Basics of Moisture Damage and Liquid Antistripping Additives
Where we started
What changed?
Pavement Failure

• Rutting
• Fatigue
• Moisture Damage
• Aging
Physical Properties

- Cohesion
- Adhesion
Cohesion
Adhesion

- Glue
Adhesion Promoters

• Majority of additives used are called Amines

• There are some Acidic additives
Adhesion

- Glue

- Surfactant (Soap)  Breaks surface tension
Adhesion

• Glue

• Surfactant (Soap) Breaks surface tension

• Polar Molecules
Adhesion

- Glue
- Surfactant (Soap) Breaks surface tension
- Polar Molecules
- Displace water with Asphalt Cement from Surface of Aggregates
How do we test for Moisture Damage?
Tests for Moisture Damage

- TSR Test  AASHTO T-283 (Lottman)
- Immersion Compression
- Hamburg Rut Tester
Do You Test for Moisture Susceptibility?

Type of Test
- Tensile
- Compressive
- Retained Stability
- Hamburg & Tensile
- None
Tensile Strength Ratio

TSR = \frac{\text{Conditioned}}{\text{Unconditioned}}
When do we test?
When Do You Test for Moisture Susceptibility?

Time of Testing
- Mix Design
- Mix Design & Field Acceptance
- None

Map of the United States showing the regions where the testing is performed.
What do we use to improve resistance to moisture damage?
Do You Treat HMA for Moisture Damage?

Predominant Type of Treatment Used

- Lime
- Lime or liquids
- Liquids
- Liquids seldom
- No or very rarely
How much adhesion promoter do we use?
Hot Mix Asphalt Materials

~ 95% Aggregate

~ 5.0% Liquid asphalt cement (AC)

~ 0.5% Adhesion promoter

Antistripping additive is 0.5% of weight of liquid asphalt cement binder most of the time.
One Ton Mix

2000 Pounds

Asphalt content 5.0%

2000 \times 0.05 = 100 \text{ pounds asphalt cement}
100 pounds AC

0.5% is adhesion promoter additive

100 \times 0.005 = 0.5 \text{ pounds}
Are the anti stripping additives safe?
Air monitoring study reported in AAPT

Two projects done in Illinois
Results

- Total Particulates
- Diesel Fumes
- Asphalt Hydrocarbons

Asphalt additive < .001
Do we have an effect on paving crews?
Are all additives the same?
NO !!!
Illinois Department of Transportation
Bureau of Materials and Physical Research
APPROVED LIST OF HOT MIX ASPHALT ANTI-STRIP ADDITIVES
August 3, 2007
This list supersedes the January 19, 2007 list.
Standard Specifications for Road and Bridge Construction,
Article 1030.04(c) (Adopted January 1, 2007)
How to prevent Moisture Damage?
Good mix designs
Use of GOOD Adhesion promoters
Good mix designs
  Use of GOOD Adhesion promoters

Good construction practices (Density)
Good mix designs
  Use of GOOD Adhesion promoters

Good construction practices (Density)

Keep water out pavements (Drainage)