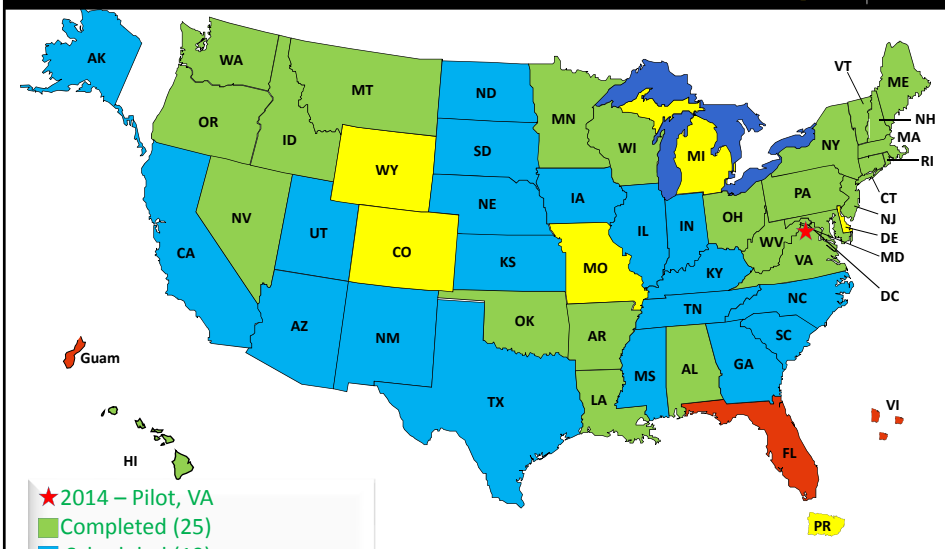
Tack Coat Best Practices

FHWA Cooperative Agreement Subtask

Idaho Asphalt Conference
October 22, 2015

ASPHALT INSTITUTE®

Tack Coat Workshops



★2014 – Pilot, VA
Completed (25)
Scheduled (19)
Requested (6)
Have not Requested (3)

As of September 2015

Far too frequent practices.

asphalt institute

Importance of Tack Coats

- **To promote th… on pavement layer…**
  - …yers.
  - …
  - All lay…

Why do we use Tack Coats?

