

**Look Ma,
No Mess**

New Approaches to Tack Application

TRB, January 14, 2004

Topics

- **The need for a tack coat**
 - Strains, strength & pavement life
- **Improved tack technologies**
 - Performance-related testing
 - Measuring bond strength
 - Materials & construction techniques

Pavement Behavior

Demonstration

Two pieces of plywood - **Unloaded**

Top of "Pavement" $4 \frac{5}{16}$ in.

Demonstration

Two pieces of plywood - **Loaded**

Top of "Pavement" $3 \frac{12}{16}$ in.

Demonstration

Two pieces of plywood - **Loaded**

Top of "Pavement" $3 \frac{12}{16}$ in.

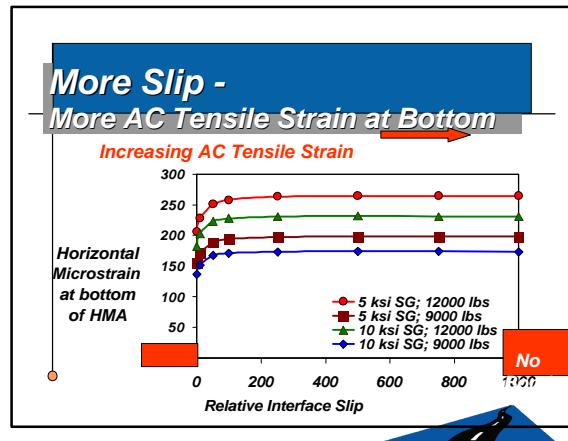
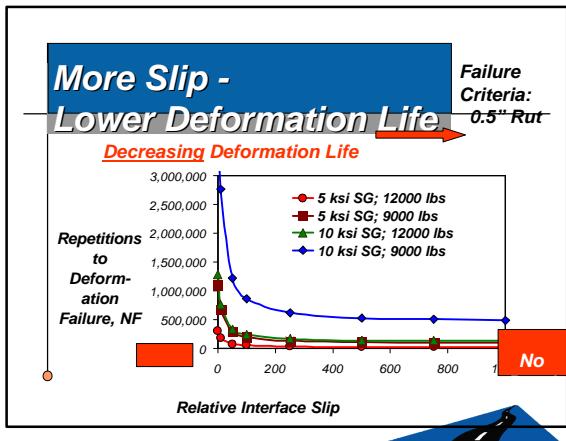
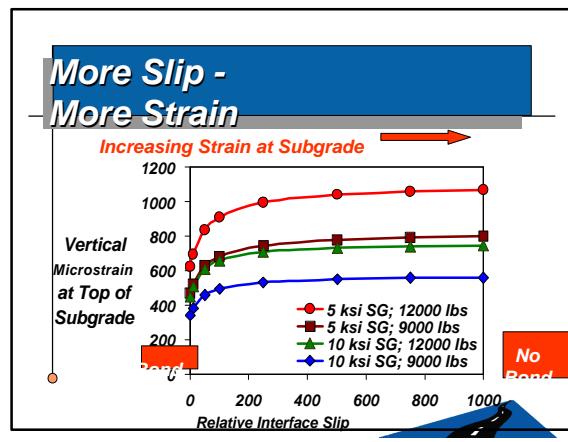
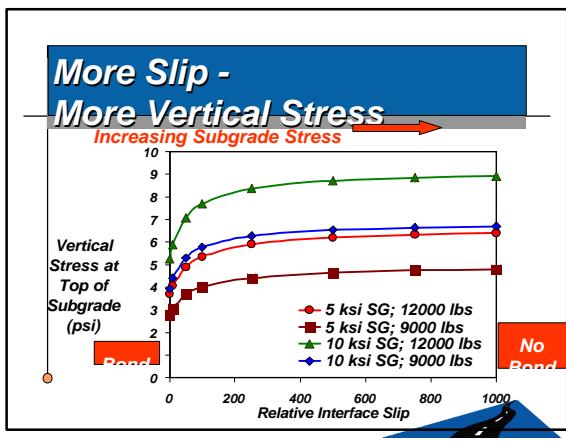
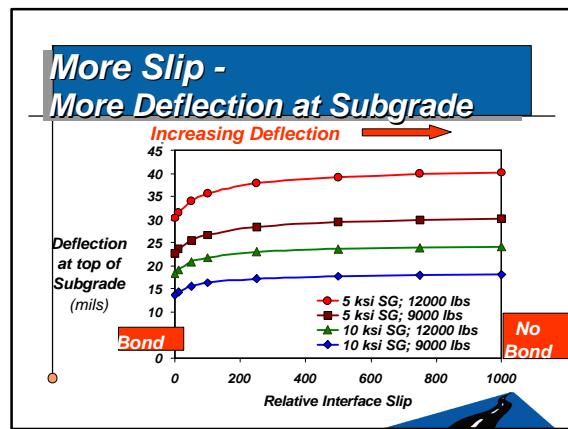
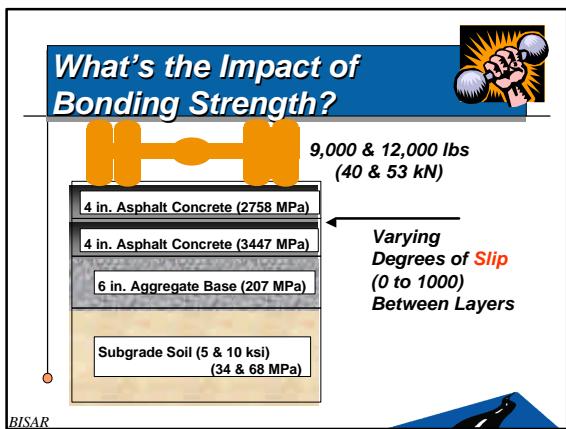
9/16 in. deflection

