AASHTO
THE VOICE OF TRANSPORTATION
SUBCOMMITTEE ON MATERIALS

SUBCOMMITTEE ON MATERIALS
2017 Annual Meeting – Phoenix, AZ
Thursday August 10, 2017
8:00 – 10:00 AM

TECHNICAL SECTION 2a Meeting Minutes
Emulsified Asphalt

TS2a 2017 Annual Meeting Summary		
Meeting Date:	10-Aug-17	
Items approved by the TS for TS/Subcommittee/Concurrent Ballot		
Standard Designation	**Summary of Proposed Changes**	**TS Only, Subcommittee Only or Concurrent? (TS / S / C)**
M140	TS Ballot with change to Footnote C in Table 1	C
M208	TS Ballot with change to Footnote C in Table 1	C
M216	TS Ballot with change to Footnote C in Table 1	C
TP121	Ballot as Full Standard with changes based on comments from TS ballot	C
PP XX	New Standard on Asphalt Tack Coat Design, ballot as concurrent with changes made based on comments from TS ballot. Example calculations will be moved to appendix.	C
MP XX	New Standard on Tack Coat Materials, to be balloted concurrently with changes based on TS ballot. Cement mixing requirement will be removed.	C
New Task Forces Formed:		
Task Force Name	**Summary of Task**	**Names of TF Members**
None.		
Research Liaison:	None selected, Illinois (Chair) be default	
Other Action Items:		
The chair will coordinate with TS 5b on the results of NCHRP report 837 and new draft standards that came out of this research.		

I. Call to Order and Opening Remarks

Ron Horner, North Dakota has retired. Brian Pfeifer, Illinois is the new Chair.

The meeting was called to order at 8:04 AM. The Chair welcomed members, visitors, and friends. The new chair briefly thanked Ron Horner for his service to the TS, and also thanked Sharon Taylor, who did a lot of the prep work for this meeting and works very closely with Ron in North Dakota.

Roll call was taken with the individuals highlighted below in attendance.

II. Roll Call

The following voting members were present when Roll Call was taken: IL, KY, NH, OH, UT, TN, MS, SD, OK, VA, SC, AL, NC, ON

Voting Members:

Brian	Pfeifer	IL	Chair	Voting
Allen	Myers	KY	Vice Chair	Voting
Denis	Boisvert	NH	Member	Voting
Eric	Biehl	OH	Member	Voting
Jason	Davis	LA	Member	Voting
Michael	Doran	TN	Member	Voting
Scott	Andrus	UT	Member	Voting
Darren	Hazlett	TX	Member	Voting
James	Williams, III	MS	Member	Voting
Joe	Feller	SD	Member	Voting
Michael	Santi	ID	Member	Voting
Peter	Wu	GA	Member	Voting
Scott	Seiter	OK	Member	Voting
Timothy	Ramirez	PA	Member	Voting
William	Bailey	VA	Member	Voting
Temple	Short	SC	Member	Voting
Tanya	Nash	FL	Member	Voting
Lyndi	Blackburn	AL	Member	Voting
Christopher	Peoples	NC	Member	Voting
Becca	Lane	ON	Associate Member	Voting

Non-Voting Members:

Evan	Rothblatt	DC	AASHTO Staff	Non-Voting
Anne	Holt	ON	Associate Member	Non-Voting
Pamela	Marks	ON	Associate Member	Non-Voting
Michael	Voth	DC	Ex Officio	Non-Voting
Delmar	Salomon	ID	Friend	Non-Voting
Robert	Horan	VA	Friend	Non-Voting
Larry	Tomkins	MS	Friend	Non-Voting
John	Malusky	MD	Liaison	Non-Voting
Maria	Knake	MD	Liaison	Non-Voting
Kelly	Morse	IL	Member	Non-Voting
Jim	Trepanier	IL	Member	Non-Voting

Introductions were made by all members, visitors, and friends.

III. Approval of Technical Section Minutes

A. The Mid-year meeting was held February 21, 2017. **Attachment 1**

A motion was made by New Hampshire and a second by North Carolina to approve the minutes. The minutes were approved unopposed.

IV. Old Business

A. SOM Ballot Items

1. All 2016 SOM ballot Issues were discussed. The Tack Coat standards were sent back to the ETG for revision and then re-balloted in June. All other standards including the new provisional standards were sent to publication. The new and/or revised standards are listed below.

   R 5 Selection and Use of Emulsified Asphalts
   MP 28 Materials for Micro Surfacing (initially published in 2016)*
   PP 86 Determination of Optimum Emulsified Asphalt Content of Cold Recycled Mixtures
   MP 31 Cold Recycled Mixture with Emulsified Asphalt
   MP 32 Materials for Slurry Seal*
   MP 87 Slurry Seal Design*
   PP 88 Emulsified Asphalt Fog Seal Design*
   MP 33 Materials for Emulsified Asphalt Fog Seal*

   *Moved to 5b May 2017. PP 83 Micro Surfacing Design was published in 2016 and also moved to 5b

B. TS Ballots – June 2017

The TS received an email from Oak Metcalfe (MT) regarding these standard. Currently in M 140, M 208, and M 316 there is a note that says "This test requirement on representative samples may be waived if successful application of the materials has been achieved in the field." The email suggests that the C footnote be applied to the Saybolt Furol Viscosities as well. The viscosity is a requirement that is typically required for application purposes. If the application is successful, than a viscosity requirement is not really necessary. It is suggested that agencies should be allowed to waive the viscosity requirement if they so choose. Other attendees mentioned that they have had similar issues. In some cases, because of transport times, emulsion samples are not received by the lab until after they have broken, or after the material has already been applied.

The standards below (M140, M208, and M316) passed TS ballot. A motion was made to move the standards to concurrent ballot with the TS changes, and the change to Table 1 footnote C noted above to concurrent ballot by Virginia. A second was made by Alabama. The motion passed unopposed.

i. **M 140 Emulsified Asphalt, Yes-17, No-0, No Vote -3**
   Comments: various editorial comments regarding missing reference to TP 121 and footnote reference ([b]) were received and will be incorporated

ii. **M 208 Cationic Emulsified Asphalt, Yes-17, No-0, No Vote-3**
   Comments: various editorial comments regarding missing reference and footnote reference were received and will be incorporated

iii. **M 316 Polymer-Modified Emulsified Asphalt. Yes-17, No-0, No Vote-3**
   Comments: various editorial comments regarding missing reference and footnote reference were received and will be incorporated

iv. **TP 121 - Determining the Viscosity of Emulsified Asphalt by a Rotational Paddle Wheel Viscometer**, Yes-17, No-0, No Vote-3 Attachment 2
   Comments received on this ballot were briefly reviewed by the TS. Several changes will be made based on the comments received.

   A motion was made by Utah and a second by Virginia to move this ballot, with the proposed changes noted below, be sent to SOM ballot as a full standard.
   Comments:

Temple Short, SC - Much of this standard reads geared towards a particular manufacturer.
Every effort has been made to make this standard as generic as possible. For example, in Figures 1 (paddle), 2 (sample cup) and 3 (paddle and sample cup with temperature probe) detailed dimensions are shown such that any supplier could develop a unit in the future.

7.10: How much is a few degrees? +/- 3 as specified in the allowable procedure limits?
A few degrees (lower) would be 3-5 degrees less than the test temperature

Entering "Run Test" sounds proprietary - reword to account for differences in manufacturers.
*This wording was changed in the standard to "**then start the test following the manufacturer's instructions**"*

Any guidance on time expected for testing to occur from loading of sample to reading viscosity?

Expected time is included in section 7:10: "The average time for testing varies from 5 to 20 minutes depending on the test temperature".

Annex A: remove subnote 3. The calibration standards should not be specified to a particular company since they are available elsewhere. The manufacturer of the piece of equipment may recommend a different source or provide their own.
Removed

Timothy Ramirez, PA - 1) In Section 2.2, ASTM E11-15 is specifically being referenced. Is there a particular reason? I know that ASTM E11-16 revised the Table 1 dimensional and permissible variation tolerances throughout the table, but are we not in agreement with the revisions made in ASTM E11-16?
That is correct the year should not be referenced and will be removed.

2) In Section 13.2, the ASTM Standards show one listed reference with the revision year designation "D2397/D2397M-13", but the other ASTM Standard is listed without a revision year designation "D977". Shouldn't these ASTM Standards be listed similarly, either both with the revision year or both without the revision year? I understand showing the revision year designation as that may have been the year that a specific standard was referenced.
Again the year designation will be removed

Kelly Morse, IL- Section 7.11 - Should add a statement on how to calculate the corrected viscosity, i.e. "Apply the correction factor by multiplying the apparent viscosity by the correction factor, F, as calculated in section 9." or a similar statement. A sample calculation would also clarify.
Agreed and the statement "apply the correction factor by multiplying the apparent viscosity by the correction factor, F, as calculated in section 9" has been incorporated to section 7.11.

Darren Hazlett, TX - 7.7 - This is the first mention of the heater block, a part that is certainly specific to a particular instrument. I'd suggest 6.1 should reference a

"temperature control apparatus," and that it should be called out in this section instead of heater block.
Agreed and have added this phrase: temperature control unit to section 6.1 where the apparatus items are listed and in section 7.7 used the phrase "temperature control unit in place of heater block.

7.10 - The equipment is not required to have an automated test sequence, and "Run test" is certainly specific to one particular piece of equipment. I think this need to describe the test sequence of testing rather than assuming it's automated.
Agreed and have made section 7:10 to read as follows:
Verify that the temperature of the sample is 3 to 5 degrees lower than the test temperature before beginning the test sequence; then start the test following the manufacturer's instructions. The rotational speed is preset by the manufacturer to 100 rpm.

The average time for testing varies from 5 to 20 minutes depending on the test temperature.

Note: "Sampling" will be moved to Section 7 and Procedure will become Section 8 in the future ballot version. References will change accordingly.

v. PP XX Asphalt Tack Coat Design, Yes-17, No-0, No Vote-3 Attachment 3
Comments received on this ballot were briefly reviewed by the TS. Several changes will be made based on the comments received.

There was brief discussion about the comment from Alabama regarding the example calculations. It was suggested that because this information is non-mandatory that it be placed in an appendix (non-mandatory). Mike Voth volunteered to work with Jason Dietz to revise editorially before SOM ballot.

A motion made by North Carolina and a Second was made by South Carolina to move this item to SOM ballot with editorial changes as discussed above.

Comments:
Temple Short, SC - .3.2 - Note 2: reword to remove reference to contractor since the contractor's level of responsibility is determined by the agency. Suggested "Ensure that emulsified asphalt residual application rates on the roadway are still satisfied after dilution."
Added

4.1.1: remove sentence about measurement and payment since this is at the discretion of the agency. The last sentence still makes sense with this one removed.
Included volume into sentence so it gives the agencies options.

4.1.2/4.1.3: reword to remove the "should". Suggested "Ensure that emulsified asphalt meets...and application rates conform to..."
Entire section was reworded

4.2.2 - 1) correct CSR-1
This was corrected

Timothy Ramirez, PA - In Section 1.2, this section moderately differs from MP XXX, Section 1.1. MP XXX, Section 1.1 includes some additional information that would seem to be applicable here and probably should be the same or very similar. Suggest revising Section 1.2 here to be same/similar to MP XXX, Section 1.1.
Change made.

2) In Section 3.1, last line, suggest revising from "needs for their product' to "needs of their product". The word "of" seems to be more appropriate for potential selection of a product and the word "for" seems to be more appropriate when a specific product has already been specified. This is design, so multiple products are being considered before a selection is made.
Change made

3) In Section 3.3.2, 3rd line, revise from "homogenous mixture" to "homogenous material" so as not to confuse with asphalt mixture.
Change made

4) In Section 3.4, 3rd line, delete second period at end of first sentence.
Change made

5) In Section 4.1.1, 3rd line, revise from "A flushed or bleeding surface requires less tack coat than a dry or aged surface" to "An existing flushed or bleeding surface or a new surface requires less tack coat than an existing dry or aged surface" since the last half of sentence includes the word "aged' but first part of sentence mentions nothing about age of pavement.
Change made

6) In Section 4.1.1, 5th line, revise from "Dense-graded mixtures" to "Overlays of dense-graded mixtures" and revise from "than open-graded friction course (OGFC) overlays" to "than overlays of open-graded friction course (OGFC) mixtures." For better readability".
Change made

7) In Section 4.1.1, 10th & 11th line, revise from "and not on residual application rates" to "and not on a residual application rate" to be consistent with singular use of "on the emulsified asphalt application rate" earlier in same sentence.
Made changes to the sentence due to others comments as well.

8) In Section 4.1.2, revise this entire Section to read "Design a tack coat by selecting a tack coat material in accordance with Table 2 unless otherwise required by the purchasing agency. When emulsified asphalt is selected as the tack coat material, select a specific type of emulsified asphalt (e.g., CSS-1) meeting the requirements of MP XXX unless otherwise specified by the purchasing agency. When performance-graded asphalt binder is selected as the tack coat material, select a specific grade of performance-graded asphalt binder (e.g., PG 64-22 or PG 64E-22) meeting the requirements of M 320 or M 332 unless otherwise specified by the purchasing agency. When a Special Purpose material is selected as the Tack Coat material, select the specific type or

grade of Special Purpose material meeting the requirements as specified by the purchasing agency." The current language uses "should meet" which is weak language and is otherwise handled by the language "unless otherwise specified by the purchasing agency". Suggested revised language also tries to enforce there is selection of tack coat material (emulsified asphalt, PGAB, or Special Purpose) and there is also selection of an emulsified asphalt type (e.g., CSS-1), a grade of PGAB (e.g., PG 64-22), or a Special Purpose material which may be either a type or grade.
Made the recommended section changes.

