Tack Coat Implementation & Success

Tack Coat Best Practices

FHWA Cooperative Agreement Subtask

Longitudinal Joints
Intelligent Compaction

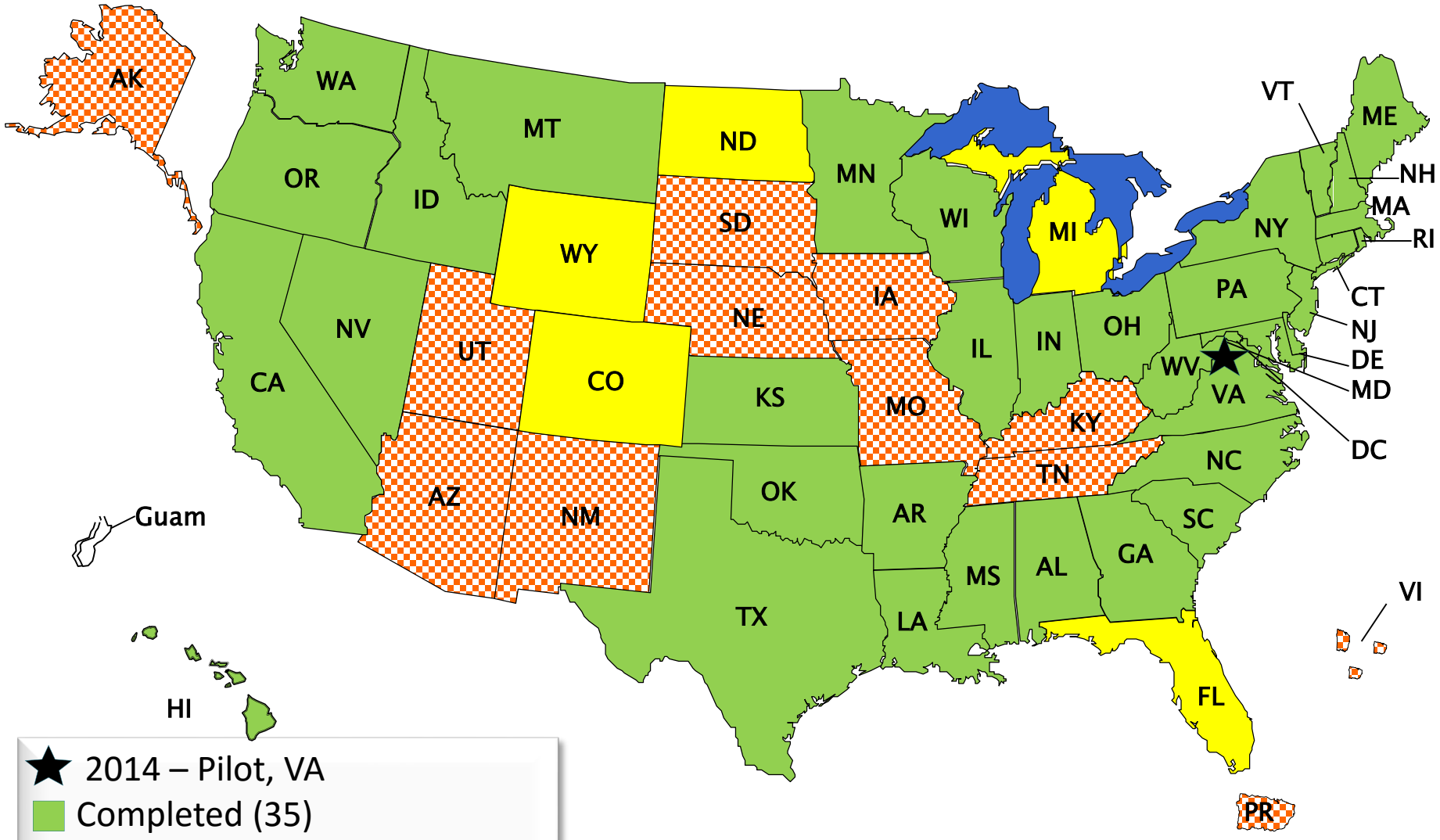
Overall Purpose

… to **improve** the overall **bonding** of pavement layers;

to **decrease distresses** associated with poor bond;

and to **improve overall pavement performance**.