5

Bonded Demonstration

½" Deflection, 60# Load

Unbonded

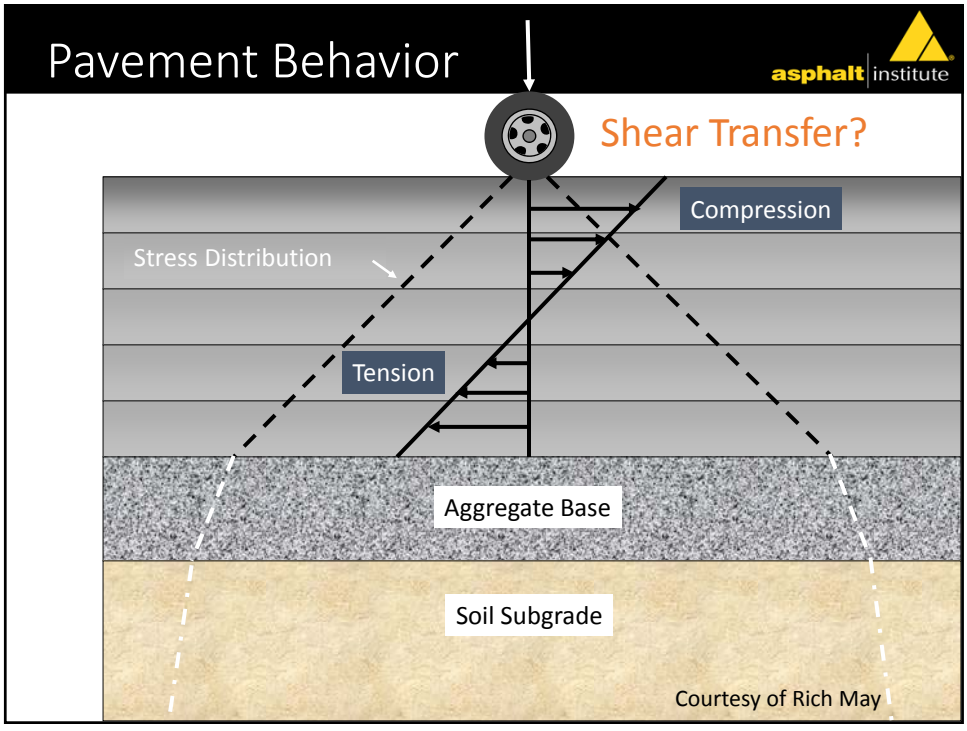
¼" Deflection, **160# Load**

Fully Bonded

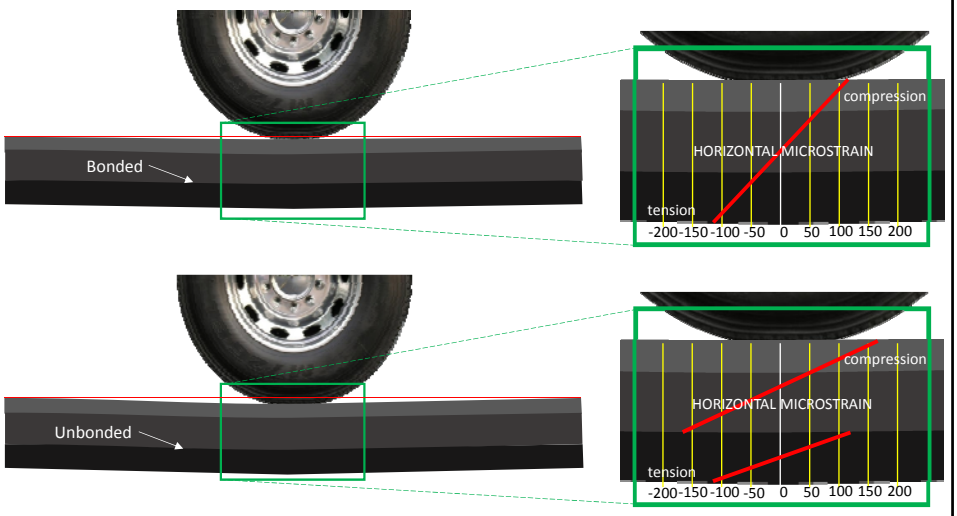
Bonded Demonstration Highlights

- Up to 5 sheets (layers)
- 48” x 4” x 11/32”
- 60, 100, or 160 pound loadings
- Various Bonding Configurations

- Two bonded layers had less deflection than five unbonded (60#).
- Five bonded layer deflected half as much as five unbonded with 267% greater loading (60# vs. 160#).



Consequences of Debonding



Courtesy of NCAT

Consequences of Poor

- Layer independence
  - Reduced fatigue life
  - Increased rutting
  - Slippage
  - Shoving
- Compaction difficulty

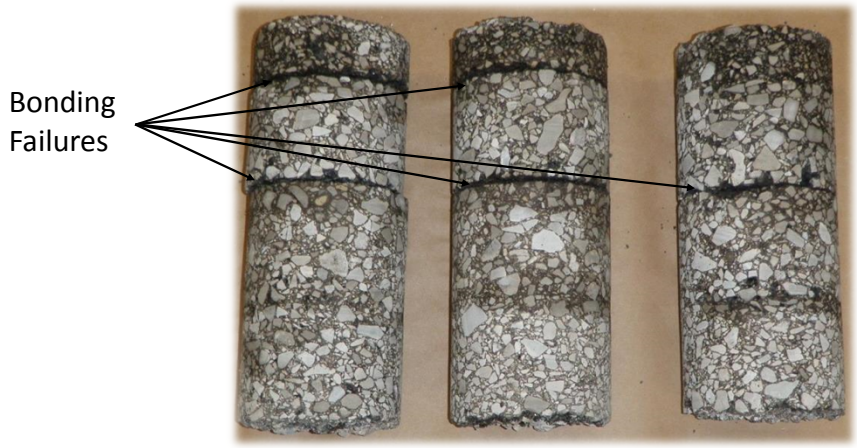
Direction of traffic?

Loss of Fatigue Life Examples

- May and King:
  - 10% bond loss = 50% less fatigue life
- Roffe and Chaignon
  - No bond = 60% loss of life
- Brown and Brunton
  - No Bond = 75% loss of life
  - 30% bond loss = 70% loss of life

8 – 10 years (est.) Interstate Pavement

Cores Showing Debonding



Courtesy of MODOT

So is it worth it to apply a tack coat?

Cost of Tack Coat

- New or Reconstruction
  - About **0.1-0.2%** of Project Total
  - About **1.0-1.5%** of Pavement Total Cost
- Mill and Overlay
  - About **1.0-2.0%** of Project Total
  - About **1.0-2.5%** of Pavement Total Cost

Estimated Cost of Bond Failure in Only the Top Lift

- Assume no inflation for materials
- Estimated traffic control
- Used project plans for thicknesses
- Used bid tabs for:
  - Milling
  - Material costs
  - Replaced pavement markings

30-100% of Original Pavement Costs

Tack Coat Challenges

- Contractor
  - Application Rate
  - Consistency of Application
  - Tack Coat Pickup or Tracking By Vehicles
  - Traction for Construction Equipment
  - Breaking/Setting Time
- Agency
  - Acceptance
  - Dilution?
  - Application Measurement
  - Bond Quality
  - Tort Claims

Best Practices

- Surfaces need to be clean and dry.
- Uniform application.
- All surfaces are tacked.
- Tack should not be tracked off the road.