9) In Section 4.1.3, revise this entire Section to read "Design residual asphalt and application rates for emulsified asphalt material are to conform to the residual asphalt rates and the emulsified asphalt application rates shown in Table 1 unless otherwise specified by the purchasing agency. Design application rates for PG asphalt binder material are to conform to the residual rates shown in Table 1 unless otherwise specified by the purchasing agency. Design application rates for Special Purpose material are to conform to the residual rate and the application rate, if applicable, as specified by the purchasing agency."
Made the recommended section changes.

10) In Table 1 caption, revise from "Recommended Residual Emulsified Asphalt, and Diluted Emulsified Asphalt Rates for Tack Coat" to "Residual, Undiluted, and Diluted Application Rates for Tack Coat Materials" since this Table 1 residual rate also applies to performance-graded asphalt binder which is currently not mentioned in the Table 1 caption (i.e., make Table 1 caption generic so it applies to both emulsified asphalt and PGAB). Also, lose "Recommended" as the language "unless otherwise specified by the purchasing agency" will cover other specified rates.
Made the recommended section changes.

11) In Table 1, 2nd column, consider revising column header from "Residual Rate" to "Residual Asphalt Rate".
Made the recommended section changes.

12) In Table 1, 3rd column, revise column header from "Emulsion" to "Emulsified Asphalt".
Made the recommended section changes.

13) In Table 1, 4th column, revise column header from "Emulsion" to "Emulsified Asphalt".
Made the recommended section changes.

14) In Section 4.1.4, suggest deleting this subsection in favor of suggested revisions for Section 4.1.2 in comment(s) above.
Deleted this subsection

15) In Table 2 caption, revise from "Recommended Tack Coat Material for Project Type/Time" to "Tack Coat Material for Project Type/Time" since suggested revision for Section 4.1.2 in comment(s) above indicates "Design a tack coat by selecting a tack coat material in accordance with Table 2 unless otherwise required by the purchasing agency".

Made the recommended change

16) In Table 2, column 1, Row 2 for "Standard", consider revising from "Standard" to "Standard (Traffic volume </= 5,000 ADT and Daytime or Nighttime Paving with Adequate Curing Time Windows)".
Made the recommended change

17) In Section 4.2.2, in the second paragraph, revise from "Assume an application rate of" to "Assume tack coat material application at a residual asphalt rate of" for better clarity.
Made the recommended change

18) In Section 4.2.2, Section 1), equation, revise the equation's first term numerator from "0.050 gal residual asphalt" to "0.050 gal residual asphalt rate" for consistency with Table 1, column 2 header (as suggested For Table 1, column 2 header in comment above).
Made the recommended change

19) In Section 4.2.2, Section 2), revise from "CSS-1 emulsion" to "CSS-1 emulsified asphalt".
Made the recommended change

20) In Section 4.2.2, Section 2), equation, revise the equation's first term numerator from "0.050 gal residual asphalt" to "0.050 gal residual asphalt rate" for consistency with Table 1, column 2 header (as suggested for Table 1, column 2 header in comment above).
Made the recommended change

21) In Section 5.1, at a minimum suggest revising from "spray rate" to "spray application rate", but see comment immediately below.
Made the recommended change

22) In Section 5, there are more items that need to be reported based on selectable items in this PP XXX. Suggest revising Section 5 as follows "5.1 Report the selected Tack Coat Material for the Project Type/Time (e.g., emulsified asphalt, performance-graded asphalt binder, or Special Purpose)", "5.2" Report the selected specific type of emulsified asphalt, specific grade of performance-graded asphalt binder, or specific type or grade of Special Purpose material (e.g., CSS-1, PG 64-22, or Special Purpose Type/Grade XXX)", "5.3 Report the designed residual asphalt rate, to the nearest 0.001 gal/yd2", "5.4 Report the emulsified asphalt application rate, to the nearest 0.001 gal/yd2 (as applicable)."
Made the recommended changes

Lyndi Blackburn, AL - Suggest moving the example calculations to their own section, separate the two examples, and include a full example with an example project with length, width, surface type, project type/time and provide a selected material with an estimated plan quantity that would be included in the report to go with the suggested rate.
It was decided to keep this in the design requirements section instead of appendix because there was not a strong preference. However, we believe it fits

well within the body of the standard and further information can be incorporated in agency specifications, construction manual, or other documents

Suggest deleting Section 3.3 from the Design practice since it is covered in the Materials specification.
There was no strong preference so we felt there was a need to leave it in for the designer awareness.

Kelly Morse, IL - Section 3.3.1 - Perhaps add a suggestion that dilution occur at the emulsion terminal and not in the field, which allows for greater control and ability to properly verify dilution ratios.
Made the recommended change

Darren Hazlett, TX - Same comments as tack coat material standard plus:
4.1.1 - Several points of disagreement between our practices and this spec with the last two sentences:
- we pay for distributor shot material by either weight or volume , but most often by volume, since the rate is volume applied
- we usually want to pay for the material based on residual rate to help eliminate confusion about dilution
- here it says payment is based on weight but uses that as justification for basing estimates on the rates, which are volume rates, not weight rates.
Made the recommended change and added volume and residual rate

Should example calculations be in an appendix rather than a required part of the spec?
There was no strong preference and think it fits well within the body of the standard

4.2.2 - (editorial) "CSR-1" is used instead of "CRS-1" in the line between 1) and the equation.
Made the recommended changes

vi. MP XX Asphalt Tack Coat Materials, Yes-17, No-0, No Vote-3 Attachment 4
Comments received on this ballot were briefly reviewed by the TS. Several changes will be made based on the comments received. The cement mixing requirement was discussed and it was decided it could be dropped.

A motion was made by Virginia and a second by Alabama to move this ballot, with the removal of the cement mixing requirement and the proposed changes noted below, be sent to Concurrent ballot.
Comments:
Timothy Ramirez, PA - Affirmative with comments:
1) In Section 1.1, this section moderately differs from PP XXX, Section 1.2. PP XXX, Section 1.2 includes some additional information regarding "overlays" and "multiple lifts" that would seem to be applicable here and probably should be the same or very similar. Suggest revising Section 1.1 here to be same/similar to PP XXX, Section 1.2.
Change made.

2) In Section 1.1, consider above comment, but at a minimum, revise line 3 from "or concrete pavement, between the layers of a structural pavement and" to "or

concrete pavement and an overlay, between the multiple lifts of a new structural pavement, and". As written, the "good bond between" gives the first part of the "between", but not the last part of the "between".
Made the recommended change

3) In Section 3.1, revise from "performance-graded binder" to performance-graded asphalt binder".
Made the recommended change

4) In Section 3.4, last line, revise from "homogenous mixture" to "homogenous material" so the language is not confused with asphalt mixture.
Made the recommended change

5) In Section 3.5, 1st line, revise from "Apply the tack coat according to PP-XX" to "Design the asphalt tack coat in accordance with PP XXX". This is a material specification and not a construction specification, so it should not specify how to "apply' and PP XXX is how to "design", not how to "apply".
Made the recommended change

Kelly Morse, IL - Section 3.2 - IL dropped the cement mixing requirement for slow-setting type emulsions when used as a tack coat; perhaps a footnote added to the table.
'I appreciate the comment but needing further information on why the cement mixing requirement was dropped due to…'

Jason Davis, LA - I am voting affirmative, but I don't understand how this standard will be used. This specification basically references the tack application specification and says "use what the purchasing agency specifies". How does a state agency use this document in a specification? We typically state "use material A, B, C or D for tack". Even if we only used "standard" tack coats (no "special purpose" products), we would still likely need to limit what could be used from the references in this document, as not all emulsions referenced would be suitable for all tack coat situations.

I can see this being used as a reference to other specifications (the entrance to the rabbit hole of emulsion specifications), but I don't see an agency specifying "use tack coat according to AASHTO MP-XXX".
This standard covers the quality requirements while for the Design it covers application rate so that is the reasoning for the difference.

Darren Hazlett, TX - This spec excludes some materials; specifically, if we can use SS and RS emulsions, why not MS? Also why not M226 (viscosity graded) asphalt? I would not classify any of those as specialty materials, since they are in AASHTO specs already.
Made the recommended changes except we didn't include M 226 due to viscosity is covered M 140, 208, 316, 320, and 332. Also, we didn't classify any of those specialty materials.

C. Task Force Reports
   i. No task forces at present time

V. New Business

A. Research Proposals
   1. 20-7 RPS
   2. Full NCHRP RPS

B. AASHTO Re:source/CCRL - Observations from Assessments?

C. NCHRP Issues - See below

D. Correspondence, calls, meetings

E. Presentation by Industry/Academia

F. Proposed New Standards (Amir Hanna, TRB) **Attachment 5** – *first three standards listed below*

Amir Hanna gave a brief update on an NCHRP project 9-50, research report 837 on surface treatments (Performance-Related Specifications for Emulsified Asphaltic Binders Used in Preservation Surface Treatments). This project is complete. Specifications were developed in a manner similar to Superpave. A second set of products included tests that are part of the specification developed. These have been written in AASHTO format for consideration by this TS. The ETF is doing a round-robin this summer on these proposed specs. Recommendations from the ETF should be expected in the winter/spring. This could be further discussed at mid-year meeting. The chair will coordinate with TS 5b on this effort.

   i. Proposed Standard Specifications for Performance-Graded Emulsions Used in Chip Seal Surface Treatments
   ii. Proposed Standard Specifications for Performance-Graded Emulsions Used in Micro Surfacing Treatments
   iii. Proposed Standard Specifications for Performance-Graded Emulsions Used in Spray Seal Treatments
   iv. Proposed Standard Method of Test for Determining Storage Stability of Emulsified Asphalts: Resistance to Physical Separation and Change in Rheological Properties
   v. Proposed Standard Method of Test for Determining the Viscosity of Spray Grade Emulsified Asphalts Using the Three-Step Shear Test
   vi. Proposed Standard Method of Test for Determining Dynamic Shear Modulus of Emulsion Residues at Critical Phase Angle Values Using the Dynamic Shear Rheometer (DSR)
   vii. Proposed Revisions to ASTM D 3121 Standard Test Method for Tack of Pressure-Sensitive Adhesives by Rolling Ball

G. Proposed New Task Forces

H. Standards Requiring Reconfirmation
   i. T 50, Float Test for Bituminous Materials
   A reconfirmation ballot will be prepared by AASHTO staff.

I. SOM Ballot Items (including any ASTM changes/equivalencies)

VI. Open Discussion – None.

VII. **Adjourn** The meeting adjourned at 8:53 AM.

AASHTO
THE VOICE OF TRANSPORTATION
SUBCOMMITTEE ON MATERIALS

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2017 Mid-Year Meeting
February 21, 2017
11:00 am – 1:00 pm EST

TECHNICAL SECTION 2a
Emulsified Asphalt

I. Call to Order and Opening Remarks

II. Roll Call

Ron	Horner	ND
Allen	Myers	KY
William	Bailey	VA
Lyndi	Blackburn	AL
Denis	Boisvert	NH
Joe	Feller	SD
Colin	Franco	RI
Darren	Hazlett	TX
Becca	Lane	ON
Cole	Mullis	OR
Tanya	Nash	FL
Christopher	Peoples	NC
Timothy	Ramirez	PA
Michael	Santi	ID
Scott	Seiter	OK
Eileen	Sheehy	NJ
Temple	Short	SC
Michael	Voth	FHWA
James	Williams, III	MS
Peter	Wu	GA
Robert	Horan	Asphalt Institute – Friend
Delmar	Salomon	Pavement Preservations Systems - Friend

III. Approval of Technical Section Minutes

Motion by: RI; Second: AL; Vote: All in favor. Motion carries.

IV. Old Business

A. Reconfirmation Ballot June 2016

i. **M 81 Cutback Asphalt (Rapid-Curing Type)**, Reconfirmation, 18-Yes, 0-No, 2-No Vote

1. No comments

ii. **T 295 Specific Gravity or API Gravity of Liquid Asphalts by Hydrometer Method,** Reconfirmation, 18-Yes, 0-No, 2-No Vote

1. No comments

iii. **T 301 Elastic Recovery Test of Asphalt Materials by Means of a Ductilometer,** Reconfirmation, 18-Yes, 0-No, 2-No Vote

1. No comments

iv. **M 82 Cutback Asphalt (Medium-Curing Type)**, 15-Yes, 0-No, 4-No Vote

1. No comment

B. SOM Ballot Items

i. **R 5 Selection and Use of Emulsified Asphalts**

Concurrent SOM Ballot item 11: 43-Yes, 0-No, 8-No Vote

1. Comments: Numerous editorial comments received will be addressed and included as appropriate.
2. CSS-1h will be removed from micro surfacing
3. Scrub Seal will remain. Recommended type of asphalt will be listed as CSS1, CSS1H - (any other suggestions) A provisional has been drafted for scrub seals, but has not been published yet. R5 tables will automatically be updated when new specs are developed as long as TS 2a is made aware of the proposed changes **(RI)**.
4. Any other suggestions for additions to grades/uses please submit

ii. **MP 28 Materials for Micro Surfacing**

Concurrent SOM Ballot item 12: 43-Yes, 0-No, 8-No Vote

1. Comments: Numerous editorial comments and corrections suggested were received and will be addressed and included as appropriate.
2. CSS-1h will be removed from R 5 so no additions needed to M 28.
3. Michael Benson (AR) - The need for a variable blend in Section 6.3 is understandable, but the sentence referencing changes from one end of the specified range to the other end will be difficult to enforce as written.

