



Superior Asphalt Performance

SURFACE TECH™

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**Superior Asphalt Performance**

## **USE ACE XP Polymer Fiber To:**

**Improve Crack Resistance  
Improve Rut Resistance  
Improve Strength**

## **Gain**

**Reduced Crack Filling Cost  
Reduced Pot Hole Repair Cost  
Reduced Pavement Thickness (If Desired)  
Reduced Overlay Cost**

## **Achieve**

**Longer Lasting Pavement Performance  
Reduced Maintenance Cost Over the Life of Pavement  
Less Traffic Congestion Due to Road Reconstruction  
A Happier Traveling Public**

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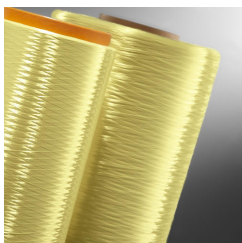




# Superior Asphalt Performance

**ACE XP Polymer Fiber™ is a true achievement in additive technology to enhance asphalt concrete performance.**

ACE XP Polymer Fiber™ extends pavement service life by dramatically improving the dynamic modulus of the asphalt layer and increasing the asphalt's resistance to cracking and rutting (distresses that may cause premature failure). To create ACE XP Polymer Fiber™, high-strength man-made "*aromatic polyamide*" or *Aramid* Fibers are bundled and coated with Sasobit® wax to create an asphalt concrete additive that is simple to mix with any WMA or HMA in through a drum and or batch asphalt operation. The 3-dimensional reinforcement throughout the asphalt layer increases the asphalt's resistance to cracking, rutting, and fatigue while providing improved ESAL (Equivalent Single Axel Load) capacity.



**Aramid Fiber**  
(2.1 to 4.2 ounces/ton)



**Sasobit® Wax**  
(1.3 to 2.6 ounces/ton)



**ACE XP Polymer Fiber™**  
(3.4 to 6.8 ounces/ton)

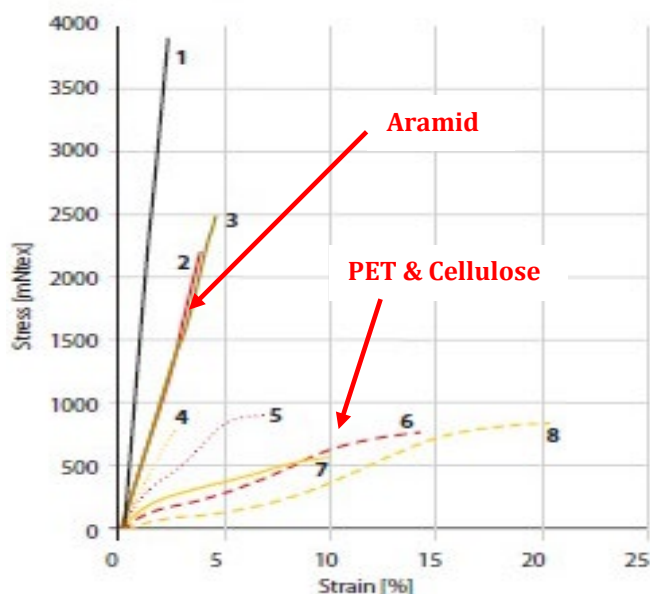
**ACE XP Polymer Fiber™ is engineered for performance.**

Aramid Fibers are used extensively in many industries and applications including ballistic protection, heat & cut protection, automotive, ropes & cables, conveyor belts, etc. However, it takes a special fiber to withstand the extreme production temperatures of asphalt concrete without changes occurring to the reinforcement properties of the fiber. That is why ACE XP Polymer Fiber™ uses aramid fibers exclusively. Aramid is a unique man-made, high-strength polymer fiber boasting high tensile strengths over 400,000 psi (5 x steel), a superior stress/strain relationship, and decomposition temperatures of 932°F (well above asphalt mixing temperatures of 400°F). Both ¾" long and 1.5" long fiber lengths are available for superior long-term performance.

