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TRB TRANSPORTATION RESEARCH BOARD

TRB Webinar: Guide Specifications—Constructing Slurry Seals, Scrub Seals, and Tack Coats

April 19, 2023

2:30 – 4:00 PM

NOVEMBER 2022 UPDATE

PDH Certification Information

1.5 Professional Development Hours (PDH) – see follow-up email

You must attend the entire webinar.

Questions? Contact Andie Pitchford at TRBwebinar@nas.edu

The Transportation Research Board has met the standards and requirements of the Registered Continuing Education Program. Credit earned on completion of this program will be reported to RCEP at RCEP.net. A certificate of completion will be issued to each participant. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the RCEP.

ENGINEERING



REGISTERED CONTINUING EDUCATION PROGRAM

Purpose Statement

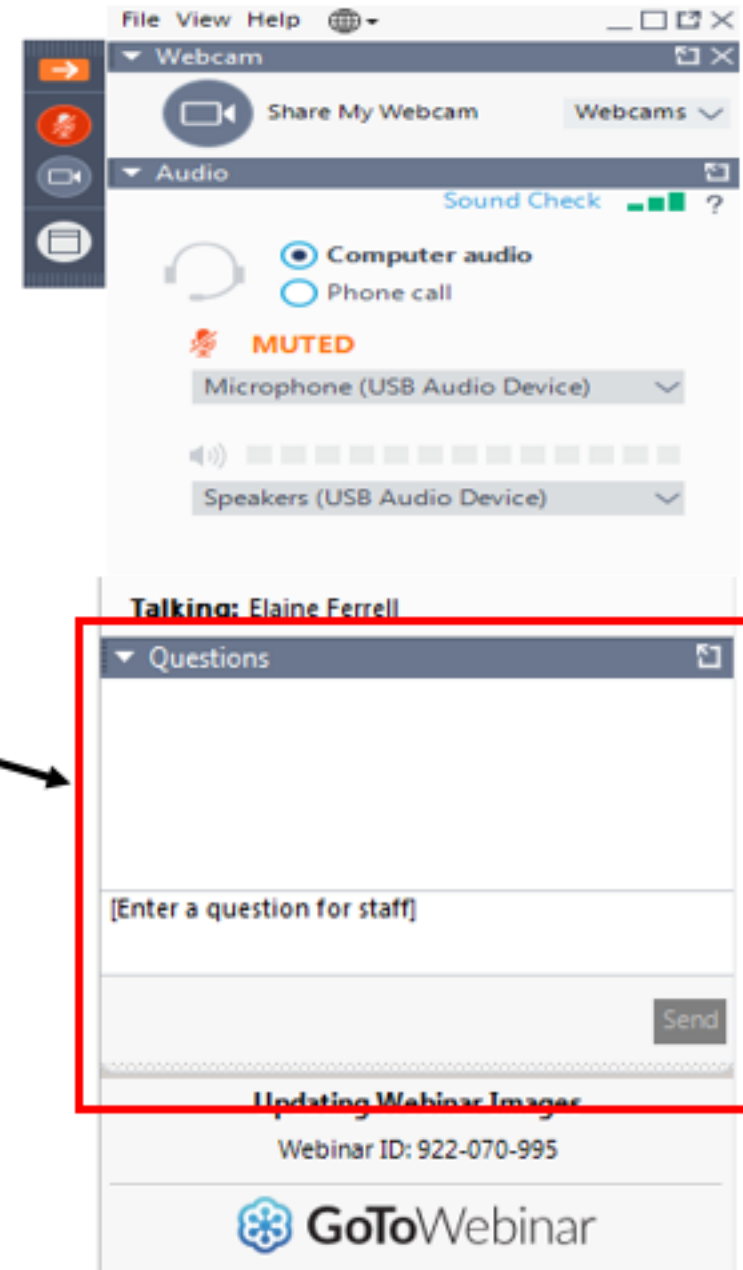
This webinar will present findings from a recent study and construction guide specifications that have been developed to help agencies fill gaps in existing construction specifications. The construction guides that will be shared by the presenters are currently in review by the AASHTO Committee on Materials and Pavements.

Learning Objectives

- (1) Identify factors important to the construction of slurry seals, scrub seals, and tack coats
- (2) Share recent advancements in the construction of slurry seals, scrub seals, and tack coats
- (3) Plan for gaps based on experiences in the construction of slurry seals, scrub seals, and tack coats

Questions and Answers

- Please type your questions into your webinar control panel
- We will read your questions out loud, and answer as many as time allows



Today's presenters



Dr. Ding Cheng
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Dr. R. Gary Hicks
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Dr. Andrew Braham
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NCHRP Project 14-44

Guide Specifications for the Construction of Slurry Seals

TRB Webinar, April 19, 2023

230-400pm, EST

R. Gary Hicks, PhD, P.E. (AK, CA, OR)

Agenda



Background



Research Effort



Construction Guide Specification Development



Implementation

Research Effort

- **Traditional Literature Review**
- **Survey of agencies**
 - **18 States with Slurry Seal Specs**
 - **Used by many local Governments**




Survey of State DOTs

- ▶ Short Internet Questionnaire to All 50 States
 - ▶ Maintenance and Construction Engineers
 - ▶ Most States Responded



Survey results: slurry seal

- ▶ About 25% of state agencies routinely use slurry seals
- ▶ Common challenges: adjusting mix design or application rates during the day (38%), durability (38%), workmanship (71%), cleanliness of existing surface (50%)
- ▶ Typical problems: delamination (65%), shedding (52%), flushing (44%)
- ▶ Majority of states
 - ▶ Follow external procedures for design
 - ▶ Use a method specification
 - ▶ Have existing construction guide specifications
 - ▶ Do not have quality assurance tests



Key slurry seal points of interest

- Surface preparation
 - Best practices
 - Crack sealing details
 - Tack coat if required by agency
- Method of payment
 - Use weight
- Performance issues
 - Root causes of early raveling and shedding
 - Key workmanship tasks



Construction Guide Specification

Guide Specification

- ▶ Balloted through AASHTO COMP 5b – Pavement Preservation
- ▶ Review and assistance from the TSP 2 Emulsion Task Force
- ▶ Remaining actions are primarily editorial
- ▶ Final vote scheduled for summer 2023

Section 4XX

Construction Guide Specification for Slurry Seal

4XX.1.

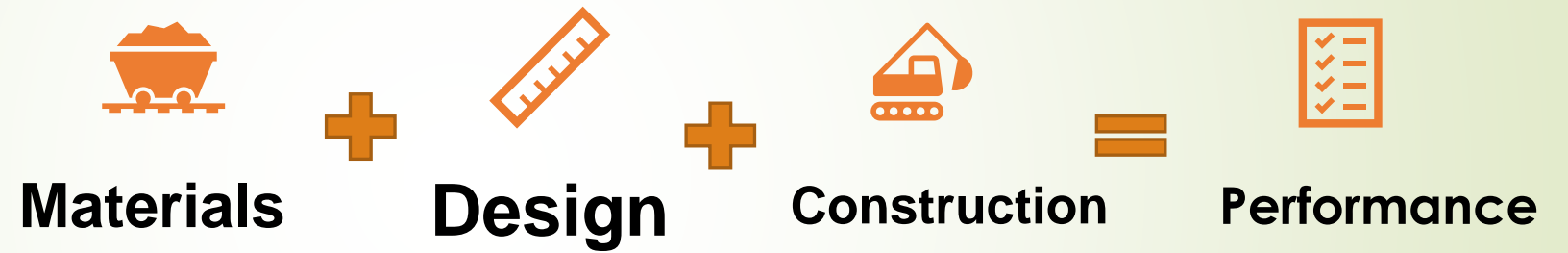
DESCRIPTION

This guide specification is intended to provide information needed for owners or contractors to construct slurry seal. A slurry seal is the application of a mixture containing and emulsified asphalt (neat or polymer modified), mineral aggregate, mineral filler, water, and other additives that are properly proportioned, mixed, and spread on a paved surface. The slurry seal shall be constructed on a prepared surface.

This guide specification refers to quality requirements for materials and a design method for slurry seals available in other AASHTO documents. However, the main purpose of this specification is to provide guidance for the construction of a slurry seal.