   Response: We have struggled with this but have not arrived at a better way of saying it. (This should be reviewed further by the ETG)

4. Denis Boisvert (NH) - Some of the requirements of MP 28 are not consistent with ISSA Recommended Performance Guidelines for Micro Surfacing. Most agencies follow ISSA and most

Micro/Slurry contractors are ISSA members. For example, the crushed 2-face requirement is not in ISSA. This method and ISSA should be consistent.

Response: ISSA does not have a crushed face requirement but comments from the SOM during previous reviews indicated the desire to insert a crushed face requirement.

5. Brad Pfeifer (IL) - Table 2 Type I is not recommended for micro surfacing in accordance with ISSA guidelines.

Response: Editorial, remove Type I from Table 2

iii. **PP XX Determination of Optimum Emulsified Asphalt Content of Cold Recycled Mixtures**

Concurrent SOM Ballot item 13: 43-Yes, 0-No, 8-No Vote

1. Comments: Numerous editorial comments and corrections suggested were received and will be addressed and included as appropriate.
2. T 164 will be added as alternative to ignition oven.
3. Becca Lane (Ontario) - Note 5 - says you can't determine AC content for RAP containing an unknown aggregate because you can't determine aggregate correction factor. Therefore you can only use the ignition oven to determine AC content if you have history/knowledge of aggregate. Recommend 6.1 starts by saying that if you aren't familiar with the aggregate, you should use T164 (extraction); but if you do know correction factor for aggregate, then ok to use the ignition oven method

Response: T 164 was added to 6.1

Peter Wu (GA) - With the following review comment: In section 5.2.2: "Provide at least 45 kg (400 lb) of RAP....." is NOT correct from the metric to English conversion. 45 kg is about 100 lb, or 400 lb is about 180 kg.

Response: **Corrected throughout the document to 45 kg (400 lb)**

4. Robert Horwhat (PA) - *Section 12.1.10 is redundant and should be deleted because these items are already reported in 12.1.5, 12.1.6, 12.1.7, and 12.1.9. Raveling should only be reported if performed (See Section 10) and moved to the optional report information.*

Response: We disagree, did not change. Sections 12.1.5, 6, 7 & 9 report properties at tested emulsion contents. Section 12.1.10 says report properties at the optimum emulsion and moisture content. These values could be slightly different if the optimum

emulsion content was not the same as one of the trial specimens.

5. George Stellmach (OR) - Section 9.5 should show the formula that is used to back calculate the rice value for the lower asphalt contents

   Response: **Adding the formulas required splitting section 9.5 into 2 sections, 9.5 and 9.6. Added section 9.7 to include the two requested formulas.**

iv. **MP 31 Cold Recycled Mixture with Emulsified Asphalt**

Concurrent SOM Ballot item 14: 43-Yes, 0-No, 8-No Vote

1. Comments: Editorial comments received will be incorporated.

v. **MP XX Materials for Asphalt Tack Coat**

Concurrent SOM Ballot item 15: 42-Yes, **1-No**, 8-No Vote.

This proposed standard has received numerous comments and negative votes in both the Tech Section ballot and now the SOM ballot. The standard will be returned to the ETG to address the comments and prepare for an upcoming technical section ballot.

vi. **PP XX Asphalt Tack Coat Design Practice**

Concurrent SOM Ballot item 16: 42-Yes, **1-No**, 8-No Vote

This proposed standard has received numerous comments and negative votes in both the Tech Section ballot and now the SOM ballot. The standard will be returned to the ETG to address the comments and prepare for an upcoming technical section ballot.

vii. **MP 32 Materials for Slurry Seal**

Concurrent SOM Ballot item 17: 43-Yes, 0-No, 8-No Vote

1. Comments: Editorial changes received will be incorporated.

2. Denis Boisvert (NH) – Recommended consistency with ISSA standards.

   Response: ISSA does not have a crushed face requirement but comments from the SOM during previous reviews indicated the desire to insert a crushed face requirement.

3. Brian Pfeifer (IL) - why just CQS-1h? The ISSA recommends SS-1, SS-1h, CSS-1h and HFMS-2s.

Response: The Emulsion Task Force recommended that the most used, performing emulsion be specified.

MPXX-2 Table 2 Type III #200 should be 5-15 per ISSA guidelines

Response: the Type III in Table 2 will be changed to 5-15.

viii. **PP XX Slurry Seal Design**

Concurrent SOM Ballot item 18: 43-Yes, 0-No, 8-No Vote

1. Comments: Editorial changes received will be incorporated.
2. Brian Pfeifer (IL) - PPXX-1 Add AASHTO M140 to referenced documents if adding the SS-1, SS-1h and HFMS-2s to the MP for slurry seal.

Response: The Emulsion Task Force recommended that the most used, performing emulsion be specified. Not adding the M 140 emulsions.

ix. **PP XX Emulsified Asphalt Fog Seal Design**

Concurrent SOM Ballot item 19: 43-Yes, 0-No, 8-No Vote

1. Comments: Editorial comments suggested will be incorporated as appropriate.

2. Lyndi Blackburn (AL) - This standard should also cover where rejuvenating fog seals are best used and standard fog seals are used.

   Response: Composition and use of rejuvenator fog seals is very different from conventional fog seals, and will be addressed in a different specification.

3. Peter Wu (GA) - Section 4.4.1 should it be revised to "Note 1- Care should be taken to ensure that the fog seal application rate does not cause a significant reduction in skid resistance of the pavement?"

   Response: Change will be made to address skid resistance of pavement.

4. Timothy Ramirez (PA) - In Section 3.3, last sentence, revise to read "All other emulsified asphalt types are not to be diluted." If dilution is occurring at the emulsified asphalt producer plant using surfactant solutions, this should be covered under the producer's QC Plan and does not need to be mentioned here. The bill of lading coming from the producer should indicate the minimum

asphalt residue percentage as the material is provided (if produced or if diluted at the plant).

Response: We believe this specification should describe the possibility for dilution of emulsions other than SS, but only if diluted at the emulsion plant with surfactant solutions known to be compatible with the fog seal emulsion of choice.

The comment regarding "Bill of Lading" is correct, and will be added as "The bill of lading coming from the emulsion producer should indicate the minimum asphalt residue percentage as the material is provided to the project."

In Section 4.1, Table 1, footnote "*", the footnote indicates to assume emulsified asphalt is 60% asphalt, but in Section 3.3, 3rd and 4th lines, it indicates "The minimum residue content for fog seal emulsified asphalts will typically be 50 percent". Section 3.3 text, Table 1, footnote "*" text, and Section 4.3.2 text ("40 percent water") should all agree and be consistent with the amount of asphalt residue and water in emulsified asphalts for fog seals.

Response: There is some confusion here, because 60% residue is meant to describe a typical SS emulsion as manufactured before dilution, and a 50:50 dilution with water would lead to an applied emulsion with 30% residue. To clarify the example, section 4.3.2 has been rewritten as follows:

"For example, a fog seal application of 0.10 gal/yd2 might be made using an SS emulsified asphalt with a 60% asphalt residue content (40% water) which is then diluted 1:1 (original emulsified asphalt–water). Calculation of the residual application rate would need to account for both sources of water. The application rate of 0.10 gal/yd2 would be multiplied by 0.50, to account for the dilution, and then by 0.60, to account for the water in the original emulsified asphalt. Therefore, the residual tack coat rate in this example would be 0.030 gal/yd2."

5. Ron Stanevich (WV) - In section 3.3.....I think it should specify when and where SS grades "may" be diluted. Just saying they "can" opens it up to a lot of issues. It should have language about not adding more water after the initial dilution process, so as not to exceed the 50/50 ratio.

   Response: Paragraph 3.3 is meant to control maximum dilution by setting a diluted residue content that must be at least 50% of the original emulsion as manufactured according to AASHTO specifications.

6. Allen Myers (KY) - In the first sentence of Section 4.2, what does the phrase "representative of the materials used for the project" mean?

   Response: section 4.2 revised as follows:

Material Quantities—Emulsified asphalt should meet recommendations in MP XXX. The application rates may be determined by a test strip according to the procedure in Section 4.4 or determined empirically by the ring test detailed in Section 4.5. Emulsified asphalt samples used to optimize application rates should be representative of the materials used for the project.

In the second sentence of Note 2 below Section 4.5.7, what is meant by the phrase "when the pavement is tight"?

Response: note 2 in section 4.5.7 rewritten as follows:

Note 2—Fog seals may be applied at a higher application rates or at higher residue contents for chip seal applications or for open-graded hot mix surfaces. Normally the ring test is used only when a pavement surface has a relatively low permeability, such that a slippery pavement can result following application of the treatment.

7. Brian Pfeifer (IL) - *3.3 Clarification on intent of dilution of slow setting emulsified asphalts with water only? Current wording implies contractor can dilute, not the intent (want at manufactures facility). Look at wording in the MP fog seal specification section 5*

   Response: This issue of diluting SS emulsions at locations other than the emulsion manufacturer's plant site is controversial, and is best addressed by local specifications. In some areas, especially in the western US, emulsion transportation distances are long, and transport of dilution water is expensive. Job-site dilution of SS emulsions can be done effectively with appropriate controls for proportioning and mixing. This issue may warrant further discussion within AASHTO materials committees.

8. Brian Egan (TN) - Don't see a need for Table 1 columns 2 and 3 since all emulsions will have different residual percentages and/or allow various dilution rates.

   Response: Table 1 is just intended to be an example of the most probable case for an undiluted SS emulsion of 60% residue. No changes made.

   6.1 states to report rate to nearest 0.01 gal/'SY but Table 1 reports rates to nearest 0.001 gal/SY.

   Response: This refers to section 5.1, which is changed to "report rate to nearest 0.001 gal/yd2"

x. **MP XX Materials for Emulsified Asphalt Fog Seal**
   Concurrent SOM ballot item 20: 43-Yes, 0-No, 8-No Vote

1. Comments: Editorial comments suggested will be incorporated as appropriate
2. Timothy Ramirez (PA) - 1) In Section 4.3, reconsider allowing dilution of polymer modified emulsified asphalts due to improper dilutions, multiple dilutions, etc.

   Response: Polymer-modified emulsions are diluted and used regularly, particularly for routine maintenance of open-graded friction courses. Appropriate discussion of dilution should be included in the fog seal design standard. No change recommended.

3. Denis Boisvert (NH) - Requiring that the emulsion meet the requirements of M 140, M 208 or M 316 prior to dilution, and requiring that the dilution occur at the plant makes it difficult for agencies to perform verification testing.

   Response: By combining agency sampling with approved supplier certification plans, it should be possible for the agency to collect residue data for both original tank samples after production, and diluted emulsions either as delivered from the supplier or as diluted by sampling the distributor. No change recommended.
   RI on behalf of ETF- will there be a TS ballot soon? Chair- yes and if approved by TS it will move to full SOM ballot in Fall.

C. Task Force Reports
   i. No current task force

V. New Business

A. Research Proposals
   1. 20-7 RPS -NCHRP ballots are closed. Recommend SCOR to vote for D10. Research formation of SBG specification for emulsion. A problem statement has been submitted. Asking for additional funding with PS. ETF is looking at conducting 4mm DSR testing on residue. If you are willing to volunteer to run 4mm DSR please reach out to Colin Franco and ETF. **(Colin Franco on behalf of ETF)**
   2. Full NCHRP RPS
B. AMRL/CCRL - Observations from Assessments?
C. NCHRP Issues
D. Correspondence, calls, meetings
E. Presentation by Industry/Academia
F. Proposed Changes to Existing Standards
   i. Proposed revisions by Delmar Salomon to M 140, M 208 and M 316 to include Rotational Paddle Viscosity (TP 121) Presentation was given at SOM in Greenville. RPV is not referenced in any standard. Should be reference in T59 or in each one of the specifications (M140, M208, and M316). Two tables would be required, one for Saybolt and one for RPV. A conversion can be made from RPV value to Saybolt if needed. Compared calculated

values and actual measured vales. The values compare within 5 to 8% of each other. A table was submitted to TS Chair to eliminate conversion process. Table will reflect direct reading of RPV. **(Delmar Salomon)**

ii. T 59- proposed changed to include reference to (TP 121) What would be the best way to handle this? **(Chair)** Reach out to the rest of the TC for input **(Knake)**. Provisional now, but is being used heavily. Should probably be put in as soon as possible **(Hanz)**. Do we need to develop a new test method for this, or could we just keep it as is **(RI)**. TP 121 is a quick alternative to Saybolt. It is a bit different then paint. Temperature is more accurately controlled **(Salomon)**. This RPV is different and it is specific to the material being tested **(Knake)**. Is there a minimum time period for this to be a provisional **(FHWA)**? We must wait for two years for it to become a full standard **(Knake)**. Maria will reach out to Evan regarding procedure. **Delmar Salomon** has asked that steps be taken to move this provisional to a full standard.

