



*High Strength Fibers for Asphalt Reinforcement*



**Lon Frey**  
**NW Solutions Engineer**



# Agenda

---

1. What is Forta-Fi®?
2. How does Forta-Fi® enhance asphalt performance?
3. Value Engineering with Forta-Fi® - Project Examples

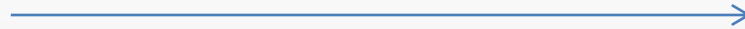
Open forum...  
please ask questions!



# What is Forta-Fi<sup>®</sup>?

# Fibers in HMA Mixtures

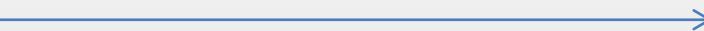
- Tire fibers



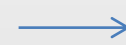
- Coconut fibers



- Cellulose fibers



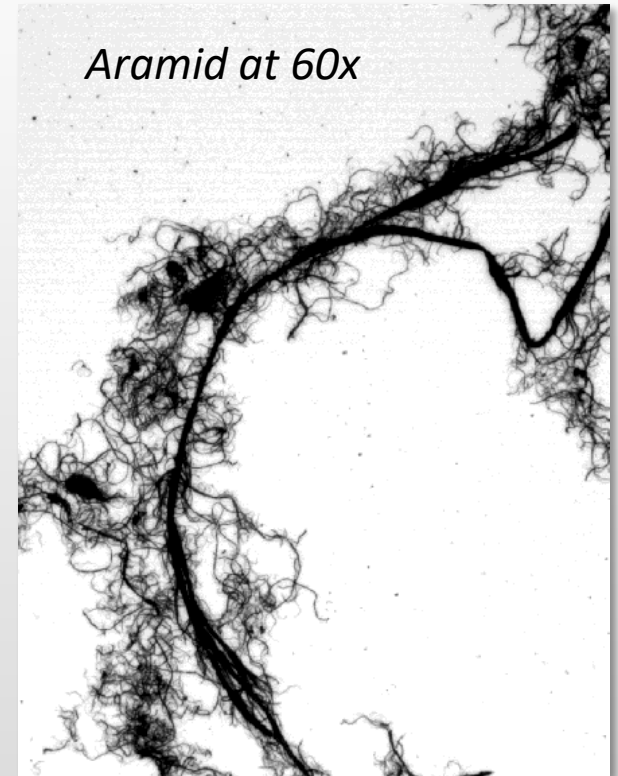
- Polyester & Glass fibers



- Now: Aramid Fibers



# Forta-Fi = Aramid Strength



*Key word: "Microfibrillation"*

# The Forta-Fi Blend

---

- Aramid fibers = HIGH TENSILE STRENGTH
- Polyolefin fibers = DISTRIBUTION





**Fiber Reinforced Asphalt Concrete - FRAC**

# Forta-Fi: Quick Facts

- **No modifications** needed to current construction practice
- **No modifications** needed to asphalt mix design. Can be used as drain-down fiber in porous mixes.
- **One pound** dosage per ton of asphalt
- **Mixes well** in both Batch and Drum plants
- **Engineered and manufactured** in the USA by the Forta Corporation for over 25 years





# Adding FORTA-FI to Asphalt



# FRAC Applications



Interstates & Arterials



New Construction



Overlays



Commercial/Industrial



Airfields



Heavy Duty

# Forta-Fi Use – Worldwide



# U.S. & NW Forta-Fi Use

## State DOT Use:

- Oregon DOT
- Idaho Trans. Dept.
- Washington DOT (Field test in 2017)
- Ohio DOT
- Illinois DOT
- Georgia DOT
- Pennsylvania DOT
- Alabama DOT
- New Jersey DOT
- Delaware DOT
- Idaho DOT
- Wyoming DOT
- Alaska DOT
- Arizona, Utah, CO next