Commentaries are included in this Guide specification to 1) emphasize and further explain this section, 2) present options to be considered by the user, or 3) provide sources of additional information. **Both English and SI units are included in this guide**

Guide Specification



Materials - MP 32

<http://tsp2-etf.org/specs-checklists/specifications/>





REQUIRED

Mix Design – PP 87

<http://tsp2-etf.org/specs-checklists/specifications/>

Mix Design Tests

Mix Time

Cohesion for Set and Traffic

Consistency

Wet Stripping

Wet Track Abrasion- 1 hour

Excess Asphalt LWT for Bleeding



Construction

Weather Requirements

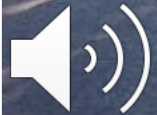




Pre-Construction Meeting

- The construction process
- The quality control plan
- Mix design
- Materials
- Material measurement
- Equipment calibration
- Traffic control plan
- Equipment and process overview
- Inspection
- Test strip
- Any unique project conditions
- Project documentation
- Expectations
- Schedule

Construction – Surface Prep



Application Equipment

Continuous Run Machine



Truck Mounted Unit



Application Equipment – Spreader Boxes



No Augers Required for Slurry seals



Augers Required For Micros



Calibration

- ▶ Each machine should be calibrated with the aggregate and emulsion to be used.
- ▶ The name of the person who carried out calibration and documentation should be provided.

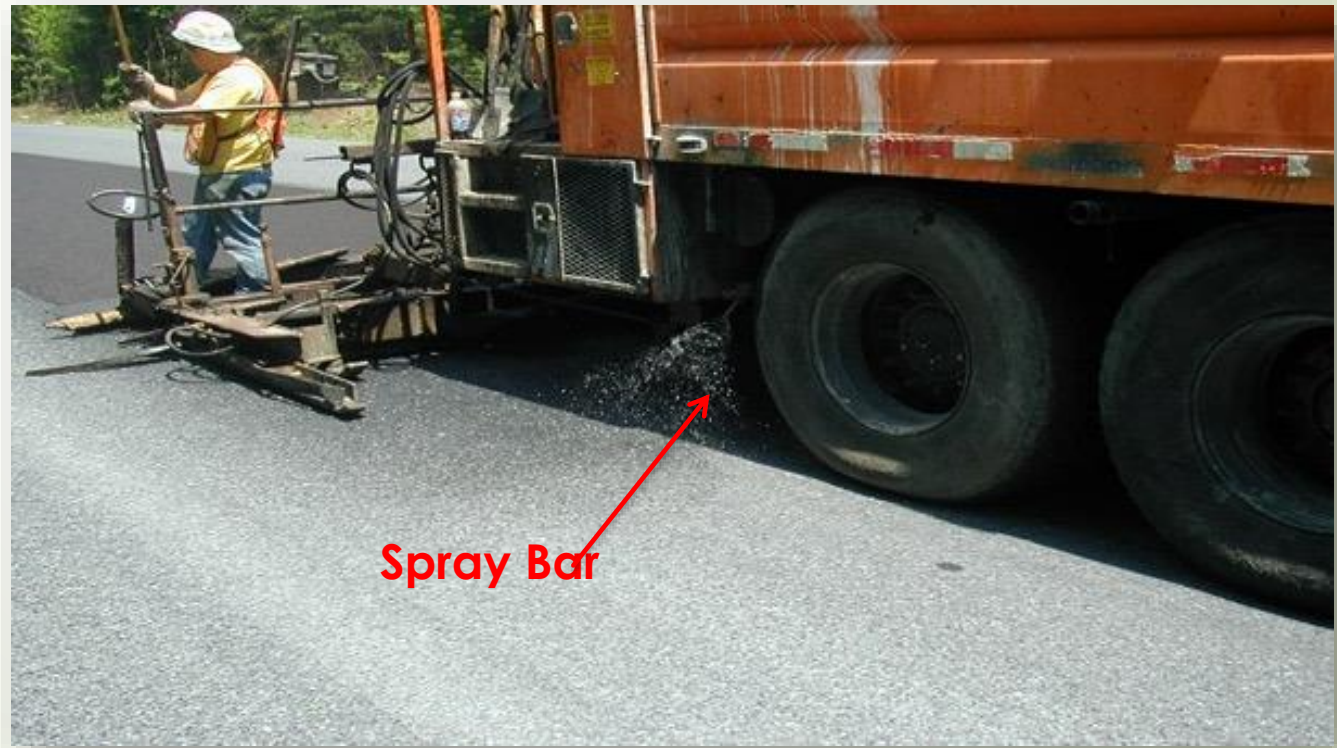
Test Strip

- Evaluation Items include:
 - Proportion optimization
 - Application rate verification
 - Uniformity of surface texture
 - Equipment in good condition
 - Adequate workforce
 - Cure Time
 - Workmanship
 - Proper alignment



Application of Mixture

- Fogging
- Handwork
- Rolling, if needed



Application – Workmanship

Joints

- Longitudinal
- Transverse
- Intersections

Edge Lines

Handwork

Drag Marks



Traffic Control

- ▶ Shall conform to the requirements of the Manual on Uniform Traffic Control Devices (MUTCD)
- ▶ Traffic control devices shall be in accordance with State and local requirements

Application – Project Documentation

- Aggregate used
- Emulsified asphalt used
- Mineral filler used
- Water used
- Additive used
- Surface area completed
- Surface area application rate
- Percentage of emulsified asphalt



Quality Control

Personnel –

- QC Manager – responsible for development and implementation of the Quality Control Plan
- QC Technicians – responsible for sampling and executing QCP
- Certified Crew Members

Testing Facilities and Equipment

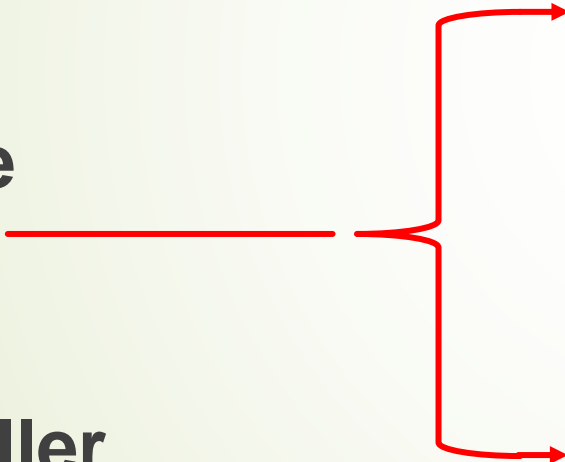
- Lab for testing of both emulsions and aggregates

Measurement/Payment

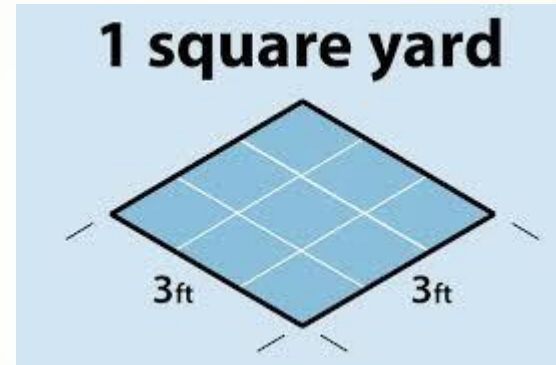
Emulsified Asphalt



Aggregate



Mineral Filler



Critical Keys to Success

Assure materials specification are met

Follow a properly prepared mix design

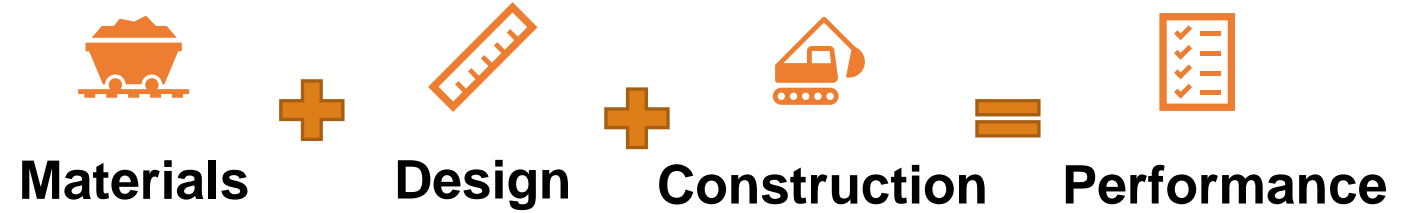
Perform calibration

Communication is a must

Incorporate a QA/QC program into spec

Trained (certified) inspector & contractor staff **Agencies get what they inspect.**

Summary





Performance!