G. Proposed New Task Forces

H. Standards Requiring Reconfirmation

I. 50-14 Float Test for Bituminous Materials

J. SOM Ballot Items (including any ASTM changes/equivalencies)

VI. Open Discussion

ETF moving ahead trying to get these specifications into AASHTO. Working on QA guidelines and expect to see something within this year. Certification and training plans will also be made available. **(Colin Franco on behalf of ETF)**

VII. Adjourn

Move- **RI**, Second- **??**; All in favor: **Motion carries.** Meeting adjourned.

Standard Method of Test for

Determining the Viscosity of Emulsified Asphalt by a Rotational Paddle Viscometer

AASHTO Designation: TP 121-16[1]

Technical Section: 2a, Emulsified Asphalts

Release: Group 3 (August 2018)

AASHTO

American Association of State Highway and Transportation Officials
444 North Capitol Street N.W., Suite 249
Washington, D.C. 20001

Standard Method of Test for

Determining the Viscosity of Emulsified Asphalt by a Rotational Paddle Viscometer

AASHTO Designation: TP 121-16[1]

AASHTO

Technical Section: 2a, Emulsified Asphalts

Release: Group 3 (August 2018)

1. SCOPE

1.1. This test method utilizes a rotational paddle viscometer to measure the viscosity of emulsified asphalt. It is applicable to all the emulsified asphalts described in M 140, M 208, and M 316, and with temperatures between 25°C and less than 90°C (77°F and less than 194°F).

Note 1—The viscometer makes measurements at 25°C (77°F), 40°C (104°F), 50°C (122°F), 80°C (176°F), and 90°C (194°F) without any external ancillary equipment and with a temperature probe directly in the liquid sample. The viscosity measurement range is from 30 mPa·s to 3000 mPa·s (30 to 3000 cP).

1.2. The values stated in SI units are to be regarded as the standard. The values given in parentheses are for informational purposes only.

1.3. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- M 140, Emulsified Asphalts
- M 208, Cationic Emulsified Asphalts
- M 316, Polymer-Modified Emulsified Asphalts
- R 66, Sampling Asphalt Materials
- T 59, Emulsified Asphalt

2.2. *ASTM Standards*:

- D7226, Standard Test Method for Determining the Viscosity of Emulsified Asphalts Using a Rotational Paddle Viscometer
- E1, Standard Specifications for ASTM Liquid-in-Glass Thermometers
- E11, Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. TERMINOLOGY

3.1. *Definition*:

3.1.1. *viscosity*—a ratio of shear stress to shear rate, η

4. SUMMARY OF TEST METHOD

4.1. The viscometer is used to measure the apparent viscosity of emulsified asphalt at 25°C (77°F), 50°C (122°F), or other agreed-upon temperatures.

4.2. A microprocessor circuitry system functioning in tandem with a temperature probe inserted directly in the sample and equipped with internal electronic sensors detects and analyzes the preset temperature. The system shall control the preset temperature to ±0.1°C (0.5°F) of the preset temperature.

4.3. A paddle is immersed in the emulsified asphalt sample and is rotated at 100 rpm. The apparent viscosity of the sample is obtained and read from the electronic display or printer.

5. SIGNIFICANCE AND USE

5.1. This test method is useful to characterize the viscosity of emulsified asphalt products, as an element to establish uniformity of shipments and sources of supply.

5.2. The viscosity of emulsified asphalts characterizes their flow properties and affects their utility at 50°C (122°F) or at other temperatures. For many applications, the sprayability and workability of emulsified asphalt are directly related to the viscosity. The material must have a viscosity low enough to be sprayed yet high enough to not flow from the crown or grade of the road.

5.3. For mixing-grade emulsified asphalts, the viscosity will affect its workability and resulting film thickness on the aggregate.

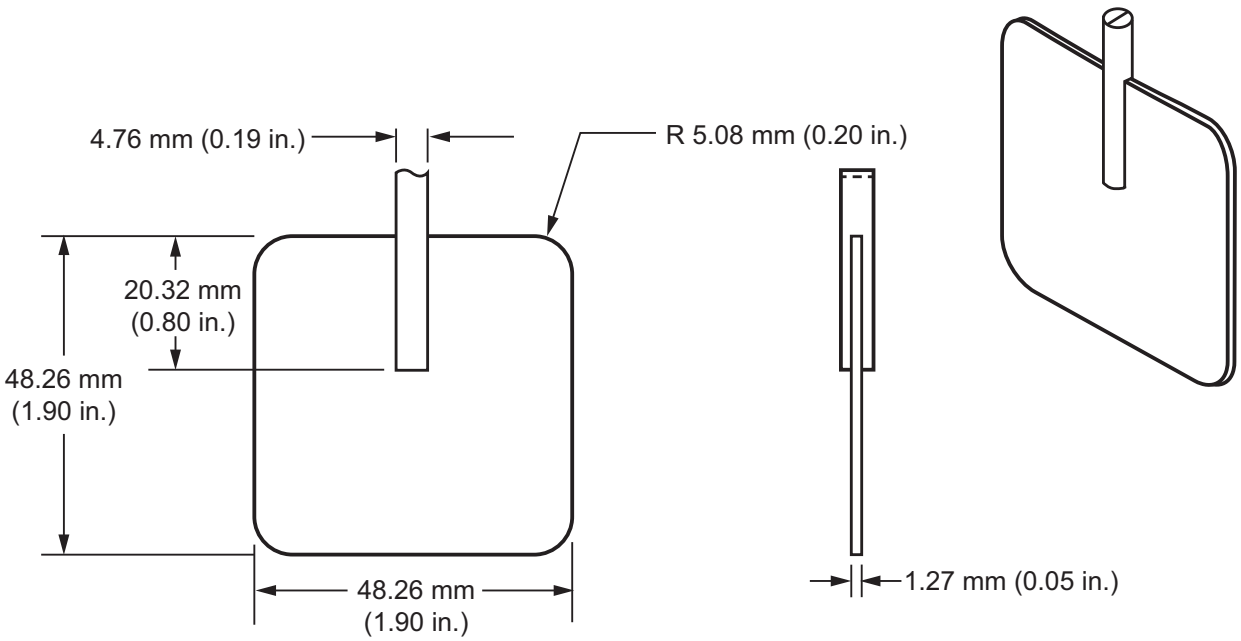
5.4. This test method is useful to measure the apparent viscosity of emulsified asphalt at a temperature of 25°C (77°F), 50°C (122°F), or another agreed-upon temperature. The preset temperature and rotational speed at 100 rpm allow for an automated and consistent determination of an emulsified asphalt viscosity within a short time.

6. APPARATUS

Note 2—All dimensions are in millimeters (inches).

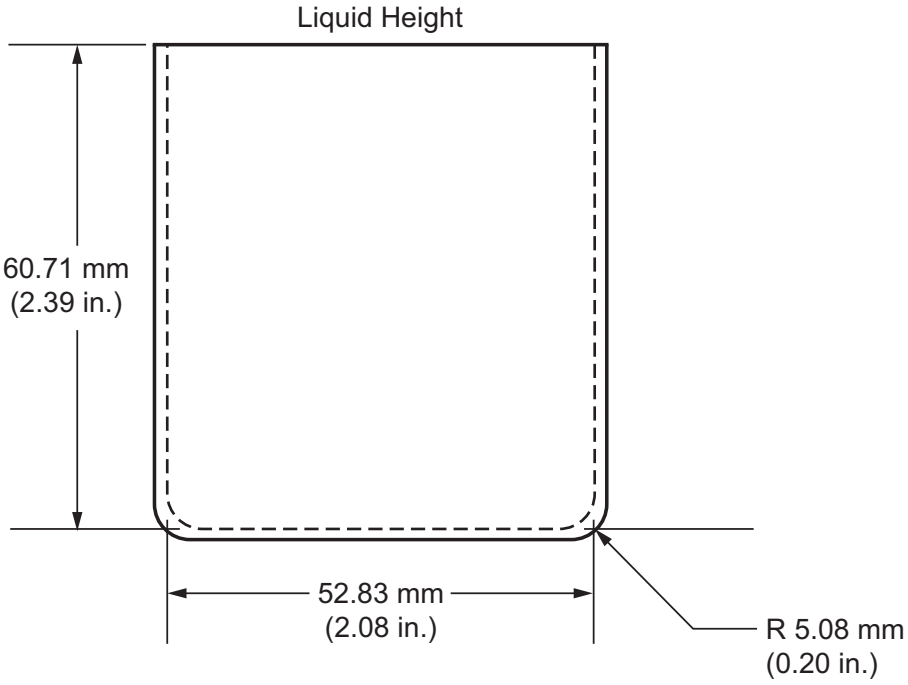
6.1. The rotational paddle viscometer test system consists of a paddle, temperature probe, sample cup, the sample cup cover, a temperature control unit for controlling the sample temperature to within ±0.1°C (0.2°F); and a readout system to display viscosity.

6.2. The parts of the viscometer are shown in Figures 1, 2, and 3.



Tolerance ±0.127 mm (±0.005 in.)

Figure 1—Paddle Dimensions



Tolerance ±0.127 mm (±0.005 in.)

Figure 2—Sample Cup Dimensions

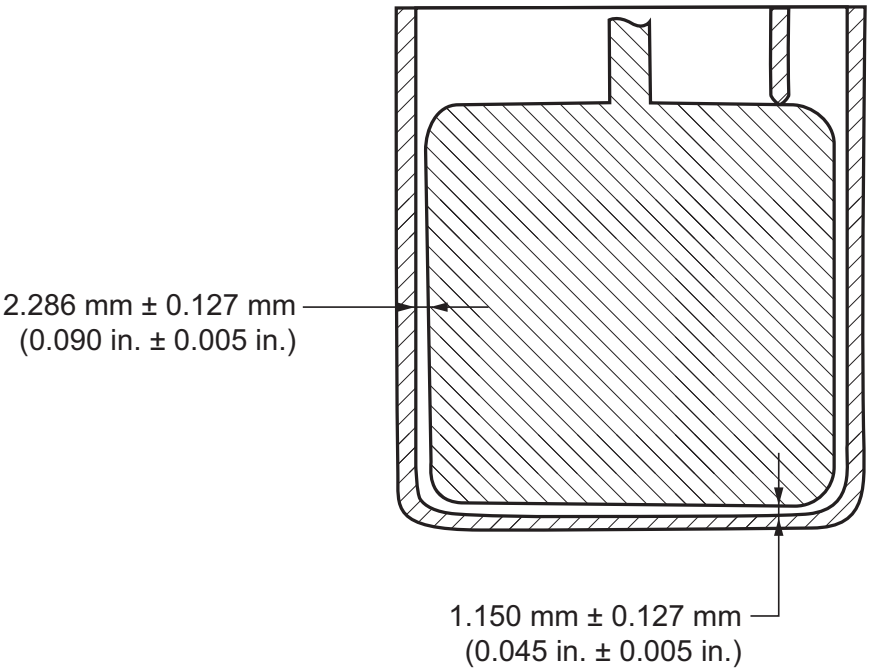


Figure 3—Paddle and Sample Cup with Temperature Probe

6.3. *Thermometer*—any thermometric device with accuracy of ±1°C (2°F) can be used to monitor the temperature of the sample being conditioned for testing.

6.4. *Sieve*—an 850-µm (No. 20) sieve or a 20-mesh strainer of wire cloth, framed or unframed, conforming to ASTM E11.

6.5. *Oven/Water Bath*—an oven/water bath capable of maintaining the required testing temperature within the limit of ±3°C (5°F).

7. SAMPLING

7.1. Obtain a representative sample of the material for testing using standard procedures as specified in R 66.

8. PROCEDURE

8.1. Turn on the viscometer power; set it to the test temperature, and attach the paddle to the viscometer. Allow the instrument to warm up for a minimum of 30 min.

8.2. Emulsified asphalts with a viscosity testing requirement of 50°C (122°F) shall be heated to 50 ± 3°C (122 ± 5°F) in the original sample container in a water bath or oven. If the sample temperature is greater or less than 50°C (122°F) it should be conditioned to the required test temperature.

8.3. Pour the sample into a clean sample cup through the 850-µm (No. 20) or 20-mesh strainer to the fill line of the viscometer sample cup.

8.4. Emulsified asphalts with a viscosity testing temperature requirement of 25°C (77°F) should be conditioned at 25 ± 3°C (77 ± 5°F) in the original sample container to achieve homogeneity.

8.5. Pour the sample into the sample cup after passing through an 850-µm (No. 20) or 20-mesh sieve.

8.6. Place the filled sample cup into the temperature control unit, and rotate the cup to lock it in place.

8.7. Submerge the paddle into the sample. Verify that the paddle and temperature probe are totally submerged in the sample.

8.8. Ensure the paddle is free to rotate. Place the sample cover over the sample cup.

8.9. Verify that the temperature of the sample is 3 to 5 degrees lower than the test temperature before beginning the test sequence; then start the test following the manufacturer's instructions. The rotational speed is preset by the manufacturer to 100 rpm.

The average time for testing varies from 5 to 20 minutes depending on the test temperature.

8.10. After the test is completed, record the viscosity reading from the viscometer, and, apply the correction factor by multiplying the apparent viscosity by the correction factor, F, as calculated in section 9.

9. CALIBRATION AND STANDARDIZATION

9.1. Calibrate the viscometer at intervals of not greater than one year or as otherwise required by measuring the viscosity at 25°C (77°F) of an appropriate standard following the procedure in Section 8. See Annex A for the recommended certified viscosity standard.