## Washington:

- City of Lacey
- City of Bremerton
- City of Spokane
- City of Puyallup
- City of Othello
- City of Pullman
- Thurston County
- Snohomish County
- Clark County
- Kitsap County
- Whitman County
- Private sector

## Idaho:

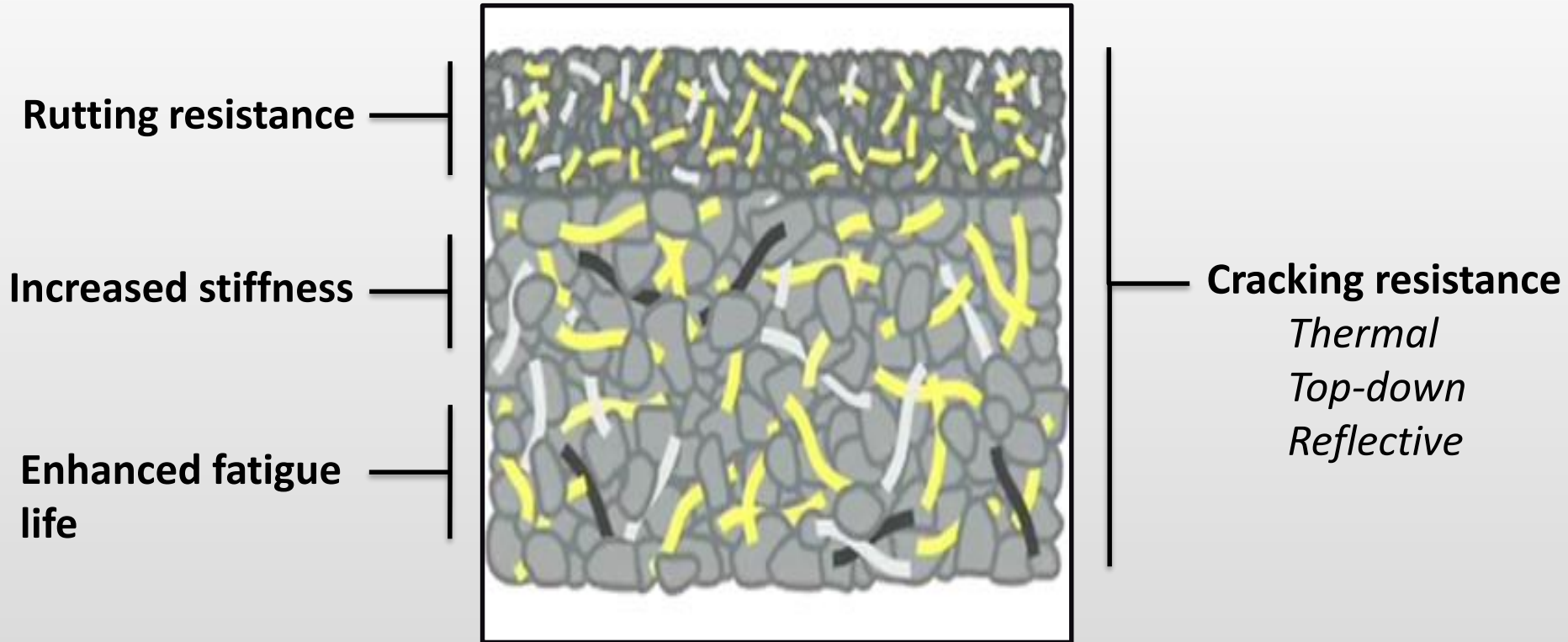
- City of Chubbuck
- Ada County
- Hagerman Highway District
- Private Sector

## Oregon:

- City of Portland
- City of Tigard
- City of Sherwood
- City of Oregon City
- City of West Linn
- City of Medford
- City of Hillsboro
- City of Beaverton
- Jackson County
- Marion County
- Multnomah County
- Private sector