Thank you, Any Questions

- R. Gary Hicks PhD, P.E.
- 530-588-4446
- rghicks40@outlook.com

NCHRP Project 14-44

Guide Specifications for the
Construction of Scrub Seals

by

DingXin (Ding) Cheng, Ph.D., P.E.

Director, CP2 Center

Professor, California State University, Chico

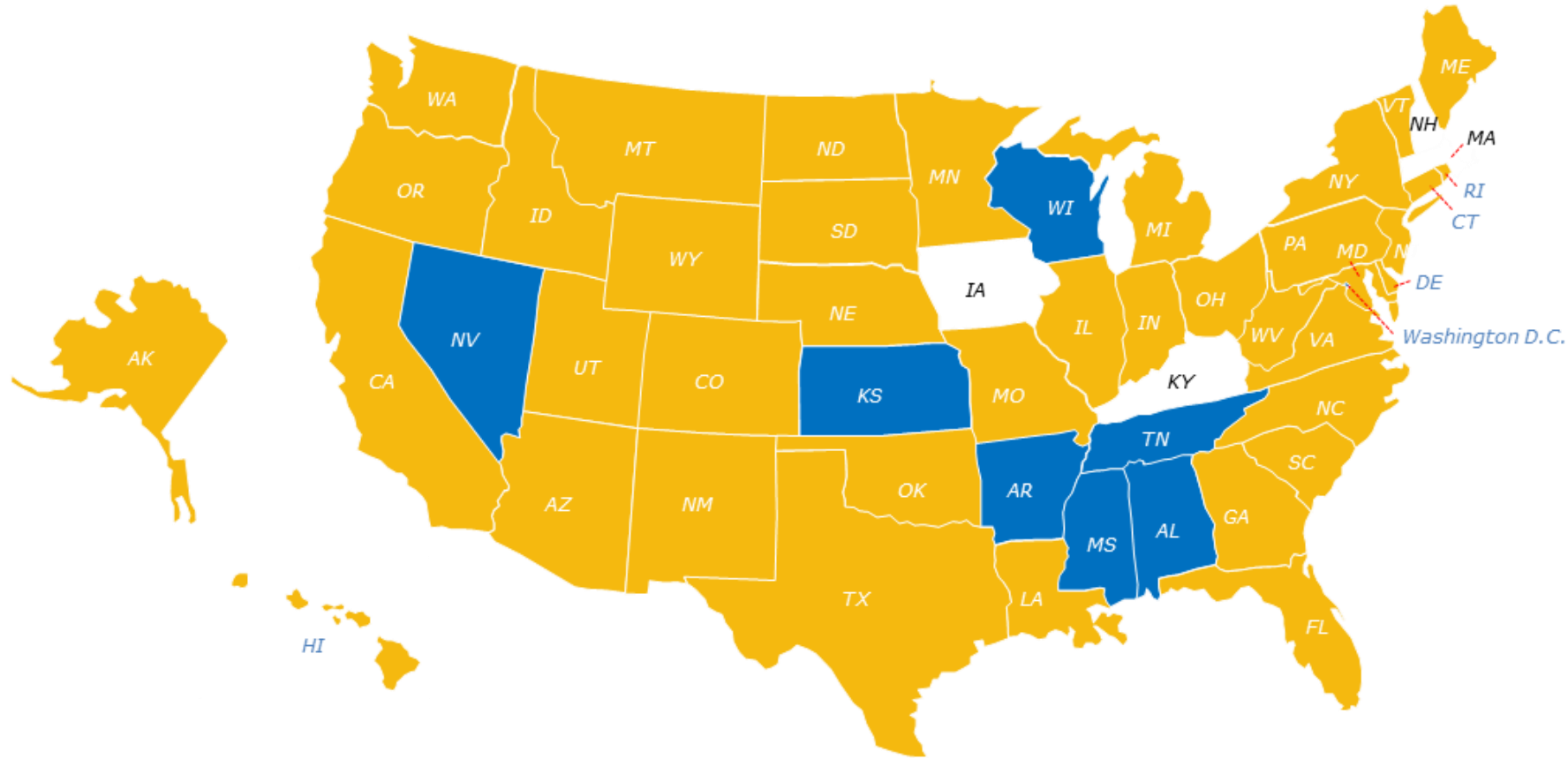
TRB Webinar, April 19, 2023



Research effort

- ▶ Traditional literature review
- ▶ Survey of states
 - ▶ 9 States with Scrub Seal specifications
 - ▶ Slightly different products used between the different areas
 - ▶ Guide development - an iterative approach

Routine scrub seal states



Use scrub seals

Do not use scrub seals

White did not participate

Note: many local agencies use scrub seals

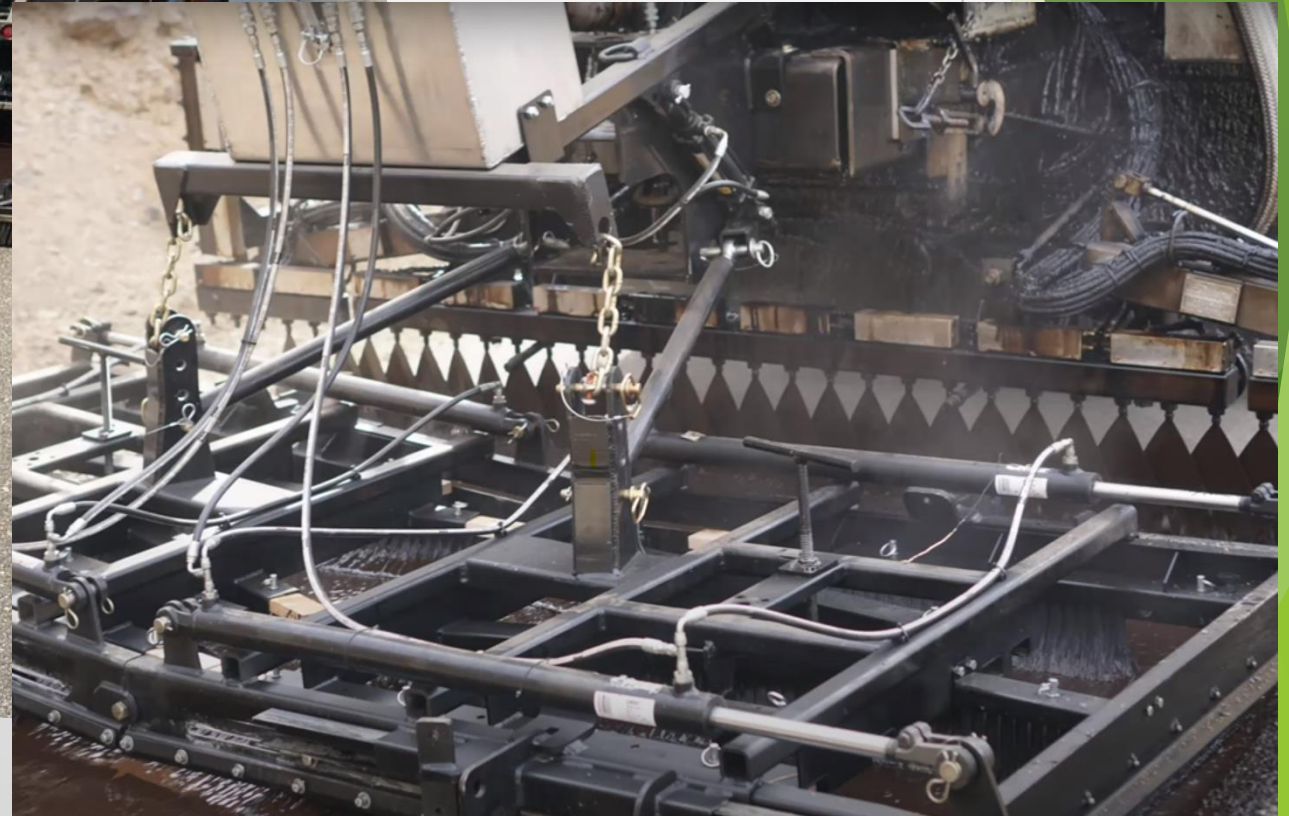
Survey results: scrub seal

- ▶ About 15% of state agencies routinely use scrub seals
- ▶ Common challenge: adjusting emulsion application rate in field (73%), functioning broom (40%)
- ▶ Problem: rock loss (54%), bleeding (39%)
- ▶ All states used polymer modified rejuvenating emulsion
- ▶ No states had quality assurance field test
- ▶ Majority states
 - ▶ Use experience for application rate
 - ▶ Did not have existing construction guide specifications

