

ARMOUR YOUR ASPHALT

HIGH PERFORMANCE FIBER REINFORCED ASPHALT CONCRETE (FRAC)



ACE FIBER

**WHEN PERFORMANCE
MATTERS**

Advanced Aramid Fiber Technology for Asphalt

Durability | Strength | Service Life | Economy

Distributed by: Layfield Group | layfieldgroup.com | 1.800.377.8404

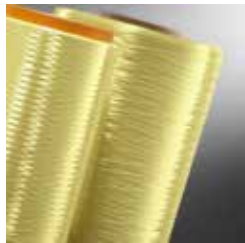
SURFACE TECH™
SURFACE-TECH.COM



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

ACE 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 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 drum and batch asphalt operations. The 3-dimensional reinforcement throughout the asphalt layer increases the asphalt's resistance to cracking, rutting, and fatigue while providing improved ESAL capacity.



Aramid Fiber
(2.1 ounces/ton)



Sasobit® Wax
(2.1 ounces/ton)



ACE Fiber™
(4.2 ounces/ton)

ACE 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 Fiber™ uses aramid fibers exclusively. Aramid is a unique man-made, high-strength fiber boasting high tensile strengths over 400,000 psi (5 x steel), a superior stress/strain relationship, and decomposition temperatures exceeding 800°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.

Material Property	Measure
Material	Para-Aramid Fiber (50-52% 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 (48-50% by weight)
Treatment Melting Temperature	> 175 {°F}
Length	¾ & 1.5" +/-0.05 (inch)
Appearance/Handling	Free Flowing Coated Fiber Bundles (visual)



How does ACE Fiber™ reinforce asphalt concrete?

As the standard dosage of ACE Fiber™ is mixed into WMA or HMA (4.2 ounces of ACE Fiber™ per ton of asphalt concrete), the Sasobit® wax melts at approximately 170oF, releasing approximately 19 million ¾” long or 9.5 million 1.5” long Aramid Fibers uniformly throughout each ton of asphalt concrete. Aramid is a unique fiber that has

hair-like fibrils which root tenaciously in the liquid asphalt binder and bond to small granules and aggregates. The combination of high tensile strength, strength at low strain, and “fiber anchoring” is how ACE Fiber™ reinforces asphalt concrete and enhances the strength and durability of the finished asphalt concrete mix.

ACE 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.



ACE Fiber™ microscopic photos after chemical extraction



Has ACE Fiber™ been Lab tested?

Lab Test Description	ACE Fiber™ Results
Lab - TTI Overlay Tester [Thermal/Reflective Cracking]	+140%
Lab - DC(T) Test [Low Temperature Fracture Energy]	+21%
Lab - IDT Strength Test [Low Temperature Strength @ Critical Crack Temperature]	+10%
Lab - IDT Creep Compliance Test [Determine Low Temperature Critical Cracking Value] Bottom PG Number	-4.3°C (-1 PG)
Lab - Hamburg Rut Test [Determine Rut Resistance of Various Asphalt Mixes] Top PG Number	PG64-22 (w/ACE) = PG70-22 (+1 PG)
Lab - Hamburg Rut Test [Determine Rut Resistance of Various Asphalt Mixes] Top PG Number	PG70-22 (w/ACE) = PG76-22 (+1 PG)



Has ACE Fiber™ been Field tested?

Field Test Description	ACE Fiber™ Results
Lab - TTI Overlay Tester [Thermal/Reflective Cracking]	+121% Rebound Ratio
Lab - DC(T) Test [Low Temperature Fracture Energy]	+150%
Lab - IDT Strength Test [Low Temperature Strength @ Critical Crack Temperature]	+40%
Lab - IDT Creep Compliance Test [Determine Low Temperature Critical Cracking Value] Bottom PG Number	+348%

Does ACE 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 Fiber™ provides added tensile strength to the asphalt and enhances the pavement’s resistance to thermal cracking.



ACE Fiber™ - County 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 Fiber™ Reinforced lane even a year later. Rutting is also controlled.