**ACE Fiber Specifications**

Material Property	Measure
Material	Para-Aramid Fiber (50-70% by weight)
Form	Filament Yarn
Tensile Strength	> 2.758 (GPa)
Elongation at Break	< 4.4 (%)
Modulus	> 95 (GPa)
Specific Gravity	1.44-1.45 (g/cm³)
Decomposition Temperature	> 800 (°F)
Treatment Type	Sasobit® Wax (30-50% by weight)
Treatment Melting Temperature	> 170 (°F)
Length	¾" & 1.5" +/-0.05 (inch)
Appearance/Handling	Free Flowing Coated Fiber Bundles (visual)

**Aramid Stress/Strain Curves**

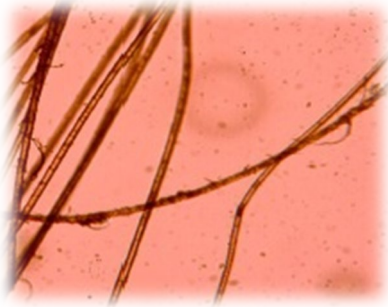




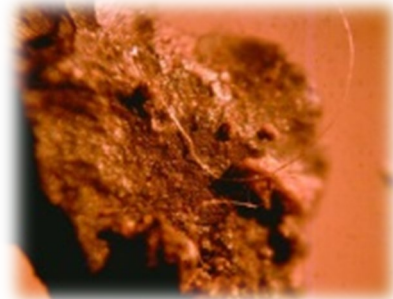
# Superior Asphalt Performance

## How does ACE XP Polymer Fiber™ reinforce asphalt concrete?

As the standard dosage of ACE XP Polymer Fiber™ is mixed into WMA or HMA (3.4 ounces of ACE Fiber™ per ton of asphalt concrete), the Sasobit® wax melts at approximately 170°F, releasing millions of Aramid Fibers uniformly throughout each ton of asphalt concrete. Aramid is a unique polymer fiber that has hair-like fibrils which root tenaciously in the liquid asphalt binder and bond to small granules and aggregates. Through the combination of high tensile strength, strength at low strain, and "fiber anchoring" ACE XP Polymer Fiber™ delivers reinforcement to asphalt concrete and enhances the strength and durability of the finished asphalt concrete mix.



ACE XP Polymer Fiber™ microscopic photos after chemical extraction



### ACE XP Polymer Fiber™ (Before & After)

Aramid Fibers have fibrils that anchor and bond themselves within the liquid asphalt binder and granules increasing the tensile strength of the mix.







# Superior Asphalt Performance

## ACE XP Polymer Fiber™ Lab Testing:

Lab Test Description	ACE XP Results
<b>Lab - TTI Overlay Tester</b> <i>Thermal/Reflective Cracking</i>	+140%
<b>Lab - DC(T) Test</b> <i>Low Temperature Fracture Energy</i>	+21%
<b>Lab - IDT Strength Test</b> <i>Low Temperature Strength @ Critical Crack Temperature (Ran both ¾" and 1 ½" ACE XP Lengths)</i>	+8 to 17%
<b>Lab - IDT Creep Compliance Test</b> <i>Determine Low Temperature Critical Cracking Value (Bottom PG Number)</i>	-4.3° C (-1 PG – Bottom Number)
<b>Lab - Hamburg Rut Test</b> <i>Determine Rut Resistance of Various Asphalt Mixes (Top PG Number)</i>	PG64-22 (w/ ACE) = PG70-22 (+1 PG – Top Number)
<b>Lab - Hamburg Rut Test</b> <i>Determine Rut Resistance of Various Asphalt Mixes (Top PG Number)</i>	PG70-22 (w/ ACE) = PG76-22 (+1 PG – Top Number)
<b>Lab – Flow Number Test (FN)</b> <i>Determine Rut Resistance of ODOT Level 3 mix vs Control (Ran both ¾" and 1 ½" ACE XP Lengths)</i>	+37.5%
<b>Lab – Flexibility Index Test (FI)</b> <i>Determine Fatigue Cracking Resistance of ODOT Level 3 mix vs Control (Ran both ¾" and 1 ½" ACE XP Lengths)</i>	+37%
<b>Lab – IDEAL CT Cracking Test</b> <i>Determine IDEAL CT Crack Index of TxDOT Dense Grade 64-22 vs Control – (1 ½" ACE XP Lengths)</i>	+36%
<b>Lab – IDEAL CT Cracking Test</b> <i>Determine IDEAL CT Crack Index of TxDOT SuperPave 76-22 vs Control (1 ½" ACE XP Lengths)</i>	+58%

