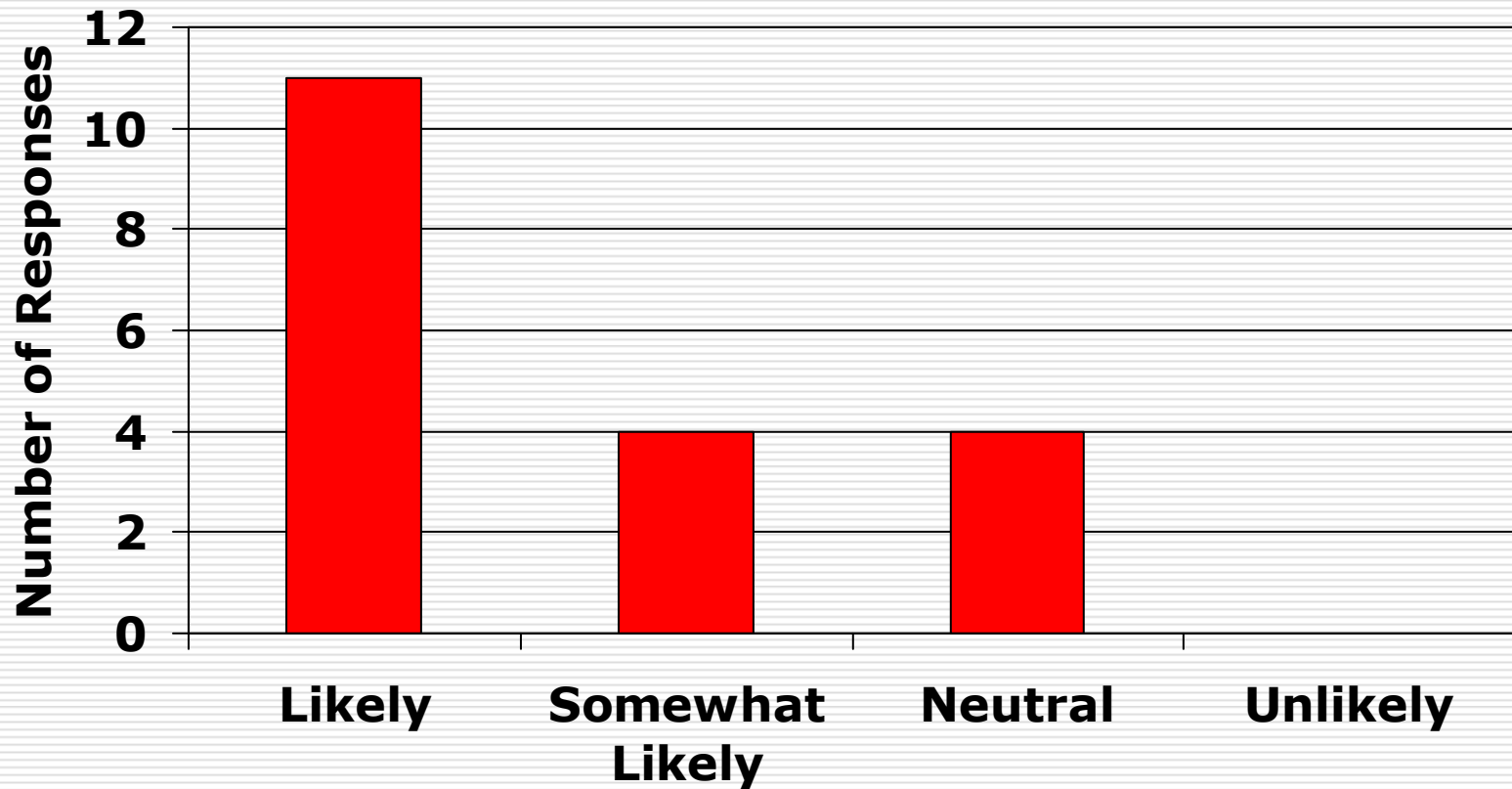
Con comments:

- ☐ 2 to 3 days is too long

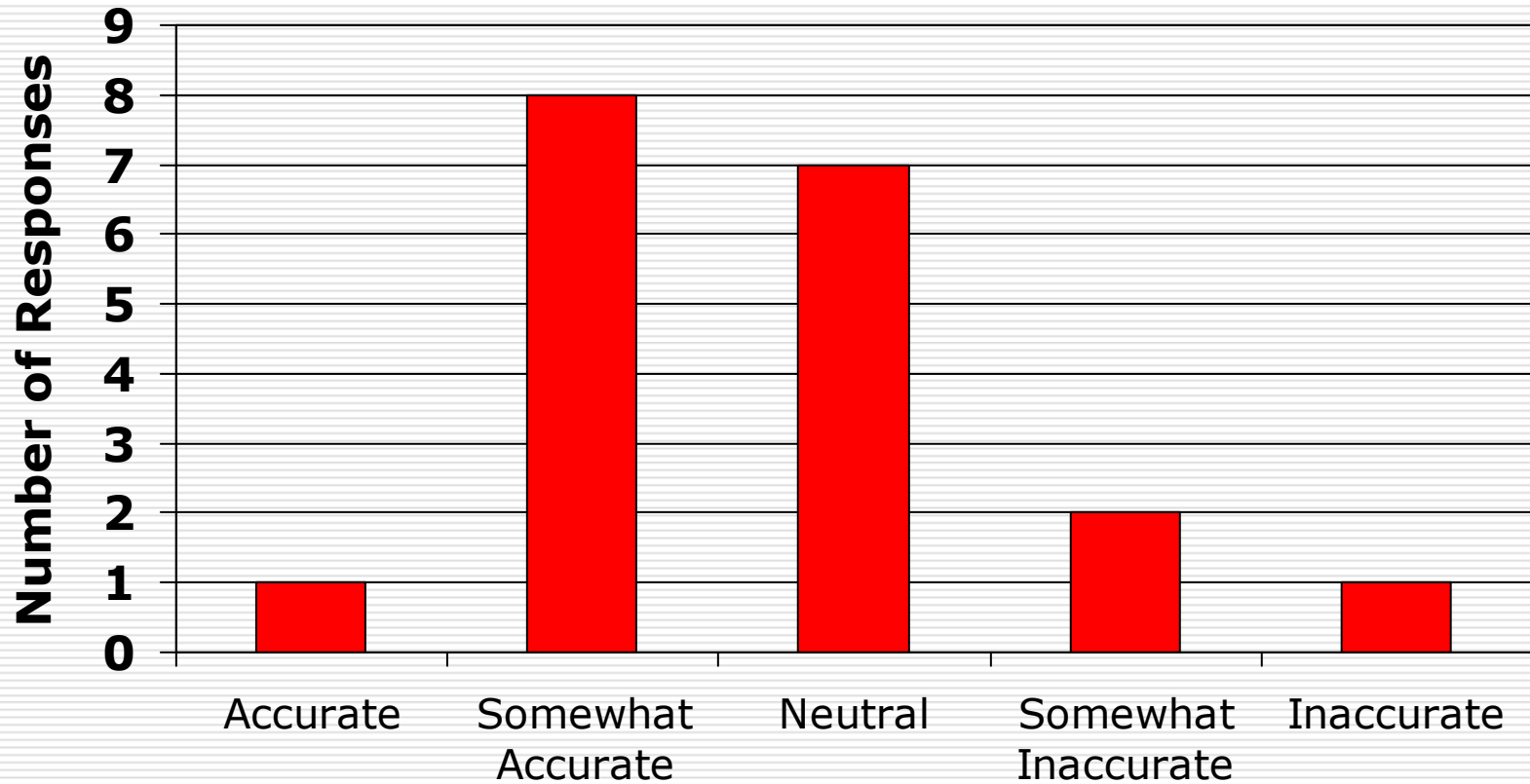
Pro comments:

- ☐ Must be a recovery method that doesn't modify the base binder
 - ☐ The closer to field conditions the better
 - ☐ Supplier certification program will offset time concern
-

How likely are you to support an
Approved Supplier Certification process?
(working with AEMA to develop)

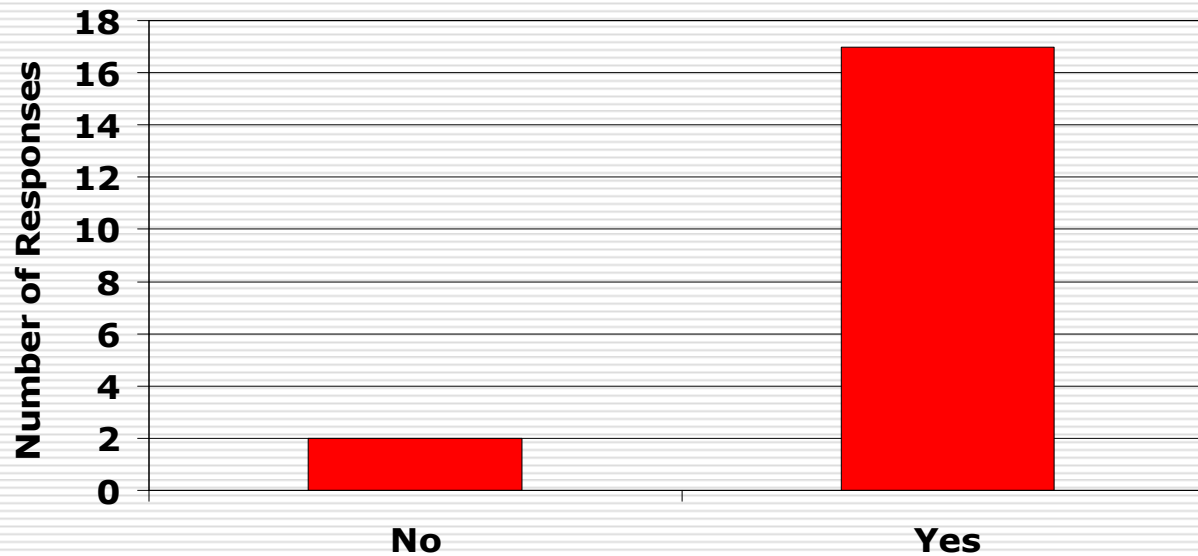


How accurate is the Elastic Recovery Test (performed in a ductilometer) in assessing polymer presence/relative concentration for polymer modifiers?



- ☐ Gives Customer or Agency some assurance that polymer is present but does not define the amount of polymer present

Would you support using the **Dynamic Shear Rheometer (DSR)** to verify **polymer** properties?



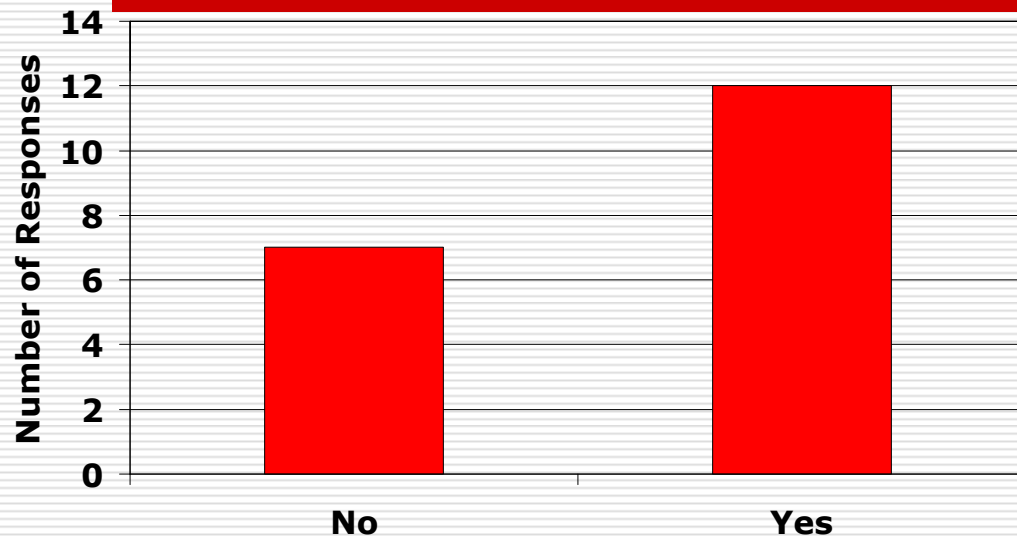
Con comments:

- ☐ Costs / time to high

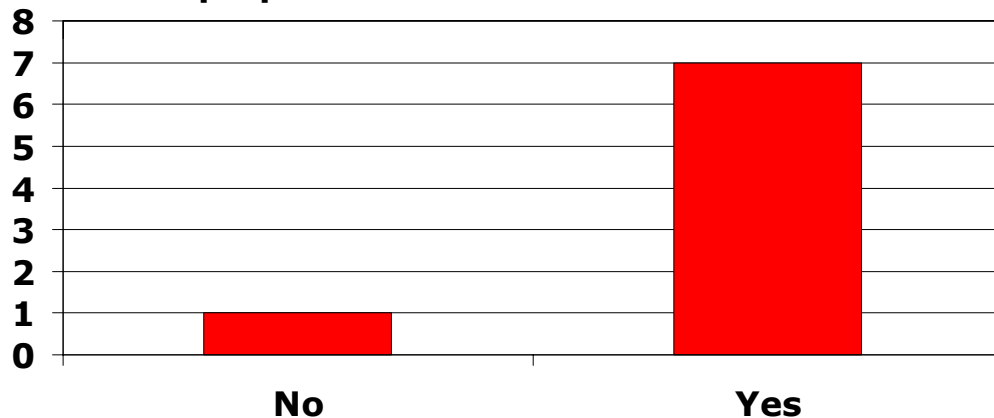
Pro comments:

- ☐ Yes, but needs verification for emulsion residue properties
 - ☐ Time efficient, low amount of binder needed
 - ☐ Suggested tests:
 - **FHWA MSCR,**
 - **maximum phase angle,**
 - **stress recovery**
 - **creep recovery**
-

Do you support the use of **Superpave binder grading tools such as the DSR, BBR, and PAV for emulsion** residue specifications?



Suppliers: Are You Willing to Provide Superpave Test Data on Your Materials?



Con comments: Too expensive, time consuming

☐ RTFO, others not applicable to emulsion applications

Pro comments:

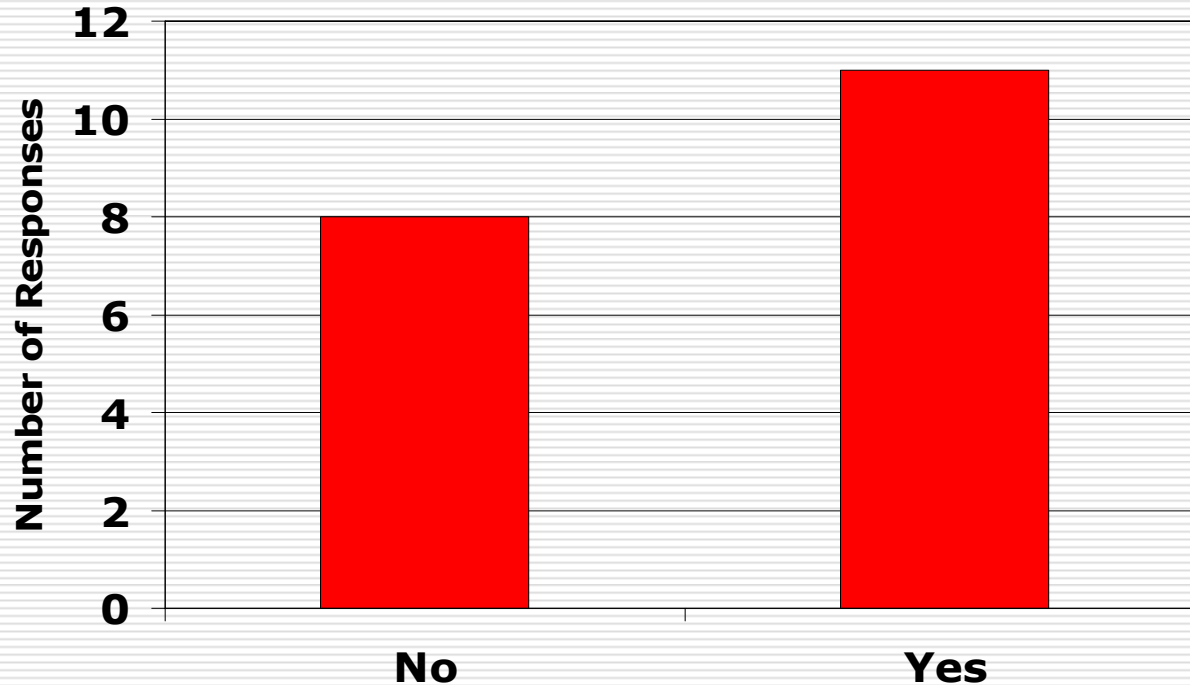
☐ Low temp residue recovery essential

☐ Best measure for climate

☐ PAV may be informative for surface treatments

Would you support Sweep Test to quantify curing time to traffic for chip seals?

(2-levels of product performance likely based upon separate limits for curing time)



Con comments:

- ☐ Too user dependent; still needs work
- ☐ Should replicate field temp & humidity
- ☐ Time consuming

Pro comments:

- ☐ Seems to be a good indicator of performance
 - ☐ Good tool to determine aggregate and emulsion compatibility
-



