

APPENDIX A – SURVEY RESULTS

A.1 Survey Questions

Industry Survey [Note: the questionnaire was web-based and had links to several on-line test procedures that were under evaluation.]

Technology Deployment Study – Modifiers for Asphalt Emulsions, Synthesis of Best Practices.

GOAL: Compile best practices information and develop a Guide and PowerPoint titled, “Using Polymer Modified Asphalt Emulsions in Surface Treatments.” The guide should include specification recommendations for Polymer Modified Emulsion Techniques for Pavement Preservation that will result in the expected performance during construction, curing and especially on the pavement. These will include criteria for emulsion and aggregate acceptance, construction quality and field performance.

SPONSORING AGENCY: FHWA Federal Lands Highway Division. The intended audience is project development engineers and maintenance engineers from federal land management agencies (FLMA). However, it is expected that the document will also be a good resource for APWA, NACE, LTAP, and AASHTO. The National Center for Pavement Preservation (NCPPI) is the principal investigator for this contract.

SPECIFIC REQUESTS: polymer-modified emulsion chip seals, polymer modified slurry (and micro surfacing) systems, and polymer modified cape seals be defined for two levels of performance based upon traffic considerations. There should be some verification that the emulsion is indeed polymer modified.

I. APPROVED SUPPLIER CERTIFICATION PROGRAM (ASC)

Problem: Timely manufacture and application of polymer-modified asphalt emulsions result in the best performance. Acceptance criteria testing using performance-related specifications can take longer than practical. This problem was addressed in the development of Superpave specifications by an Approved Supplier Certification Program (ASC) for binder suppliers.

Pros: the supplier can ship materials before the lab certification is completed, allowing timely shipping and application of emulsions. It has generally been successful with Superpave.

Cons: requires a number of elements, including certification of labs and technicians, detailed reporting requirements, agency inspections and data verification.

Question 1 – How likely would it be that you would support working with the AEMA technical committee to create an Asphalt Emulsion Approved Supplier Certification (AEASC) Program using the AASHTO ASC program for HMA binders as a model? [The AEASC Program would include QC Plan, Self-Certification Plan, Access Plan, and timeframe for testing and technical support.]

Unlikely Somewhat Unlikely Neutral Somewhat Likely Likely

Other considerations, comments:

II. EMULSION ACCEPTANCE

Part A: Low Temperature Residue Recovery Methods

The Problem: Conventional 500 °F distillation procedures can damage polymers in ways that would not occur during normal emulsion curing at ambient pavement temperatures. The industry has evaluated several methods for lower temperature procedures.

Pros:
Reducing temperatures preserve the polymer structures and more accurately reflect field curing.

Cons:
Low temperature recoveries typically require two to three days to completely remove the water so that residues can be tested for physical properties.

Question 2 – How likely would it be that you would support the adoption of one of the proposed low temperature recovery procedures (see reference list below), using AEMA/ARRA/ISSA members and technical panels to test and review alternatives?

Unlikely Somewhat Unlikely Neutral Somewhat Likely Likely

Do you have a preference? If so, why? Please give other considerations, comments:

Recovery Procedure References

Part B: Liquid Emulsion Specification Tests

The Problem: Changes to Specification Tests have been proposed because for the following reasons: many current specification tests do not relate to performance; there is little or no compatibility check with the job aggregate; emulsion viscosities tested in the lab are often not the same as when they are applied in the field; most asphalt cement is now supplied using Superpave grading; and current specifications were generally developed for non-polymer emulsions (and those that were developed for polymers reflect just one type of polymer). Questions raised by previous industry input during this study are given below (links to specific test procedures are also given below):

Pros: current specification tests are generally quick, easy-to-run, with well-determined repeatability limits.

Cons: there has been limited round-robin and reliability testing of new methods

Question 3 – Is the demulsibility test needed for chip seal emulsions if the sweep test is used to establish cure rates?

Yes No
Considerations, comments:

Question 4 – Should emulsion viscosity be measured with a Brookfield viscometer, rather than Saybolt-Furol?

Yes No

Considerations, comments:

Question 5 – Should chip seal emulsion viscosity be raised from the typical 100-400 sec SF to 200-500 sec SF per specifications in some states, such as ARK?

Yes No

Considerations, comments:

Question 6 – Should field testing of emulsions for compliance testing be addressed in some way? (Note that WYDOT has developed a simple field viscometer to allow for real-time viscosity verification at the job site)

Yes No

Considerations, comments:

Question 7 – Can polymer latex be post-added to the emulsion, or should it be added to the soap or asphalt before processing through the emulsion mill?

Yes No

Considerations, comments:

Question 8 – What other changes would you suggest to insure polymer emulsion specifications really relate to performance during storage, construction, curing and on-the-pavement durability?

Liquid Emulsion Specification Test References

Part C: Emulsion Residue Specifications

The Problems: Emulsion residue specifications remain largely penetration-graded, with material grade selection only loosely tied to climate and traffic. There is a very clear need to narrow penetration range for grades more closely related to climatic and traffic needs. There is a desire to apply the more sophisticated Superpave methods to emulsions. Furthermore, it is difficult to capture the specific advantages of each of the various types of polymer modifiers in PME with a

single physical test and specification parameter. Parameters for tensile strength (such as force ductility ratio), tend to favor SBS, whereas low temperature ductility tend to favor SBR. As a compromise, common specifications meant to allow both polymer types frequently use some measure of elasticity, such as the Elastic Recovery Test in a Ductilometer.

Pros: Superpave tests are more closely related to performance and adapted for climate and traffic than conventional tests such as penetration. With newer rheometers, elasticity can be measured more accurately under controlled stress or strain conditions by using a creep recovery test in a dynamic shear rheometer (DSR). One possibility is to apply test conditions as recently developed for hot mix binders under a new AASHTO testing protocol entitled the Multi-Stress Creep Recovery Test.

Cons: Some forms of binder testing such as RTFO are inappropriate or may require significant revision for emulsion residue assessment. Rheological requirements are much different for emulsion and binder applications; the Superpave tests were developed to address rutting and cracking, not chip retention and bleeding.

Question 8 – In your opinion, how accurate or representative is the Elastic Recovery Test (performed in a ductilometer) in assessing polymer presence and relative concentration for polymer modifiers?

Inaccurate Somewhat Inaccurate Neutral Somewhat Accurate Accurate
Other considerations, comments:

Question 10 – Would you support using the Dynamic Shear Rheometer (DSR) to verify polymer properties?

Yes No
If yes, how might this be done most effectively? If no, why not? Please give other considerations, comments:

Question 11 – Compatibility can be monitored through microscopy, but such methods are difficult to translate into specifications. Emulsion heat stability, if a concern, could be addressed by the Laboratory Asphalt Stability Test (LAST) (or variation) as developed by NCHRP 9-10. If a certified supplier program is developed for asphalt emulsions, some of these stability/compatibility criteria might be required as part of the certification process, rather than including them in formal product specifications.

Would you support the use of microscopy to assess compatibility if implemented under a program of certification rather than as a formal product specification?

Yes No
Why or why not? Other considerations, comments:

Question 12 - Is a heat stability test necessary for emulsion residues?

Yes No

Why or why not? Other considerations, comments:

If yes, would you prefer current standards using the aluminum tube separation test (ASTM D5976) or incorporating the LAST (Laboratory Asphalt Stability Test) as developed by NCHRP 9-10? Would your thoughts change if storage stability were implemented as part of a precertification program rather than as a formal product specification?

Explain; please give other considerations, comments:

Question 13 – Do you support the use of Superpave binder grading tools such as the DSR, BBR, and PAV for emulsion residue specifications?

Yes No

If yes, please cite references or discuss approaches that might make this possible, and give other considerations, comments:

For suppliers: Would you be willing to provide Superpave binder test data for your own materials following protocols eventually established by this project?

Yes No

Emulsion Residue Test / Specification References

III. AGGREGATE TESTS AND SPECIFICATIONS

The Problem: Even with a perfect emulsion, if it is not chemically or physically compatible with the job aggregate or the aggregate cannot withstand the demands of the construction or application, the project may be a failure. Typically aggregate quality varies widely and testing is minimal for these types of applications, especially testing of the job emulsion with the job aggregate. Therefore, performance-based tests must address the unique problems and expectations for a given application. The FHWA Central Federal Lands Highway Division has requested that both polymer-modified chip seal emulsions and polymer modified slurry systems be defined for two levels of performance based upon traffic considerations.

Question 14 – Which of the following aggregate tests / specifications do you feel might be appropriate for polymer-modified emulsion based surface treatments (select all that apply)?

LA Abrasion Micro Deval Soundness Polish Size/Gradation

Cleanliness Methylene Blue (clay content)

List other aggregate tests that might apply: _____

Discuss preferences in detail:

Other considerations, comments:

Aggregate Test / Specification References

Question 15 – Would you support using the Sweep Test to quantify curing time to traffic for chip seals (2-levels of product performance would likely be established based upon separate limits for curing time)?

Yes No

Why or why not? Please give other considerations and comments:

Question 16 – Should performance specifications include chip seal testing procedures, which differentiate long-term chip loss (e.g., Frosted Marble Cohesion and Vialit Plate Shock tests)?

Yes No

If yes, what test methods would you prefer (provide references)? If no, why? Please give other considerations and comments:

Question 17 – Should the current ISSA micro surfacing performance-related tests for areas needing rapid cure, rut-filling, or with heavy traffic be adopted?