9.2. If the specific viscometer does not allow a digital calibration, the user shall manually calculate a correction factor, *F*, as follows:

$$F = \frac{\eta_s}{\eta} \qquad (1)$$

where:

η_s = certified viscosity of the standard at the test temperature, and

η = measured viscosity at 25°C (77°F).

9.3. If the specific viscometer permits the user to digitally calibrate the viscosity, follow the instructions provided by the manufacturer.

9.4. Calibrate the viscometer in the same manner as above, using a viscosity standard for 50°C (122°F). See Annex A1 for the recommended certified viscosity standard.

10. REPORT

10.1. Report the corrected viscosity where appropriate by using the correction factor, *F*, determined in Section 9.2.

10.2. Report the apparent viscosity in mPa·s of the sample at the temperature at which the test was performed.

10.3. Report the temperature to the nearest 0.1°C (0.2° F) and the viscosity to the nearest 0.1 mPa·s.

11. PRECISION AND BIAS

11.1. *The following criteria should be used for judging the acceptability of results (95 percent probability)*[2]:

11.1.1. *Single-Operator Precision*—Duplicate results by the same operator should not be considered suspect unless they differ by more than the following amount:

Test Temperature °C (°F)	Viscosity mPa·s	Repeatability % of the mean
25 (77)	25 to 200	8.2
50 (122)	100 to 1000	12.9

11.1.2. *Multilaboratory Precision*—The results submitted by each of two laboratories should not be considered suspect unless they differ by more than the following amount:

Test Temperature °C (°F)	Viscosity mPa·s	Reproducibility % of the mean
25 (77)	25 to 200	22
50 (122)	100 to 1000	64

11.2. *Bias*—No information can be presented on the bias of the procedure because no material having the accepted reference value is available.

12. KEYWORDS

12.1. Emulsified asphalt; rotational; rotational paddle viscometer; viscosity.

13. REFERENCES

13.1. *ASTM Standards*:

- D0977- Standard Specification for Emulsified Asphalt
- D2397/D2397M-, Standard Specification for Cationic Emulsified Asphalt

ANNEX A—VISCOSITY STANDARDS

(Mandatory Information)

A1. STANDARDS

A1.1. Certified Standard S60 with a viscosity of 100 mPa·s for 25°C (77°F).

A1.2. Certified Standard S600 with a viscosity of 240 mPa·s for 50°C (122°F).

[1] This provisional standard was first published in 2016.

[2] Research Reports RR:D04-1037 and RR:D04-1038 present the results of the Interlaboratory Study used to establish the precision and bias statement for ASTM D7226, Standard Test Method for Determining the Viscosity of Emulsified Asphalt Using a Rotational Paddle Viscometer. The collaborative study included participation of 14 labs for Research Report RR:D04-1037 and 15 labs for Research Report RR:D04-1038 that used ASTM D7226 to analyze the viscosity of several types of emulsified asphalt of varying viscosity levels, including three different standards. The research reports present a summary method performance statistics as well as the measurement data used to calculate the results for the study.

Standard Practice for

Asphalt Tack Coat Design

AASHTO Designation: PP xxx-yy[1]
Technical Section: 2a
Release: Group 3 (Month yyyy)

AASHTO

American Association of State Highway and Transportation Officials
444 North Capitol Street N.W., Suite 249
Washington, D.C. 20001

Standard Practice for

Asphalt Tack Coat Design

AASHTO Designation: PP xxx-yy
Technical Section: 2a
Release: Group 3n (Month yyyy)

1. SCOPE

1.1. This standard determines an application rate for emulsified asphalt or performance-graded (PG) asphalt binder for tack coats.

1.2. A tack coat is the application of an emulsified asphalt or performance-graded (PG) asphalt binder, followed by any applied surface layer. The tack coat is used to ensure a good bond between the existing asphalt or concrete pavement and an overlay, between the multiple lifts of a new structural pavement and at any vertical surfaces that the new layer will be placed adjacent to, such as curbs, gutters, utilities, and construction joints.

~~1.2.~~1.3. ~~A tack coat is the application of emulsified asphalt or PG asphalt binder on an existing asphalt or concrete pavement, followed immediately by any applied layer. Tack coats are a vital component of an asphalt pavement's structural system as they bond the multiple asphalt lifts into one monolithic layer.~~

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- M 320, Performance-Graded Asphalt Binder
- M 332, Performance-Graded Asphalt Binders Using Multiple Stress Creep Recovery (MSCR)
- MP XXX, Materials for Asphalt Tack Coats

3. SIGNIFICANCE AND USE

3.1. This standard may be used to select the residual application quantities of the asphalt materials required for the construction of asphalt tack coats. Consult with the supplier for the type of emulsified asphalt or PG asphalt binder, application temperature, tracking and unique handling needs of their product.

Note 1—Many agencies use "special purpose" tack applications that yield much higher bond strengths, reduce tracking, and allow tack coat materials to be applied at much higher rates. Examples include hot-applied materials, trackless tack coats and tack coats applied through a spray paver. These applications may be proprietary and should be specified through local agency standards. Consult supplier recommendations for application rates and special equipment needs.

3.2. Tack coats are applied to a number of different pavement surface types (Table 1). The residual asphalt from the emulsified asphalt and the application rate for a PG binder will be the same. Materials specifications for tack coats can be found in MP XXX (Materials for Asphalt Tack Coats).

3.3. *Dilution*:

3.3.1. When using slow-setting emulsified asphalt, dilute by adding one part additional water (1:1), unless otherwise specified by the purchasing agency. Dilution involves the controlled addition of water or a compatible surfactant solution to the manufactured emulsified asphalt before application. Control of dilution is essential for calculating residual asphalt, as well as for achieving ultimate bond strength. It is suggested that dilution occur at the emulsion terminal and not in the field, which would allow for greater control and ability to properly verify dilution ratios.

3.3.2. Do not dilute rapid-setting or quick-setting emulsified asphalt for tack coat applications, unless otherwise specified by the purchasing agency. Provide a final product that is a fluid and homogeneous material that does not plug distributor nozzles.

Note 2—Ensure that emulsified asphalt residual application rates on the roadway are still satisfied after dilution

3.4. Apply tack coats to existing paved surfaces, including new or existing asphalt mixtures, milled surfaces, Portland cement concrete, cold- or hot-in-place recycled mixes, and vertical surfaces that a new layer will be placed adjacent to, such as curbs, gutters, and construction joints. . The rate of application will vary with the type and condition of the surface.

4. ASPHALT TACK COAT DESIGN REQUIREMENTS

4.1. *Material Quantities*:

4.1.1. The tack coat application rate varies with the condition of the existing surface to which it is applied. In general, a tight or dense surface requires less tack coat than an open-textured, raveled, or milled surface. A flushed or bleeding surface requires less tack coat than a dry or aged surface. The proper application rate also varies with the type of tack coat material used and the asphalt mixture that will be placed as an overlay. Dense-graded mixtures including Stone Matrix Asphalt (SMA) require less tack coat than open-graded friction course (OGFC) overlays. Because emulsified asphalt contains water, the tack coat application rates used by contractors are higher in order to achieve the minimum residual rates. Therefore, the estimated quantity of tack coat needed should be based on the emulsified asphalt application rate and not on residual application rates.

4.1.2. Emulsified asphalt should meet MP XXX specifications. The application rates should conform to those shown in Table 1, unless otherwise specified.

4.1.3. Application rates for PG binder used as tack coats should be the same as the residual rates shown in Table 1. PG asphalt binders should meet M 320 or M 332 specifications.

Table 1—~~Minimum~~ Recommended Residual~~,~~ Emulsified Asphalt~~on~~, and Diluted ~~Rates~~ Emulsified Asphalt~~ion~~ Rates ~~Recommended~~ for ~~Slow Setting Emulsified~~ ~~Asphalt Used for~~ Tack Coat

Existing Surface Type	Residual Rate, gal/yd^2	Emulsion Application Rate Undiluted[a], gal/yd^2	Emulsion Application Rate Diluted 1:1[a], gal/yd^2
New Asphalt Mixture	0.020–0.045	0.033–0.075	0.066–0.150
Existing Asphalt Mixture	0.040–0.070	0.067–0.117	0.133–0.234
Milled Surfaces	0.040–0.080	0.067–0.133	0.133–0.266
Portland Cement Concrete	0.030–0.050	0.050–0.083	0.100–0.166

[a] Assumed slow setting emulsified asphalt ~~is~~ at 43 percent water and 57 percent asphalt.

4.1.4. Options for choosing emulsified asphalt and PG asphalt binder are shown in Table 2.

Table 2—Recommended Tack Coat Material for Project Type/Time

Project Type/Time	Recommended Tack Coat Material
Standard	Emulsified Asphalt
High Traffic Volume (>5,000 ADT)	PG Asphalt Binder or Special Purpose[a]
Nighttime Paving with Short Time Windows (<8 hours)	PG Asphalt Binder, Special Purpose[a]

[a]See Section 3, Note 1

4.2. *Method to convert residual binder rates~~content~~ to ~~total~~ emulsified asphalt rates ~~content~~ based on emulsified~~on~~ asphalt contents and dilution rates ~~residual values~~*:

4.2.1. Calculating ~~residual asphalt~~asphalt ~~emulsified~~on asphalt application rates needs to account for not only the water that is present in the original emulsified asphalt, but also any added water via dilution.

4.2.2. ~~For e~~Example calculations~~s~~:~~,~~

Assume ~~if an~~an application rate of 0.~~10~~050 gal/yd^2 of residual emulsified asphalt ~~asphalt~~ is needed for the application.

1) What should be the application rate for undiluted CRS-1 emuls~~ion~~ified asphalt?

CRS~~R~~-1 is 60% residual asphalt.

$$\frac{0.050\ gal\ residual\ asphalt}{yd2} \times \frac{1\ gal\ CRS-1}{0.60\ gal\ residual\ asphalt} = \frac{0.083\ gal\ CRS-1}{yd2}$$

2) What should be the application rate for CSS-1 emulsion diluted 1:1 with water?

CSS-1 is 57% residual asphalt. Diluting 1 gal of CSS-1 at 1:1 with water results in 2 gal of diluted CSS-1.

$$\frac{0.050\ gal\ residual\ asphalt}{yd2} \times \frac{1\ gal\ CSS-1}{0.57\ gal\ residual\ asphalt} \times \frac{2\ gal\ Diluted\ CSS-1}{1\ gal\ CSS-1} = \frac{0.175\ gal\ Diluted\ CSS-1}{yd2}$$

~~4.2.2. was applied with an emulsified asphalt diluted 1:1 (original emulsified asphalt:water), and the original emulsified asphalt contained 40 percent water, calculation of the residual application rate would need to account for both sources of water. The application rate of 0.10 gal/yd^2 would be multiplied by 0.50, to account for the dilution, and then by 0.60, to account for the water in the original emulsified asphalt. Therefore, the residual tack coat rate in this example would be 0.030 gal/yd^2.~~

5. REPORT

5.1. Report the emulsified asphalt or hot PG asphalt binder spray rate in gallons per square yard to the nearest 0.001 gal/yd^2.

6. KEYWORDS

6.1. Tack coat; emulsified asphalt, performance-graded asphalt binder

5.3. Report the designed residual asphalt rate to the nearest 0.001 gal/yd^2.
5.4. Report the emulsified asphalt application rate, to the nearest 0.001 gal/yd^2 (as applicable).

6. KEYWORDS

6.1. Tack coat; emulsified asphalt, performance-graded asphalt binder.

Standard Specification for

Materials for Asphalt Tack Coat

AASHTO Designation: MP xxx-yy[1]
Technical Section: 2a
Release: Group 3 (Month yyyy)

AASHTO

American Association of State Highway and Transportation Officials
444 North Capitol Street N.W., Suite 249
Washington, D.C. 20001

Standard Specification for

Materials for Asphalt Tack Coat

AASHTO Designation: MP xxx-yy
Technical Section: 2a
Release: Group 3 (Month yyyy)

1. SCOPE

1.1. This standard specifies quality requirements for emulsified asphalt or performance-graded asphalt binder for tack coats.

~~1.1.~~1.2. A tack coat is the application of an emulsified asphalt or performance-graded (PG) asphalt binder, followed by any applied surface layer. The tack coat is used to ensure a good bond between the existing asphalt or concrete pavement and an overlay, between the multiple lifts ~~layers~~ of a structural pavement and at any vertical surfaces that the new layer will be placed adjacent to, such as curbs, gutters, utilities, and construction joints.

~~1.2.1.1. This standard specifies quality requirements for emulsified asphalt or performance-graded asphalt binder for tack coats.~~

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- M 140, Emulsified Asphalt
- M 208, Cationic Emulsified Asphalt
- M 316, Polymer-Modified Emulsified Asphalt
- M 320, Performance-Graded Asphalt Binder
- M 332, Performance-Graded Asphalt Binder Using Multiple Stress Creep Recovery Test
- PP XX, Asphalt Tack Coat Design

3. ASPHALT REQUIREMENTS

3.1. Use an emulsified asphalt type or performance-graded asphalt binder designated by the purchasing agency.

Note 1— When using emulsified asphalt, select either cationic or anionic emulsified asphalt. Cationic and anionic emulsified asphalt cannot be used together.

Note 2—Cationic emulsified asphalts are often recommended for areas with damp pavement, such as coastal areas, because they are less sensitive to moisture and temperature

3.2. Slow-setting, medium-setting, rapid-setting, or quick-setting emulsified asphalt should ~~shall~~[MDV1] meet the requirements in M 140, M 208, or M 316. Performance-graded asphalt binder should ~~shall~~[MDV2] meet the requirements of M 320 or M 332.