Tack Coat Workshops



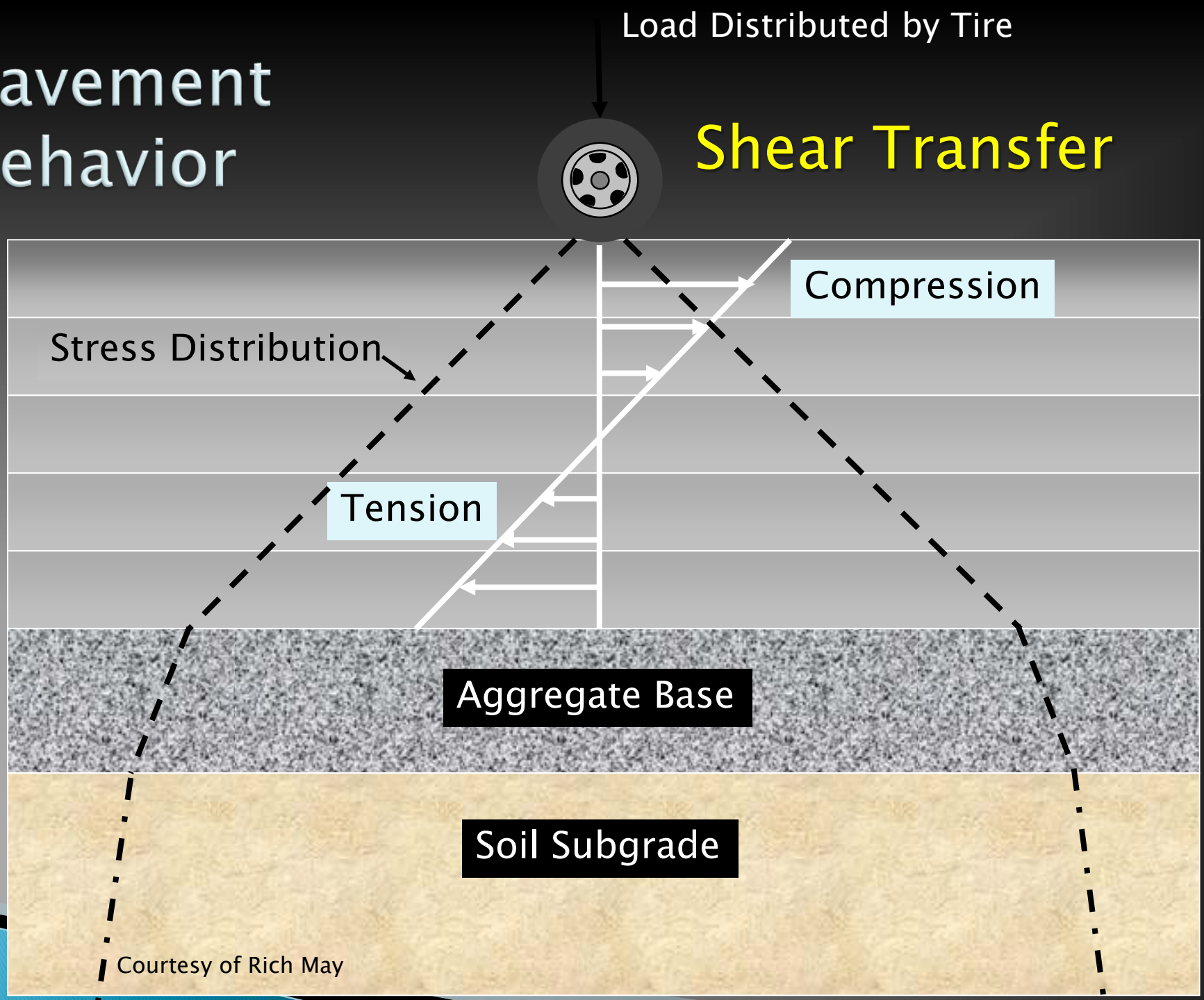
Successful Tack Coat

The Ultimate Goal:
Uniform, complete, and adequate coverage

Importance of Tack Coats

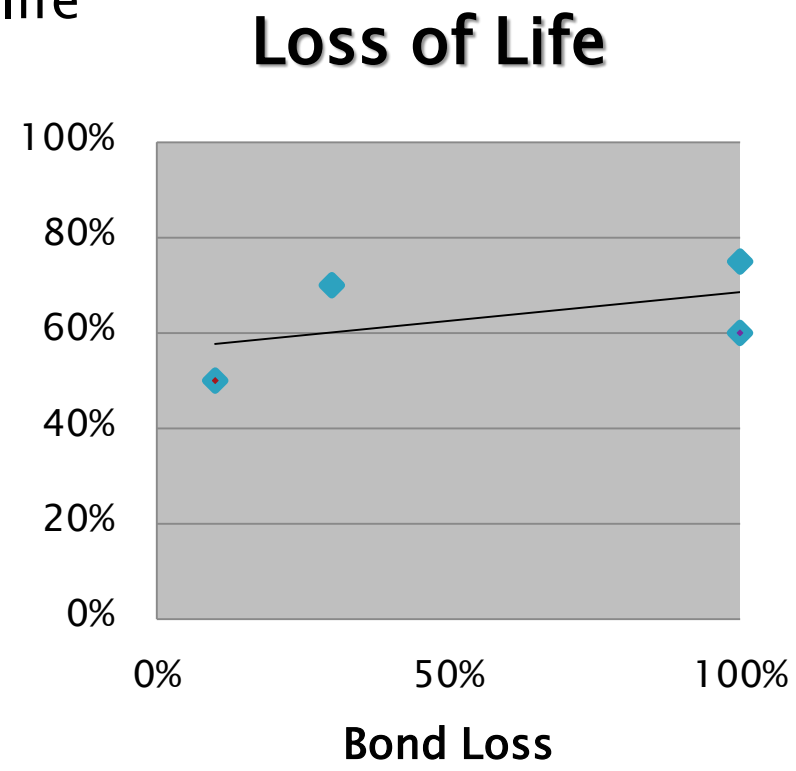
- Promote the bond between pavement layers
- To prevent slippage between pavement layers
- Vital for structural performance
- Achieve optimum density
- Prevent rutting

Pavement Behavior



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 <u>additional</u> 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/yd^2"

What difference does it make?

If the example spec *intended* 0.05 *gal/yd²* of residual asphalt:

Original emulsion *applied at* ***0.05 gal/yd²*** *using an emulsion with 60% residual asphalt, leaves* ***0.03 gal/yd²*** *on the roadway?*

40% less than intended

What difference does it make?

If the example spec *intended* 0.05 *gal/yd²* of residual asphalt:

Diluted Emulsion using the same emulsion diluted 1:1 with water and applied at ***0.05 gal/yd²*** leaves ***0.015 gal/yd²*** *on the roadway?*

70% less than intended

What difference does it make?

If the example spec *intended* 0.05 *gal/yd²* of residual asphalt:

*To receive **Residual Asphalt** at **0.05 gal/yd²** using an emulsion with 60% residual asphalt, the contractor would need to apply:*