Yes No

Why or why not? Please describe any deficiencies or needed changes, and give other considerations or comments

Question 18 – Should a micro surfacing PME grade be used specifically for rut-filling with performance-related tests selected accordingly?

Yes No

Why or why not? Please give other considerations or comments

Question 19 – Should the existing polymer-modified slurry specifications be upgraded with input from ISSA technical representatives for use on lower traffic areas?

Yes No

Why or why not? Please give specific recommendations or other considerations or comments

Question 20 – Fugro Consultants is currently working with a FHWA pooled-fund study to develop new guidelines for micro surfacing mix design procedures. Recommended changes include modifications to the wet-track abrasion test, automated tests for mixing and cohesion, etc. Are you aware of that research, and do you generally support these changes?

Yes No Don't Know

Why or why not? Please give specifics or other considerations or comments

Application Performance-based testing References

IV. CONSTRUCTION

The Problem: Many failures of emulsion surface treatments are caused by poor construction practices and/or construction during inclement weather. There is a Transportation Curriculum Coordination Council (TCCC) panel that is working to implement contractor certification for contractors. Certification requires both training and testing to demonstrate competency. Several states have volunteered to pilot this concept and others have expressed interest.

Question 21 – Which of the following forms of certification would you support (check all that apply)?

Contractor Individual Materials Supplier Laboratory

Please explain or give other considerations or comments

Question 22 – Describe your level of interest in participating in the development of certification criteria, training, testing, etc.?

Not Interested Neutral Somewhat Interested Interested

Please explain or give other considerations or recommendations

Construction Certification References

V. GENERAL INFORMATION

Please fill-in the following items as completely as possible. Items marked with a * are required.

*Name: _____

*Company / Organization / Agency: _____

*Current Job Title: _____

*Email: _____

Phone: _____

*Which of the following best describes your current job function?

- Technical Sales/Marketing Managerial Regulatory Industry
- Representation

*Which of the following best describes your current occupational affiliation?

- Contractor Supplier Consulting Government Academia Trade Association

A.2 Raw Data from Survey

See A.1 for the full questions. Comments follow the data tables.

Job Function	Affiliation	Low Temp Recovery	Certification	Demulsibility	Viscosity	Other Viscosity	Raise Viscosity	Post Add	Viscometer	Elastic Recovery	DSR
Technical	Supplier	Somewhat Likely	Neutral	No	Yes	Brookfield	No	Yes	Yes	Somewhat Accurate	Yes
Technical	Supplier	Likely	Likely	No	Yes	Brookfield	No	Yes	Yes	Inaccurate	Yes
Regulatory	Government	Likely	Likely	No	No	NA	No	No	No	Somewhat Accurate	Yes
Technical	Consulting	Likely	Neutral	No	No	NA	No	No	No	Somewhat Accurate	Yes
Technical	Supplier	Somewhat Likely	Likely	No	Yes	Paddle	No	No	Yes	Somewhat Accurate	Yes
Technical	Contractor	Likely	Neutral	No	Yes	Brookfield	No	No	No	Neutral	Yes
Regulatory	Trade Association	Likely	Somewhat Likely	No	Yes	Paddle	Yes	No	Yes	Neutral	No
Technical	Supplier	Somewhat Likely	Likely	Yes	Yes	NA	No	No	No	Somewhat Inaccurate	Yes
Technical	Supplier	Likely	Likely	Yes	Yes	Paddle	No	Yes	No	Somewhat Inaccurate	Yes
Regulatory	Government	Likely	Somewhat Likely	Yes	Yes	Brookfield	Yes	Yes	Yes	Somewhat Accurate	Yes
Technical	Academia	Likely	Likely	No	No	NA	No	Yes	Yes	Neutral	No
Regulatory	Government	Likely	Likely	No	No	NA	No	No	No	Accurate	Yes
SalesMarketing	Supplier	Likely	Likely	Yes	Yes	Brookfield	Yes	No	Yes	Somewhat Accurate	Yes
Technical	Consulting	Likely	Likely	No	Yes	Paddle	No	No	Yes	Somewhat Accurate	Yes
Technical	Supplier	Likely	Likely	Yes	Yes	Paddle	No	Yes	Yes	Somewhat Accurate	Yes
Technical	Supplier	Somewhat Likely	Somewhat Likely	Yes	No	NA	No	No	Yes	Neutral	Yes
Technical	Academia	Likely	Likely	No	Yes	Brookfield	Yes	Yes	Yes	Neutral	Yes
Managerial	Consulting	Somewhat Unlikely	Somewhat Likely	No	No	NA	No	No	Yes	Neutral	Yes
Managerial	Government	Unlikely	Neutral	Yes	Yes	Brookfield	Yes	No	Yes	Neutral	Yes
Technical	Academia	Somewhat Likely	Yes	Yes	Paddle	Yes	Yes	Yes	Somewhat Accurate	Yes	
Managerial	Supplier	Likely	Somewhat Likely	No	No	NA	Yes	No	No	Neutral	No
Technical	Supplier	Unlikely	Somewhat Unlikely	No	No	NA	No	Yes	Yes	Accurate	No
Technical	Supplier	Somewhat Unlikely	Somewhat Unlikely	No	No	NA	No	Yes	Yes	Inaccurate	Yes
Technical	Supplier	Likely	Somewhat Likely	No	Yes	NA	No	Yes	No	Somewhat Accurate	Yes
Technical	Supplier	Likely	Likely	No	No	NA	No	No	No	Somewhat Inaccurate	Yes
Technical	Supplier	Somewhat Unlikely	No	Yes	Brookfield	No	No	Yes	Somewhat Accurate	Yes	
Managerial	Supplier	Somewhat Likely	Neutral	No	Yes	Brookfield	No	Yes	No	Somewhat Accurate	No
Technical	Supplier	Unlikely	Somewhat Likely	Yes	No	NA	No	Yes	Yes	Somewhat Inaccurate	Yes
Technical	Supplier	Likely	Likely	Yes	No	NA	Yes	No	Yes	Somewhat Accurate	Yes
Managerial	Government	Likely	Likely	No	Yes	Brookfield	No	No	Yes	Somewhat Accurate	Yes
Technical	Supplier	Somewhat Unlikely	No	No	NA	No	No	Yes	Somewhat Accurate	Yes	
SalesMarketing	Supplier	Somewhat Likely	Likely	No	No	NA	No	Yes	No	Neutral	Yes

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Job Function	Microscopy	Heat Stability	Superpave	Super Suppliers	LA Abrasion	Micro Deval	Soundness	Polish	Size	Cleanliness	MB
Technical	No	No	Yes	No						Yes	Yes
Technical	No	No	No	Yes							
Regulatory	No	No	Yes		Yes	Yes				Yes	Yes
Technical	No		No								
Technical	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Technical	No	No	Yes	Yes	Yes			Yes	Yes	Yes	
Regulatory	Yes	Yes	Yes	NA	Yes		Yes	Yes	Yes	Yes	
Technical	Yes	No	Yes	Yes							
Technical	No	No	Yes	Yes				Yes	Yes	Yes	
Regulatory	Yes	No	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Technical	No	No	No	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regulatory	No		No							Yes	
SalesMarketing	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Technical	No		Yes		Yes		Yes	Yes		Yes	
Technical	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Technical	Yes	No	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Technical	Yes	Yes	Yes	NA	Yes		Yes	Yes	Yes	Yes	Yes
Managerial	Yes	No	Yes	NA		Yes		Yes		Yes	
Managerial	No	No	No		Yes				Yes	Yes	
Technical	No		No							Yes	
Managerial	No	No	No	Yes	Yes	Yes	Yes	Yes		Yes	Yes
Technical	No	No	No	NA	Yes		Yes	Yes	Yes	Yes	Yes
Technical	No	No	Yes	No	Yes		Yes		Yes	Yes	Yes
Technical	No	No	Yes	Yes			Yes	Yes	Yes	Yes	
Technical	Yes	No	No	No	Yes		Yes	Yes	Yes		Yes
Technical	Yes		No							Yes	
Managerial	No	No	No								
Technical	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Technical	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Managerial	Yes	Yes	Yes	NA	Yes		Yes		Yes	Yes	
Technical	No		Yes					Yes		Yes	
SalesMarketing	Yes	No	Yes	Yes	Yes				Yes	Yes	Yes

