Asphalt Emulsions in Pavement Preservation

ETF Lessons & Status

Colin A. Franco, P.E.
Rhode Island DOT

AASHTO TSP2 ETF
Graduate Providence
Providence, RI
October 24, 2023
Pavement Preservation
AASHTO Emulsion Task Force (ETF)

- An AASHTO TSP-2 sponsored program
- It is an all-volunteer stake holder working group
- 2008-Originally part of the FHWA Pavement Preservation Expert Task Group (ETG)
ETF is part of AASHTO TSP2

9 Regional Bridge & Pavement Preservation Partnerships
ETF – Original Mandate

A. Develop Performance Based Stds and Specifications for Emulsions (EAPG)

1) Develop a Surface Performance Grade Specification for Emulsion Binders (EAPG)

2) Develop Performance Based Specifications for Emulsion Treatments in AASHTO Format
   - Materials (M) - Specifications and Tests
   - Materials (R) - Design Practices
   - Construction - Guide Specs
   - QA Specifications
ETF – Original Mandate (Cont.)

B. Encourage Adoption of Uniform National Standards by DOTs/Local Agencies

1) AASHTO -
   - TSP·2 Regional Partnerships
   - Committee on Materials and Pavements
   - Committee on Maintenance

2) FHWA – Pavement Preservation ETG

3) TRB (Webinars)

4) FP2-Industry / Academia (Workshops & Webinars)
ETF Members

**States**
- Illinois DOT
- Minnesota DOT
- Montana DOT
- Ohio DOT
- Oregon DOT
- Rhode Island DOT

**Academia**
- Chico State University
- Colorado State U.
- NCAT
- Texas A&M University
- University of Texas
  - FHWA
- Direct Federal Lands
  - Highway Division

**Producers**
- Asphalt Materials
- Associated Asphalt
- Ergon
- Flint Hills Resource
- Husky Energy
- Kraton Polymers
- Marathon Petroleum
- MTE Services

**Testing Labs**
- Heritage
- MTE Services
- PRI Asphalt

**AASHTO**
- AASHTO Re:source

**TSP·2**
- NCPP
ETF Members

Associations

- Asphalt Institute
- Asphalt Emulsion Manufacturers Association
- Asphalt Reclaiming and Recycling Association
- FP² (Foundation for Pavement Preservation)
- International Slurry Surfacing Association

Total ETF Members  = 32
Total ETF Friends   = 31
ETF - Original Organization-2008

- AASHTO TSP·2
- ETF Co-Chairs
  - Colin Franco, RIDOT
  - Chris Lubbers, Kraton Polymers
- Admin-NCPP
  - Larry Galehouse

Subcommittees:
- Residue Recovery and Testing- Arlis K
- Spray & Mix Treatments-Jim M & Gary H
- Certification & Quality Assurance-Larry G & Colin F
- Recycling Emulsion- Steve C
- Messaging & Implementation- Larry T
- Rejuvenators- Hassan T
- Research- Darren H

*Special Working Group (SWG)
EAPG Grading- MikeV

Reorganized in 2019
ETF - Reorganization

AASHTO TSP·2

ETF Co-Chairs
Kelly Morse, IIDOT
Chris Lubbers, Kraton Polymers

Admin-NCPP – B. Choubane

Subcommittees

- Emulsion Treatments – Morse/Walbeck
- Quality Assurance, Education- Certification – Tito/Biehl
- Messaging & Implementation – Tomkins/Brewster
- Research – Hazlett/Braham
- Emulsion Binders – Voth/Lubbers
ETF Subcommittee Tasks

ETF Co-Chairs
Kelly Morse
Chris Lubbers

NCPP Administrator
B. Choubane

#1 Emulsion Treatments
Construction Guides and AASHTO Standards
Best Practices
Test Methods

#2 QA. Education, and Certification
QA Treatments Guides Working
-Education Course Development for Treatment -Training
Certification

#3 Messaging & Implementation
Messaging
Outreach
Training Delivery
Demonstration Proj.

