

Extending Asphalt Pavement Life with Geosynthetic Interlayers

October 24, 2019

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Tensar



“All roads are designed to fail”



Current US roads downgraded to D+

Maintenance/Rehabilitation Challenges

- Funding
- Roads not designed to carry current traffic
- Ability to improve PCI of streets
- Maintenance frequency required
- Material selection, specifications, and installation quality
- Safety risk from impatient/distracted public
- Work zone accidents / lawsuits

Objective

- Extend the life of asphalt overlays
- Increase structural capacity
- Reduce long term maintenance
- Improve overall PCI of your roadway network
- Safer roads
- Extend life cycle dollars

Today's Agenda

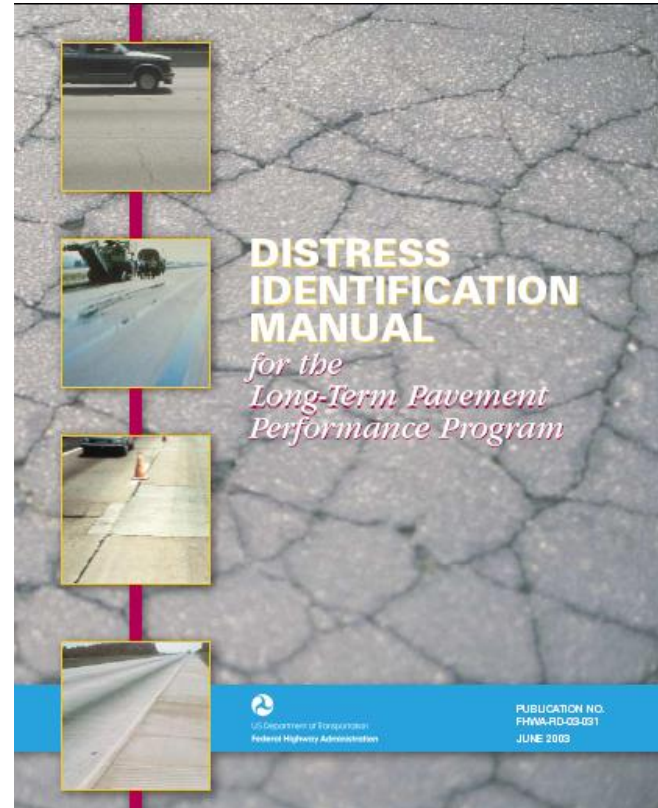
- Pavement distress types
- Interlayer types and mechanisms to extend pavement life
- Interlayer selection
- Designing with interlayers
- Installation guidance



Pavement Distresses

Pavement Evaluation

Great Resource:
FHWA Distress ID Manual

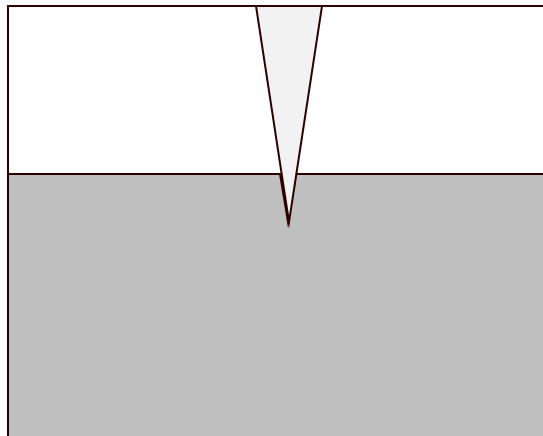


The Problem

New AC
overlay



Original
cracked AC



What influences cracking?

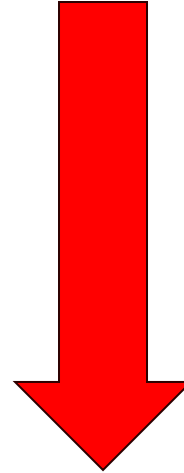
Type and severity of cracks depend on:

- Properties and types of pavement structure
 - Thickness
 - PCC joints
 - Flexible vs. rigid
 - Subgrade conditions
- Traffic - % Trucks
- Climatic conditions

All cracks aren't equal in severity

- Block Crack
- Paving Seam Crack
- Lane Widening Crack
- Alligator / Crocodile Crack
- PCC Joint Crack
- Expansive Soil Crack
- Thermal Crack
- Frost Heave Crack

Less Severe



Based on Cause

More Severe

Fatigue Cracking

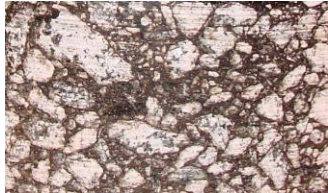


Reflective Cracking



Crack Evaluation

PCC Joint Cracking



Thermal Cracking



Lane Widening



It is important to understand the type of movements associated with each crack type

Correcting Deterioration

To achieve longer life, more maintenance free performance we must correct the root causes of deterioration