***0.083 gal/yd²** of **Original Emulsion** or*
0.167 gal/yd²** of **1:1 Diluted Emulsion

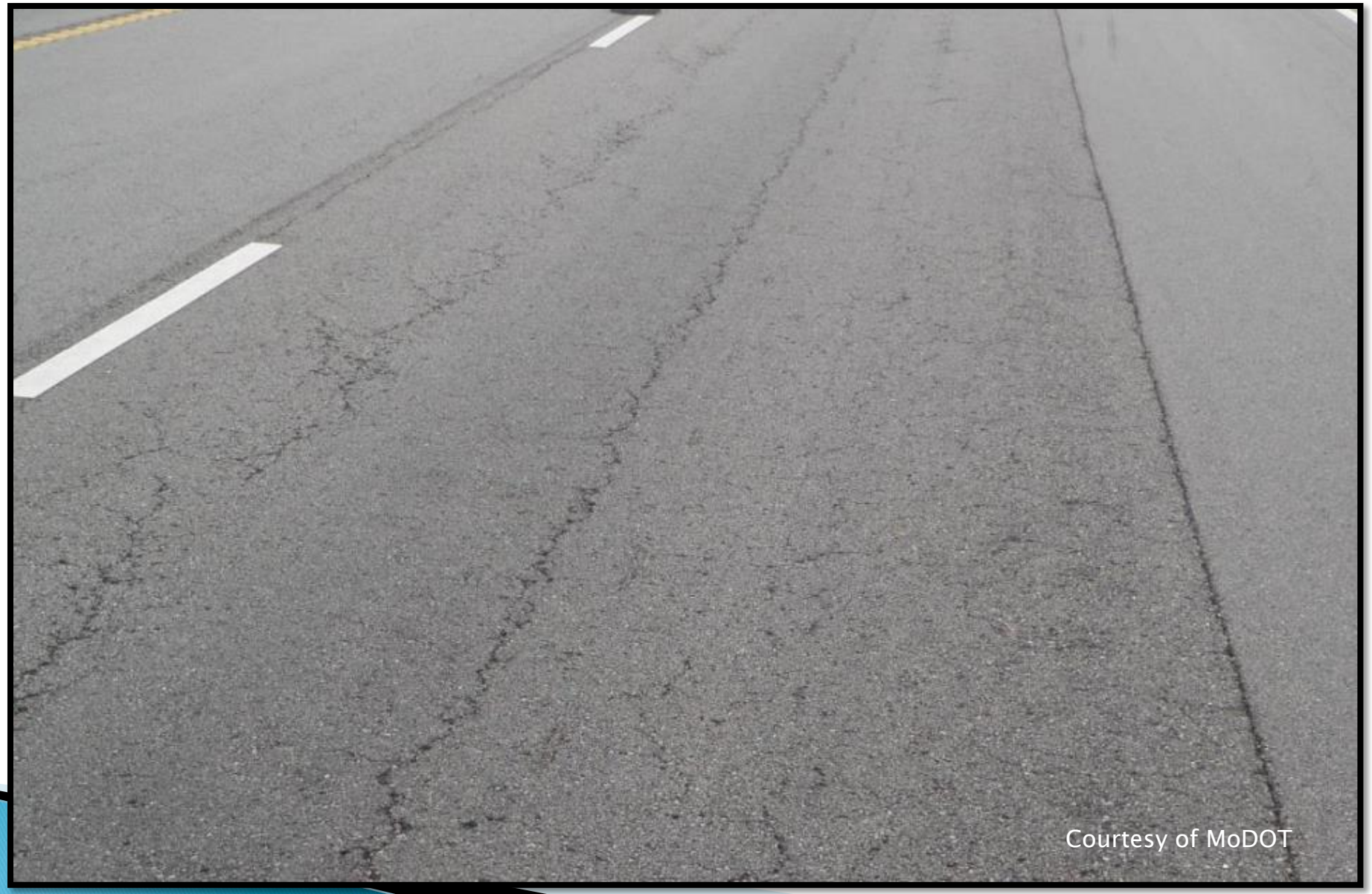
Isolated Slippage Failure