# How does Forta-Fi<sup>®</sup> Enhance Asphalt Performance?

# Forta-FI: Full AC Section Reinforcement



# Rutting Resistance (ADOT, 2014)

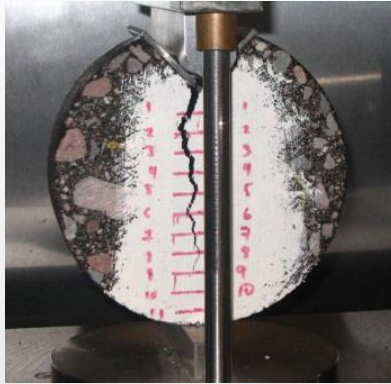
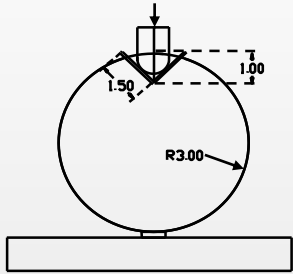
## *The Hamburg Wheel Tracking Test*

37% Reduction  
in Rut Depth!

Project Name:	NON FIBER SAMPLE	Date:	1/14/2015
Project Number:	XM12202X	Date Sampled:	1/14/2015
Job Number:	LOT #	Lab Number:	
Project Engineer:	Project Engineer	Mix Type:	Mix Type
Submitted By:	Submitted By	Asphalt Grade:	Asphalt Grade
Temperature:	50°C	Pit Source:	Pit Source
Comments:	TEST # 50 LV=7.2, RV=7.4, 60 MM GYRO PLUGS <i>Test # 50</i>		
Max Impression:	Left -7.13 mm Pass #: 20000 / Pt: 6	Right -11.01 mm Pass #: 19950 / Pt: 4	Average -9.07 mm
Fail Depth: 20.00mm	PASS	PASS	PASS

Project Name:	WITH FIBER #3	Date:	1/28/2015
Project Number:		Date Sampled:	1/28/2015
Job Number:	LOT #	Lab Number:	
Project Engineer:	Project Engineer	Mix Type:	Mix Type
Submitted By:	Submitted By	Asphalt Grade:	Asphalt Grade
Temperature:	50°C	Pit Source:	Pit Source
Comments:			
Max Impression:	Left -7.04 mm Pass #: 20000 / Pt: 8	Right -4.42 mm Pass #: 19950 / Pt: 10	Average -5.73 mm
Fail Depth: 20.00mm	PASS	PASS	PASS

# Cracking Resistance (Kaloush, 2008)



- 50% increase in peak strength
- 100% increase in fracture energy





# Cracking Resistance (NAU, 2015)

- Havasupai Road, 2 Year Study



Forta-Fi: 3 Cracks TL 11.2'  
Conventional: 18 Cracks TL 123'

# Field Testing – PCI Study

- PennDOT SR3036, June 2011
- 1.5” overlay, Forta-Fi vs. conventional mix



# PCI Comparison

- PCI measured July 2015 after four years of service

BRANCH	SECTION	DESCRIPTION	SEVERITY	QUANTITY	UNITS	AID	ASU
						PCI	PCI
SR 3036	1 (fiber)	ALLIGATOR CR	L	18.5	SF	95	93.46
		L & T CR	L	80.00	FT		
		PATCH/CUT	L	3.00	SF		
	2 (no fiber)	ALLIGATOR CR	L	120.75	SF	72	69.08
		ALLIGATOR CR	M	18.00	SF		
		L & T CR	L	73.00	FT		
		L & T CR	M	40.50	FT		
		RAVELING	M	746.00	SF		