#4 Research
Materials
Equipment
Cood. with Lee Rd & Mn Rd P.R. Research

#5 Emulsion Binders
Rejuvenator
Modifiers
ETF Subcommittee Tasks – Emulsion Treatments

## Immediate Needs

1) Complete construction guides specs for rest of Emulsion treatments

2) Develop Best Practices documents for each treatment

3) Identify new test methods that focus on performance
ETF Subcommittee Tasks – QA Education & Certification

Immediate Needs

1) Develop QA guides for remaining treatments

2) Use Best Practices document to develop training, syllabus, and media

3) Promote the need for national certification for emulsion treatments
ETF Subcommittee Tasks – Messaging & Implementation

#3 Messaging & Implementation

1) Direct support of NCHRP 20-44(26) – Implementation Project

2) Initiate training on new AASHTO Standards

3) Develop a ‘Primer’ for the implementation of all emulsion treatment standards.
# ETF Subcommittee Tasks - Research

<table>
<thead>
<tr>
<th>#4 Research</th>
<th>Materials</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Liase With Lee Rd &amp; Mn Rd P.R. Research</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Immediate Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Develop RNS for NCHRP - Review the TSP research roadmap on the NCPP website</td>
</tr>
<tr>
<td>2) Review pavement preservation related research that has been completed within the last 5 years (TRIS/TRID)</td>
</tr>
<tr>
<td>3) Review needs and enhancements for PP construction equipment and pavement condition assessment vehicles</td>
</tr>
<tr>
<td>4) Coord. With Mn Rd and Lee Rd (NCAT Research) on PP research.</td>
</tr>
</tbody>
</table>
ETF Subcommittee Tasks - Binders

Immediate Needs

1) Assist AASHTO Comp with MI40, M208, M316

2) Support of NCHRP 9-63 emulsion EAPG spec

3) Develop specific outcomes expected for NCHRP 10-114 (Rejuvenators) for all mix and surface spray applied petroleum and non-petroleum rejuvenators
Accomplishments-NCHRP Research Projects

ETF- RESEARCH INITIATIVES

A. NCHRP – Ongoing/Completed/ New research projects submitted by ETF

1. NCHRP 14-37, Construction guide specs for Chip seal, Micro Surfacing and Fog seal. (Shuler Consultants; Completed 7-13-2018)
2. NCHRP 20-50(18), CIR, FDR and CCPR reclamation specifications and test methods.
3. NCHRP 9-62, Rapid Test and Specifications for Construction of Asphalt Treated Cold Recycled pavements (VTRC; Completed 8-31-2022)
4. NCHRP 9-63, Performance Grade Specification (EPG) for Emulsion Binders. (Asphalt Institute; Estimated Completion 3-20-2027)
5. NCHRP 14-43, Construction Guide Specs for CIR (NCAT; Completed 8-31-2022)
6. NCHRP 14-44, Guide Specifications for the Construction of Slurry Seals, Scrub Seals, and Tack Coats; (University of Arkansas, Completed 3-1-2022)
7. NCHRP 20-44(26), Implementing Guide Specifications for Construction of Chip seals and Micro Surfacing (NCPP; Estimated Completion 9-23-2023)
8. NCHRP 10-114, Performance and Safety Specs for Rejuvenating Seals (Auburn University, In Progress)
9. NCHRP 10-124, Development of Field Test to determine Actual Percent Embedment of Chip Seal Aggregate (Auburn University, In Progress)
10. NCHRP 10-134, Performance Based Test for Asphalt Emulsion Treatments for Agency Acceptance and Incentive Programs NEW

B. Special Research Project: Testing of Asphalt Emulsion was conducted by several Emulsion Labs to Calibrate/validate certain tenets of the EAPG specification. This effort was coordinated by the Asphalt Institute and funded by Husky Asphalt of Canada.

