Tack Coat Implementation & Success
Tack Coat Best Practices
FHWA Cooperative Agreement Subtask
Longitudinal Joints
Intelligent Compaction
Overall Purpose

... to improve the overall bonding of pavement layers;

   to decrease distresses associated with poor bond;

   and to improve overall pavement performance.
Tack Coat Workshops

2014 – Pilot, VA
- Completed (35)
- Scheduled (10)
- Requested (6)
- Have not Requested (1)

* California (CA)
* Arizona (AZ)
* Colorado (CO)
* Nebraska (NE)
* South Dakota (SD)
* Wyoming (WY)
* Kansas (KS)
* Missouri (MO)
* Iowa (IA)
* Illinois (IL)
* Indiana (IN)
* Ohio (OH)
* Michigan (MI)
* Pennsylvania (PA)
* Vermont (VT)
* New Hampshire (NH)
* Massachusetts (MA)
* Connecticut (CT)
* New Jersey (NJ)
* Delaware (DE)
* Maryland (MD)
* District of Columbia (DC)
* Virginia (VA)
* West Virginia (WV)
* Pennsylvania (PA)
* New York (NY)
* New Jersey (NJ)
* Delaware (DE)
* Maryland (MD)
* District of Columbia (DC)

* Guam
* HI

- Alaska (AK)
- Hawaii (HI)
- Puerto Rico (PR)
- Virgin Islands (VI)
Successful Tack Coat

The Ultimate Goal:
Uniform, complete, and adequate coverage
Importance of Tack Coats

- Promote the bond between pavement layers
- To prevent slippage between pavement layers
- Vital for structural performance
- Achieve optimum density
- Prevent rutting
Loss of Fatigue Life Examples

- **May & King:**
  - 10% bond loss = 50% less fatigue life

- **Roffe & Chaignon**
  - No bond = 60% loss of life

- **Brown & Brunton**
  - No Bond = 75% loss of life
  - 30% bond loss = 70% loss of life
Consequences of Poor Bonding

- Costly pavement repairs
  - Repair of isolated area relatively inexpensive
  - Removal and replacement of a portion or the entire pavement structure is very expensive
  - Shorter than expected performance can be devastating for agency budgets
  - Influences future Life Cycle Cost Analysis
Everyone MUST be on the same page

What we are talking about:

- **Original Emulsion**—an undiluted emulsion which primarily consists of a paving grade binder, water, and an emulsifying agent.

- **Diluted Emulsion**—an emulsion that has been diluted with additional water.
  - Critical to control
  - 1:1 typical (Original Emulsion: Added Water)

- **Residual Asphalt**—the remaining asphalt after an emulsion has set typically 57–70 percent.
What’s wrong (if anything) with the following specification regarding application rate?:

“Apply the tack coat at a rate of 0.05 gallons/yd²”
What difference does it make?

If the example spec intended 0.05 \(\text{gal/yd}^2\) of residual asphalt:

*Original emulsion* applied at 0.05 \(\text{gal/yd}^2\) using an emulsion with 60% residual asphalt, leaves \(0.03 \text{ gal/yd}^2\) on the roadway?

40% less than intended
What difference does it make?

If the example spec intended 0.05 \text{gal/\text{yd}^2} of residual asphalt:

\textbf{Diluted Emulsion} using the same emulsion diluted 1:1 with water and applied at 0.05 \text{gal/\text{yd}^2} leaves 0.015 \text{gal/\text{yd}^2} on the roadway?

\textit{70\% less than intended}
What difference does it make?

If the example spec intended 0.05 gal/yd$^2$ of residual asphalt:

To receive Residual Asphalt at 0.05 gal/yd$^2$ using an emulsion with 60% residual asphalt, the contractor would need to apply:

0.083 gal/yd$^2$ of Original Emulsion or 0.167 gal/yd$^2$ of 1:1 Diluted Emulsion
Isolated Slippage Failure
Slippage Failure
Days later!

Courtesy of Road Science™
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 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
$15,000 now or $2 M later?
Obstacles In Getting a Good Tack?

- Project Pressure due to:
  - Working in short construction windows
  - Cool, damp weather
  - Night time paving
  - High traffic areas
  - Proper surface cleaning
Current Research

- NCHRP 9–40a
- SHRP2
- Arkansas
- Colorado
- Illinois
- Louisiana

- NCAT
- Texas
- Wisconsin
- Oregon
- MnRoads
- International
Testing

- Field/Laboratory Bond Testing
  - Shear Testing
  - Torsion Testing
  - Pull–Off Testing (tensile)
  - Cyclic
Trends From 35 Workshops

- FHWA Best Practices Tech Brief (Dec. 2015)
Trends From 35 Workshops

- DOTs Specification Revisions
  - Increasing Application Rates
    - Spray rates to increase residual rate
  - Adjusting application rates for different surfaces
    - Fresh asphalt, old asphalt, milled, PCC
  - Adding more heat prior to spraying
Trends From 35 Workshops

- DOTs Specification Revisions
  - Verifying Calibration of Distributors
  - Adding more heat prior to spraying
  - Eliminating dilution from specifications
    - Only when needed and only once by supplier
  - Tack as Separate Pay Item vs. Incidental Item
  - Moving to Stiffer Base Asphalts
    - Improve bonding & reduce tracking
Future Trends

- Performance testing as proof of bond strength
  - DOT’s will adopt a standardized test
  - Monitoring results for a period of time
  - Establish a baseline as minimum
  - Eventually, contactors will be rewarded or penalized
    - Based on test results
Thank You!

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