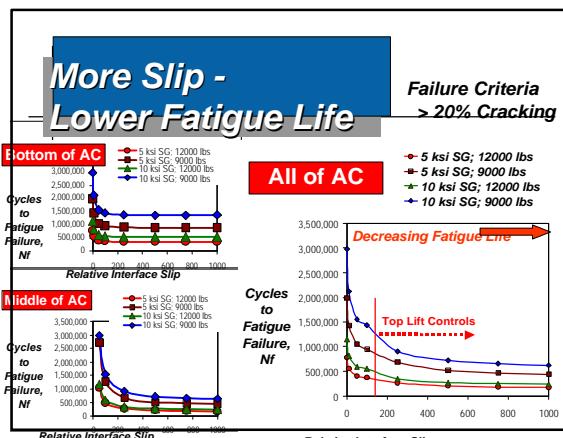
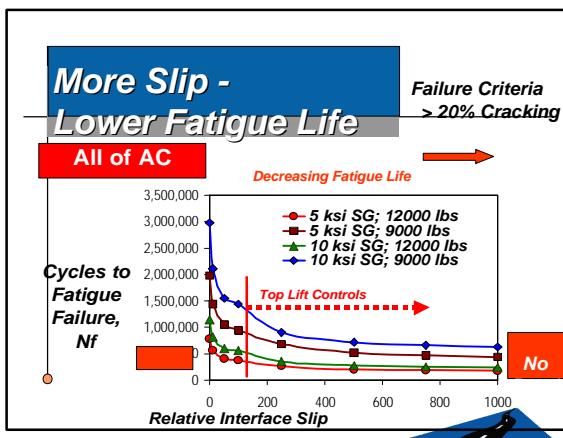
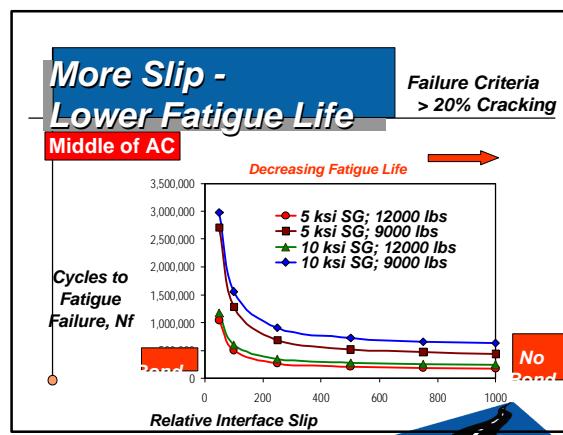
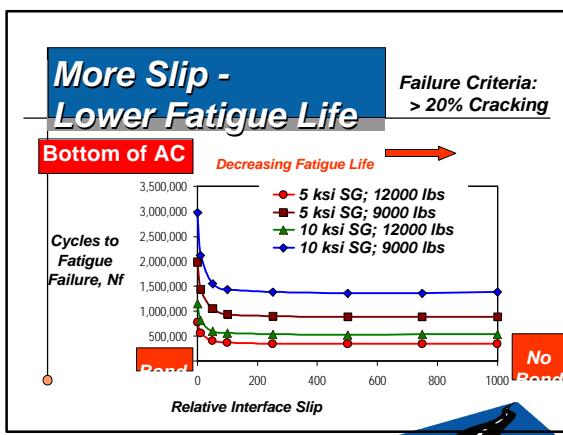
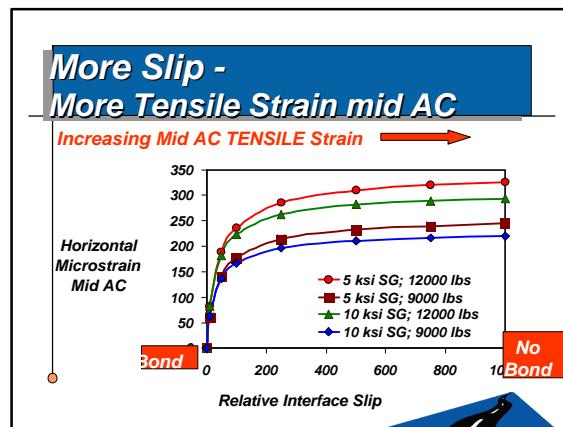
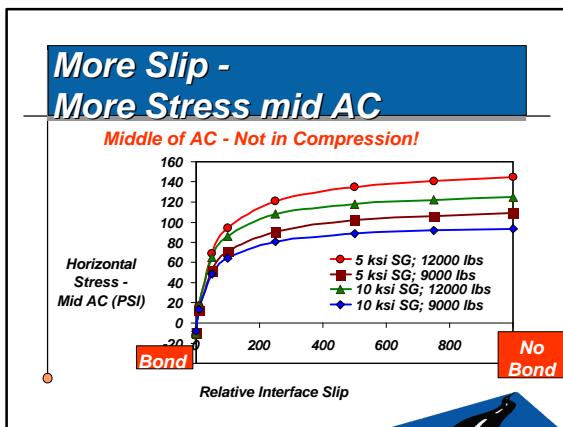
Demonstration

