Bonding of Asphalt Pavement Layers
Slip on 2003 Track
Content

• Why worry about bond strength?
• How can you measure bond quality?
• Comprehensive study (lab vs field)
• Results from 2009 & 2012 Tracks
• Conclusions & recommendations
Impact of Slip on M-E Response

-250 -200 -150 -100 -50 0 50 100 150 200

Horizontal Microstrain

Depth, in

- Full Bond
- SMA Slip
- Double Slip

SMA
HMA
Rich Bottom

Tension  Compression
Measuring Bond Strength
M-E Predictions + Field Measurements

![Graph showing the relationship between Shear Stress (psi) and Wearing Course Thickness (in.) for different traffic scenarios. The graph includes lines for 100K/250K_E, 250K/100K_E, 500K/250K_E, 750K/500K_E, 1000K/750K_E, and 1500K/1000K_E.]
Comprehensive Tack Study Design

• Results from both laboratory & field
• New, milled, and micro milled surfaces
• Representative products and practical rates
  – PG67-22 at 0.03, 0.05, 0.07 gal/yd\(^2\)
  – NTSS-1HM at 0.04, 0.06, 0.08 gal/yd\(^2\)
  – CRS-2, CRS-2L, CQS-1h at 0.05, 0.075, 0.10 gal/yd\(^2\)
Lab Sample Preparation

Comparison of ridge to valley depth

RVD = 8mm

Traditional Milling

RVD = 3-4mm

Micro-Milling
Lab Results for PG67-22

Surface Type and Application Rate, gal/sy

Bond Strength, psi

- Micro-milled
- Milled
- New
Field Rate Measurements
Field Results for PG67-22

![Graph showing bond strength over time for different conditions]

- **Test Track**
- 
  - 0.0246 gal/sy & existing
  - 0.0473 gal/sy & existing
  - 0.0625 gal/sy & existing
  - 0.025 gal/sy & milled
  - 0.0348 gal/sy & milled
  - 0.0639 gal/sy & milled

**Bond Strength, psi**

**No. of Days after Construction**
Comprehensive Tack Study Findings

- Results from both laboratory and field
  - Laboratory bond strengths higher than field
- New, milled, and micro milled surfaces
  - Milling and micro milling improves bond in lab
  - Debris necessitates higher rate (x2) in field
- Representative products and rates
  - Bond develops quicker for PG67-22 & NTSS-1HM
  - Traffic does not increase bond strength
NCAT Pavement Test Track
Wheelpath Pickup
Spray Paver on 2009 Track
Spray Paver (Top) vs Conventional
2012 Tack Coat Study

N1A eTac 0.10/0.06
N1B UltraFuse 0.15/0.15
N2 Trackless 0.05/0.03
2012 Tack Coat Study

N1A eTac 0.10/0.06

N1B UltraFuse 0.15/0.15

N2 Trackless 0.05/0.03
2012 Tack Coat Study
2012 Tack Coat Study

Average of BOND_STRENGTH  Sum of % INTERFACE

Values
- Average of BOND_STRENGTH
- Sum of % INTERFACE

2009 Test Track
- N1
- N2
- E1A
- E1B

2012 Test Track
- N1A
- N1B
- N2

PROJECT_LOCATION  SECTION_ID

TT 2012 N1B
TT 2012 N2
Bottom Line on Asphalt Layer Bonding

- 100 psi minimum bond strength
- PG67-22
  - 0.03 to 0.07 gal/yd² on new pavement
  - 0.05 to 0.09 gal/yd² on milled surface
- NTSS-1HM
  - 0.04 to 0.08 gal/yd² on new pavement
  - 0.06 to 0.10 gal/yd² on milled surface
- CQS-1H and CRS-2
  - 0.05 to 0.10 gal/yd² on all surfaces
Questions?

Dr. R. Buzz Powell, PE
Assistant Director & Test Track Manager

277 Technology Parkway
Auburn, AL 36830

Phone: (334) 844-6857
Cell: (334) 750-6293

Email: buzz@auburn.edu
Web: www.pavetrack.com
Twitter: www.twitter.com/pavetrack