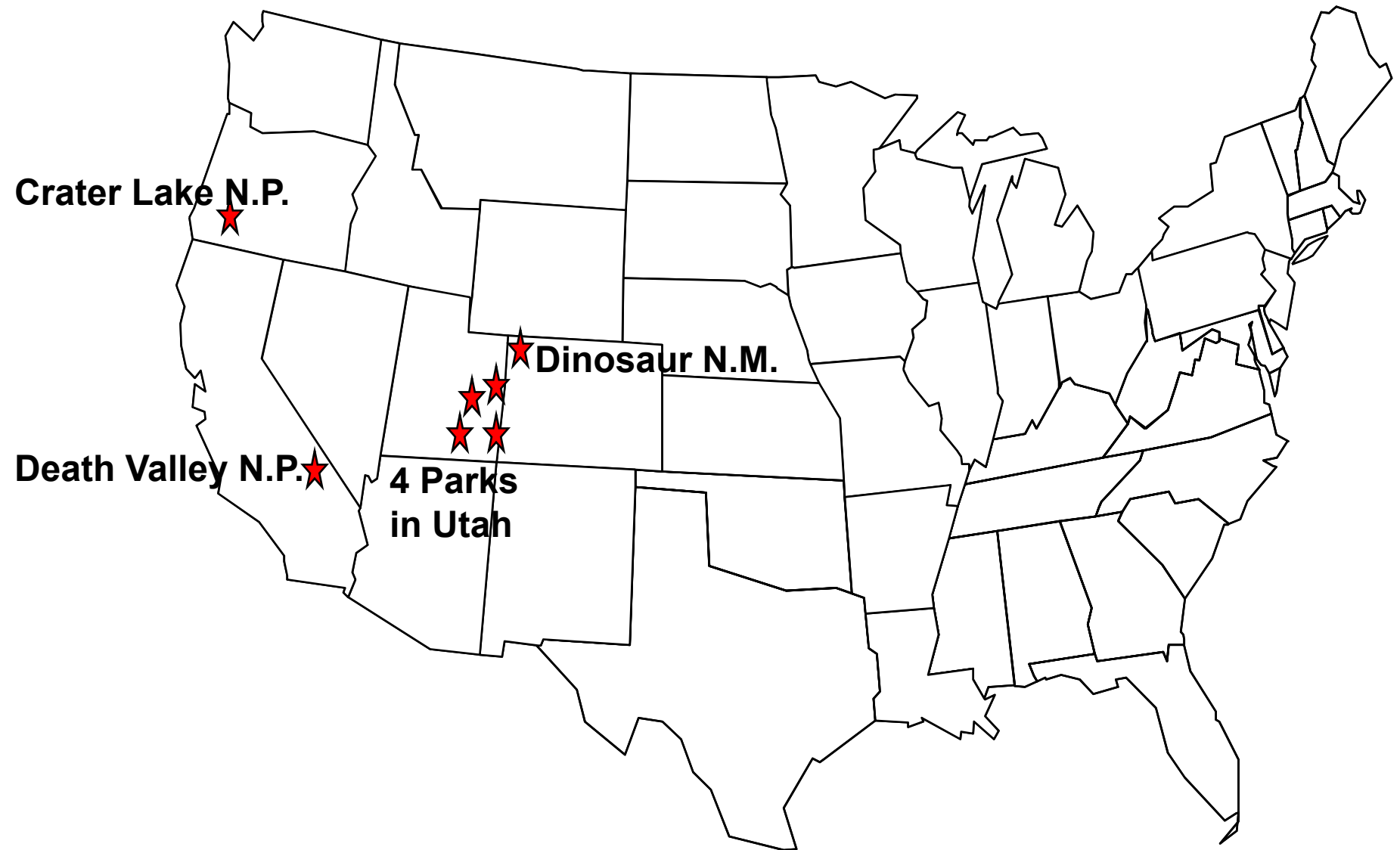
Strawman specification

- ◆ Framework for Addressing the development of a PRS:
 - New Residue Recovery Method
 - New Tests to Measure Effectiveness of Polymer Modification
 - More Time Needed to Complete Testing; Delayed Acceptance or Supplier Certification Program Needed
 - Specifications that Reflect Actual Field Performance

Strawman Emulsion Residue Performance-Related Specification

Purpose	Test	Conditions	Report
Residue Recovery	Forced Draft Oven	24 hrs @ambient + 24 hrs @60°C	✓ % Residue
Tests on Residue from Forced Draft Oven			
High Temperature (Rutting & Bleeding)	DSR-MSCR DSR freq sweep	T_h T_h	✓ Jnr ✓ G^* & phase angle
Polymer Identifier (Elasticity/Durability)	DSR-MSCR	T_h @3200 Pa	✓ % Recoverable Strain
High Float Identifier (Bleeding)*	DSR – non-linearity	T_h	✓ <i>Test to be developed</i>
Tests on PAV (run on emulsions evaporated in the PAV pan using the Forced Draft Oven procedure)			
Low Temperature (Aged Brittleness)*	DSR freq sweep	10°C & 20°C Model Low Temperature	✓ G^* ✓ Phase Angle
Polymer Degradation (Before/After PAV)*	DSR-MSCR	T_h @3200 Pa	✓ Recoverable Strain Ratio

Surface Treatment Project Locations – For Evaluating Strawman Specifications



Thank You....Questions?

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NCPP website: www.pavementpreservation.org



Mesa Verde N.P.