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Job Function	Agg Others	Sweep Test	Chip Loss	Micro	Rut	Low Traffic	Fugro	Contractor	Individ.	Supplier	Lab	Interest
Technical	adhesion type tests, mixing type tests	Yes	No	Yes	No	No	Don't Know	Yes		Yes	Yes	Not Interested
Technical		Yes	Yes	Yes	Yes	Yes	Don't Know	Yes	Yes	Yes	Yes	Somewhat Interested
Regulatory	Flakiness	No	No	Yes		No	Yes	Yes	Yes		Yes	Interested
Technical	Particle shape is one of the most important characteristics in chip seal design.	No		No		Yes		Yes			Yes	
Technical		Yes	No	Yes	Yes	Yes	Don't Know	Yes		Yes	Yes	Interested
Technical	shape, 10% fines or crushing resistance.	No	Yes	Yes	No	No	Don't Know	Yes	Yes	Yes	Yes	Interested
Regulatory		Yes	Yes	Yes	Yes	Yes	Don't Know	Yes	Yes	Yes	Yes	Not Interested
Technical		No	No	No	No	No	Don't Know	Yes		Yes	Yes	Interested
Technical	Sand Equivalent	Yes	No	Yes	Yes	No	Don't Know	Yes		Yes	Yes	
Regulatory	Flat and elongated particles or some other shape factor test.	Yes	Yes	Yes	Yes	No	Don't Know	Yes		Yes	Yes	Neutral
Technical		Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Interested
Regulatory		No		No		No		Yes	Yes		Yes	
SalesMarketing	sand equivalency	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Interested
Technical		Yes		Yes		No			Yes		Yes	
Technical		Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Interested
Technical		No	Yes	Yes		Yes	Don't Know	Yes		Yes	Yes	Interested
Technical	Adhesion (resistance to stripping)	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Neutral
Managerial		No	No	No	No	Yes	Don't Know	Yes			Yes	Interested
Managerial		No	No	No		No	Don't Know	Yes	Yes	Yes	Yes	Neutral
Technical		Yes		Yes		Yes		Yes	Yes			
Managerial		No	No	No	No	No	Don't Know	Yes			Yes	Neutral
Technical	particle charge	No	No	No	No	Yes	Yes					Interested
Technical		Yes	No	No	No	No		Yes			Yes	Interested
Technical		No	No	Yes	Yes	No	Don't Know					Interested
Technical	Sand Equivalent in place of Methylene Blue.	No	No	Yes	Yes	Yes	Don't Know			Yes		Interested
Technical		Yes		Yes		No		Yes			Yes	
Managerial		No	Yes	No		No		Yes	Yes	Yes	Yes	
Technical	a modified Sand Equivalent test (aggregate oven dried then conditioned 24hr@ 2% moisture). much better indication of clay content than reference	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Somewhat Interested
Technical	I think all apply. If you are trying to develop and place high performance seals then good high quality aggregates are needed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Interested
Managerial		Yes	Yes	Yes	Yes	Yes	Don't Know			Yes	Yes	Neutral
Technical		No		Yes		No		Yes			Yes	
SalesMarketing		Yes	No	No	No	Yes	Don't Know	Yes	Yes	Yes	Yes	Interested

Responses from the “comments” questions. *Note that to protect the integrity of the data the responses here have not been edited. Apparently there was a limit on the number of characters accepted on the website for each response, and some answers appear truncated.*

Low Temperature Residue Recovery Comments

- Any method that can recover binder suitable for testing accurately and repeatably, and which is representative of in-service properties will have our support
- Keep options open to alternative recovery methods that will duplicate field conditions.
- It is my opinion that a new method that more represents what happen on the roadway needs to be develop. I also believe developing methods to test the base asphalt before emulsification would be helpful.
- Would ultimately depend upon ease of use, accuracy, cost to implement and time to perform.
- We have just completed a research project developing a low temperature procedure. We found that there were variations in polymer modified binder properties based on the methods of test used due to the requirement of remixing and reheating.
- Pre-testing has some risks related to testing the actual product delivered to the field, however the process of making specified products is usually verified.
- I appreciate the value of low temperature methods. It makes sense to evaluate emulsion based on performance. My hesitation with changing the current system, however, has more to do with quality monitoring, rather than specification validation. We use t
- If the evaporation technique does not exceed 60C, and remove all of the moisture from the sample, this would be a great method to utilize. The BASF procedure 25C for 24 hours and 60C for 24 hours seems to do a very good job.
- The step to an effective performance specification must be a recovery method that doesn't modify the base binder. Correlation with other quicker recovery methods may be possible for some systems for use in quality control and acceptance testing. If the ASC is implemented and successful, the cons discussed here are not applicable.
- the closer to field temperatures that we can obtain residue the better we can relate to performance
- We would look at all potential ways at low temperature.

I am in favor of performance criteria that measure properties to be expected in service, so using methods that match in service conditions makes sense.

- Any procedure that produces a more representative residue for testing and characterization is desirable. It seems to me that a certification program would eliminate the concern of time delays in recovering residue?
- If there was a certified supplier procedure that would certify plants would possibly eliminate the low temp recovery methods.
- Tests need to be able to be performed in a timely manner. Two to three days is too long.
- As long as the method used is thoroughly evaluated.
- We need to have a test were we are not increasing the time in which to achieve an answer. We would support a vacuum distillation at lower temperatures.
- The methods are too time consuming. We will support one that can cut the time down to 2 hours.
- This is an important part of moving the science of asphalt emulsion forward. We can support this effort through cooperative work with the researchers.
- If adopted in conjunction with the certification system mentioned in the previous question, I believe this would be beneficial for the industry. Low temperature binder recovery systems are without doubt more realistic as a field performance indicator.
- A procedure with reduced sample preparation time is required. We would support SAFT even though the equipment costs are high if it can reduce the sample preparation time to hours instead of a day or more. The tests that take longer may be of value
- We would support adoption of low temperature recovery methods. We would NOT support the adoption of only ONE low temperature recovery method. As a manufacturer of both premodified and latex modified PME's, we do not think that one recovery method will likely be involved in testing
- The EN13074 method seems very cost effective and time efficient. However, I would like to see any methods established as either AASHTO or ASTM procedures (if not already going in that direction).
- I would support this as long as the frequency of the testing (i.e. Elastic Recovery) outlined into the Certification program was set reasonably (i.e. Twice per month for certification). The percent residue can be obtained through a quicker procedure for recovery.

Approved Supplier Certification Comments

- This is more likely to be adopted in the USA and may not meet broad acceptance internationally. Hence suppliers outside of the USA, such as ourselves will not benefit from an ASC program
- Will support an Emulsion Approved Supplier Certification Program.
- Consistency in specifications and certification procedures across the states would be a great benefit from a suppliers perspective.
- We are contractor in New Zealand
- I have been retired for two and a half years and am somewhat disconnected with the technicalities of emulsions.
- We manufacture emulsions into small storage tanks, turning over our inventory, in most cases, the same day. We would not only be in favor of such a program, we would like to play an active role in its development.
- If a good program was in place for the appropriate training of technicians this would be a good practice. I would think agencies would need to be on board if recovery procedures are used that take additional time to get material to test.
- Having all the elements of the program in place would be a benefit. However, it is unlikely that we would base acceptance on "Approved Supplier Certification" only. We would still do some testing on samples of the delivered product. We have had many cas
- I see no reason to start from scratch. Many of the issues are the same between the two processes so I think it would be highly beneficial to use a similar, and now successful, model. Most emulsion plants are capable of producing a steady, consistent emu
- That the plan should be based on the existing AASHTO ASC plan aside, supplier certification is clearly needed is some form
- we work in the asphalt industry producing both emulsion and performance binder asphalt. We are aware of the plan for PG.
- A supplier certification program has worked quite well in California for asphalt cements. I am not sure if it is also used for emulsions but I believe so.
- This would give it more direction as to what needs to be done and to ensure everyone is doing the same.
- If the AASHTO ASC program is similar to the AASHTO AMRL certification for HMA and Aggregate testing I would probably be somewhat unlikely. AMRL is expensive and

in my opinion overkill. A program similar to NETTCP used in the Northeast US would be more p

- The problem would be the shelf life of the sample and getting uniform results back.
- Suppliers have enough self regulation and the current requirements from different agencies are more than sufficient.
- As a supplier the idea of an AEASC program has it merits. The complication occurs when different agencies adopt parts or modify a "national" program to a point where suppliers essentially end up adhering to programs that are effectively different for eThis would be good for the industry as a whole. I believe an approved suppliers program would lift the whole manufacturing segment with regards to delivering a quality product.
- We would support an AEASC program as long as it is usable by small companies.
- Have been involved with AEMA ITC for a number of years
- We are currently evaluating a program for ASC for emulsions based on our ASC program for binders. Our original binder program was based on AASHTO PP26.
- This is a great way to outline what testing needs are required along with the frequency of testing required allowing for timely shipping.

Demulsibility Comments

- The sweep test is intended to simulate field performance and hence is preferred. The demulsibility test artificially breaks the emulsion and may be more representative of the chemical reactivity of the emulsion than the curing behaviour.
- Performance based. Demulsibility can be a tool for the emulsion producer to optimize production.
- I don't believe that demul test is very accurate.
- Would not be required in the specification portion. Probably would still be used as a QC test if a reasonable correlation was found.
- We are more focused on performance based testing, which looks at the binder, which is all that is important for the client how it is delivered to the road is the problem of the contractor and most specs regarding the emulsion should be developed between theDemulsibility test never gave the field much information.
- If we change to a "system based" test, like the sweep test, we also introduce more variables. Are we able to identify a leaking heating coil, for example, as quickly with the sweep test, as we would if we saw a sudden rise in the demulsibility value? Wh

- This is a difficult question to answer. My answer would be no if the appropriate temperatures and curing conditions for the area and time of year were to be used for the sweep test. The demulsibility test (or the breaking index test) is/are good descriptors
- Demulsibility may not be the best test, but a test is needed that can be performed on a tank or load basis. Testing the emulsion aggregate system on one sample does not insure consistency in production. Measuring break time is especially important with
- But I think that both should be run simultaneously, at least in a few plants, to make sure that the sweep test is practical, and gives the information needed before phasing out the demulsibility test.
- Unless the sweep test is run per batch or lot there is nothing saying that a particular load of emulsion will pass the sweep test. I realize that demul is not run on every batch so the same problem applies. It is my understanding that the sweep test is quite The sweep test can take too long to use in the a quality control lab. A program that would use a demulsibility and correlate the results would be beneficial.
- Demulsibility measures an emulsion characteristic, while Sweep measures system performance. We check both, but from the standpoint of emulsion plant operations, Demulsibility is the better emulsion test.
- However, the sweep test and demulsibility test results should be compared for a wide range of emulsions to be sure we are not missing something from the demulsibility test with this replacement.
- It might depend on what part of the country the material will be sold in and the temperatures and weather conditions it would be susceptible to.
- I still like to have the demulsibility test in place as an option. I haven't seen the sweep test and have concerns about equipment prices, test times. etc.
- I am not familiar with the sweep test.
- If the sweep test was done in similar time frame. Demulsibility is a test used for quality control but would not need to be part of specifications if the sweep test could be very reproducible.
- Demulsibility has only an indirect correlation to field performance. As a manufacturer it has some value as method to determine if manufacturing is being done in a consistent manner. As a specifying agency the field behavior regarding the property definNew emulsifier chemistries can now produce high demulsibility emulsions without affecting stability. I do not agree that the sweep test is a reliable test for field performance in all cases as the field variables are difficult to imitate. Would this mean