Colin Franco & Darren Hazlett

Updated Oct. 2023
# Accomplishments – Emulsion Treatment Standards

**Status:** AASHTO Emulsion STDs (2023)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chip Seal</td>
<td>M340</td>
<td></td>
<td>R102</td>
<td>NCHRP 14-37</td>
<td>Published</td>
<td>Section 406</td>
<td></td>
</tr>
<tr>
<td>Micro Surfacing</td>
<td>M341</td>
<td></td>
<td>R103</td>
<td>NCHRP 14-37</td>
<td>Published</td>
<td>Section 408</td>
<td></td>
</tr>
<tr>
<td>Tack Coat</td>
<td>M349</td>
<td></td>
<td>R112</td>
<td>NCHRP 14-44</td>
<td></td>
<td>Section 404</td>
<td>5b COMP</td>
</tr>
<tr>
<td>Fog Seal</td>
<td>M343</td>
<td></td>
<td>R105</td>
<td>NCHRP 14-37</td>
<td>Published</td>
<td>Section 410</td>
<td></td>
</tr>
<tr>
<td>Asphalt Rejuvenators</td>
<td></td>
<td></td>
<td></td>
<td>NCHRP 10-114</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scrub Seal</td>
<td>M345</td>
<td></td>
<td>R107</td>
<td>NCHRP 14-44</td>
<td></td>
<td></td>
<td>5b COMP</td>
</tr>
<tr>
<td>Sand Seal</td>
<td>M344</td>
<td></td>
<td>R106</td>
<td>NCHRP 14-48</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slurry Seal</td>
<td>M342</td>
<td></td>
<td>R104</td>
<td>NCHRP 14-44</td>
<td>Published</td>
<td></td>
<td>5b COMP</td>
</tr>
<tr>
<td>Cold Recycled Mixtures with Foamed Asphalt</td>
<td>MP38</td>
<td></td>
<td>PP94</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ultrathin Bonded Wearing Course</td>
<td>M346</td>
<td></td>
<td>R108</td>
<td>NCHRP 14-48</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cold Recycled Mixtures with Emulsified Asphalt</td>
<td>MP31</td>
<td></td>
<td>PP86</td>
<td>NCHRP 9-62 NCHRP 14-43</td>
<td>Published</td>
<td>Section 411</td>
<td>5b COMP</td>
</tr>
<tr>
<td>Emulsified Asphalt</td>
<td>M140-16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cationic Emulsified Asphalt</td>
<td>M208-16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polymer-Modified Cationic Emulsified Asphalt</td>
<td>M316-16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emulsion/Surface Performance Grades (E/SPG)</td>
<td></td>
<td></td>
<td></td>
<td>NCHRP.9-63</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The ETF Special Working Group (M. Voth) developed a draft Emulsified Asphalt Performance Grade (EAPG) specification.
- Based on work by Drs. A Epps, Texas A&M and R Kim, NC State.

This draft was the basis for project NCHRP 9-63, “A Calibrated and Validated National Performance-Related Specification for Emulsified Asphalt Binder”.
- PI is the Asphalt Institute & NCAT.
- The project will formally validate the EAPG specification.
Accomplishments - EAPG Draft Specification

<table>
<thead>
<tr>
<th>Table 1 - Performance Graded Emulsified Asphalt Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Grade</td>
</tr>
<tr>
<td>--------------------</td>
</tr>
<tr>
<td>Average 7-day max</td>
</tr>
<tr>
<td>pavement surface</td>
</tr>
<tr>
<td>design temperature,</td>
</tr>
<tr>
<td>°C</td>
</tr>
<tr>
<td>Min pavement</td>
</tr>
<tr>
<td>surface design</td>
</tr>
<tr>
<td>temperature, °C</td>
</tr>
<tr>
<td>Dynamic shear, T 315:</td>
</tr>
<tr>
<td>G*sinδ, min 0.65 kPa, test temp @ 10 rad/s, °C</td>
</tr>
<tr>
<td>Critical phase angle, δc, degree</td>
</tr>
<tr>
<td>DSR Temperature Frequency Sweep, NCHRP Report 837</td>
</tr>
<tr>
<td>Low* traffic max G* at δc, MPa</td>
</tr>
<tr>
<td>High* traffic max G* at δc, MPa</td>
</tr>
<tr>
<td>Max. phase angle(c) @ temp where G*sin δ = 0.65 kPa</td>
</tr>
</tbody>
</table>