Key scrub seal points of interest

- ▶ Surface preparation
 - ▶ Best practices
 - ▶ Crack sealing required for cracks wider than ½ in
- ▶ Method of payment
 - ▶ Use area (not weight)
- ▶ Performance issues
 - ▶ Prefilling/presealing cracks
 - ▶ Changing application rate based on existing distresses
 - ▶ Broom operation best practices

Construction Guides





- ▶ Description
- ▶ Material
- ▶ Construction
- ▶ Measurement
- ▶ Payment

AASHTO Outline for construction guide specifications

Materials

- ▶ Emulsified asphalt
- ▶ Aggregates





Equipment



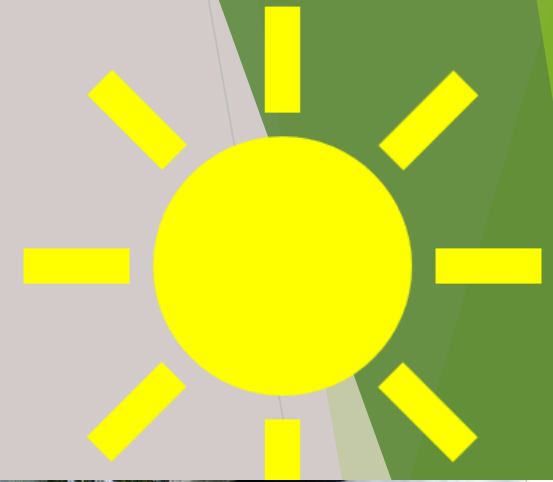
- ▶ Similar project placement conditions:
 - ▶ Time of day
 - ▶ Temperature
 - ▶ Humidity

Construction of test strip

Construction

➤ Weather

- 50°F and rising
- Suspend when pavement exceeds 140°F
- During daylight or night hours?
- Surface shall be dry



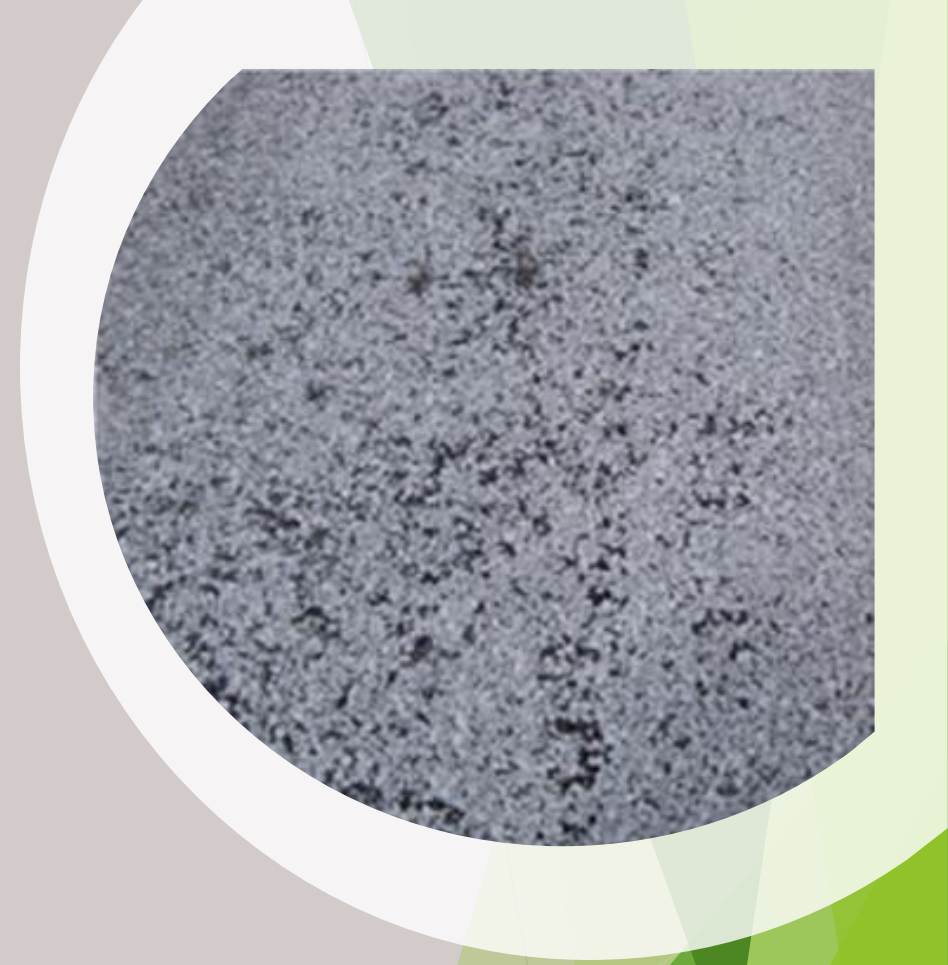


Construction

- Binder Application
 - Should be at specified temperature
 - Binder placed within $\pm 5\%$ of the design rate
 - Some binder should be visible through the chips (salt and pepper look)
 - Binder should not be sticking to the tire rollers
 - Adjustments may be necessary in the field

Construction

- Aggregate Application
 - Aggregate shall be moist
 - Shall be similar to design rate



Construction

- Transverse Joints - A roofing felt or heavy construction paper joint shall be used so excess asphalt and chips are not placed at the joint.



Construction

- Rolling
 - First pass of rollers must be within 2 minutes of applying aggregate.
 - Roller speed, 3MPH or less
 - Three complete passes
 - Position rollers so entire width of chip sealed surface is covered
 - If desired, a steel wheel roller can be used for final pass




Construction

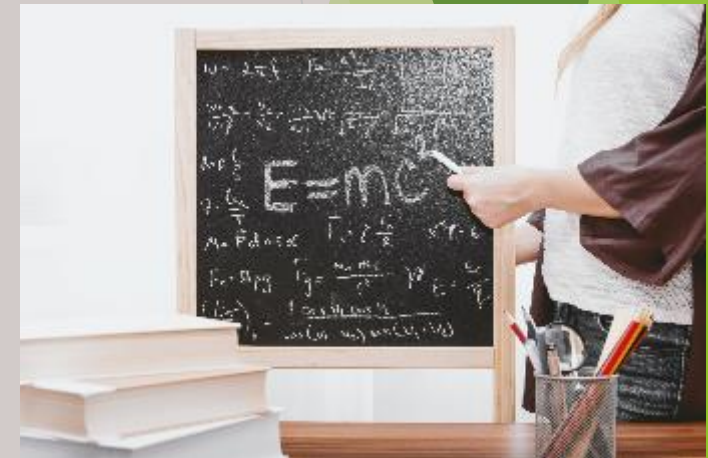
Sweeping

- When-as soon as possible
- How-with vacuum or kick brooms
- Why-to prevent flying rock