- The sweep test is a SYSTEM test. The demulsibility test is an emulsion test. If demulsibility was eliminated as an emulsion requirement, the term CRS, RS, and HFRS would not have meaning. While demulsibility does not correlate to on-road performance
- The parameters for the sweep test have not been established as of yet. Till there is a definite spec some other test will be needed.
- A field test seems the most useful, although refineries should maintain demulsibility information.
- For the majority of chip seal applications I feel the demulsibility test is a good indicator and a very quick test method. Would you need this test if it was replaced probably not from a certification standpoint. The main thing is the material has to work

Viscosity Comments

- The Brookfield can measure viscosity at a number of shear rates and can provide estimates of shear susceptibility and more complex flow behaviour. It is an established method and is also readily available in most asphalt labs.
- A level of comfort is needed for the agency.
- The paddle viscometer looks the most promising. Would likely need to revise the specification ranges.
- We have been using Brookfield measurements for at least 20 years and it was in the Transit NZ emulsion spec until recently when all emulsion specs were removed.
- Rotational Paddle Viscometer is a practical test to measure viscosity.
- Either method--I would welcome a new method of measuring emulsion viscosity. Saybolt Furol clean-up between tests is difficult--especially in the production lab, where viscosity is being monitored during production. It is an attractive idea to have a sa
- I think it is time to change, but I would like to see an emulsion viscosity to be done at a range of temperatures from 20-70C and possibly a slope being specified along with a range at a specified temperature. The reason for this is that the emulsion vis
- I am not familiar with the Paddle Viscometer so either test may be appropriate. I would also suggest investigating the possibility of measuring emulsion viscosity at a temperature that corresponds to the application temperature range. It would then be po
- The Saybolt-Furol viscosity is so easy to run, with simple, inexpensive equipment. The alternate viscometers listed above are not as easy, and much more expensive.
- only because I have no experience with the paddle

- I do not know much about the paddle viscometer, but I know it is used in the paint industry. Again upon review of other options would be a program that should be considered.
- Although Brookfield measures at constant shear rate, it only measures one shear rate, and therefore does not characterize the rheological profile any better (or worse) than SFS (unless you are thinking about measuring viscosity as a function of shear rate)
- Brookfield Viscometer is widely used and easy to run. It is part of specifications for PG asphalts so most labs have basic equipment.
- I'm actually neutral on this. I have no problem with the Saybolt, other than cleaning. If a change was made, I would prefer the Brookfield and/or other rotational viscometers. I don't feel that it is correct to specify a brand of equipment in a test p
- We have found in the Pacific Coast Conference round robin that the emulsion results for the Brookfield varied up to 100%. The emulsion started to break in the test. A better suggestion might be to consider raising the temperature at which the saybolt-furol
- What are the extra information that the different tests can get?
- Would like to understand what we intend to test (temperature, shear rate, spindle geometry, etc.)
- Every emulsion chip seal producer is currently equipped with Saybolt Viscometers and I do not believe the Brookfield viscometer takes thixotropic properties of emulsions into account, which the Saybolt Viscometer does.
- If the Brookfield (or equivalent - because Brookfield is a supplier of test equipment) can be used with success then this should be used as most labs have this equipment. Is there any drop in viscosity over time observed when testing emulsions in the Br
- The SSF viscosity method works well and is proven. While the rotational methods (Brookfield and paddle) can give more information at different shear rates, neither is adequate to accurately predict run-off. A simpler method would be to add some type of
- Do not have any feel for the two proposed alternatives
- Many labs have the Brookfield equipment already. If it can be used effectively (i.e. more consistent results), it would be cost-effective as a replacement for the Saybolt-Furol.
- At this point I don't feel the other test methods have been proven. The Rotational Paddle Viscometer when tested in our lab varied significantly due to temperature control of the device.

Raise Viscosity Comments

- Viscosity is a matter of fitness for purpose and in some situations a low viscosity emulsion may perform equally as well if not better than a higher viscosity emulsion (e.g voidfills). This needs to be considered before a change is made. Having said that,
- If it can be proved to be performance driven.
- It is my opinion that any raising of minimum would cause more drilling of the chip seals.
- 100 second vis material works just fine. No need to raise it.
- Need to have agreed viscosities for the type of treatment as low viscosity is good for flow into voids and around the stone but also across and down the road with steep geometry. You sometimes need thicker emulsion that won't run.
- This warranted in some states and ought to be decision made by each state.
- I see value in changing the specification to 100-500, with the specifying agency having the option of changing the minimum to 200. In some cases it is difficult to maintain even a 100 viscosity when using polymer modified base stock. On the other hand, I don't have the data one way or the other, but it should be investigated to determine if the present specifications is allowing for proper application.
- If states think it should be changed based on their experience, they should change it. However, states with success on the lower viscosities should not have to change.
- in my opinion viscosity in the low 100's is not sufficient to obtain 70% embedment of some gradations...especially if the agg spreader is not immediately following the dist truck. Additionally for the larger grades of aggregate the low visc are is not suf
- The Furoil Vis should be 150-400 SSF. A vis of 500 SSF would be too thick for some levels in the field. Anything less than 150 SSF would flow on the road.
- Neutral on this one.
- Most likely especially for hot climate regions.
- Depends on if they have had problems in the past.
- Maintenance managers have commented that viscosities of 100 SFS are too low for a good chip seal. However, I do not know if 500 is too high for spraying. That would need to be confirmed.
- If the test is performed at the suppliers plant. No if the testing is done after sampling on the job.

- I believe that the test temperature should be raised to reflex application temperature instead of raising the viscosity. Some agencies in the state have raised the viscosity to avoid run off in this state already.
- Should be 50 to 500.
- Lower range then 100 - 400 SSF being used in many locations with success.
- No. These specifications were primarily identified by past field performance, some regions would benefit from very high viscosity chip seal emulsions, other regions would not benefit due to climate.
- The standard specifications are fine. While certain conditions (steep hills) might require a higher viscosity, we have seen most distributor trucks start to have spray pattern issues (drilling) at 500SSF.
- Most production CRS-2 is at greater than 200 sec. Based on all the pumping, which can occur it is better to have a higher minimum to prevent pumping viscosity loss to the point where the product becomes too fluid to spray and hold properly
- Since shipping and pumping can affect viscosity, the truest measure should be viscosity at the point of application. This may be based on visual methods. As the recommendations stated, unless field personnel are complaining about too thick / thin material
- I don't believe this is needed as long as you manufacture stable product. If you raise this viscosity by 100 seconds that still doesn't prevent the viscosity drop off issue that some face.

Post Add Polymer Comments

- Once again it is a matter of fitness for purpose. If the mode of addition does not affect the desired emulsion properties then there is no reason to prohibit post addition. This should be left up to the manufacturer to decide.
- Beyond the scope of this research. BUT if it does not affect performance, then it should be allowed. With true performance-based test, we will be able to determine if it can be post added. The current concern is the loss of viscosity in a Chip Seal Emulsion if
- I don't currently believe the latex modified emulsion performs a good as true polymer modified emulsion. We have don't field test in Minnesota and true CRS-2p out performs CRS-2L
- Should be 2 questions. The specification, if correctly identifying parameters, should allow either manufacturing process. Performance-based specifications should be blind to methods and materials.

- Prefer to see it added before the mil.
- it can be post added but the emulsions produced are different as are the properties of the resultant binder.
- Better processing is achieved by adding before being milled.
- As I understand it, the most valuable place for the latex to be added, is in the soap phase. I would think that there may be some issues with achieving proper mixing if it were post-added.
- It would not be wise to determine any companies manufacturing policies if a performance test is included such as the sweep test for seal coats or the slurry seal/micro surfacing tests.
- It would be desirable to develop test methods and performance criteria that would be blind to how the latex is added.
- This is not a yes/no question. I think it depends on the plant/state/situation. If people have had success with post-adding polymer latex, I do not think they should be forbidden to continue. However, if the general consensus is that this is not a good
- the latex should be co-milled in some systems though it may not be necessary in other systems or for other applications. for example a mixing grade emulsion may perform equally well in a post add situation. If it has to be yes or no i vote to co-mill.
- I believe that it can be post added with success but should be checked before it is allowed.
- It should be added to the soap or the asphalt depending on the type of polymer.
- We see better performance when milling the latex.
- I believe in-line blending of polymer latex and asphalt emulsion has been done successfully. However, a more uniform product is likely if the polymer latex is added at the emulsion mill.
- Not applicable. We are not an asphalt manufacturer.
- Never post added, only co-milled.
- The specifications should be end result driven. The supplier should be able to use whatever method there is out in industry to make a product that meets specifications. We have used all different kinds of polymer and added them many different ways. We ha
- Are there any data that indicate one method is better than the other? I see no difference.