Tests on Residue Recovered Using AASHTO R 78, Procedure B

- Temperatures are at the surface of the pavement structure. These may be determined from experience or may be estimated using equations developed by SHRP or LTPP, but modified to represent surface temperatures. Surface-grade high temperatures are generally 3°C to 4°C greater than those determined for Superpave PG binders.
- Low traffic is defined as any roadway with an AADT between 0 and 1000 vehicles.
- High traffic is defined as any roadway with an AADT between 1001 and 20,000 vehicles.
- Phase angle is determined at the temperature where G*sin δ = 0.65 kPa. For routine testing and quality assurance, the phase angle can be interpolated from testing at two temperatures, one above and one below where G*sin δ = 0.65 kPa.
- If required by the buyer, change to 80° for SHS/SS modified emulsions.
Looking Ahead

Remaining Work

1. Keep progressing the state of the Science in Emulsion Technology through Research to create new and better Emulsion Products.

2. Encourage state DOTs and local agencies to use the new PP AASHTO Standards for Emulsion Treatments:-
   - Pavement Preservation Materials AASHTO Standards
   - Construction Guides and Quality Assurance Standards
   - New Test Methods
Remaining Work (Cont.)

3. Work with state DOTs and local agencies to host demonstration projects where treatments are constructed using the new AASHTO specifications.
   
   [ NCHRP Project 20-44(26) ]

4. Develop New ‘Performance related’ tests to support the new Emulsion Treatment standards
ETF- Future Considerations (1)

1) Emulsion Surface Treatments -Surface Functional Characteristics:

Take a Look at the surface Characteristic (positive and Negative) of all Emulsion Treatments and how they can be utilized and/or improved. Characteristics such as:

a) Friction – this directly affects safety- improving friction numbers and slowing friction loss
b) Ride Quality- Smoothness which includes mitigating wash boarding, delamination’s, and shelling
c) Noise- Internal to the vehicle
d) Sealing of Pavements – especially smaller cracks < 1/8 inch
e) Visual – Improve overall pavement visibility especially nighttime/wet condition visibility
f) Spray/splash reduction under wet conditions.
g) Pavement marking compatibility
h) Aging protection and mitigation for HMA pavements
ETF- Future Considerations (2)

2) Progressing the state of the Science.
   a) Good Adhesion with substrate (Asphalt or concrete)
   b) Additives to enhance properties that effect performance and durability
   c) Improved adhesion for aggregate in emulsion mixes - Agg Pretreatment?
   d) Reliable predictability/control for Emulsion breaks/set
   e) Performance tests for Emulsion Treatments
   f) Modernize Construction equipment (Sensors) to better control and apply the treatments
ETF- Future Considerations (3)

3) Special Non-Traditional Uses for Asphalt Emulsions.
   a) Surfacing of Concrete roads to reduce noise and joint rideability
   b) Surfacing for concrete bridge decks to ‘flex” seal cracks, stop corrosion.
   c) Light Weight solution for Bridge deck overlays/Suspension Bridges
   d) Bike paths preservation treatments.
ETF – Closing Thoughts

MOVING FWD ON IMPLEMENTATION OF EMULSION TREATMENTS:

- **The growth of emulsion use** is still in the early stages though it is encouraging to see that more agencies are beginning to use these treatments. To expand the use of Emulsions Treatments there must be a concerted, continuing and relentless effort by all stakeholders to work together and partner to achieve this end.

- **Partnering** between FHWA, AASHTO, AWPA, Industry (FP2) and Academia will be critical. The message to be broadcasted, is that Emulsions treatments have progressed to the point that they – Perform well; Have QA standards that ensure Quality job; Construction operations/ applications are expeditious; are cost effective, and environmentally friendly.

- **Quality Assurance** plays a huge part in the successful placement of a treatment. This builds credibility and confidence in getting owners to use these treatments, with training and certification being the cornerstones of the QA effort.
Questions