# Project PCI curves – SR3036

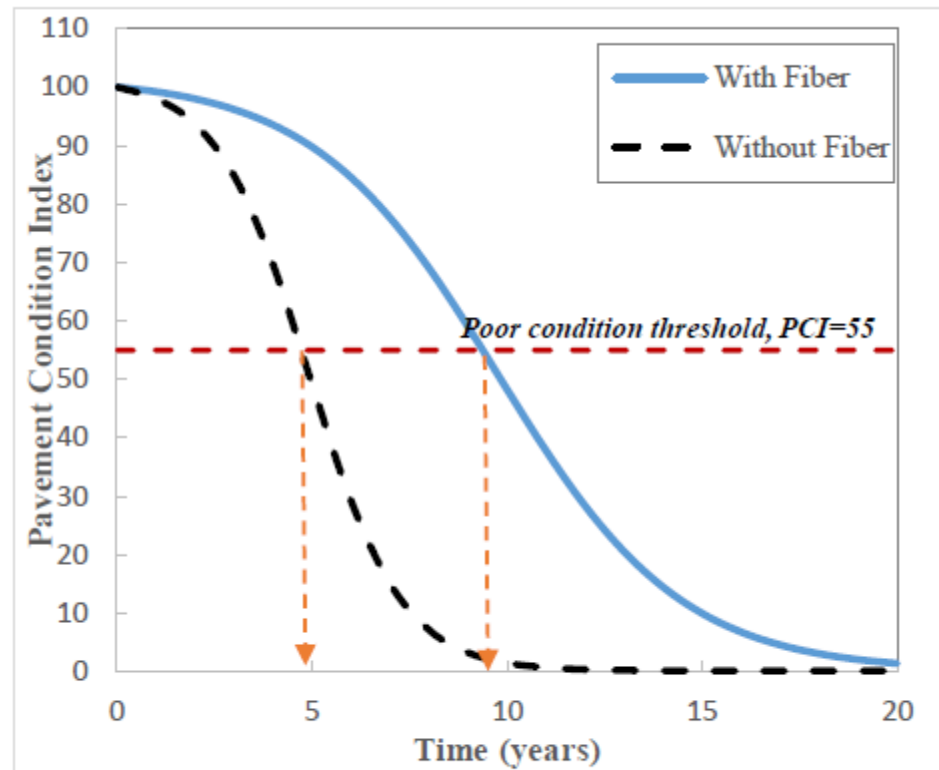
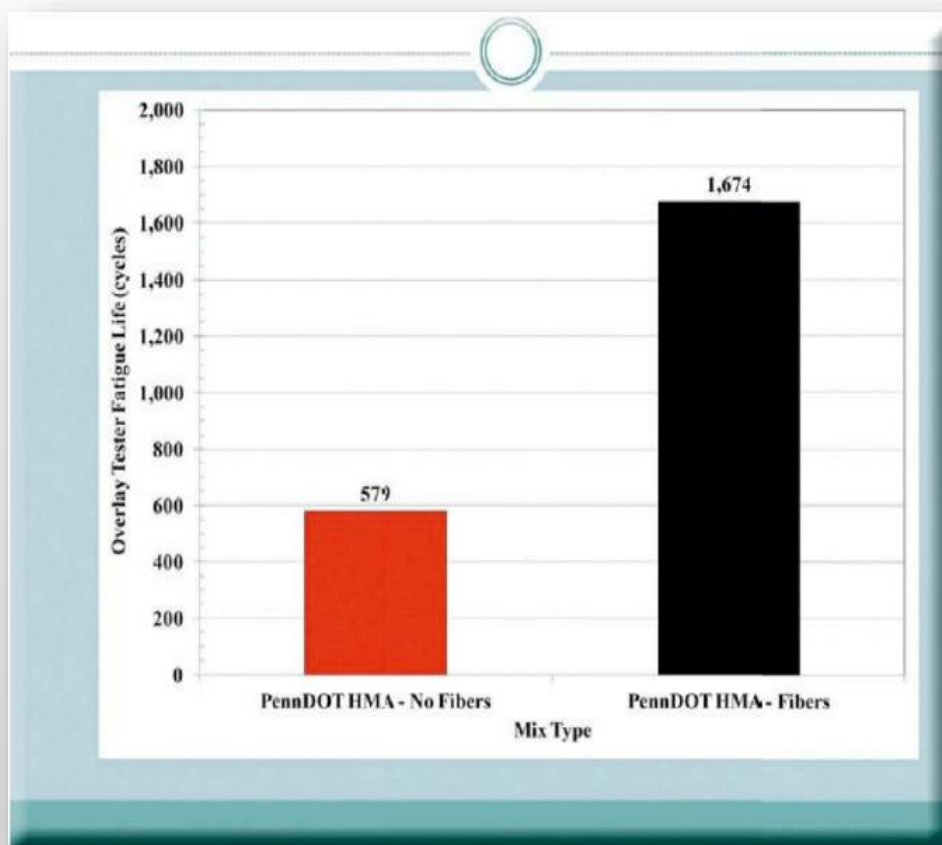