Note[TSD3][TSD4] **3**—Many agencies use “special purpose” tack coat materials that yield much higher bond strengths, reduce tracking, and allow tack coat emulsified asphalts to be applied at much higher rates. Examples include hot-applied materials, trackless tack coats, and tack coats applied through a spray paver. These applications may be proprietary and should be specified through local agency standards.

3.3. When using a slow-setting emulsified asphalt, dilute by adding one part additional water (1:1), unless otherwise specified by the purchasing agency.

3.4. Do not dilute rapid-setting or quick-setting emulsified asphalt for tack coat applications, unless otherwise specified by the purchasing agency. Provide a final product that is a fluid and homogeneous material ~~mixture~~ that does not plug distributor nozzles.

3.5. Design the asphalt ~~Apply the~~ tack coat according to PP-XX.

Note 4—For emulsified asphalt, the rate of setting depends upon the type of emulsified asphalt, the amount of water added, the type and concentration of the emulsifying agent, and atmospheric conditions.

4. KEYWORDS

4.1. Tack coat; emulsified asphalt; performance grade asphalt binder, PG asphalt binder

ATTACHMENT 5:
PROPOSED SPECIFICATIONS

This attachment describes three proposed performance-related specifications for determining the asphalt emulsion and binder residue properties that are related to surface treatment performance.

These proposed specifications are the suggestions of the NCHRP Project 9-50 research team. These specifications have not been approved by the NCHRP or any AASHTO committee nor have they been formally accepted for AASHTO specifications.

Proposed Standard Specifications for

Performance-Graded Emulsions Used in Chip Seal Surface Treatments

AASHTO Designation: M-XX

1. SCOPE

1.1 These specifications cover the performance grading of asphalt emulsions used in constructing chip seal surface treatments. Grading designations are related to the average seven-day maximum pavement surface design temperature, minimum pavement surface design temperature, and design traffic level.

1.2 The values stated in SI units are to be regarded as the standard.

2. REFERENCED DOCUMENTS

2.1 *AASHTO Standards:*

- M 140, Standard Specification for Emulsified Asphalt
- M 208, Standard Specification for Cationic Emulsified Asphalt
- M 316, Standard Specification for Polymer-Modified Cationic Emulsified Asphalt
- T 40, Test Method for Sampling Bituminous Materials
- T 44, Test Method for Solubility of Bituminous Materials
- TP 48, Test Method for Viscosity Determination of Asphalt Binder Using Rotational Viscometer
- T 49, Test Method for Penetration of Bituminous Materials
- T 50, Test Method for Float Test for Bituminous Materials
- T 51, Standard Specification for Ductility of Asphalt Materials
- T 53, Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
- T 59, Test Method for Emulsified Asphalts
- T 350, Test Method for Multiple Stress Creep Recovery (MSCR) Test of Asphalt Binder Using a Dynamic Shear Rheometer
- TP 91, Test Method for Determining Asphalt Binder Bond Strength By Means of the Asphalt Bond Strength Test
- T 200, Test Method for pH of Aqueous Solutions with the Glass Electrode
- T 300, Test Method for Force Ductility Test of Asphalt Materials
- T 301, Test Method for Elastic Recovery Test of Asphalt Materials by Means of a Ductilometer

- T 302, Test Method for Polymer Content of Polymer-Modified Emulsified Asphalt Residue and Asphalt Binders

2.2 *ASTM Standards:*

- D5, Test Method for Penetration of Bituminous Materials
- D8, Standard Terminology Relating to Materials for Roads and Pavements
- D977, Standard Specification for Emulsified Asphalt
- D5546, Test Method for Solubility of Asphalt Binders in Toluene by Centrifuge
- D6930, Test Method for Settlement and Storage Stability of Emulsified Asphalts
- D7497, Standard Practice for Recovering Residue from Emulsified Asphalt Using Low Temperature Evaporative Techniques

3. TERMINOLOGY

3.1 Definitions of terms common to asphalt emulsions are found in ASTM D8.

4. ORDERING INFORMATION

4.1 When ordering under these specifications, include in the purchase order the prevailing charge of the emulsifying agent and setting rate (e.g., CRS, RS, etc.), the performance grade (PG), and the traffic level (i.e., low, medium, or high) for the asphalt emulsion required.

5. MATERIALS AND MANUFACTURE

5.1 Asphalt emulsions shall be manufactured by the emulsification of asphalt prepared by the refinement of crude petroleum using suitable methods, with or without the addition of modifiers.

5.2 Modifiers may be any organic material of suitable manufacture that is used in a virgin or recycled condition and that is dissolved, dispersed, or reacted in asphalt emulsion to enhance its performance.

5.3 The asphalt emulsion shall conform to the requirements detailed in M 140 for anionic and high float emulsions, M 208 for cationic emulsions, and M 316 for modified emulsions.

6. REQUIREMENTS

6.1 As specified in M 140, the emulsified asphalt shall be tested within 14 days of delivery. The emulsified asphalt shall be homogenous after thorough mixing, provided separation has not been caused by freezing. Emulsified asphalts separated by freezing shall not be tested.

6.2 Emulsified asphalt shall conform to the requirements prescribed in Table 1.

7. SAMPLING

7.1 The material shall be sampled in accordance with T 40.

8. TEST METHODS

8.1 The properties outlined in Section 6.2 shall be determined in accordance with TP 48, T 350, ASTM D 6930, and the proposed "Standard Test Method for Determining Dynamic Shear Modulus of Emulsion Residues at Critical Phase Angle Values Using the Dynamic Shear Rheometer" specifications provided in the Attachments of the NCHRP 9-50 draft final report.

9. INSPECTION AND CERTIFICATION

9.1 Inspection and certification of the material(s) shall be agreed upon between the purchaser and the seller. Specific requirements shall be made part of the purchase contract. The seller shall provide material handling and storage procedures to the purchaser for each asphalt binder grade certified.

10. REJECTION AND RETESTING

10.1 If the results of any test do not conform to the requirements of these specifications, retesting to determine conformity must be performed as indicated in the purchase order or as otherwise agreed upon between the purchaser and the seller.

11. KEYWORDS

11.1 Asphalt binder, asphalt cement, asphalt emulsion, modifier; performance specifications, rheology

Table 1. Performance-Graded Chip Seal Emulsion Specifications

	Chip Seal Emulsion Performance Grade											
	EPG 49				EPG 55				EPG 61			
	-7	-13	-19	-25	-7	-13	-19	-25	-7	-13	-19	-25
Average 7-day Maximum Pavement Surface Design Temperature, °C[a]	<49				<55				<61			
Minimum Pavement Surface Design Temperature, °C[a]	>-7	>-13	>-19	>-25	>-7	>-13	>-19	>-25	>-7	>-13	>-19	>-25
Proposed Test Methods[b]	**Proposed Testing Temperature (°C)**											
Tests on Original Emulsion												
Storage Stability Modified AASHTO T 59 Measured responses: Rotational viscosity, η, A – 24-hour separation ratio (Rs): 0.5 to 1.5 B – 24-hour stability ratio (Rd): max. 2	60											
Sprayability Modified AASHTO TP 48 Measured response: Viscosity @ 3 shear rates, Max. 400 cP @ high shear rate (150 rpm)	60											
Resistance to Drain – Out Modified AASHTO TP 48 Measured response: Viscosity @ 3 shear rates, Min. 50 cP @ low shear rate (5 rpm)	60											
Demulsibility AASHTO T 59 Measured response: % demulsibility Min. 40% (anionic) Min. 60% (cationic)	25											
Particle Charge AASHTO T 59 Measured response: particle charge Positive (cationic)	25											
Sieve Test AASHTO T 59 Measured response: % mass Max. 0.1%	25											
Solubility AASHTO T 44 Measured response: % solubility Min. 97.5%	25											
Float[c] AASHTO T 50 Measured response: float time Min. 1200 seconds	60											
Percent Residue AASHTO PP72 Measured response: % residue Min. 65% (cationic) Min. 63% (anionic)	25											
Tests on Residue Recovered Using AASHTO PP 72- Method B												
Resistance to Bleeding and Rutting AASHTO T 350 Measured response: Non recoverable creep compliance, J_{nr} Max Jnr @ 3.2 kPa, 8 kPa^{-1} (low traffic) [d] Max Jnr @ 3.2 kPa, 5.5 kPa^{-1} (medium traffic) [e] Max Jnr @ 3.2 kPa, 3.5 kPa^{-1} (high traffic) [f g]	49				55				61			
Resistance to Low Temperature Raveling DSR Temperature Frequency Sweep Measured response: $\|G^*\|$ at critical phase angle, δc Max. $\|G^*\|$ @ δc: 30 MPa (low traffic) [d] Max. $\|G^*\|$ @ δc: 20 MPa (medium traffic) [e] Max. $\|G^*\|$ @ δc: 12 MPa (high traffic) [f]	5°C and 15°C Critical phase angle, δc (°)											
	54	51	48	45	54	51	48	45	54	51	48	45

[a] Pavement surface temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, or may be provided by the specifying agency.

[b] Bitumen bond strength (BBS) should be used in accordance with AASHTO TP 91 to measure resistance to aggregate loss due to compatibility issues between aggregate and emulsion at the intermediate temperature grade, which is the average of the high and low emulsion performance grades, plus 4 degrees.

[c] For high float emulsions only

[d] Low traffic is defined as any roadway with an AADT between 0 and 500 vehicles.

[e] Medium traffic is defined as any roadway with an AADT between 501 and 2,500 vehicles.

[f] High traffic is defined as any roadway with an AADT between 2,500 and 20,000 vehicles.

[g] Check that $\delta \leq 80°$ to ensure presence of emulsion modifier for high traffic roadways.

	Chip Seal Emulsion Performance Grade											
	EPG 49				EPG 55				EPG 61			
	-31	-37	-43	-49	-31	-37	-43	-49	-31	-37	-43	-49
Average 7-day Maximum Pavement Surface Design Temperature, °C[a]	<49				<55				<61			
Minimum Pavement Surface Design Temperature, °C[a]	>-31	>-37	>-43	>-49	>-31	>-37	>-43	>-49	>-31	>-37	>-43	>-49
Proposed Test Methods[b]	**Proposed Testing Temperature (°C)**											
Tests on Original Emulsion												
Storage Stability Modified AASHTO T 59 Measured responses: Rotational viscosity, η, A – 24-hour separation ratio (Rs): 0.5 to 1.5 B – 24-hour stability ratio (Rd): max. 2	60											
Sprayability Modified AASHTO TP 48 Measured response: Viscosity @ 3 shear rates, Max. 400 cP @ high shear rate (150 rpm)	60											
Resistance to Drain – Out Modified AASHTO TP 48 Measured response: Viscosity @ 3 shear rates, Min. 50 cP @ low shear rate (5 rpm)	60											
Demulsibility AASHTO T 59 Measured response: % demulsibility Min. 40% (anionic) Min. 60% (cationic)	25											
Particle Charge AASHTO T 59 Measured response: particle charge Positive (cationic)	25											
Sieve Test AASHTO T 59 Measured response: % mass Max. 0.1%	25											
Solubility AASHTO T 44 Measured response: % solubility Min. 97.5%	25											
Float[c] AASHTO T 50 Measured response: float time Min. 1200 seconds	60											
Percent Residue AASHTO PP72 Measured response: % residue Min. 65% (cationic) Min. 63% (anionic)	25											
Tests on Residue Recovered Using AASHTO PP 72- Method B												
Resistance to Bleeding and Rutting AASHTO T 350 Measured response: Non recoverable creep compliance, J_{nr} Max Jnr @ 3.2 kPa, 8 kPa^{-1} (low traffic) [d] Max Jnr @ 3.2 kPa, 5.5 kPa^{-1} (medium traffic) [e] Max Jnr @ 3.2 kPa, 3.5 kPa^{-1} (high traffic) [f g]	49				55				61			
Resistance to Low Temperature Raveling DSR Temperature Frequency Sweep Measured response: $\|G^*\|$ at critical phase angle, δc Max. $\|G^*\|$ @ δc: 30 MPa (low traffic) [d] Max. $\|G^*\|$ @ δc: 20 MPa (medium traffic) [e] Max. $\|G^*\|$ @ δc: 12 MPa (high traffic) [f]	5°C and 15°C Critical phase angle, δc (°)											
	42	39	36	33	42	39	36	33	42	39	36	33

[a] Pavement surface temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, or may be provided by the specifying agency.

[b] Bitumen bond strength (BBS) should be used in accordance with AASHTO TP 91 to measure resistance to aggregate loss due to compatibility issues between aggregate and emulsion at the intermediate temperature grade which is the average of the high and low emulsion performance grade, plus 4 degrees.

[c] For high float emulsions only

[d] Low traffic is defined as any roadway with an AADT between 0 and 500 vehicles.

[e] Medium traffic is defined as any roadway with an AADT between 501 and 2,500 vehicles.

[f] High traffic is defined as any roadway with an AADT between 2,500 and 20,000 vehicles.

[g] Check that $\delta \leq 80°$ to ensure presence of emulsion modifier for high traffic roadways.