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

Absolutely! Once ACE Fiber™ is dispersed throughout the asphalt mix, the 19 million light-weight individual fibers do not cause any changes to the working characteristics of asphalt concrete. ACE Fiber™ reinforced asphalt concrete goes through the paver in the exact same way, can

be raked and shoveled the in the same way, and can be compacted the same way using the same equipment. All lay down procedures are seamless, making adoption of the technology easy and cost effective. Add ACE Fiber™ to overlays and new pavements alike.



The Line-Vac® is used to transport ACE Fiber™ to the RAP Collar at a Drum Plant



The Micro Doser MD3.0 delivers ACE Fiber™ continuously to either the Drum or Pug Mill

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



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



Although ACE Fiber™ is engineered with controlled amounts of Sasobit® Wax in order to efficiently disperse the Aramid Fiber throughout the asphalt mix, we recognize the importance of proper dosage and mixing of the ACE Fiber™ during production at the asphalt plant. ACE 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 MD3.0 is used to transport the appropriate amount of ACE Fiber™ to either the mixing drum of a drum plant or the pug mill/weigh hopper of a batch plant.

Once ACE Fiber™ is fed into mixing drum, the Sasobit® wax becomes fully soluble in the liquid asphalt binder

and releases the 19 million aramid fibers to be dispersed throughout the heated aggregate and Recycled Asphalt Pavement (RAP) prior to the injection of the liquid asphalt binder. ACE Fiber™ is light weight and requires low dosage (standard dosage is 4.2 ounces per ton of asphalt). The addition of ACE Fiber™ does not change the asphalt volumes or require any change to the job mix formula (JMF).

Every ACE Fiber™ sale provides a robust QA/QC program to ensure the right amount of ACE 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 Fiber™ mixing at their plants:

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



ACE Fiber™ Value Proposition Examples

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

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

Increase Durability of Overlay

1.5" asphalt overlay with ACE
Service Life increase: >50%
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
Service Life increase: >50%
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: >140%
Cost Neutral: +/- \$0.00 per SY

In-lieu of Polymer Modified Binder

1.5" asphalt overlay with ACE
Equal Service BUT Easier Lay Down
Cost Neutral: +/- \$0.00 per SY



Locally Distributed By:



2500 Sweetwater Springs Blvd #110
Spring Valley, CA 91978 | 619.562.1200

18417 72nd Avenue
South Kent, WA 98032 | 425.254.1075

layfieldgroup.com



INNOVATIVE SOLUTIONS **WITH** GEOSYNTHETICS & GEOMEMBRANES



Soil Reinforcement Products

- High strength/High Efficiency Geotextiles
- H2Ri Wicking Fabric
- Geoweb
- Geogrid
- EnviroSlope
- Flex MSE

Geomembranes

- Pit/Pond Liners
- Tank/Frac Liners
- Brine Pit Liners
- Secondary Containment
- Pad Liners
- Landfill Liners
- Fortified Geomembranes
- Textured Liners

Floating Covers & Baffle Curtains

- Potable Water Protection
- Evaporation Control
- Odor Control Cover

- Biogas Collection
- Insulated Covers
- Remediation Covers

Geotubes – Geotextile Dewatering

- Tubes
- Pond Dewatering
- Desludging

Erosion Control Products

- Turf Reinforcement Products
- Straw Wattles
- Construction Poly Sheeting
- Soil Lynx

Silt and Sediment Control Products

- Spring Berms
- Catch Basin Sediment Traps
- Silt Containment Bags, Silt Fence
- Floating Silt Curtains

Stream and Channel Products

- Turbidity Barriers

- Floating Silt Curtains
- Treated GeoJute Curtains

Storm Water Management

- Detention Systems (StormTank)
- Infiltration Systems
- Rainwater Harvesting

Tarps and Enclosures

- Custom Enclosures
- Insulated Blankets
- Fire Retardant Tarps & Roll Stock
- Scaffold Enclosure Systems
- CGSB and C&A Film
- Heat Shrink Hoarding & Supplies

Services

- Design and Design Assistance
- Construction/Installation Services
- Repair and Maintenance Services
- Fabricated Liners and Geotextiles (Prewelded/Presewn in Our Fabrication Plants)