- This is a manufacturing process directive, depending on the end use and chemistry different introductory methods may be preferable.
- A better dispersion is obtained when the latex is passed through the colloid mill.
- "Post added polymer latex is not adequately dispersed in the emulsion. Addition of latex to the soap or asphalt prior to emulsion allows the high shear mill to adequately disperse the polymer, thus forming a truly homogeneous emulsion."
- Suppliers of emulsions should meet specifications. The supplier should be free to elect how to best provide a product that meets specifications and performs in the application.
- The question should be "can polymer latex be post added to the emulsion in the field?" Latex addition works well as a co-milled ingredient and with proper dispersion, latex can be added to emulsion at the emulsion plant. We have manufactured CSS, CQS,
- The post addition of latex could create viscosity and separation issues. Better latex? AC relationship if comilled or is in AC prior to emulsification
- We saw inconsistent performance with in-line blending with latex and binder. Smaller operations might not have the control necessary to give consistent performance with post-mill blending.
- I feel this should be co-milled to add to the stability of the emulsion.

Viscometer Comments

- Any compliance testing, whether in the field or lab needs to be undertaken by competent, suitably qualified staff. Such personnel should be certified or accredited to a suitable quality or competency standard.
- Performance related and can be tested. This is where we can determine if the emulsion will perform.
- It has been my experience that as long as the emulsion does not run off the road before you can put the chips on the viscosity is not an issues. So I don't believe field testing necessary.
- The field properties are what matters. Not the properties after the emulsion has been transported to the lab.
- Why bother testing if it sprays okay and doesn't flow off the road it is good but if there are issues then there is a problem that needs to be fixed and a field test may not be able to show the difference.

- Some type of field testing is always useful to back up or verify the laboratory testing and for quality assurance purposes. However, field testing probably should not take precedence over the laboratory testing.
- I think that job-site verification would be a great thing. We can certify an emulsion before it leaves our facility. But if a sample is taken and left in some guy's trunk for a few weeks before being delivered to the DOT lab--we are not going to be conf
- This is a slippery slope due to sampling of the material. I would suggest that if there are application problems there should be a means of sampling that would be able to validate the material. If there are no application issues regarding emulsion distr
- There needs to be a method to address consistency from load to load of emulsion and be able to reject material that will cause application issues. The application viscosity is much more important than a viscosity measured hours or days earlier or days after
- Yes. Field testing of emulsions can be easily accomplished with a Zahn cup or equivalent. This would influence question 3, as the viscosity usually drops during shipment.
- from a supplier point of view this is tough. yes it would be helpful in preventing the application of low visc or off spec emulsion but if everything is good at the plant and in the tank how can I convince that the storage, handling and shipping container
- But field testing and acceptance should be verified for reproducibility and accuracy
- AS long as it is repeatable and applicable. There is also contractor acceptance, and also handling the product.
- Many things can go awry once emulsion has left the producing plant. I think this is a good idea.
- This gives the Agency some confidence that the emulsion he is getting at the job site is similar to that in supplier's storage tanks. Helps eliminate contamination problems in shipping, etc.
- There should be some kind of control for in the field. If so then there should also be some solutions to typical problems that have been seen.
- We currently field test for viscosity using the Saybolt Viscometer.
- I am not familiar with the WYDOT method, but most crews know if there is a viscosity problem in the field.
- Any time that an agency is allowed to test the product where price adjustment are applied, then the testing must be repeatable and reproducible. Many of these field viscometer methods are not uniform nor reproducible.

- Viscosity does change. Suppliers should not be penalized if the field test passed and the central lab test failed.
- Emulsion viscosity can be important during the transport and application of emulsion, however other factors may be much more important to the success of chip seal. with the limited amount of field inspectors that most agencies now have in the field they
- I would say it should be at the discretion of the client.
- Field testing of PME allows for a timely determination if the PME used will meet specifications.
- I would need to see more data on the repeatability/reproducibility of the field viscometer results and see how these results related to testing the sample in a QC lab in order to comment.
- We would support this only if tested from a sealed transport. Once emulsion is transferred into the customers equipment, the emulsion manufacture loses control with regard to contamination, temperature control, over pumping, dilution, and added materials
- Allows for protection against low viscosity products being sprayed, which could create issues with field performance. Although some type of warranty might resolve that concern.
- A quick field test for contaminants or early breaking would be useful (i.e. Sieve test or some sort of visual viscosity test).
- Compliance testing should be performed from the suppliers tank. However field testing is not a bad practice for usability of the material.

Other Changes Comments

- Identify what is critical for performance of the emulsion then go from there. Start with a blank slate to remove preconceive paradigms.
- I am not sure.
- Define performance characteristics and necessary limits. Be prepared accept new materials and to obsolete current materials.
- Need to focus on the end result not on irrelevant spec that pass or fail an emulsion even when it is delivering the binder as required to the road surface.
- Percent of chip loss after the roadway is opened again to traffic would tell the real story of chip seal performance.

- I really like the idea of evaluating the residue using the DSR, specifically the MSCR values. I think that this would be a great replacement for elastic recovery testing.
- A test for storage stability may be needed in certain circumstances. In some cases such as chip seal or micro surfacing it is not as important. A sieve test is also important for appropriate application.
- "THERE WAS NOT A GENERAL COMMENT BOX, SO I WILL USE THIS ONE. Many of the same issues and proposed products are being addressed under NCHRP 14-17. This project was tasked with developing a chip sealing manual, evaluating some test methods, and developing"
- I think multiple labs/plants around the country should explore the new performance tests (sweep, low temp recovery procedures, etc.) and track the performance in the field. New, more expensive tests in the lab are not necessary if they do not show a cons
- Ensure that field personnel follow SOPs in storing and delivering field samples.
- There are many performance based tests in the industry. As the industry grows, these should be used to help distinguish between good and poor products
- The use of some type of performance grading, and also the FHWA use of the MSCR program.
- There are several. Emulsion specifications should focus on performance related issues such as adhesion to existing pavement surface, adhesion to rock (chip seals), abrasion resistance (slurry seals), tackiness (tack coats), controlled break times (chip s
- Some type of separation test or settling test for the polymer.
- If an adhesion test were developed and easy to use that would go a long way to performance on the road.
- Much of what constitutes "good" field performance is determined by the applicator and field conditions. We need to understand what materials are successful and what drives their success.
- 1-Some type of temperature/shear stability test for the emulsion that would indicate a minimum handling/pumping temperature for the emulsion. Many CRS and RS grades of chip seal emulsion are manufactured to not be stable at low temperatures. This allows
- some type of performance test done in the lab. Don't know what but thinking about it
- As noted in the references, DSR and BBR testing will be useful to determine effects of storage and curing on durability.

Elastic Recovery Test Comments

- Elastic recovery can indicate the presence of polymer but I suggest that there are too many other factors affecting the values obtained to be able to accurately assess relative concentration.
- As stated in the ASTM 6084 "Standard Test Method for Elastic Recovery of Bituminous Materials by Ductilometer" in Section 3. Significance and use: "This test method is useful in confirming that a material has been added to the asphalt to provide a significant
- It is my belief that testing the base asphalt before emulsification would be a better way to make sure that one receives true CRS-2p. It is my experience that the effect of milling the asphalt gives you better Elastic Recovery Test results that testing the
- ER can display the presence of modifiers, but not concentration when comparing different polymers and systems.
- Various systems do better than others. The test is somewhat messy and the ductilometer takes up a lot of space. Other tests are able to identify polymer as well or better.
- No experience with the ductilometer
- No comment as I'm unfamiliar with the technicalities of these tests.
- There are so many variations of the Elastic Recovery method that sometimes it is like comparing apples to oranges. One concern that I have about the elastic recovery method is that it is sometimes difficult to get consistent results. The "lumpiness" of
- The particular residue testing will need to include application specific tests to identify the appropriate polymer is used. A micro surfacing needs a different polymer than a chip seal or a latex modified slurry seal. The stretchy-pully tests that are a
- Elastic recovery can be used to accurately indicate the presence of polymer but as mentioned is sensitive to polymer type and may need some method adjustments based on polymer type. It probably has little relation to performance and needs to be replaced
- This is not in my area.
- in that it indicates some amount of elastomeric polymer present...not how much and not what type to a great degree of accuracy
- good for presence but bad for concentration
- There is some correlation to the percent and the results of ER. This is not necessarily a correlation between elastic property and seal coat performance.
- I'm not sure how accurate it is for relative concentration.

- Gives Customer or Agency some assurance that polymer is present but does not define the amount of polymer present.
- Don't know the test.
- Very limited experience with the Elastic Recovery Test. Currently use torsional recovery.
- I have not had enough experience with this test.
- It is the only good test available that will determine the presents of polymer. All the other tests are only good enough for one type of polymer.
- Especially on latex modified asphalt.
- The temperature / cut / hold timing all play into what number is generated by the Elastic Recovery Test. If industry is going to use this would like to think through what desirable properties we are trying to rate.
- While the elastic recovery does indicate the presence of polymer, I do not believe it is a good indicator of the relative concentration of polymer. Take three different asphalts with the same PG grading and add polymer, the results will not correlate.
- Elastic recovery measures the presence of elastomers, but is not a quantitative test. It reflects that enough polymer has been added to achieve elasticity, but does not actually measure the amount of polymer.
- ER does correlate only roughly to elastic type polymer concentration. It does not correlate with thermoplastic type polymers. ER is a physical test; there is no expectation that it could be used to assess polymer concentration.
- Somewhat accurate for certain polymer types but not all.
- We use the Elastic Recovery for both binders and emulsion residue (by evaporation) and feel it gives a good general idea of polymer presence. We also use force ductility, which will show polymers that have performed well in Louisiana.