Measurement/Payment

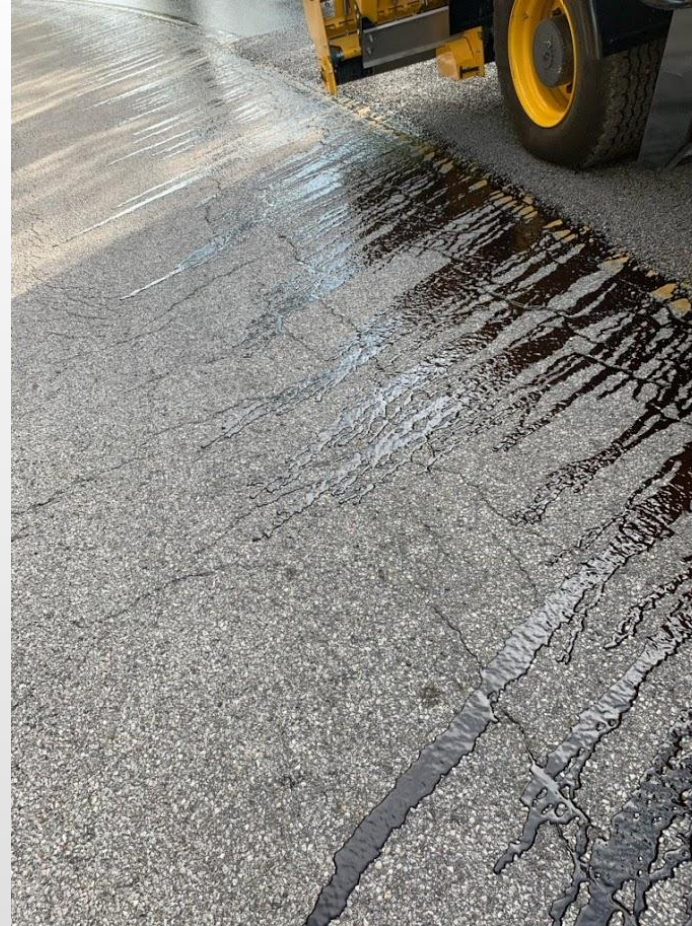
- Measurement 
 - Binder - by volume at 60°F
 - Aggregate - Aggregate(tons),
- Payment
- Unit costs or total area covered?
 - Unit cost - Binder(gal), Fog seal(gal)
 - Total area covered - aggregates(yd²)



JESHOTS.com

- ▶ Incorporate a QA program
- ▶ Developed for Emulsion Chip Seal

Critical Key to
Success



Emulsion Chip Seal Quality Assurance Guide

Description: Chip Seal

Emulsion Chip Seal is an application of an emulsified asphalt binder covered with an application of clean graded aggregate to an existing asphalt surface. The emulsified asphalt binders may be modified with various polymers such as latex, tire and natural rubbers. Aggregate must be durable consisting of crushed stone, gravels, or manufactured aggregates varying in size from 3/8 inch to a minimum of 1/4 inch.

Quality Assurance (QA)

AASHTO R 10 provides standard definitions for terms used in quality assurance procedures.

QA is defined as all those planned and systematic actions taken by the Agency and Contractor to provide the necessary confidence that the procured material and workmanship will satisfy the quality requirements of the contract.

QA includes Quality Control (QC), Acceptance and Independent Assurance (IA).

QC is the system used by the Contractor/Inspector to assess and adjust production and placement processes to ensure that the material and workmanship will meet the specified quality. QC is the responsibility of the Contractor.

Acceptance is the system used by the Agency/ Engineer to measure the degree of compliance of the quality of the material and workmanship with the Contract requirements. Acceptance is


517-432-8220 | ncpp@egr.msu.edu





TSP2 Emulsion Task Force

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|---|---|--|---|
|  |  |  |  |
| Tampa Meeting [13 Dec 2016] | Wilmington Meeting [29 Nov 2017] | Indianapolis Meeting [28 Nov 2018] | Indianapolis Meeting [12 Jun 2019] |

Status of Scrub Seal Construction Guide

Latest draft can be found at [https://www.pavementpreservation.org/wp-content/uploads/ETF/Specifications/Finals/407_Hot%20Applied%20Chip%20Seal%209-4-20%20\(V-3\).pdf](https://www.pavementpreservation.org/wp-content/uploads/ETF/Specifications/Finals/407_Hot%20Applied%20Chip%20Seal%209-4-20%20(V-3).pdf)



What we expect- Good, Finished, & Striped

- ▶ Thank you!
- ▶ Contact Ding Cheng
- ▶ Email: dxcheng@csuchico.edu



SR 162 June Lake, CA

NCHRP Project 14-44

Guide Specifications for the Construction of Tack Coats for Pavement Preservation Treatments

TRB Webinar: Guide Specifications

April 19, 2023

Andrew Braham, Ph.D., P.E.

University of Arkansas - Fayetteville

Tack coats

for pavement preservation treatments including:

- Slurry seal
- Micro surfacing
- Ultra Thin Bonded Wearing Course
- Thin overlays (<1.5 in)

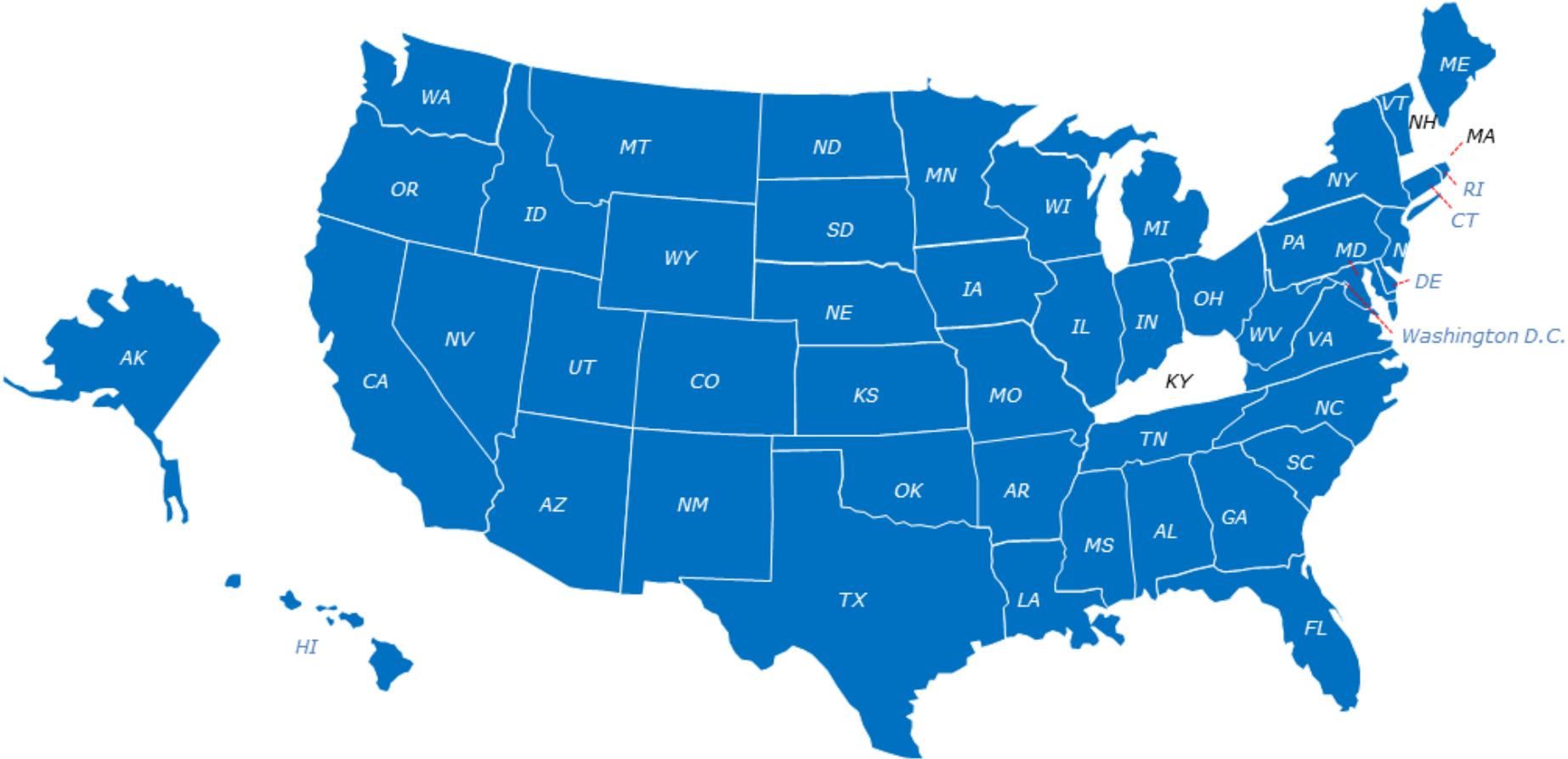


(from RoadResource.org)