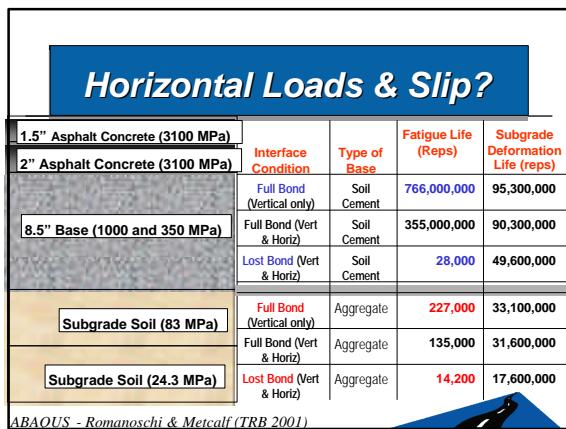
Two bonded pieces of plywood - **Loaded**

With Nails
Top of "Pavement" $3 \frac{15}{16}$ in.

6/16 in. deflection
33% Less

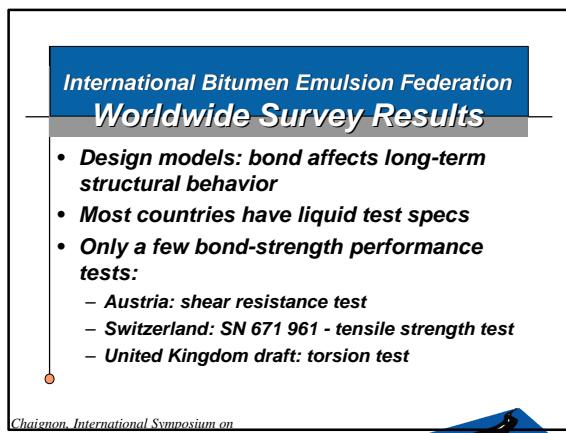
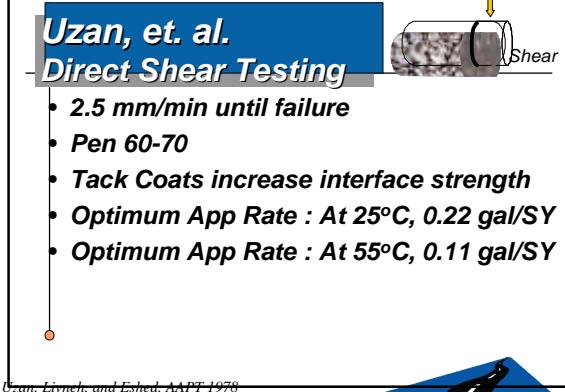
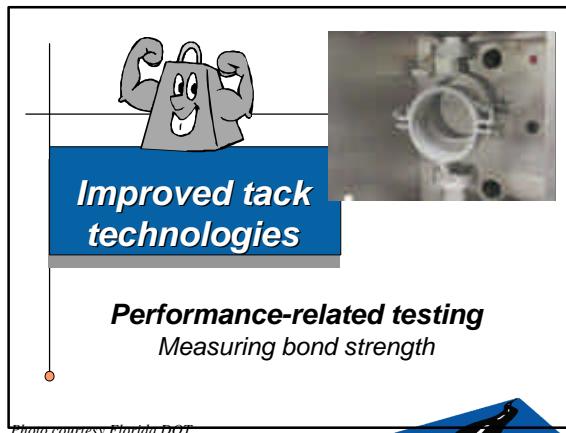






What Affects Interface Bonding ?