	Chip Seal Emulsion Performance Grade											
	EPG 67				EPG 73				EPG 79			
	-7	-13	-19	-25	-7	-13	-19	-25	-7	-13	-19	-25
Average 7-day Maximum Pavement Surface Design Temperature, °C[a]	<67				<73				<79			
Minimum Pavement Surface Design Temperature, °C[a]	>-7	>-13	>-19	>-25	>-7	>-13	>-19	>-25	>-7	>-13	>-19	>-25
Proposed Test Methods[b]	**Proposed Testing Temperature (°C)**											
Tests on Original Emulsion												
Storage Stability Modified AASHTO T 59 Measured responses: Rotational viscosity, η, A – 24-hour separation ratio (Rs): 0.5 to 1.5 B – 24-hour stability ratio (Rd): max. 2	60											
Sprayability Modified AASHTO TP 48 Measured response: Viscosity @ 3 shear rates, Max. 400 cP @ high shear rate (150 rpm)	60											
Resistance to Drain – Out Modified AASHTO TP 48 Measured response: Viscosity @ 3 shear rates, Min. 50 cP @ low shear rate (5 rpm)	60											
Demulsibility AASHTO T 59 Measured response: % demulsibility Min. 40% (anionic) Min. 60% (cationic)	25											
Particle Charge AASHTO T 59 Measured response: particle charge Positive (cationic)	25											
Sieve Test AASHTO T 59 Measured response: % mass Max. 0.1%	25											
Solubility AASHTO T 44 Measured response: % solubility Min. 97.5%	25											
Float[c] AASHTO T 50 Measured response: float time Min. 1200 seconds	60											
Percent Residue AASHTO PP72 Measured response: % residue Min. 65% (cationic) Min. 63% (anionic)	25											
Tests on Residue Recovered Using AASHTO PP 72- Method B												
Resistance to Bleeding and Rutting AASHTO T 350 Measured response: Non recoverable creep compliance, J_{nr} Max Jnr @ 3.2 kPa, 8 kPa^{-1} (low traffic) [d] Max Jnr @ 3.2 kPa, 5.5 kPa^{-1} (medium traffic) [e] Max Jnr @ 3.2 kPa, 3.5 kPa^{-1} (high traffic) [f g]	67				73				79			
Resistance to Low Temperature Raveling DSR Temperature Frequency Sweep Measured response: $\|G^*\|$ at critical phase angle, δc Max. $\|G^*\|$ @ δc: 30 MPa (low traffic) [d] Max. $\|G^*\|$ @ δc: 20 MPa (medium traffic) [e] Max. $\|G^*\|$ @ δc: 12 MPa (high traffic) [f]	5°C and 15°C Critical phase angle, δc (°)											
	54	51	48	45	54	51	48	45	54	51	48	45

[a] Pavement surface temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, or may be provided by the specifying agency.

[b] Bitumen bond strength (BBS) should be used in accordance with AASHTO TP 91 to measure resistance to aggregate loss due to compatibility issues between aggregate and emulsion at the intermediate temperature grade which is the average of the high and low emulsion performance grade, plus 4 degrees.

[c] For high float emulsions only

[d] Low traffic is defined as any roadway with an AADT between 0 and 500 vehicles.

[e] Medium traffic is defined as any roadway with an AADT between 501 and 2,500 vehicles.

[f] High traffic is defined as any roadway with an AADT between 2,500 and 20,000 vehicles.

[g] Check that $\delta \leq 80°$ to ensure presence of emulsion modifier for high traffic roadways.

	Chip Seal Emulsion Performance Grade											
	EPG 67				EPG 73				EPG 79			
	-31	-37	-43	-49	-31	-37	-43	-49	-31	-37	-43	-49
Average 7-day Maximum Pavement Surface Design Temperature, °C[a]	<67				<73				<79			
Minimum Pavement Surface Design Temperature, °C[a]	>-31	>-37	>-43	>-49	>-31	>-37	>-43	>-49	>-31	>-37	>-43	>-49
Proposed Test Methods[b]	**Proposed Testing Temperature (°C)**											
Tests on Original Emulsion												
Storage Stability Modified AASHTO T 59 Measured responses: Rotational viscosity, η, A – 24-hour separation ratio (Rs): 0.5 to 1.5 B – 24-hour stability ratio (Rd): max. 2	60											
Sprayability Modified AASHTO TP 48 Measured response: Viscosity @ 3 shear rates, Max. 400 cP @ high shear rate (150 rpm)	60											
Resistance to Drain – Out Modified AASHTO TP 48 Measured response: Viscosity @ 3 shear rates, Min. 50 cP @ low shear rate (5 rpm)	60											
Demulsibility AASHTO T 59 Measured response: % demulsibility Min. 40% (anionic) Min. 60% (cationic)	25											
Particle Charge AASHTO T 59 Measured response: particle charge Positive (cationic)	25											
Sieve Test AASHTO T 59 Measured response: % mass Max. 0.1%	25											
Solubility AASHTO T 44 Measured response: % solubility Min. 97.5%	25											
Float[c] AASHTO T 50 Measured response: float time Min. 1200 seconds	60											
Percent Residue AASHTO PP72 Measured response: % residue Min. 65% (cationic) Min. 63% (anionic)	25											
Tests on Residue Recovered Using AASHTO PP 72- Method B												
Resistance to Bleeding and Rutting AASHTO T 350 Measured response: Non recoverable creep compliance, J_{nr} Max Jnr @ 3.2 kPa, 8 kPa^{-1} (low traffic) [d] Max Jnr @ 3.2 kPa, 5.5 kPa^{-1} (medium traffic) [e] Max Jnr @ 3.2 kPa, 3.5 kPa^{-1} (high traffic) [f g]	67				73				79			
Resistance to Low Temperature Raveling DSR Temperature Frequency Sweep Measured response: $\|G^*\|$ at critical phase angle, δc Max. $\|G^*\|$ @ δc: 30 MPa (low traffic) [d] Max. $\|G^*\|$ @ δc: 20 MPa (medium traffic) [e] Max. $\|G^*\|$ @ δc: 12 MPa (high traffic) [f]	5°C and 15°C Critical phase angle, δc (°)											
	42	39	36	33	42	39	36	33	42	39	36	33

[a] Pavement surface temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, or may be provided by the specifying agency.

[b] Bitumen bond strength (BBS) should be used in accordance with AASHTO TP 91 to measure resistance to aggregate loss due to compatibility issues between aggregate and emulsion at the intermediate temperature grade which is the average of the high and low emulsion performance grades, plus 4 degrees.

[c] For high float emulsions only

[d] Low traffic is defined as any roadway with an AADT between 0 and 500 vehicles.

[e] Medium traffic is defined as any roadway with an AADT between 501 and 2,500 vehicles.

[f] High traffic is defined as any roadway with an AADT between 2,500 and 20,000 vehicles.

[g] Check that $\delta \leq 80°$ to ensure presence of emulsion modifier for high traffic roadways.

Proposed Standard Specifications for

Performance-Graded Emulsions Used in Microsurfacing Treatments

AASHTO Designation: M-XX

1. SCOPE

1.1 These specifications cover the performance grading of asphalt emulsions used in constructing microsurfacing and slurry surface treatments. Grading designations are related to the average seven-day maximum pavement surface design temperature, minimum pavement surface design temperature, and design traffic level.

1.2 The values stated in SI units are to be regarded as the standard.

2. REFERENCED DOCUMENTS

2.1 *AASHTO Standards:*

- M 140, Standard Specification for Emulsified Asphalt
- M 208, Standard Specification for Cationic Emulsified Asphalt
- M 316, Standard Specification for Polymer-Modified Cationic Emulsified Asphalt
- T 40, Test Method for Sampling Bituminous Materials
- T 44, Test Method for Solubility of Bituminous Materials
- T 49, Test Method for Penetration of Bituminous Materials
- T 50, Test Method for Float Test for Bituminous Materials
- T 51, Standard Specification for Ductility of Asphalt Materials
- T 53, Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
- T 59, Test Method for Emulsified Asphalts
- T 350, Test Method for Multiple Stress Creep Recovery (MSCR) Test of Asphalt Binder Using a Dynamic Shear Rheometer
- T 200, Test Method for pH of Aqueous Solutions with the Glass Electrode
- T 300, Test Method for Force Ductility Test of Asphalt Materials
- T 301, Test Method for Elastic Recovery Test of Asphalt Materials by Means of a Ductilometer
- T 302, Test Method for Polymer Content of Polymer-Modified Emulsified Asphalt Residue and Asphalt Binders

2.2 *ASTM Standards:*

- D5, Test Method for Penetration of Bituminous Materials
- D8, Standard Terminology Relating to Materials for Roads and Pavements
- D242, Specification for Mineral Filler for Bituminous Paving Mixtures
- D977, Standard Specification for Emulsified Asphalt
- D3910, Standard Practices for Design, Testing, and Construction of Slurry Seal
- D6930, Test Method for Settlement and Storage Stability of Emulsified Asphalts
- D7497, Standard Practice for Recovering Residue from Emulsified Asphalt Using Low Temperature Evaporative Techniques

3. TERMINOLOGY

3.1 Definitions of terms common to asphalt emulsions are found in ASTM D8.

4. ORDERING INFORMATION

4.1 When ordering under these specifications, include in the purchase order the prevailing charge of the emulsifying agent and setting rate (e.g., CQS, CSS, SS, etc.), the performance grade (PG), and the traffic level (i.e., low, medium, or high) for the asphalt emulsion required.

5. MATERIALS AND MANUFACTURE

5.1 Asphalt emulsions shall be manufactured by the emulsification of asphalt prepared by the refinement of crude petroleum using suitable methods, with or without the addition of modifiers.

5.2 Modifiers may be any organic material of suitable manufacture that is used in a virgin or recycled condition and that is dissolved, dispersed, or reacted in asphalt emulsion to enhance its performance.

5.3 Mineral filler used in microsurfacing shall meet the requirements of ASTM D242.

5.4 The asphalt emulsion shall conform to the requirements detailed in M 140 for anionic and high float emulsions, M 208 for cationic emulsions, and M 316 for modified emulsions.

6. REQUIREMENTS

6.1 As specified in M 140, the emulsified asphalt shall be tested within 14 days of delivery. The emulsified asphalt shall be homogenous after thorough mixing, provided separation has not been caused by freezing. Emulsified asphalts separated by freezing shall not be tested.

6.2 Emulsified asphalt shall conform to the requirements prescribed in Table 1.

7. SAMPLING

7.1 The material shall be sampled in accordance with T 40.

8. TEST METHODS

8.1 The properties outlined in Section 6.2 shall be determined in accordance with T350, ASTM D6930, and the proposed "Standard Test Method for Determining Dynamic Shear Modulus of Emulsion Residues at Critical Phase Angle Values Using the Dynamic Shear Rheometer" specifications provided in the Attachments of the NCHRP 9-50 draft final report.

9. INSPECTION AND CERTIFICATION

9.1 Inspection and certification of the material(s) shall be agreed upon between the purchaser and the seller. Specific requirements shall be made part of the purchase contract. The seller shall provide material handling and storage procedures to the purchaser for each asphalt binder grade certified.

10. REJECTION AND RETESTING

10.1 If the results of any test do not conform to the requirements of these specifications, retesting to determine conformity must be performed as indicated in the purchase order or as otherwise agreed upon between the purchaser and the seller.

11. KEYWORDS

11.1 Asphalt binder, asphalt cement, asphalt emulsion, modifier, performance specifications, rheology, microsurfacing, slurry surfacing

Table 1. Performance-Graded Microsurfacing Emulsion Specifications

	Microsurfacing Emulsion Performance Grade											
	EPG 49				EPG 55				EPG 61			
	-7	-13	-19	-25	-7	-13	-19	-25	-7	-13	-19	-25
Average 7-day Maximum Pavement Surface Design Temperature, °C[a]	<49				<55				<61			
Minimum Pavement Surface Design Temperature, °C[a]	>-7	>-13	>-19	>-25	>-7	>-13	>-19	>-25	>-7	>-13	>-19	>-25
Proposed Test Methods [b]	**Proposed Testing Temperature (°C)**											
Tests on Original Emulsion												
Storage Stability Modified AASHTO T 59 Measured responses: Rotational viscosity, η, A – 24-hour separation ratio (Rs): 0.2 to 1.5 B – 24-hour stability ratio (Rd): max. 1.5	25											
Emulsion Viscosity Rotational viscometer Measured response: Rotational viscosity, η Mixability: Viscosity @ 5 rpm, Viscosity: max. 600 cP	25											
Particle Charge AASHTO T 59 Measured response: particle charge Positive (cationic)	25											
Sieve Test AASHTO T 59 Measured response: % mass Max. 0.1%	25											
Solubility AASHTO T 44 Measured response: % solubility Min. 97.5%	25											
Float[e] AASHTO T 50 Measured response: float time Min. 1200 seconds	60											
Percent Residue AASHTO PP72 Measured response: % residue Min. 57%	25											
Tests on Residue Recovered Using AASHTO PP 72- Method B												
Resistance to Rutting and Bleeding AASHTO T 350 Measured response: Non recoverable creep compliance, J_{nr} Max J_{nr} @ 3.2kPa, 5 kPa^{-1} (low traffic)[c] Max J_{nr} @ 3.2 kPa, 1.5 kPa^{-1} (medium-high traffic)[d]	49				55				61			
Resistance to Thermal Cracking DSR Temperature Frequency Sweep Measured response: $\|G^*\|$ at critical phase angle, δc Max. $\|G^*\|$ @ δc: 16 MPa	5°C and 15°C											
	Critical phase angle, δc (°)											
	50	48	46	44	50	48	46	44	50	48	46	44

[a] Pavement surface temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, or may be provided by the specifying agency.