Best Practices

- Match application to conditions.
  - Materials
  - Residual rate
- Verify application rate.
- Resist tacking too far ahead of paver.

Distributor Truck Setup

- Liquid temperature
  - Monitor and match to material
- Calibrate distributor truck
  - Spray bar height
  - Spray bar pressure
  - Nozzle angle
  - Nozzle selection
  - Thermometers
  - Volumeter

Calculating field application rates

- There are three primary methods of determining field application rates.
  - Determination by volume.
  - Determination by weight or mass.
  - Determination by direct measurement, ASTM D2995

Critical elements in determining application rates

- Dilution rates are critical in determining final application rates.
- Temperature is important in determining accurate volumetric rates.

Table 13. Temperature - volume corrections for asphalt emulsions [6].

°C	°F	M	°C	°F	M	°C	°F	M
10.0	50	1.0025	35.0	95	0.9912	60.0	140	0.9800
10.6	51	1.0022	35.6	96	0.9910	60.6	141	0.9797
11.1	52	1.0020	36.1	97	0.9907	61.1	142	0.9795
11.7	53	1.0017	36.7	98	0.9905	61.7	143	0.9792
12.2	54	1.0015	37.2	99	0.9902	62.2	144	0.9790
12.8	55	1.0012	37.8	100	0.9900	62.8	145	0.9787
13.3	56							0.9785
13.9	57							0.9782
14.4	58	1.0005	39.4	103	0.9892	64.4	148	0.9780
15.0	59							0.9777
15.6	60							0.9775
16.1	61	0.9997	41.1	106	0.9885	66.1	151	0.9772
16.7	62	0.9995	41.7	107	0.9882	66.7	152	0.9770
17.2	63	0.9992	42.2	108	0.9880	67.2	153	0.9767
17.8	64	0.9990	42.8	109	0.9877	67.8	154	0.9765
18.3	65	0.9987	43.3	110	0.9875	68.3	155	0.9762
18.9	66	0.9985	43.9	111	0.9872	68.9	156	0.9760
19.4	67	0.9982	44.4	112	0.9870	69.4	157	0.9757
20.0	68	0.9980	45.0	113	0.9867	70.0	158	0.9755
20.6	69	0.9977	45.6	114	0.9865	70.6	159	0.9752
21.1	70	0.9975	46.1	115	0.9862	71.1	160	0.9750

$$Volume_{@\,°F} \times M_{value} = 60°\text{F}\,Vol.$$

$$Volume_{@\,°C} \times M_{value} = 15.6°\text{C}\,Vol.$$

Recommended Application Rates

Surface Type	Residual Rate (gsy)	Appx. Bar Rate Undiluted* (gsy)	Appx. Bar Rate Diluted 1:1* (gsy)
New Asphalt	0.020 – 0.045	0.030 – 0.065	0.060 – 0.130
Existing Asphalt	0.040 – 0.070	0.060 – 0.105	0.120 – 0.210
Milled Surface	0.040 – 0.080	0.060 – 0.120	0.120 – 0.240
Portland Cement Concrete	0.030 – 0.050	0.045 – 0.075	0.090 – 0.150

*Assume emulsion is 33% water and 67% asphalt.

Review and Summary

Areas of Known Agreement

- Layer Bonding is Vital
- Surface Preparation
  - Clean
  - Dry
- Millings Improves Field Performance
  - Shear
  - Cleaning

Areas of Known Agreement

- Application Quality Vital
  - Proper Rate
  - Consistency
- Distributor Truck
  - Setup
  - Calibration/Verification
  - Maintenance
- Tacking of Longitudinal Joints
  - Bonding
  - Confinement
- Excessive Tack is Bad
- Thicker/Stiffer Lifts Less Prone to Slippage

Areas of Known Agreement

- Tack Coat Rate Depends on Surface Condition
  - Fresh
  - Weathered
  - Raveled
  - Milled
- Need for Research
  - Field Performance
  - Field Testing
    - Bond strength
    - Application amount
- Treat Tack as **Separate Pay Item** vs. Incidental Item

Tack Coat Application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Free 4-hour workshop requested through FHWA divisional offices
Questions?
Free webinar:
http://www.asphaltinstitute.org/public/asphalt_academy/webinars/tack-coat-best-practices-webinar-recording.dot