



FORTA-FI (Fiber Infused) **Presentation** (September, 2009)

Tracy Lang – Manager Asphalt

Original Product

- FORTA-AR
 - Patented August, 1982
 - Used on a number of projects through today, both Domestic & International
 - Key benefit
 - Reinforcing fibers designed to add life to asphalt, but difficult to quantify
 - Testing
 - University of Texas at Austin, 1986

Transition

● FORTA-FI

- Launched in March, 2009
- Key benefits
 - Cost savings, immediate or long term or both!
 - Reduce asphalt thickness by 35%
 - Extend life of asphalt by more than 50%
- New testing
 - Arizona State University, 2008 & 2009
 - Incredible results

Selling Proposition

- FORTA-FI *FIBER INFUSED*
 - Immediate cost savings, (*35% reduction in asphalt thickness*)
 - Extended cost savings, (*>50% longer asphalt life*)
 - Mixes well in both Batch and Drum plants
 - One bag/dosage per ton of asphalt
 - Plastic bag is integral part of new blends
 - Complete product range with (3) unique blends for specific applications
 - Mixes thoroughly in seconds and distributes uniformly and completely

Selling Proposition

- FORTA-FI *FIBER INFUSED*
 - Provides 3D (*isotropic*) reinforcement
 - No modifications needed to current asphalt mix
 - No modifications needed to asphalt plants
 - No modifications needed to standard placement or compaction practices
 - 27 year history of successful applications
 - Tested to today's tough new industry standards
 - From the industry leader in structurally reinforced concrete

Product Definition

- FORTA-FI *FIBER INFUSED*
 - (3) proprietary blends containing aramid and polyolefin fibers and other materials packaged in polyethylene bags



HMA



WMA



PAT

Product Definition

- FORTA-FI *FIBER INFUSED*
 - Developed for (3) specific asphalt types...
 - **HMA Blend**, (for Hot Mix Asphalt)
 - Designed for working temperatures of 250°F - 375°F (121°C - 190°C)
 - Mix in batch or drum plants at any production speed
 - Distributes uniformly and completely
 - Available in 3/4" (19mm) and 1-1/2" (38mm) fiber lengths for smaller/larger typical aggregate sizes



Product Definition

- **FORTA-FI** *FIBER INFUSED*
 - **WMA Blend**, (for Warm Mix Asphalt)
 - Designed for working temperatures of 212°F (100°C) and higher
 - Mix in drum plants at any production speed
 - Distributes uniformly and completely
 - Available in 3/4" (19mm) and 1-1/2" (38mm) fiber lengths for smaller/larger typical aggregate sizes
 - Formulated for all foaming methods



Product Definition

- **FORTA-FI** *FIBER INFUSED*
 - **PAT Blend**, (for Hot/Cold Patch Asphalt)
 - Designed for any working temperature
 - Formulated for high percentages of solubles
 - May be added in plant, or directly in rejuvenated material on site
 - Available in 3/4" (19mm) fiber lengths



Asphalt Failure Modes

- Rutting
 - Typically when ruts become 1/2" deep
- Cracking
 - Typically width, length, and number of cracks

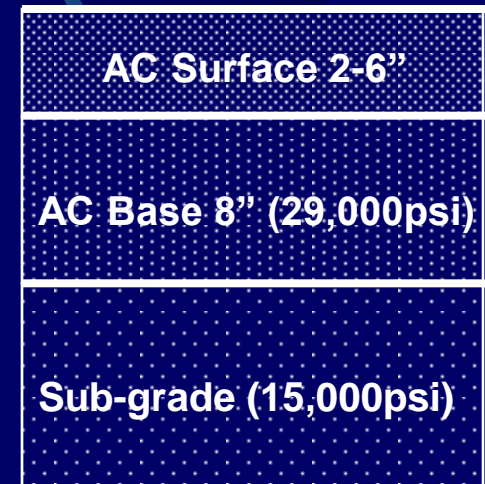
Science Objective

- Use advanced laboratory tests from ASU
 - Assess field performance
 - Evaluate impact on pavement design thickness
- Use laboratory and field results as input to:
 - ANY existing pavement design methodology
 - Mechanistic Empirical Pavement Design Guide (MEPDG)

Case Study

Rutting

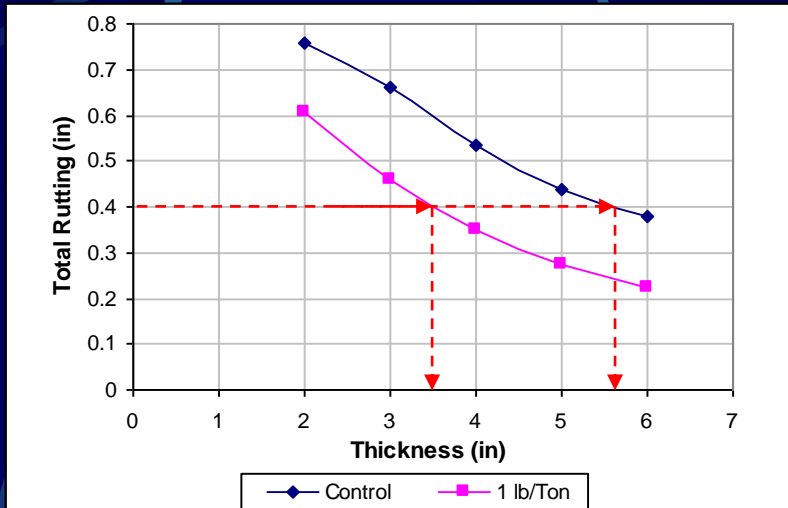
- 10 runs were performed for each of the control and fiber reinforced asphalt mixtures as follows:
 - 2 Traffic Levels, 1500 and 7000 AADT (*intermediate & high traffic*)
 - 5 Different (AC) layer thicknesses (2"-6")
- Project location: Phoenix
- Design life: 10 years
- Distress evaluated: Rutting