DSR Comments

- Use similar protocols to Superpave requirements
- TEST by all concerned.
- The obstacle is the residue recovery method. It needs to closely simulate field conditions.

- MSCR test. Would need to define the spec limits but this is a good way to determine polymer.
- can use samples of recovered binder without the need for reheating and remixing.
- The DSR is a much more time-efficient instrument. We can learn more in a shorter period of time. The amount of residue required is much less, which also makes it attractive.
- If the use is for identifying polymer content I would say yes a maximum phase angle can be used to determine a certain polymer content or verification there is polymer in the emulsion residue.
- The test method and criteria developed for paving binders should not be used directly without being confirmed that they accurately meet the needs of emulsion applications. The test method and properties need to be modified to address the needs of sealing
- I think the added cost does not give enough added value in the field.
- some but maybe not all properties and maybe not all polymers...need to see what is out there
- phase angle or actual dsr number
- The use of FHWA MSCR test.
- No sure of the best way.
- Phase angle determinations or stress recovery measurements should be helpful.
- Those that design the machine might have a better chance to answer this than myself.
- I would guess looking at a creep recovery test such as AASHTO TP-70. My only concern would be equipment costs for labs possibly needing additional DSR's.
- Frequency sweep tests on dsr
- I should put maybe. As long as the testing could be done after shipments, I would possibly support this.
- The date that has been used to determine if the DSR is good in from a small pool of suppliers. Most of the date comes from Texas. There is no reproducibility on the residue and price adjustments will be made if it becomes specification. The specification
- Change the residue recovery method.

- Multiple Stress Creep Recovery - Run protocol at a temperature that is characteristic of the surface temperature where the emulsion is applied.
- This is currently done for PG graded asphalts and indicates the presence of polymers. I don't know how this translates to field performance of the specific polymer.
- The repetitive creep test being work on currently, once validated, should be a much better tool.
- I would support if it can be validated that DSR relates to performance in the application that the emulsion was being used for.
- I am assuming that you are asking about using the DSR to look at the properties of the PME residue, not to quantify the properties of the polymer separate from the residue. DSR procedure would need to be developed that represent what is happening in the
- MSCRT could be used to determine polymer properties. A proper residue recovery test, which simulates curing in the field will be needed to recover the binder. Obviously the RTFOT does not reflex what occurs in the field. A recovery test is needed which
- MSCR should give usable results using equipment currently in most labs.
- As long as the frequency of testing is aligned with the type of instrumentation needed to perform these tests. (i.e. It would be expensive to put a DSR in every plant)

Microscopy Comments

- Physical property testing is more likely to indicate performance than a compatibility test such as microscopy. I see microscopy as being of limited value.
- Microscopy may be a good indicator when looking at PMA, but not necessarily the PME. Compatibility of polymer is not an issue with emulsion modified with different modifiers (Latex). The polymer is in the water phase not asphalt. What will you be looking
- I do not know anything about this test so I am neutral.
- If you cannot specify compatibility parameters you cannot certify them.
- It may or may not relate to performance.
- Compatibility is important in the manufacture process but is it important once the binder is emulsified? I suppose this is more a problem in latex modified emulsions, which I don't have much experience with.
- If it could be shown to be relevant to compatibility performance then it might be worthwhile. Generally, cationic emulsion are compatible with nearly all aggregates.

- I am not familiar with these tests.
- I think that this is another slippery slope in trying to formulate for suppliers. If the material performs adequately in a performance test such as the sweep test at the appropriate conditions or a loaded wheel test and wet track test for slurry and micr
- It should be adequate to this type of testing on a base asphalt-modifier system for certification. These tests should not be considered for tank or load acceptance testing.
- Again, I think the added cost does not give enough added value in the field.
- good and quick indicator of compatibility between polymer and system
- Too variable and it is dependent upon an individual's opinion
- I not sure if I understand the question. Does mean using a microscope for polymer content?
- However, some suppliers may not have the necessary equipment or personnel to carry out this evaluation. They would have to contract it out and would need timely responses.
- Only if the testing does not take too long to get results back for certification.
- Would rather depend on specification tests to ensure product compliance.
- to cumbersome
- Too complicated.
- The microscopy is very subjective. Certification is going to determined by someone who has want no knowledge of how to work a microscopy. Microscopies are not used by engineers.
- It is not readily available and it depends too much on the individual who run the test. The repeatability is too low.
- In emulsion residues - the need to have a "single phase" polymer / asphalt blend seems less evident. It may actually be better to have some degree of separation when the emulsion is acting as a binder
- I believe this "test" is too subjective to be incorporated in a product specification.
- Some form of the measurement of compatibility is necessary to ensure a good performing product. Since microscopy and other tests are cumbersome, the test should be confined to certification, not as a product specification.
- It is difficult to turn a subjective evaluation procedure into a specification.

- This question is biased to the premodified emulsions. A latex product works by forming a polymer matrix during emulsion curing that is external to the asphalt. This type of compatibility test is meaningless for a latex modified emulsion. In the case of
- A certification or Designated sources list would cover it. It would not have to be run all the time as a part of standard everyday testing. Only when polymers change or crude slates change would it be needed and that would be up to the supplier.
- Until a specification can be developed, proof of compatibility would be sufficient.
- Use MSCR recovery loss between 100 & 3200 Pa instead.
- Again if this is an annual item and not a certification test i think it would be ok.

Heat Stability Comments

- A heat stability test is not needed on the residue. We make both premodified and latex modified emulsions. A heat stability test will change the polymer morphology of a latex PME residue and would be meaningless. In the case of premodified PMEs, since
- Emulsion residues are not exposed to extreme temperatures like a tank of modified binder would be. Therefore, I do not see the need for testing for heat stability. If I am understanding the question correctly, and there are some that are using the aluminum tubes
- Emulsion residues are not subjected to storage at high temperatures for long time periods.
- Emulsions are not subjected to the same conditions as hot binders, so heat stability testing is redundant.
- Heat stability of the residue could be a relevant test for emulsions placed in very hot desert conditions where the surface temperature can get up to 180 degrees F.
- I don't understand what you will be certifying.
- lower heat during storage and use of latex rather than SBS seem to reduce the tendency to migrate polymer. Some systems may differ.
- Not generally needed, but I would be in favor of a heat stability criteria for a precertification program.
- Not really that important as if it is not heat stable and falls apart then it is a supplier/contractor problem not a client problem.
- Performance base using field conditions. How hot in the field?

- precertification would be the way to handle.
- Probably prefer using current standards.
- See the question above.
- Storage stability is the responsibility of the supplier. It is not required in the specification or the certification program. If you are in the business then it is part of your program and not something that outside people should be judging or reviewing.
- The product is an emulsion. The heat stability test is used to make sure that asphalt and polymer are compatible in a tank setting at elevated temperatures. Emulsion tanks are low temp and the end use is low temp.
- The storage stability test is sufficient. Easy to perform.
- This is definitely not necessary since the emulsions do not see those temperatures. If you are making an emulsion from a modified asphalt I believe the production limits may dictate the stability in many cases.
- This is not in my area.
- This would depend on storage time, but if the material is expected to be stored for extended periods (weeks) I'd like to see heat / storage stability information. Whether this is done as a specification or pre-certification depends on the program and tes
- We have never experienced any problems with polymer modified emulsions currently in use.

Superpave Comments

- A grading system using these tools was developed by Texas A & M for the Texas DOT. They also conducted a second study to correlate the specification to field performance. The specification was developed for climate conditions in Texas and needs to be ex
- ASTM has discussed these issues in task groups. Superpave grading has proven useful for binders, so it is logical that Superpave emulsified asphalt residue would be useful.
- But do we know what those numbers will actually be telling us based on performance. Might need to compare to similar base asphalts the emulsions are made from.
- Chip Seal Emulsions have been successfully applied for many years in the different States. This is a low cost, effective road preservation treatment. Many of the smaller emulsion manufacturers do not have the means or the staff to purchase and operate Su

- Chip seal specifications will have to figure out how to use SuperPave asphalt cements, rather than a whole new set of specifications just for the base stock of emulsion products. If paving-grade asphalt cement is used neat (without emulsifying) then
- Evaluating residues using Superpave binder tests seems appropriate to better match the appropriate binder with climate. PAV would be useful in evaluating the aging characteristics of certain emulsion residues (surface seals).
- How does the DSR, BBR and PAV relate to early chip lose. or lose of chips after a season. People are trying to take something made for hot mix and apply it to a product that does not see those conditions. The whole idea of PG is to relate to performance.
- i do however support looking at these test methods. it is difficult for most to extend the concept that was developed for 1.5 inch thickness of an encapsulated mix and relate that behavior to applications less than 3/8 inch where the aggregate may be expe
- I support the use of the DSR for residue, but PAV and BBR tests require too large a sample size to be practical.
- I would say yes if the appropriate specifications are developed. I would say that the rolling thin film oven is definitely not appropriate, but the aging in the PAV and ultimately testing the BBR may be appropriate for some long term performance.
- I would support using the equipment as long as test methods and protocols are developed that relate to PME performance. I would not support an adoption of the PG of SPG grades for PMEs.
- If we use a different method to recover the asphalt. With heating to 500 degrees, I am not sure who accurate the results are.
- Only if we can validate that they relate to performance in the application that the emulsion is being used for.
- Possibly for polymer modified emulsions if they can be tested after shipment.
- Specifying the original binder grade to be used for the emulsion.
- Superpave is the closest, most accepted procedure for assessing performance properties that we currently have. So, I am more than willing to support their use for residue testing.
- The added cost does not give enough added value in the field.
- The removal of water at lower temperature is necessary. Dealing with polymer and chemical modified emulsions would a challenge.