The first steps

- Traditional literature review
 - TRB Transportation Research Innovation Documentation database (TRID)
 - FHWA information resources
 - State and regional transportation agencies
 - Industry organizations
 - Academic institutions
 - Military departments
 - International sources
- Survey of states
 - Sent to AASHTO COMP members and state TRB representatives
 - 47/50 states responded

Routinely use tack coat (100%)



Use tack coats

White did not respond

Survey results: tack coat

- 100% of state agencies routinely use tack coats
- Common challenges: clean existing surface (72%), even application distribution (83%), tracking (87%)
- Largest problems: delamination (69%), tracking (71%)
- Materials used
 - 94%: neat conventional emulsified asphalt
 - 50%: polymer modified, reduced tracking emulsified asphalt
 - 24%: hot applied asphalt binder
- Use: slurry (18%), micro (38%), UTBWC (40%), thin overlay (78%)
- Majority of states
 - Had changes for materials and design practices since 2018 (previous NCHRP survey)
 - Have existing construction guide specifications

Key tack coat points of interest: 1 of 2

- Materials
 - Polymer modified versus neat base asphalt binder
 - Minimum residual asphalt content
 - Discussion of reduced tracking tack material options
 - Updating allowable materials for each state
- Application rates
 - Identify design procedures
 - Consideration of existing pavement, environment, preservation treatment
 - Dilution practices
 - Field adjustments

Key tack coat points of interest: 2 of 2

- Equipment
 - Calibration of emulsion and hot applied distributors
 - Proper use of spray wand, including locations
 - Areas of focus during placement of test strip
- Surface preparation
 - Best practices
 - Existing moisture on pavement (emulsion – damp or dry; hot applied – dry)
- Method of payment
 - Use gallons
- Performance issues
 - Root causes of tracking
 - Minimize bonding issues

Construction guide specification



(from RoadResource.org)

Tack coat for
pavement
preservation
treatments

Section 4ZZ

Construction Guide Specification for Tack Coats for Pavement Preservation Treatments

- Sections of high interest
 - Section 4: Materials
 - Section 5: Construction
 - Section 6: Measurement
 - Section 7: Payment
- Other sections (Sections 1-3)
 - Description, reference documents, terminology

Materials

- Emulsified asphalt (M 140, 208, 316)
 - May be diluted at plant, not in field
 - Kept at 70-180°F until application
- Asphalt binder (M 320)
 - Heated to > 300°F
- Reduced tracking tack coat
 - Either emulsified asphalt or asphalt binder
 - Meet requirements of state specifications
- Blotter aggregate
 - Crushed, >45% void content (T 304)
 - Application rate 1-3 psy
 - Gradation requirements

| Sieve Size (T 27) | Passing, % |
|-------------------|------------|
| No. 8 (2.36 mm) | 100 |
| No. 16 (1.18 mm) | 50-85 |
| No. 30 (0.60 mm) | 25-60 |
| No. 50 (0.30 mm) | 5-30 |
| No. 200 (0.075mm) | 0-10 |

Construction

- Weather limitations
- Application rate
- Preconstruction meeting
- Road surface preparation
- Equipment
- Traffic control
- Application



(from RoadResource.org)

Construction: weather limitations

- Emulsified asphalt
 - Ambient/pavement temps: 60°F and rising
 - Only during daylight
 - Surface dry/moist, no standing water
- Hot applied asphalt binder
 - Ambient/pavement temps: 60°F and rising
 - <40°F within 24 hours not allowed
 - Surface dry
 - Stop if rain imminent
 - Wind speed <10 mph

Construction: application rate

Emulsified asphalt

| Surface Type | Residual Rate, gal/yd ² | Undiluted, gal/yd ² | Diluted 1:1, gal/yd ² |
|--------------------------|------------------------------------|--------------------------------|----------------------------------|
| New asphalt | 0.02 – 0.05 | 0.03 – 0.07 | 0.06 – 0.14 |
| Existing/old asphalt | 0.04 – 0.07 | 0.06 – 0.11 | 0.12 – 0.22 |
| Milled surface | 0.03 – 0.08 | 0.04 – 0.12 | 0.09 – 0.24 |
| Portland Cement Concrete | 0.03 – 0.06 | 0.05 – 0.09 | 0.10 – 0.18 |

Hot applied: use residual rate levels (2nd column)

Construction: preconstruction meeting

- General discussion on
 - Expectations
 - Schedule
 - Materials control and measurement
 - Construction process
 - Equipment/process overview
 - Test strip
 - Unique project conditions
 - Traffic control plan
 - Inspection
 - Project documentation
- Required to be submitted
 - Tack coat design and application rates
 - Quality control plan
 - Equipment calibration

Construction: road surface preparation

- Preparing pavement
 - Remove all fill material >1.5 in cracks
 - Seal all cracks > 0.5 in
 - Cure crack seal material >30 days
 - Flush patches >30 days
- Cleaning pavement
 - Sweep <30 minutes before tack
 - Use motorized broom
 - Hand broom follow-up
- Protecting accessories
 - Cover utilities before tack
 - Remove after tack

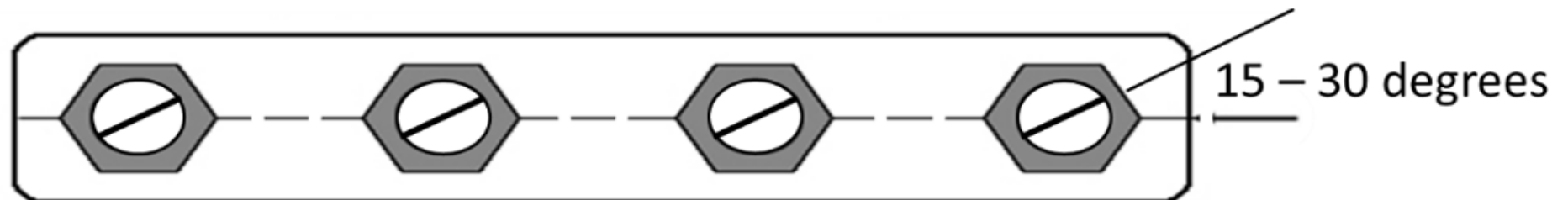


(from RoadResource.org)

Construction: equipment

- Various types
 - Asphalt distributor, spray paver, spray wands
 - Brooms, blotter aggregate spreader
- Calibration
 - Asphalt distributor/spray bar of spray paver
 - Nozzle angle, spray bar height
 - Double/triple bar overlap
 - Transverse/longitudinal flow rate (with example)
 - Blotter aggregate (with example)