## ACE XP Polymer Fiber™ Field Testing:

Field Test Description	ACE XP Results
<b>Field – APLT (Automated Plate Load Test) Static Creep</b> <i>Measure Plastic Deformation of In-Place Asphalt (Rut) vs Control</i>	+11 to 19% Rebound Ratio over Control
<b>Field – APLT (Automated Plate Load Test) Elastic Modulus</b> <i>Measure Elastic Modulus of In-Place Asphalt w/ ACE Fiber</i>	+150%
<b>Field – APLT (Automated Plate Load Test)</b> <i>SN Layer Coefficient, a<sub>1</sub> Back Calculate SN Layer Coefficient, a<sub>1</sub> using Measured Elastic Modulus</i>	+40%
<b>Field – APLT (Automated Plate Load Test)</b> <i>ESAL Prediction Using AASHTO 93 Calculate Increase ESAL Capacity of In-Place Asphalt Reinforced w/ ACE XP Polymer Fiber</i>	+100% or more Depending of Depth of Asphalt
<b>Field – APLT (Automated Plate Load Test)</b> <i>Measure Plastic Deformation of In-Place Asphalt (Rut) vs Control at various simulated tire pressures ranging from 150 to 750psi</i>	24% to 31% Less Rutting Depth
<b>Field – APLT (Automated Plate Load Test)</b> <i>Measure Plastic Deformation of In-Place Asphalt (Rut) vs Control at constant load of 20,000 lbs. for 15 minutes</i>	61% Less Rutting Depth



# Superior Asphalt Performance

## Does ACE XP Polymer Fiber™ Lab performance translate to Field performance?

During summer months when asphalt pavements get hot and "soften" it is easier for wheel loads to create ruts in the surface, but not when millions of Aramid Fibers are rooted in the asphalt because they provide resistance to the "flow" of the soft binder. Likewise, in winter months when asphalt pavements are cold, and the asphalt shrinks and expands, ACE XP Polymer Fiber™ provides added tensile strength to the asphalt and enhances the pavement's resistance to thermal cracking as well as fatigue cracking that tends to happen during at higher temperatures.



Burnside Road – Portland, OR (2014)



Burnside Road – Portland, OR (2014)

### ACE XP Polymer Fiber™ - 1<sup>st</sup> Commercial Installation – Burnside Road – Portland, OR (June 2014)

Burnside Road is a heavily traveled arterial roadway in downtown Portland, Oregon. The City chose this roadway for their first ACE XP project due to the poor condition of the existing roadway at the time. Both cracking and some rutting, especially at the intersections was obvious. These photos were taken in March of 2017 after 3 winters by the City of Portland and shared with Surface Tech.



Burnside Road – Portland, OR (2014)



Burnside Road – Portland, OR (2014)





## Superior Asphalt Performance



Westchester Rd - 2015



Westchester Rd - 2016

### ACE XP Polymer Fiber™ - Butler County, Ohio - Westchester Rd. Overlay Test Project (Before & After)

Reflective cracks from extensive thermal cracking in Control lane propagated through the asphalt overlay less than 10 months after the 1.5-inch overlay was completed, but not through the ACE XP Polymer Fiber™ Reinforced lane even a year later. Rutting is also controlled.



Travel Center Entrance – November 2015



Travel Center Entrance – November 2015

### ACE XP Polymer Fiber™ - Sadieville, KY – LOVE'S Travel Center (2015 - Before & After)

Building a pavement section that can handle the pounding of the daily Truck Traffic is very appealing to LOVES. Beside the cost of the building, asphalt maintenance is the second largest expense for each location over the life of the Travel Center. Reducing the cost of this maintenance and the disruption caused by such maintenance was instrumental for LOVES to trust their pavements to ACE XP Polymer Fiber.



Travel Center Entrance – April 2016



Travel Center Entrance – March 2018

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## Superior Asphalt Performance

### Is ACE XP Polymer Fiber™ reinforced asphalt concrete easy to pave with?

Absolutely! Once ACE XP Polymer Fiber™ is dispersed throughout the asphalt mix, millions of light-weight aramid fibers go to work reinforcing the asphalt mix, but they do not cause any changes to the working characteristics of asphalt mix. ACE XP Polymer Fiber™ reinforced asphalt concrete goes through the paver in the exact same way, it can be raked and shoveled the in the same way and can be compacted the same way using the same equipment. All laydown procedures are seamless, making adoption of the technology easy and cost effective. Add ACE XP Polymer Fiber™ to overlays and new pavements alike.