- There would have to be changes in the protocols to reflect how emulsion residues in chip seals age in the field. I have no idea what those changes might be in relation to aging temperatures and residue recovery temperatures.
- To the extent this is frequency of testing is reasonable.
- Too time consuming.
- Tools yes, protocols to be developed that are applicable to polymer modified emulsions.
- Use the current PG spec. Eliminate the plus spec.
- Using the Original DSR to establish the appropriateness of a binder for a given region is a good tool. The RTFOT should be excluded due to the lack of a hot plant and therefore the omission of the binder ageing step. The PAV should then be evaluated on th
- Yes but using the SPG and maybe developing some better tests that mean more for thicker surface films that are exposed to direct high frequency impacts in chip seals

Super Supplier Comments

- How to recover to duplicate field conditions? How to condition? Test?
- If there was clear evidence that the tests related to performance final product on the road then we would supply data. It is not clear that all the SHRP tests developed for hot-mix necessarily apply to emulsion applications.
- Certainly a better way to recover residue
- It depends on how it is shared and used.
- it will begin the process of comparing different equipment and different systems. need to be able to correlate the sample with specific jobs to back up performance or lack thereof
- maybe
- No real explanations should be necessary. I think this is in the best interest of the industry. If there are issues with variability this would be discovered quickly and the group could discuss how things could be adjusted.
- Once everything is established I would imagine we would run SHRP testing
- This is a USA initiative and may not be adopted internationally
- We would follow the ASC program or a state program. It would be difficult to test every batch of product.

- We would provide data for our binders both before and after emulsification.
- We would provide if requested.
- We would welcome the opportunity to be involved.

Aggregate Test Comments

- Aggregate quality is essential for successful surface treatments, whether polymer modified or not.
- Aggregate specifications need to be related to traffic conditions. A lower quality aggregate may perform satisfactorily when subjected to low traffic volumes. We successfully use limestone for most chip seals, but it polishes if used in higher traffic a
- Aggregates are obviously very important. I think all of these tests are critical. Usually, aggregate supplies have already run most of these tests on their aggregates for HMA, so it shouldn't be too much more work to incorporate into their chips/slurry
- All are important. LA Abrasion is really impact resistance and should not be dropped in favor of Micro Deval. Each test tells you something different and valuable.
- Cleanliness, size/gradation, resistance to abrasion and polishing are all critical with chip seal aggregates.
- From 35 years of dealing with chip seals cleanliness of the aggregates is extremely important, particularly in areas where the aggregates are not washed. Wetting the chips before delivery to the chip box helps to clean them. When paving-grade asphalt ce
- Gradation and hardness (LA or Micro D).
- I believe the tests are available now to give good numbers for the aggregates used in the pavement preservation techniques used. The only suggestion I would have is something like a tolerance for the sand equivalent test to make sure some measure of cons
- I think all apply. If you are trying to develop and place high performance seals then good high quality aggregates are needed. All the above tests help in that regard. Maximum and minimum test values would have to be established to ensure high quality. A
- I think that it is a very good idea to evaluate chip seal aggregates. In Wisconsin, the only requirements are in size/gradation along with fractured surfaces. In my opinion, there are many other factors besides size that make up a good chip sealing aggr
- Mainly Micro Deval and Cleanliness.

- Only tests that are applicable to the interaction between the emulsion and aggregate should be included in an emulsion spec. Other test such as polishing and LA Abrasion relate to pavement performance and not necessarily to the quality of the emulsion.
- Particle shape is one of the most important characteristics in chip seal design. This should be controlled.
- Quality aggregate is a necessity. While pme will allow you to obtain satisfactory results with marginal aggregate, the objective should be the best performance possible and a way to reduce the risk. Identify the test that are applicable to the application
- SEQ spec for micro needs to be enhanced by adding a tolerance to mix design sample for example min of 70 with +/- 5 tolerance
- The most critical would be cleanliness and gradation followed by some type of durability.
- The sand equivalent test indicates the presence of clays whereas the Methylene blue indicated the presence of clay as well as reactive fines. I believe the presence of clay materials is more detrimental.
- These tests are instrumental to determine the quality of the aggregate as well as sizing and adhesion qualities (cleanliness).
- We have aggregate specifications that are adequate that cover our sealing chip quality in New Zealand.

Sweep Test Comments

- Will vary to much based on the various aggregates and weather conditions.
- We like to let the traffic on the new seal as soon as possible and conditions on the day are likely to be different than lab conditions normally faster and specs developed around a lab test could create more issues than they solve. A contractor will not
- Too many field variables, which cannot be duplicated in the laboratory. This test is only relevant when compared to a control sample and then only at the test conditions of temperature and humidity. Softer asphalts will not perform as well on the sweep test
- This test is specifically designed to simulate field performance.
- The sweep test was one of the first performance test for Chip Seal. Still needs work.
- The sweep test is interesting from a comparative standpoint (single rock source / multiple formulas) when formulating. However I am reluctant to have this become an acceptance or penalty test - because of the uncertainty of obtaining representative emulsion

- The sweep test is an excellent tool for formulating emulsions. But as a QA test it has several deficiencies; it takes too long to perform, it is only relevant with job aggregates.
- The agencies do not vary the time for curing. The job is chip sealed, rolled and traffic is opened immediately.
- Sweep test is a good replicate of the soundness of the finished pavement, especially is loose aggregates leading to windshield damage is a concern.
- So many factors contribute to successful performance that could not be manipulated/controlled in the lab sweep test that I think this approach is impractical.
- Seems to be a good indicator of performance.
- Refinement of the test is necessary. The test can be highly variable and a slight change can induce large errors.
- Once performance criteria can be established I think the sweep test or an improved version would be a solid tool to help
- Not as written. It needs the Takamura modifications to be more consistent. It also needs the aggregate to be graded to a specified single size for the test to have meaning. If a multi sized aggregate is used, the loss can be considerable even if the e
- No additional comments.
- Maybe for certain high traffic situations
- Lab conditions would not necessarily indicate field performance due to varying conditions of temperature, sunlight, moisture, etc.
- Knowing the necessary cure time or specifying a maximum cure time or even a pass fail cure time addresses the fundamental problem of chips adhering to the road surface. Cure time is different than the break time and is dependent upon temperature and other
- It is my opinion that the sweep test is too user depended. I worked on devolving the test and it is a good test to make sure the asphalt and rock will work together but not sure about time to sweep. There are easier ways to determine in the field which
- I would support using the sweep test--perhaps in its modified version--to certify a job aggregate/emulsion formula. I would not be in favor of using the sweep test as part of emulsion specification verification testing.
- I have never done the test so I can't give an informed response.
- I believe the two level spec helps keep the cost down on lower volume while increasing the performance on higher ADT

- I believe it would be good tool to determine aggregate and emulsion compatibility. After that it would help in performance.
- Field tests would be helpful to identify application issues in support of visual observations.
- Extensive testing is being done under NCHRP 14-17 and a specification is to be developed.
- But, as discussed before, this needs to be verified with multiple labs before implementing any sort of specifications.
- Again, if the appropriate curing times and temperatures are used for the climate and performance expectations.

Chip Loss Comments

- Are these test indicators of long-term chip loss? Validate. We need help.
- Frosted Marble
- frosted marble to take aggregate variations out of play
- Frosted Marble
- I believe as time passes, chip loss is less of a problem.
- I don't know if these truly represent what happens in the field.
- I prefer the Vialit Plate Shock Test but this test is only relevant on the fresh emulsion and is no indicator of longer term performance.
- I think this question assumes that these tests actually do differentiate the long term chip loss and I do not think they may.
- It is a chip seal that adds no structural value to the pavement and is for maintenance purposes mainly.
- Long-term chip loss is more often caused by inappropriate binder application rate or poor surfacing design rather than the quality of the binder or emulsion.
- Methods selected should have some relation to field performance.
- Not applicable. Not currently familiar with these tests.

- Not familiar with the quoted tests, but something to address long-term performance would be beneficial.
- Not that familiar with these tests. However, have heard good things about Vialit Plate Shock test.
- The finished product of a chip seal is the contractor's responsibility, not that of the emulsion supplier. Emulsion suppliers have no control over the quality of the aggregate used and should not be subjected to the responsibility.
- These seem to be a bit subjective. May not be good indicators of performance.
- These tests do not consider the traffic.
- They should be evaluated and compared to field performance. I would support this type of test if there is a correlation to actual performance. Field performance would need to be evaluated in multiple climates and conditions, such as snow plowing.
- Vialit may give more meaning to chip loss as it involves the aggregate and emulsion residue being used on the job. The frosted marble relates more to the binder and one aggregate.
- Vialit cohesion and adhesion tests
- We currently use ASTM D-7000 and the Frosted Marble to evaluate products. We use the Frosted Marble to measure Binder cohesion development and cure rate and ASTM D-7000 to evaluate the system.
- We have found that the Vialit does not indicate the chip loss because we cannot get the job aggregate, nor do we have any control of the aggregate.
- We have used the Vialit test to confirm poor aggregate / binder combinations. If these different tests provide a way of identifying different problems with the emulsion, they would help. Otherwise it might be extra testing to identify the same issue.
- With all this testing the chip would be too hard for agencies to use. I support better training of the inspectors and contractors to take care of these issues.