Figure 2. Projected pavement performance master curves for SR 3036 road sections.

# Enhanced Fatigue Life (PennDOT, 2012)



*Texas Overlay Tester*

300% increase in  
fatigue life!

# Value Engineering with Forta-Fi®

# FORTA-Fi Value Proposition

## Save Now

Use 35% Less Asphalt Thickness  
Stronger than your traditional asphalt mixture.



## Save Down the Road

Lasts 50% Longer  
Reduce cracking and rutting.



*For overlays, reconstructions, and new pavements*

# 1 - Save Now



# Asphalt Thickness Reduction

- City of Huntington Beach (2014)
- 5" FRAC replaced 7" AC on Argosy Road
- Saved City \$4/SY or \$80,000 total on project



# ASU West Campus – Phoenix, AZ

- Bus lane: 6" AC design reduced to 4" FRAC (2010)
- 6 years of service and no visible distress



# ASU West Campus – Phoenix, AZ



- 1.5” thin overlay on inbound campus entrance lanes (2010)



# Asphalt Thickness Reduction

- City of St. Charles MO (2016)
- 6" FRAC replaced 9" AC on Headland Dr.
- Saved City \$8.00/SY or 15% on total project



# 2 - Save Down The Road

# I-5 Truck Ramp – Roseburg, OR

- Forta-Fi used on weigh station off-ramp in 2013
- Dynamic load from braking trucks was causing asphalt replacement every 2 years Oregon DOT
- Ramps are still in good shape after 2 years:



# City of Lacey – Marvin Road (2016)

- 8” FRAC for new lane and 2” FRAC inlay on existing roundabout with heavy truck traffic to warehouses
- Looking for extended design life and reduced top-down fatigue cracking



# Ada County ID – Bogus Basin Road

- 2" FRAC overlay to extend life and reduce future maintenance
- Paving crew and field inspector both surprised at easy of compaction on inclines and hairpin turns





# Reduce Future Maintenance Costs

- West Jordan, UT (2014)
- 2.5" overlay, polymer modified w/ Forta-Fi
- Reduced cracking & increased fatigue life



# 3 - Save Now and Down The Road?

# Partial Thickness Reduction

- City of Laguna Niguel, CA (2013)
- Fiber reduced AC thickness from 5" to 4"



# City of Laguna Niguel, CA

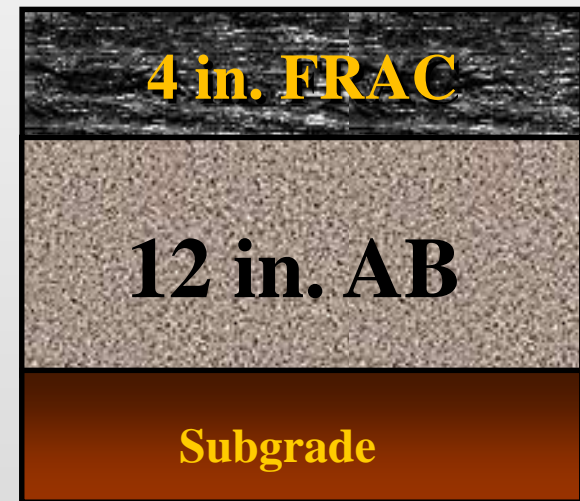
**Cost Savings of \$2.50/sy, over \$150,000 total**