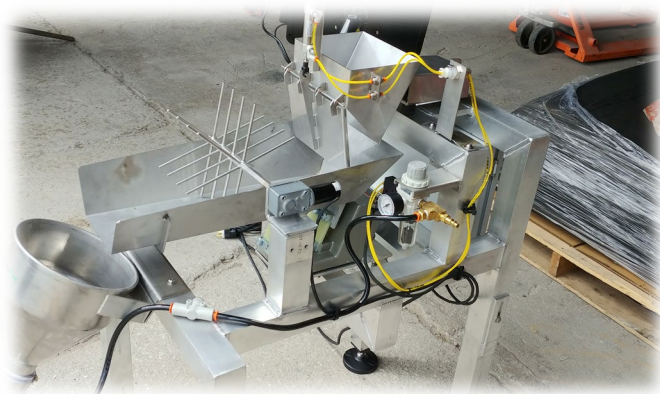
### How do I assure the right amount of ACE Fiber™ gets added to my asphalt?

Although ACE XP Polymer Fiber™ is engineered with controlled amounts of Sasobit® Wax in order to efficiently disperse the Aramid Fiber throughout the asphalt mix, Surface Tech recognizes the importance of proper dosage and mixing of the ACE XP Polymer Fiber™ during production at the asphalt plant. ACE XP Polymer Fiber™ is easily included into the asphalt mixing process at both batch and drum plant facilities. A simple-to-operate Line-Vac® Compressed Air Delivery System or the Automated Micro Doser MD3+ is used to transport the appropriate amount of ACE XP Polymer Fiber™ to either the mixing drum of a drum plant or the pug mill/weigh hopper of a batch plant.

Once ACE XP Polymer Fiber™ is fed into mixing drum, the Sasobit® wax becomes fully soluble in the liquid asphalt binder and releases millions aramid fibers to be dispersed throughout the heated aggregate and Recycled Asphalt Pavement (RAP) prior to the injection of the liquid asphalt binder. The addition of a single dose (3.4 ounces per ton of asphalt) of ACE XP Polymer Fiber™ does not change the asphalt volumes or require any change to the job mix formula (JMF).

Every ACE XP Polymer Fiber™ sale provides a robust QA/QC program to ensure the right amount of ACE XP Polymer Fiber™ makes its way into each ton of asphalt concrete for every project. Asphalt producers may choose from the following options to perform Certified ACE XP Polymer Fiber™ mixing at their plants:

- ▲ Full Service – Provided by a Trained and Certified QA/QC Technicians
- ▲ Do-it-Yourself (DIY) – Self Perform after Training & Certification is Obtained



The MD3 Mini is used to transport ACE XP Polymer Fiber™ to the RAP Collar at a Drum Plant



The Micro Doser MD3+ delivers ACE XP Polymer Fiber™ continuously to either the Drum or Pug Mill

Both QA/QC Methods ensure ACE XP Polymer Fiber™ is well dispersed in the Asphalt Mix





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## ACE XP Polymer Fiber™ Value Proposition Examples:

Adding ACE XP Polymer Fiber™ to an asphalt concrete mix design, an engineer, owner or agency can expect the following Value-Added Results:

1. **ADD** strength and durability at **VERY LITTLE COST**
2. **ADD** some strength and durability at **NO COST**
3. **SAVE COST** in-lieu of traditional methods (Polymer Modified Binders and or Interlayers)

### Increase Durability of Overlay

**1.5" asphalt overlay with ACE**  
2-to-5-year Service Life Increase  
Cost Increase: +/- \$1.00 per SY

### Strengthen Light Duty Pavements

**3.0" light duty asphalt with ACE**  
ESAL increase: >160%  
Cost Increase: +/- \$2.00 per SY

### In-lieu of Reflective Crack Interlayers

**1.5" asphalt overlay with ACE**  
2-to-5 year Service Life Increase  
Cost Savings: \$1-10 per SY

### Optimize Heavy Duty Pavements

**5.0" heavy duty asphalt with ACE**  
**(In-lieu of 6" w/o ACE)**  
ESAL increase: >40%  
Cost Neutral: +/- \$0.00 per SY

### In Lieu of Polymer Modified Binder

**2.0" asphalt overlay with ACE**  
Equal Service Life BUT Easier Lay Down  
Cost Neutral: \$0.00 per SY



KYTC Bluegrass Parkway – Lawrenceburg, KY  
Installed August 2018



Burlington Coat Factory - Milwaukee, WI  
Installed October 2016





## Superior Asphalt Performance



### What's In Your Asphalt?



Superior Asphalt Performance

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