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

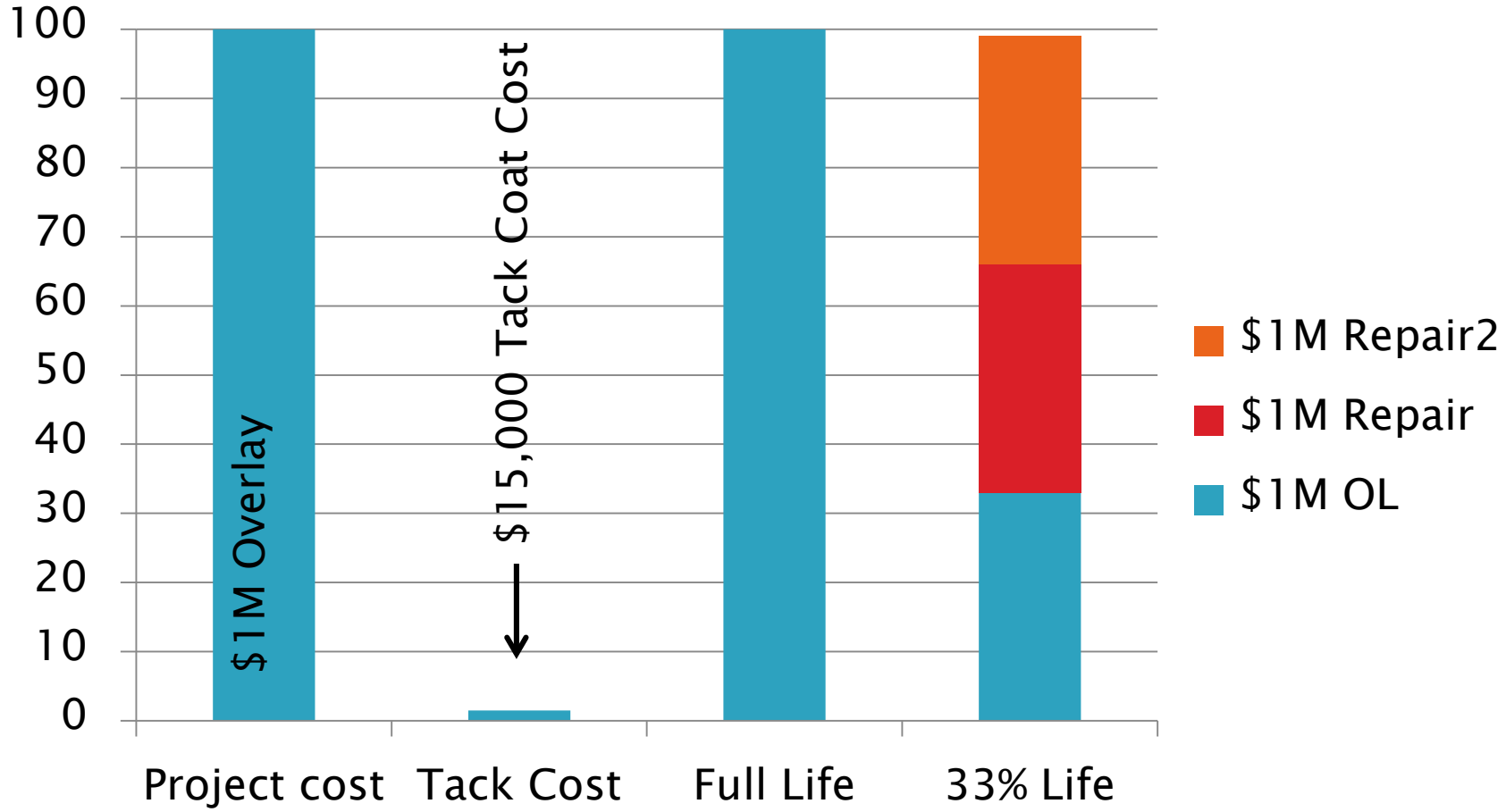
- Mill and Overlay
  - About 1.0–2.0% of Project Total
  - About 1.0–2.5% of Pavement Total Cost