## Conventional Design



320,000 ESALs

## FRAC Design



440,000 ESALs



*Longer Life Too!*

# Boeing – Mesa, AZ

- Forta-Fi used to reduce all 4" AC sections to 3" FRAC (2008)
- Used on high traffic roadways and airfields



# Boeing – Mesa, AZ

- 7 years of service, **0 cracks!**



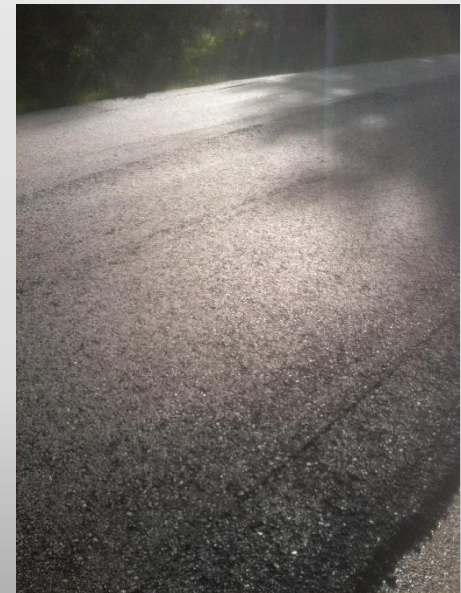
# Forta-Fi<sup>®</sup> Solves Project Challenges



# City of Bremerton – Belfair Road (2013)

---

- Badly cracked road with subgrade issues needed rehabilitation but limited budget
- Conventional HMA overlay would probably only last 3-4 years before existing cracks reflected through so instead went with 1.5” FRAC overlay to extend life at a modest cost
- Virtually no cracks after 3 years!





# Avoid Full Reconstruction

- Newport Beach, CA (2013)
- New truck traffic meant thicker AC required... but what about curb & gutter restrictions?!



# Avoid Full Reconstruction (cont.)

- Conventional design required 6" AC over 6" AB
- Instead went with 4" FRAC over 6" existing AB
- Forta-Fi allowed existing AB section to remain in place, saving \$\$\$



# Use Forta-Fi Instead of Other Strategy

- City of Othello WA Overlay (2016)
- Used Forta-Fi in 2" overlay on high traffic downtown street instead of paving fabric
- Less labor intensive and quicker construction



# Jackson Hole Airport, WY (2009)

## Unique challenges:

- Extreme dynamic loading at 7000' elevation
- Raveling due to snow plowing
- High thermal stresses due to temp swings
- 7 years old when overlay was required
- 1.5" Open Graded Friction Course with Forta-Fi



# Jackson Hole Airport – 7 Years Later

Runway is holding up great with minimal maintenance!



# Forta-Fi Strong!!!



# Forta Fi Value Proposition Summary

---

- **Forta-Fi adds structural capacity, strength, and durability to your asphalt**
- **This added strength allows you to:**
  - a) Reduce AC thickness up to 35% and save money now
  - b) Keep existing AC thickness and extend life by 50%
  - c) Both reduce AC thickness (<35%) and extended life
  - d) Increase AC strength when traffic loads exceed original design or utility/gutter constraints exist
- **Alliance Geo provides these services for free:**
  - a) Provide alternate FRAC designs to meet your priorities
  - b) Provide FRAC HMA specs (5.04) for your project
  - c) Support your asphalt producer with mixing fiber at their plant

# Thank you for your time!



Questions or need additional information?  
Please email me at [lon@alliancegeo.com](mailto:lon@alliancegeo.com)