Distributor nozzle angle

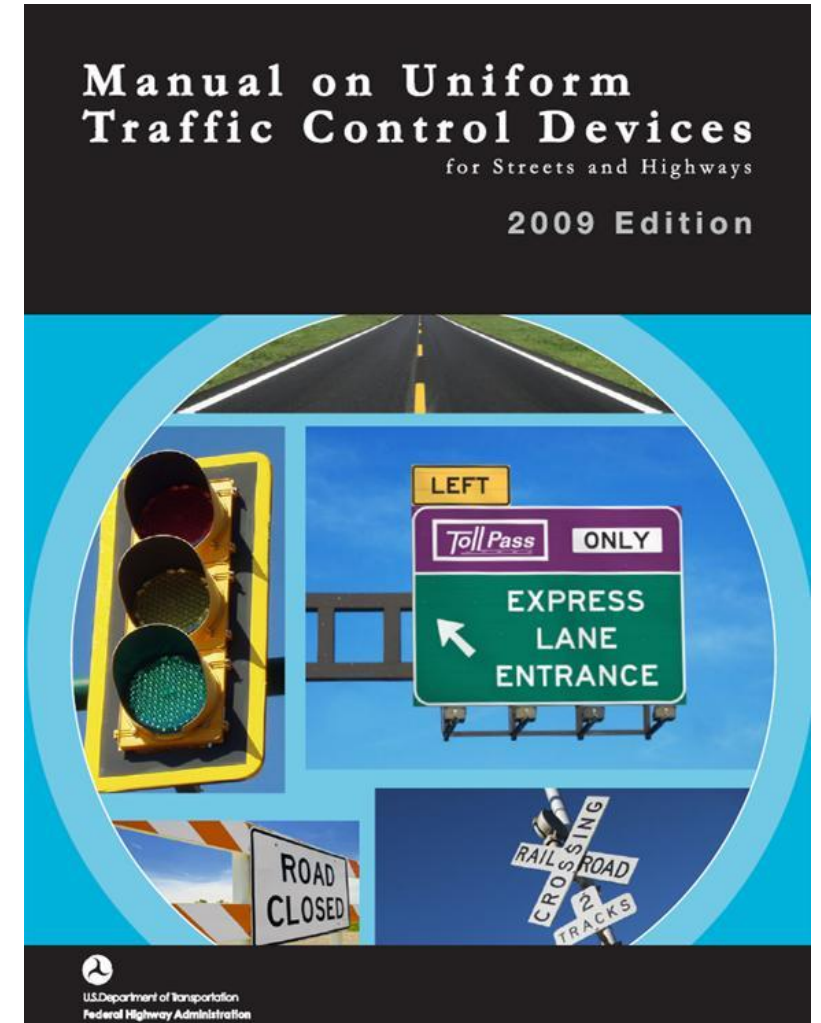


Construction: traffic control

- No traffic on tack coat
- Manual on Uniform Traffic Control Devices
 - MUTCD (can download free from FHWA)
 - Barricades, signage, traffic control



(from
RoadResource.org)



(from FHWA)

Construction: application

- Apply $\pm 5\%$ of test strip
- Watch road surface changes
 - Weathering, bleeding, etc.
- Emulsified asphalt $> 120^\circ\text{F}$
- Hot applied asphalt binder $> 270^\circ\text{F}$
- Longitudinal construction joint for tack
 - ~2" wider than treatment joint
- Leverage transverse paper joints
- Protect motor vehicles
- Implement quality assurance



(from RoadResource.org)

Measurement and payment

- Measurement
 - Emulsified asphalt: undiluted by weight at 60°F
 - Hot applied asphalt binder: weight at application temperature
 - Both: measure area of tack placed and accepted
- Payment
 - Unit price: gallons/liters
 - Completed: yd² (specify type applied, whether diluted)

Keys to success

- Meet materials specifications
- Follow proper application rate
- Calibrate equipment
- Communication between all parties
- Incorporate quality assurance
 - Quality control, agency acceptance, independent assurance
- Train inspector and contractor staff



(from RoadResource.org)

Thank you! Questions?



(from RoadResource.org)

Andrew Braham, Ph.D., P.E.

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Illinois and Slurry Systems

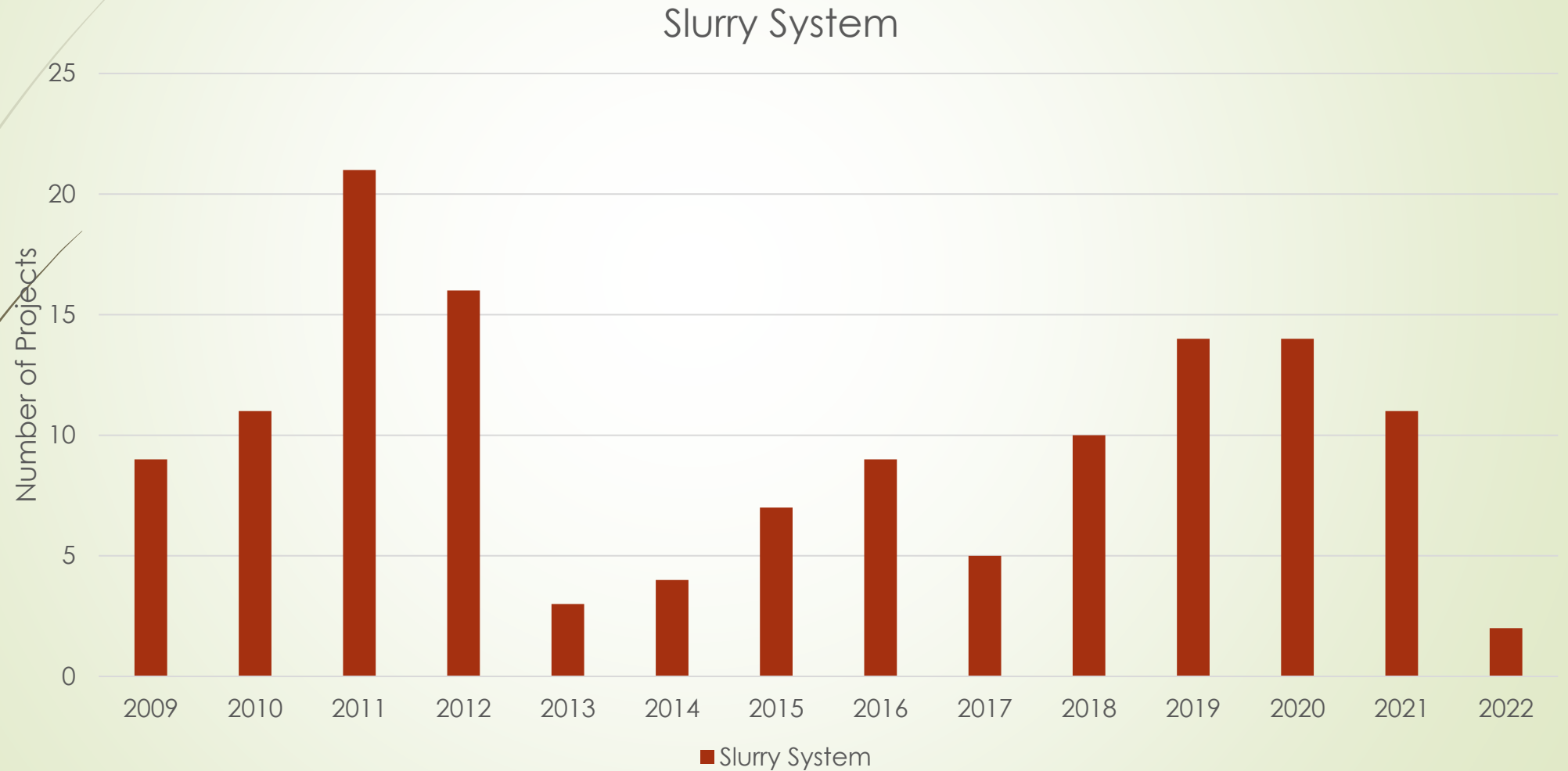


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2:30-4:00 PM, EST

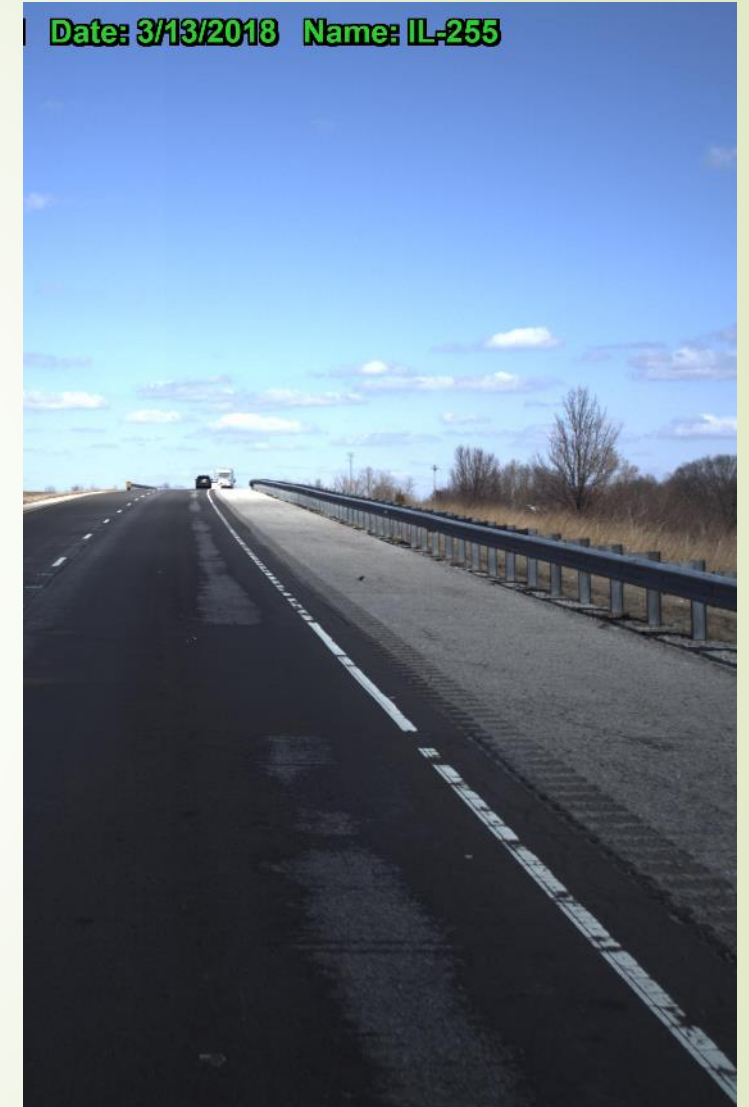
John Senger, P.E.