[b] Wet Track Abrasion Test (WTAT) should be used in accordance with ASTM D3910 to measure the resistance to abrasion loss due to chemistry issues between aggregate and emulsion at the intermediate temperature grade.

[c] Low traffic is defined as any roadway with an AADT between 0 and 500 vehicles.

[d] Medium-high traffic is defined as any roadway with an AADT between 501 and 20,000 vehicles.

[e] For high float emulsions only

	Microsurfacing Emulsion Performance Grade											
	EPG 49				EPG 55				EPG 61			
	-31	-37	-43	-49	-31	-37	-43	-49	-31	-37	-43	-49
Average 7-day Maximum Pavement Surface Design Temperature, °C[a]	<49				<55				<61			
Minimum Pavement Surface Design Temperature, °C[a]	>-31	>-37	>-43	>-49	>-31	>-37	>-43	>-49	>-31	>-37	>-43	>-49
Proposed Test Methods [b]	**Proposed Testing Temperature (°C)**											
Tests on Original Emulsion												
Storage Stability Modified AASHTO T 59 Measured responses: Rotational viscosity, η, A – 24-hour separation ratio (Rs): 0.2 to 1.5 B – 24-hour stability ratio (Rd): max. 1.5	25											
Emulsion Viscosity Rotational viscometer Measured response: Rotational viscosity, η Mixability: Viscosity @ 5 rpm, Viscosity: max. 600 cP	25											
Particle Charge AASHTO T 59 Measured response: particle charge Positive (cationic)	25											
Sieve Test AASHTO T 59 Measured response: % mass Max. 0.1%	25											
Solubility AASHTO T 44 Measured response: % solubility Min. 97.5%	25											
Float[e] AASHTO T 50 Measured response: float time Min. 1200 seconds	60											
Percent Residue AASHTO PP72 Measured response: % residue Min. 57%	25											
Tests on Residue Recovered Using AASHTO PP 72- Method B												
Resistance to Rutting and Bleeding AASHTO T 350 Measured response: Non recoverable creep compliance, J_{nr} Max J_{nr} @ 3.2kPa, 5 kPa^{-1} (low traffic)[c] Max J_{nr} @ 3.2 kPa, 1.5 kPa^{-1} (medium-high traffic)[d]	49				55				61			
Resistance to Thermal Cracking DSR Temperature Frequency Sweep Measured response: $\|G^*\|$ at critical phase angle, δc Max. $\|G^*\|$ @ δc: 16 MPa	5°C and 15°C											
	Critical phase angle, δc (°)											
	42	40	38	36	42	40	38	36	42	40	38	36

[a] Pavement surface temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, or may be provided by the specifying agency.

[b] Wet Track Abrasion Test (WTAT) should be used in accordance with ASTM D3910 to measure the resistance to abrasion loss due to chemistry issues between aggregate and emulsion at the intermediate temperature grade.

[c] Low traffic is defined as any roadway with an AADT between 0 and 500 vehicles.

[d] Medium-high traffic is defined as any roadway with an AADT between 501 and 20,000 vehicles.

[e] For high float emulsions only

	Microsurfacing Emulsion Performance Grade											
	EPG 67				EPG 73				EPG 79			
	-7	-13	-19	-25	-7	-13	-19	-25	-7	-13	-19	-25
Average 7-day Maximum Pavement Surface Design Temperature, °C[a]	<67				<73				<79			
Minimum Pavement Surface Design Temperature, °C[a]	>-7	>-13	>-19	>-25	>-7	>-13	>-19	>-25	>-7	>-13	>-19	>-25
Proposed Test Methods [b]	**Proposed Testing Temperature (°C)**											
Tests on Original Emulsion												
Storage Stability Modified AASHTO T 59 Measured responses: Rotational viscosity, η, A – 24-hour separation ratio (Rs): 0.2 to 1.5 B – 24-hour stability ratio (Rd): max. 1.5	25											
Emulsion Viscosity Rotational viscometer Measured response: Rotational viscosity, η Mixability: Viscosity @ 5 rpm, Viscosity: max. 600 cP	25											
Particle Charge AASHTO T 59 Measured response: particle charge Positive (cationic)	25											
Sieve Test AASHTO T 59 Measured response: % mass Max. 0.1%	25											
Solubility AASHTO T 44 Measured response: % solubility Min. 97.5%	25											
Float[e] AASHTO T 50 Measured response: float time Min. 1200 seconds	60											
Percent Residue AASHTO PP72 Measured response: % residue Min. 57%	25											
Tests on Residue Recovered Using AASHTO PP 72- Method B												
Resistance to Rutting and Bleeding AASHTO T 350 Measured response: Non recoverable creep compliance, J_{nr} Max J_{nr} @ 3.2kPa, 5 kPa^{-1} (low traffic)[c] Max J_{nr} @ 3.2 kPa, 1.5 kPa^{-1} (medium-high traffic)[d]	67				73				79			
Resistance to Thermal Cracking DSR Temperature Frequency Sweep Measured response: |G*| at critical phase angle, δc Max. |G*| @ δc: 16 MPa	5°C and 15°C											
	Critical phase angle, δc (°)											
	50	48	46	44	50	48	46	44	50	48	46	44

[a] Pavement surface temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, or may be provided by the specifying agency.

[b] Wet Track Abrasion Test (WTAT) should be used in accordance with ASTM D 3910 to measure the resistance to abrasion loss due to chemistry issues between aggregate and emulsion at the intermediate temperature grade.

[c] Low traffic is defined as any roadway with an AADT between 0 and 500 vehicles.

[d] Medium-high traffic is defined as any roadway with an AADT between 501 and 20,000 vehicles.

[e] For high float emulsions only

	Microsurfacing Emulsion Performance Grade											
	EPG 67				EPG 73				EPG 79			
	-31	-37	-43	-49	-31	-37	-43	-49	-31	-37	-43	-49
Average 7-day Maximum Pavement Surface Design Temperature, °C[a]	<67				<73				<79			
Minimum Pavement Surface Design Temperature, °C[a]	>-31	>-37	>-43	>-49	>-31	>-37	>-43	>-49	>-31	>-37	>-43	>-49
Proposed Test Methods [b]	**Proposed Testing Temperature (°C)**											
Tests on Original Emulsion												
Storage Stability Modified AASHTO T 59 Measured responses: Rotational viscosity, η, A – 24-hour separation ratio (Rs): 0.2 to 1.5 B – 24-hour stability ratio (Rd): max. 1.5	25											
Emulsion Viscosity Rotational viscometer Measured response: Rotational viscosity, η Mixability: Viscosity @ 5 rpm, Viscosity: max. 600 cP	25											
Particle Charge AASHTO T 59 Measured response: particle charge Positive (cationic)	25											
Sieve Test AASHTO T 59 Measured response: % mass Max. 0.1%	25											
Solubility AASHTO T 44 Measured response: % solubility Min. 97.5%	25											
Float[e] AASHTO T 50 Measured response: float time Min. 1200 seconds	60											
Percent Residue AASHTO PP72 Measured response: % residue Min. 57%	25											
Tests on Residue Recovered Using AASHTO PP 72- Method B												
Resistance to Rutting and Bleeding AASHTO T 350 Measured response: Non recoverable creep compliance, J_{nr} Max J_{nr} @ 3.2kPa, 5 kPa^{-1} (low traffic)[c] Max J_{nr} @ 3.2 kPa, 1.5 kPa^{-1} (medium-high traffic)[d]	67				73				79			
Resistance to Thermal Cracking DSR Temperature Frequency Sweep Measured response: |G*| at critical phase angle, δc Max. |G*| @ δc: 16 MPa	5°C and 15°C											
	Critical phase angle, δc (°)											
	42	40	38	36	42	40	38	36	42	40	38	36

[a] Pavement surface temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, or may be provided by the specifying agency.

[b] Wet Track Abrasion Test (WTAT) should be used in accordance with ASTM D3910 to measure resistance to abrasion loss due to chemistry issues between aggregate and emulsion at the intermediate temperature grade.

[c] Low traffic is defined as any roadway with an AADT between 0 and 500 vehicles.

[d] Medium-high traffic is defined as any roadway with an AADT between 501 and 20000 vehicles.

[e] For high float emulsions only

Proposed Standard Specifications for

Performance-Graded Emulsions Used in Spray Seal Surface Treatments

AASHTO Designation: M-XX

1. SCOPE

1.1 These specifications cover the performance grading of asphalt emulsions used in constructing spray seal surface treatments.

1.2 The values stated in SI units are to be regarded as the standard.

2. REFERENCED DOCUMENTS

2.1 *AASHTO Standards:*

- M 140, Standard Specification for Emulsified Asphalt
- M 208, Standard Specification for Cationic Emulsified Asphalt
- M 316, Standard Specification for Polymer-Modified Cationic Emulsified Asphalt
- T 40, Test Method for Sampling Bituminous Materials
- T 44, Test Method for Solubility of Bituminous Materials
- TP 48, Test Method for Viscosity Determination of Asphalt Binder Using Rotational Viscometer
- T 49, Test Method for Penetration of Bituminous Materials
- T 50, Test Method for Float Test for Bituminous Materials
- T 51, Standard Specification for Ductility of Asphalt Materials
- T 53, Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
- T 59, Test Method for Emulsified Asphalts
- T 200, Test Method for pH of Aqueous Solutions with the Glass Electrode
- T 300, Test Method for Force Ductility Test of Asphalt Materials
- T 301, Test Method for Elastic Recovery Test of Asphalt Materials by Means of a Ductilometer
- T 302, Test Method for Polymer Content of Polymer-Modified Emulsified Asphalt Residue and Asphalt Binders

2.2 *ASTM Standards:*

- D5, Test Method for Penetration of Bituminous Materials
- D8, Standard Terminology Relating to Materials for Roads and Pavements

- D977, Standard Specification for Emulsified Asphalt
- D3121, Test Method for Tack of Pressure-Sensitive Adhesives by Rolling Ball
- D5546, Test Method for Solubility of Asphalt Binders in Toluene by Centrifuge

3. TERMINOLOGY

3.1 Definitions of terms common to asphalt emulsions are found in ASTM D8.

4. ORDERING INFORMATION

4.1 When ordering under these specifications, include in the purchase order the prevailing charge of emulsifying agent and setting rate (e.g., CSS, RS, SS, etc.).

5. MATERIALS AND MANUFACTURE

5.1 Asphalt emulsions shall be manufactured by the emulsification of asphalt prepared by the refining of crude petroleum using suitable methods, with or without the addition of modifiers.

5.2 Modifiers may be any organic material of suitable manufacture that is used in a virgin or recycled condition and that is dissolved, dispersed, or reacted in asphalt emulsion to enhance its performance.

5.3 The asphalt emulsion shall conform to the requirements detailed in M 140 for anionic and high float emulsions, M 208 for cationic emulsions, and M 316 for modified emulsions.

6. REQUIREMENTS

6.1 As specified in M 140, emulsified asphalt shall be tested within 14 days of delivery. The emulsified asphalt shall be homogenous after thorough mixing, provided separation has not been caused by freezing. Emulsified asphalts separated by freezing shall not be tested.

6.2 Emulsified asphalt shall conform to the requirements prescribed in Table 1.

7. SAMPLING

7.1 The material shall be sampled in accordance with T 40.

8. TEST METHODS

8.1 The properties outlined in Section 6.2 shall be determined in accordance with TP 48, ASTM D 6930, and ASTM D 3121.

9. INSPECTION AND CERTIFICATION

9.1 Inspection and certification of the material shall be agreed upon between the purchaser and the seller. Specific requirements shall be made part of the purchase contract. The seller shall provide material handling and storage procedures to the purchaser for each asphalt binder grade certified.

10. REJECTION AND RETESTING

10.1 If the results of any test do not conform to the requirements of these specifications, retesting to determine conformity must be performed as indicated in the purchase order or as otherwise agreed upon between the purchaser and the seller.

11. KEYWORDS

11.1 Asphalt binder, asphalt cement, asphalt emulsion, modifier, performance specifications, rheology, spray seal, fog seal

Table 1. Spray Seal Emulsion Specifications

Proposed Test Methods	Proposed Testing Temperature (°C)
Storage Stability Modified AASHTO T 59 Measured responses - Rotational Viscosity, η, A – 24-hour separation ratio (Rs): 0.5 to 1.5 B – 24-hour stability ratio (Rd): Max. 1.5	25
Sprayability Modified AASHTO TP 48 Measured response – Viscosity @ 3 shear rates, Max.100 cP @ high shear rate (150 rpm)	25
Resistance to Drain–Out Modified AASHTO TP 48 Measured response – Viscosity @ 3 shear rates, Min.100 cP @ low shear rate (5 rpm)	25
Curing Time to Resist Tracking Modified ASTM D 3121 Measured response: rolling distance, Time to 25 cm rolling distance	25
Demulsibility AASHTO T 59 Measured response: % demulsibility Min. 40% (anionic) Min. 60% (cationic)	25
Particle Charge AASHTO T 59 Measured response: particle charge Positive (cationic)	25
Sieve Test AASHTO T 59 Measured response: % mass Max. 0.1%	25
Solubility AASHTO T 44 Measured response: % solubility Min. 97.5%	25
Float[b] AASHTO T 50 Measured response: float time Min. 1200 seconds	60
Percent Residue AASHTO PP 72 Measured response: % residue Min. 55%	25