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

What is the Risk?



$15,000 now or $2 M later?

Obstacles In Getting a Good Tack?

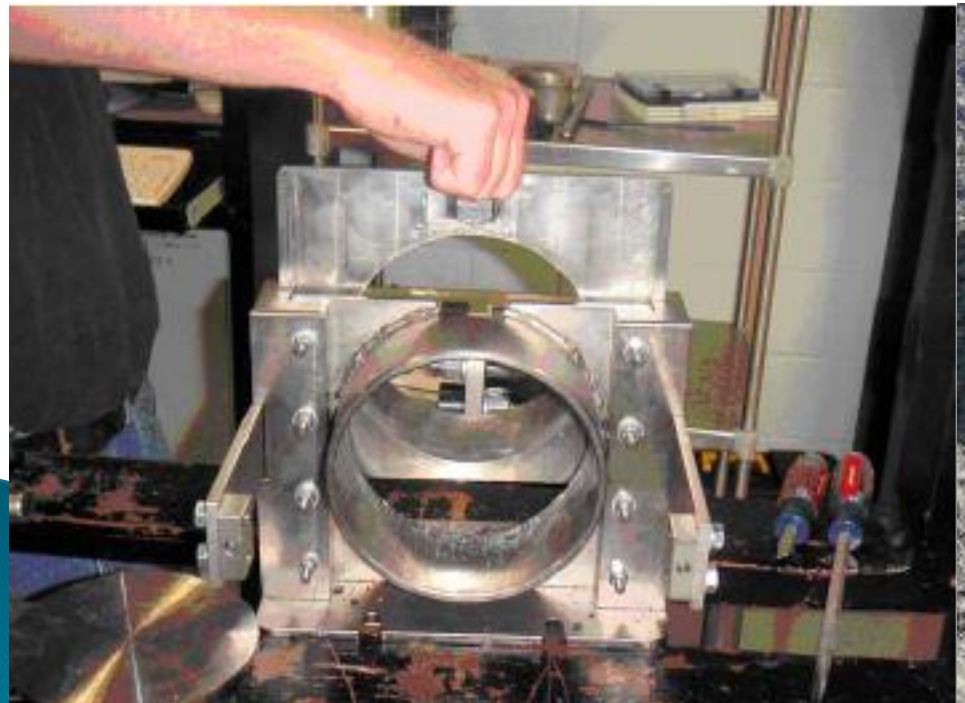
- Project Pressure due to:
  - Working in short construction windows
  - Cool, damp weather
  - Night time paving
  - High traffic areas
  - Proper surface cleaning

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

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