- Temperature
 - Normal Stress
 - Application Rate
 - Type of Tack Material
 - Moisture
 - Aggregate interlock / milling
-



Austrian Method: Tensile mode

- Metal plates bonded to each end of field core
- Core pulled apart in tensile mode
- Specifications :
 - $< 1.5 \text{ N/mm}^2$ for polymer modified bond coat
 - $< 1.0 \text{ N/mm}^2$ for non-polymer modified bond coat
- For each 0.1 N mm^2 below specifications severe fine imposed



Chaignon & Roffe, CTAA, 2001

United Kingdom Draft Method: Torque mode

- Lab or field test method using 100-mm diameter core
- Metal plate bonded to thin surfacing
- Bond measured in torque mode
- No specification set - record value only



Chaignon & Roffe, CTAA, 2001

LTRC Method Simple Shear Testing

- 50 lb/min until failure
- Residual: 0, 0.02, 0.05, 0.1, & 0.2 gal/SY
- CRS-2P, SS-1, CSS-1, SS-1h
- PG 64-22 & PG 76-22M
- 25 & 55°C
- Best : CRS-2P @ 0.02 gal/SY
- Not as strong as single lift!

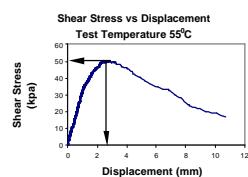
Mohammad, TRB 2002

LTRC Method Sample Prep



Mohammad, TRB 2002

LTRC Method Test Procedure



Mohammad, TRB 2002

NCAT Method Bond Strength Testing Device



Zhang; Courtesy of NCAT, 2003

NCAT Method
Loading Equipment

Shear Loading Rate: 2"/min
Parameters: Shear strength
Shear deformation
Dissipated energy

Zhang: Courtesy of NCAT

Florida DOT Method

Shear
Max Load

Sholar, Page, Musselman, Upshaw & Moseley, TRB 2004

Innovative Tack Technologies

New Materials
New Construction Methods

New Materials

- Polymer modified emulsions
 - CRS-2P, CSS-1P, SS-1P, etc.
- Rapid setting emulsions
- Materials developed for special processes

New Processes

Colnet® Process

1. Interface additive
 - To adjust surface tension & improve adhesion
2. Emulsion
3. Breaking agent (Emulcol® process)
 - For instantaneous cure
 - Vehicles will not disturb / track cured emulsion

Colas



New Processes

Ultrathin bonded wearing course

- Tack: Polymer emulsion membrane
- Special machine applies both tack & PMAC
- Heavier membrane application; hot AC cures emulsion
- HMA applied without damaging membrane
- No emulsion tracking
- Traffic in <15 minutes

One-Pass Paver

One-pass Paver

The UTBWC Process

The emulsion membrane "wicks up" around the HMA aggregates

The emulsion cures, bonding the mix & pavement

5/8" minimum Depth of Mix
3/8" Nominal Ag Size
3/16" Emulsion membrane depth
9-12 mm coating on aggregates
Existing Pavement

UTBWC One-Pass Machine - New applications

- Florida DOT
 - 2003: 5 test sections on US 27
 - UTBWC (FDOT bonded asphalt concrete friction course, BACFC), FDOT FC-5 (open graded GTR crumb rubber mix), with & without special machine
 - Preliminary results: one-pass machine placed materials look best

UTBWC One-Pass Machine - New applications

- Arizona
 - 2003: UTBWC with asphalt-rubber binder in HMA
- Texas DOT
 - 2004: Thin Bonded Permeable Friction Course (TBPFC) over PCC

Engineering News Record, 3/3/03

Lessons learned:

- *Bonding between lifts essential for pavement design life*
- *Performance tests & specifications needed for bond strength*
- *Stronger binders (PMA) & faster breaking emulsions can help*
- *Improved construction equipment*
 - reduces tracking
 - allows heavier application of modified emulsions

Thank You.

Questions?

... Longer Lasting Roads