Micro Comments

- Examination of the mix cure behavior at an appropriate depth would be an improvement.
- I am not familiar with these tests, but if they can be implemented cost-effectively they will be attractive.

- I said yes on this, but I think a deficiency is in the determination of a true rut filling test on the mixture. A micro surfacing material can cure quickly, but still not perform in a rut filling application.
- I think these performance tests are more useful than the emulsion or aggregate tests, as they explore the full mixture, instead of just the components.
- N/A
- Not applicable. Need to fully examine ISSA tests.
- One of the best test is also very easy to run and repeatable and that is one hour night time test strip. In our state it has separated the polymer modified slurry systems from the true chemical curing Micro systems. It is easy for the inspector to run
- Should be reviewed by a task group before just accepting it.
- The ISSA tests are a good starting place
- the test method used in the mix design were mostly if not completely the work of the late Ben Benedict. great man , great pioneering work but still there are a lot of loop hole in the methods and a lot of unfinished work as to confirmation of design the
- Tighter specs, higher minimum polymer loading, tighter lateral and vertical values. A refinement of the loaded wheel tester should be done. A different way of how the weighted material is mover across the sample strip. Tends to put high stress on ends
- Too many contractors are putting down a rapid cure slurry and calling it a micro-surface. We need to hold micro, which is a higher price product to a higher standard so that the tax payers get what they paid for.
- Validate.
- We have had good performance from micro surfacing designed to ISSA standards.
- What is the benefit? Ruts have nothing to do with agencies that is chip sealing as it is usually done with maintenance.

Rut Comments

- Although the same equipment is used, rut filling is a very different application than a general surfacing.
- An excellent tool for rut filling.
- Don't know.

- I believe that PG grading would be more important. Using the same PG grade for southern Texas as for Minnesota makes no sense. We have filled ruts using PG asphalt that graded as 48-34 with no rutting. This grade of asphalt cracked slow and less.
- If states have had success with non-PME grades, there is no reason to force them to change.
- If the application is limited, testing for only the application performance criteria is logical.
- Most CQS emulsions will pass the regular test for Micro Surfacing PME until rut filling comes into the equation.
- N/A
- need polymer/mineral filler structure
- Not applicable, see above.
- not sure
- Performance. Blind to the system.
- pg 76-28
- polymer should be included for rut filling, either latex or polymer in the asphalt.
- Rut fill is a separate area and specific requirements should be established. Possibly tighter numbers on laterals and verticals and higher minimum polymer loading.
- Rut-filling to any extent pushes the capability of aggregate and binder, necessitating the need for a very tough binder.
- See above response in question four. We are using too many latex modified slurry seals that are called micro surfacing. When not used for rut filling they are usually appropriate, but for filling ruts some formulations are inadequate.
- The performance tests on the on the system (aggregate, additives, emulsion) such as ISSA displacement, are adequate. There are too many variables in a micro system to dictate specific grades of PME.
- The reality of a multistone depth rut fill introduces a higher expectation of performance of the emulsion / aggregate system. As such a short term strength of cure test should be adopted.

- The same emulsion can be used for rut-filling and surfacing. Any required difference in performance can be achieved through aggregate gradation and construction or mix design.
- There are many rut-filling mixes that are working great currently and do not need the added expense of PME grading. We have our own product that works and developed testing in house to maintain quality. Easy street is a good example of another product. Th
- We would use a PME grade for all micro surfacing applications. A lot is expected from micro surfacing and the PME is worth the additional cost.
- why specifically for rut filling if the mix needs the modified binder then use it otherwise don't.

Low Traffic Comments

- They should be upgraded but low traffic does not apply in most places. I would like to see more specifications on the product.
- There are some issues with the equipment that merit some changes.
- The technical representative from ISSA have a wealth of practical field experience.
- Possible refinement of WTAT maximums to a lower number.
- Performance Testing.
- Our experience has shown that the current design works well for low traffic areas.
- Not sure what this question means. If it means that a latex modified slurry seal should be differentiated for low volume areas, while a true micro surfacing spec can be in place for low and high volume areas I would agree.
- not sure
- Not applicable, no comment.
- No opinion. We have not used a slurry system for many years.
- N/A
- Lower traffic areas generally require higher levels of asphalt. High levels of asphalt almost always pass the wet track abrasion test.
- If they can be implemented cost-effectively they will be attractive.

- If the wet track is being used for control then it is being used incorrectly. The wet track is run to determine the minimum amount of asphalt needed for a given system. It does not demonstrate too much asphalt or even the correct amount of asphalt...just
- Any improvement to the system is a good thing.
- Again, if agencies have had success with their current procedures, there is no reason to force them to change.
- 1 day soak WTAT's should be allowed. All should be 6 day soak. I would not recommend any other changes.

Fugro Micro Surfacing Study Comments

- Conflicting answers so Yes I am familiar but no i do not support the changes wholesale at least as I currently understand them. Two examples, There is a single spec for both micro and slurry...this is not practical. There is no effort to determine minim
- Again, micro is a more expensive product, not just a fast setting slurry. We need better standards to distinguish micro from regular slurry.
- I agree with some of the changes, but not others that they are recommending
- I am aware and very limited to the knowledge.
- I am not aware of the details of this. I would like to know more.
- I am not aware of this research and would wish to review proposed changes before offering support.
- I am on the TAP for the pooled fund and I am very disappointed with the work. They missed what the States where asking for in my opinion.
- I support the research only if the automated testing is not going to be put into specification without a lot of test date. Many times automated equipment comes in and it can only work on one type of material or the results are all over the map depending o
- N/A
- Need to review. Validate. Performance changes.
- Not aware of their specific recommendations.
- Not up with the play on this

- Two questions here. I am not aware of the research, so I cannot support the changes one way or the other.
- We have not had the equipment to compare and evaluate. Once that equipment is in stock and comparable testing can be made we can make better judgments on this.
- Yes, better tests or improvements in the current tests are needed to better reflect what is going on in the real world.

Certification Comments

- all are equally important.
- All participants in the supply chain (including consultant) should be certified for minimum levels of competency, training and quality management.
- As you know, there are many factors that can cause chip seal failures. Some of these failures are linked to emulsion quality. But many others are caused by construction practices, weather, existing road conditions, etc. As an emulsion supplier, we feel
- Certification is a good way to educate, but unless jobs are inspected by knowledgeable inspectors with the authority and willingness to shut down a project for non-compliance, the certification will be a waste of time.
- Contractors could be certified but not individual workers. Labs and technicians could be certified. Superpave lab tests on emulsion residues would need additional time (after shipment) to be tested, possibly at a central or outside lab.
- For our binder ASC program we only accept certification testing from laboratories AMRL accredited in the applicable tests. Contractors generally do not have the facilities to become accredited.
- I believe all parties should be certified.
- I think a contractor could be ISO certified, which would cover him. I believe the technicians doing the testing should be certified as is the case with HMA and concrete. The suppliers should be certified be it through ISO or some other type of certificate
- If the owner's representative is one of the Individuals that is as it should be because too often it is the on-site inspector or engineer who is not experienced enough to make the necessary field decisions. For instance cure time is a time versus condition
- Individual certification for contractors would be difficult to accomplish. I feel a contractor certification in general would be adequate if the certification includes them having a good training practice for employees.

- Material Supplier
- Material supplier certification similar to the Combined States Binder Group certification program.
- Most material suppliers have trained staff and equipment to perform certification tests , some more than others.
- Only those with a reasonable liability or contractual obligation need to be certified.
- Should be certification to ISO 9000 Quality systems with standard prescribed requirements from TCCC specific for each portion. eg Contractor requirements, Materials Suppliers requirements etc.
- The total system should be certified to insure the opportunities for success.
- Until it is determined which of the four is most useful, all four should be run in parallel.
- We have found that the contractor is very knowledgeable about the emulsion and chip seal. We found that often times it is the agency who knows nothing and tries to control the job thus causing the problem themselves.

Interest Comments

- Again, we would welcome the opportunity to be involved.
- As a supplier would be willing to contribute and comment on any program
- I believe I'm out of this game and my ideas are probably dated.
- I believe the certification process at all levels should include folks from all industries and agencies.
- I do not know if I would be able to be directly involved in the development of the program.
- I think this a great start to continue to improve our products and certification processes.
- I would like to kept updated on the status of this.
- I would like to see more RELEVANT testing of asphalt emulsions for different applications in place. However I would not like to see certification criteria put in place, which are detrimental to the smaller operations in our industry who make a quality prod

- Interested in training. I think the roads would improve a great deal by just a little training. I feel we are a long way off for certification. In the states where we supply there are only a few contractors who do chip seals or slurry seals. They are very
- Might be interested in providing some training through our Tech Transfer program.
- These programs should have wide participation to get the best results.
- This is a USA initiative and may not be adopted internationally
- we are suppliers to the industry...what helps industry grow helps us grow.
- We have a limited research budget and since we have had overall success with micro surfacing we would probably not contribute to the development of certification criteria. We would evaluate any developments to determine if it would be beneficial for us t
- Would be willing to participate in establishing certification criteria as well technicians and labs.
- Would participate in developing the criteria and resulting specifications.