Science Details

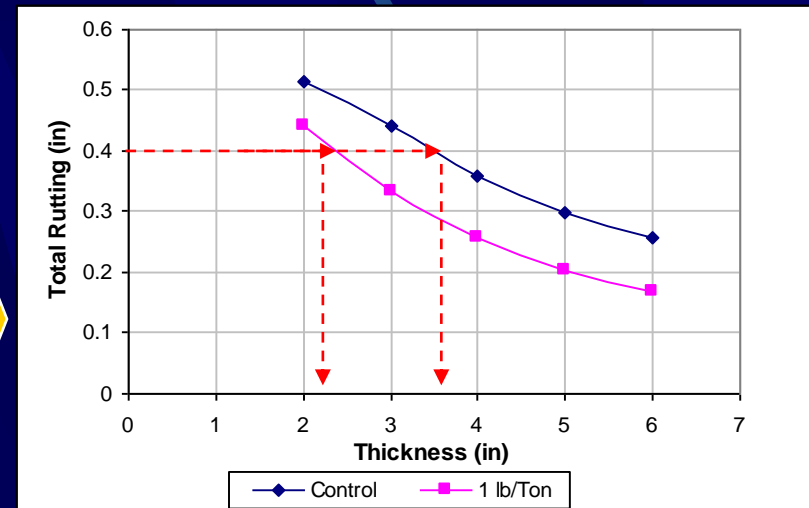
Rutting Evaluation

AADT=7000~50,000,000 ESAL's



To reach no more than 0.4" of rutting during a design period of 10 years, a control AC pavement thickness would require 5.5"; whereas the fiber reinforced AC layer thickness needed would be only 3.5", a saving of 2" (35%)

AADT=1500~10,000,000 ESAL's



Similarly for an intermediate traffic analysis, the saving would be 1.5" of AC layer thickness, or (35%)

Science Details

Reduced Thickness Findings

- FORTA fiber-reinforced asphalt mixture
 - Better than the control mixture
 - Using the rutting distress criteria:
 - Reduced wearing course thickness 1-1/2" to 2"
 - FORTA-FI provides 35% material savings!

Science Details

Extended Life Findings

- FORTA fiber-reinforced asphalt mixture
 - Better than the control mixture
 - Using the rutting distress criteria:
 - Same wearing course thickness showed extended design life from 10 years to 15+ years
 - FORTA-FI provides >50% longer asphalt life!

Science

Cracking Evaluation

- Cracking
 - Fatigue- *repetitive traffic loading*
 - Reflective- *joint, crack or defect in under layers*
 - Thermal- *expansion/contraction due to temperature*
- FORTA-FI significantly reduces crack propagation!



Project

Jackson Hole Air Port - Jackson, WY 5/09

- FORTA-FI was used in a 1 1/2" porous friction course. This airport has several unique attributes that demanded a specific asphalt mixture:
 - It is located in Grand Teton National Park
 - 35,000 flights annually, >300,000 emplanements



Project

Jackson Hole Air Port - Jackson, WY 5/09

- 6,450' (1,966 m) runway elevation causes planes to land at higher speeds
- 6,300' (1,920 m) runway length is relatively short for higher speeds and larger aircraft
- Accommodates both smaller planes and larger planes like 757's and A320's



Project

Jackson Hole Air Port - Jackson, WY 5/09

- 300" (7.62 m) of snow annually
- Snow plowing causes pavement to ravel
- Temperatures can swing from -40F (-40C) to 41F (5C) in the winter months, and annually from -40F (-40C) winter to 104F (40C) summer



Project

Jackson Hole Air Port - Jackson, WY 5/09

● Fiber-Reinforced Porous Friction Course, JMF:

- Aggregate
 - 50% ¾" rock
 - 30% ½" rock
 - 20% crusher fines
- Asphalt
 - PG 64-34
 - Specific gravity 1.028
 - Mixed at 325F, placed at 284F – 302F
 - 5.7% of total mix

Project

Jackson Hole Air Port - Jackson, WY 5/09

● Fiber-Reinforced Porous Friction Course, JMF:

- Hydrated lime
 - Added at 0.75% of dry aggregate weight
- Reinforcing-fibers
 - FORTA-FI HMA blend
 - (FIHMA191.0SM)
 - Added at 1 lb. per ton, 0.15% per ton dry aggregate
- Density
 - 152.1 pounds per cubic foot, (PCF)

Project

Jackson Hole Air Port - Jackson, WY 5/09

- Asphalt plant:
 - Rate averaged 230 tons per hour, (TPH)
 - Built in 1956, transported to site
 - Fiber added at discharge shoot, (not recommended)



Project

Jackson Hole Air Port - Jackson, WY 5/09

● Observations:

- Very good distribution
- 1 small fiber clump found in 9,500 tons
- Any fiber build-up should be removed when noted



FORTA-FI

Typical Project Benefits

● Cost

- Increased crack spacing
- Reduced sections
- Faster scheduling

● Schedule

- Fewer trucks
- Reduction of materials
- Fewer cracks
- Overlay versus replacement

● Performance

- Determinate
 - 3D (*isotropic*) reinforcement
- Indeterminate
 - Improved energy issues
 - Toughness
 - Post crack load capability
 - Crack control
 - Impact resistance
 - Fatigue & durability life
 - Inert

Thank you for your time!



- FORTA Corporation
 - Tracy Lang