Use of micro surfacing and slurry seals



Early experiences

- Short life span
- Raveling and delaminating in the wheel paths





First Changes

- In 2019, IDOT added a tack coat to the specification
 - Lab testing indicated superior bond when tack was used
- Removed all mineral filler outside of cement
- Updated test strip requirements
- 2 pass micro surfacing required for roadways with ADT > 25,000

Additional Lessons Learned

- Greater attention needed to be paid to mix designs, minimum asphalt content, and paver calibration



Paver Maintenance



- Aggregate blisters in the final surface
- Wash boarding



Mix Design Workshops

- Representatives from IDOT visited the labs at Heritage Research Group.
- IDOT Central Bureau of Materials and Research hosted a larger workshop with HRG.
- Wider acceptance and understanding of the material



Mix Design Verification

- Mix Design Labs submit mix designs annually
- Material samples are submitted as well
- Designs are verified in IDOT lab
- Approval letters are sent to mix design labs
- Mix designs and approval letter **are** provided to contractor by lab



Paver Calibration

- ▶ Approved mix design is used for calibration
- ▶ IDOT construction or materials staff will witness and document
- ▶ Currently not required if the same mix design was used on previous project
 - Might change to required for every project
- ▶ Test strip is required for projects greater than 70,000 square yards




Quality Assurance Asphalt Extraction

- IL Modified AASHTO T164
- Use the centrifuge extraction
- Sample must be completely dry prior to testing
- District labs have been experimenting with the auto-extractor
- Fine tuning needed in the sampling method
- Currently in-place slurry system must be within $\pm 1\%$ of the JMF



Next Steps?

- Pavement Preservation Training
 - Adoption and Use of NCPP Certification Program
 - Transition to alignment with other AASHTO Standards
- 

Questions



Illinois Department of Transportation

**John Senger, P.E.
Engineer of Pavement Technology**

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Upcoming events for you

July 8, 2023

TRB's National Conference on
Transportation Asset Management



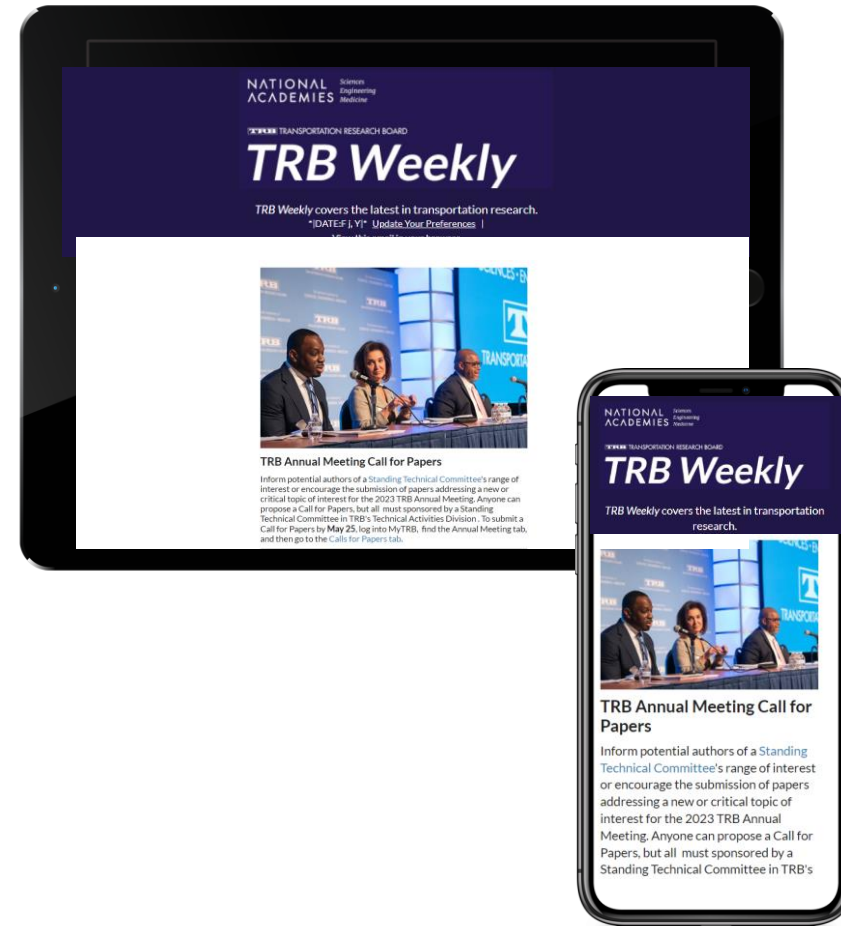
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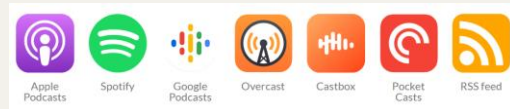
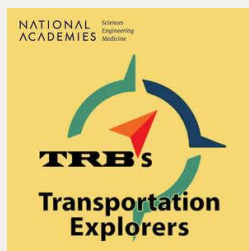
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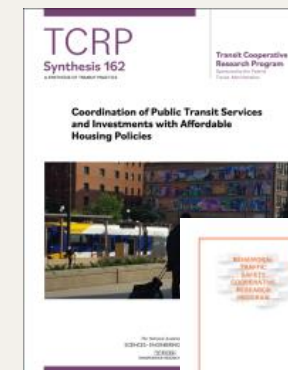
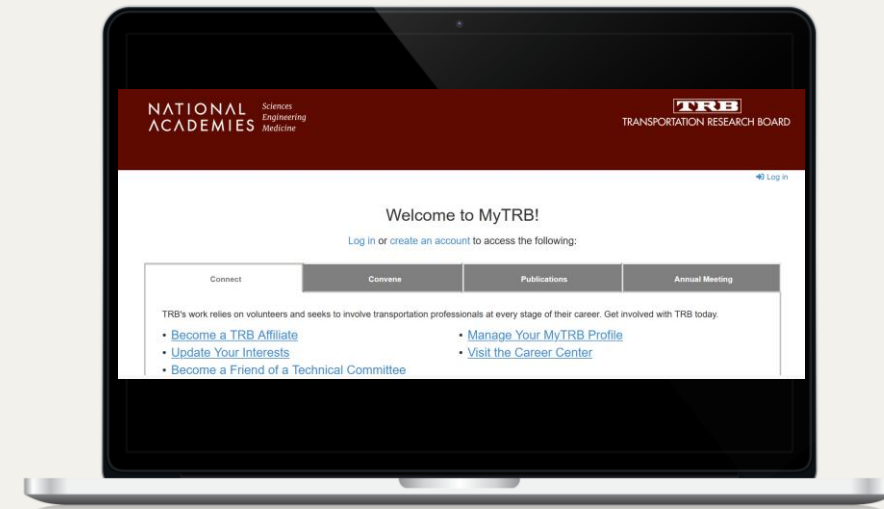
Network and pursue a path to Standing Committee membership

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