- Maximize traffic capacity
- Delay crack return
- Mitigate the effects of water

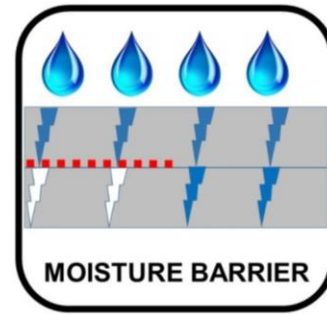
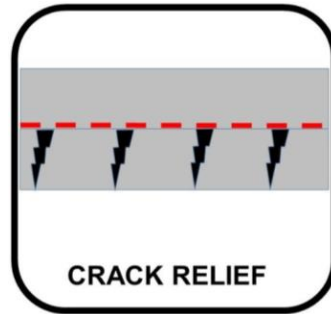
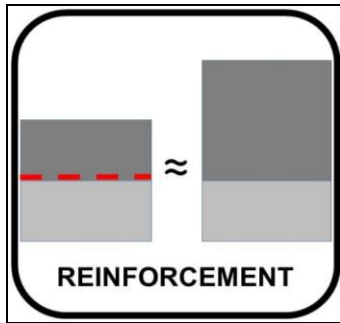


Interlayer Functions

Functions

Priorities

- Reinforce to maximize traffic capacity
- Tensile to mitigate cracking
- Waterproofing to keep base dry
- Sustainable

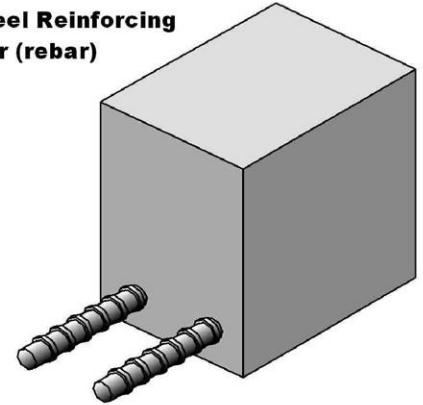


Reinforcement to Maximize Traffic Capacity

Continuous high tensile fiberglass is to asphalt as steel rebar is to concrete

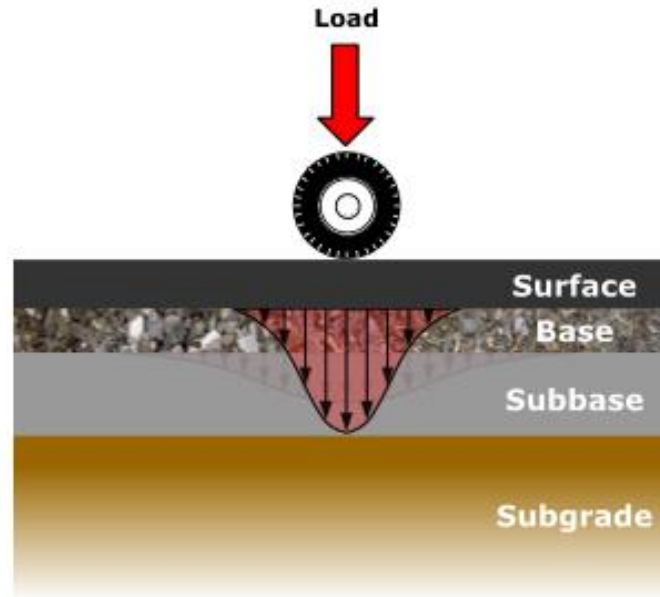
- Increases the structural life of asphalt pavements due to modulus advantage over asphalt
- Not water/temperature sensitive

**Steel Reinforcing
Bar (rebar)**



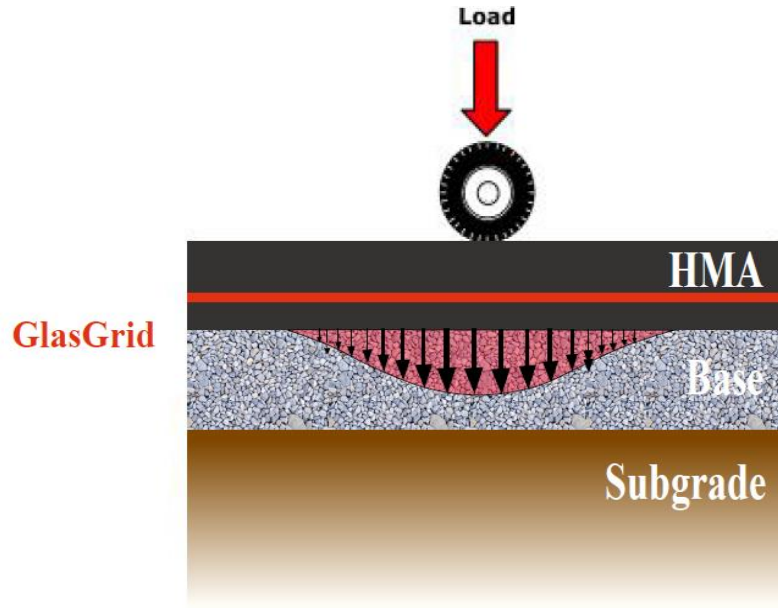
Load Distribution: A Primary Pavement Function

Conventional Pavement Load Distribution Curves

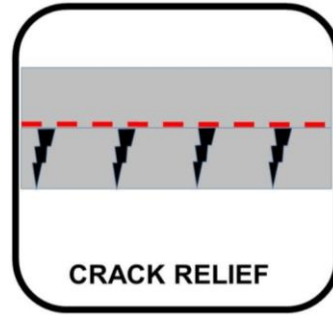


Load Distribution: A Primary Pavement Function

Rehabilitation



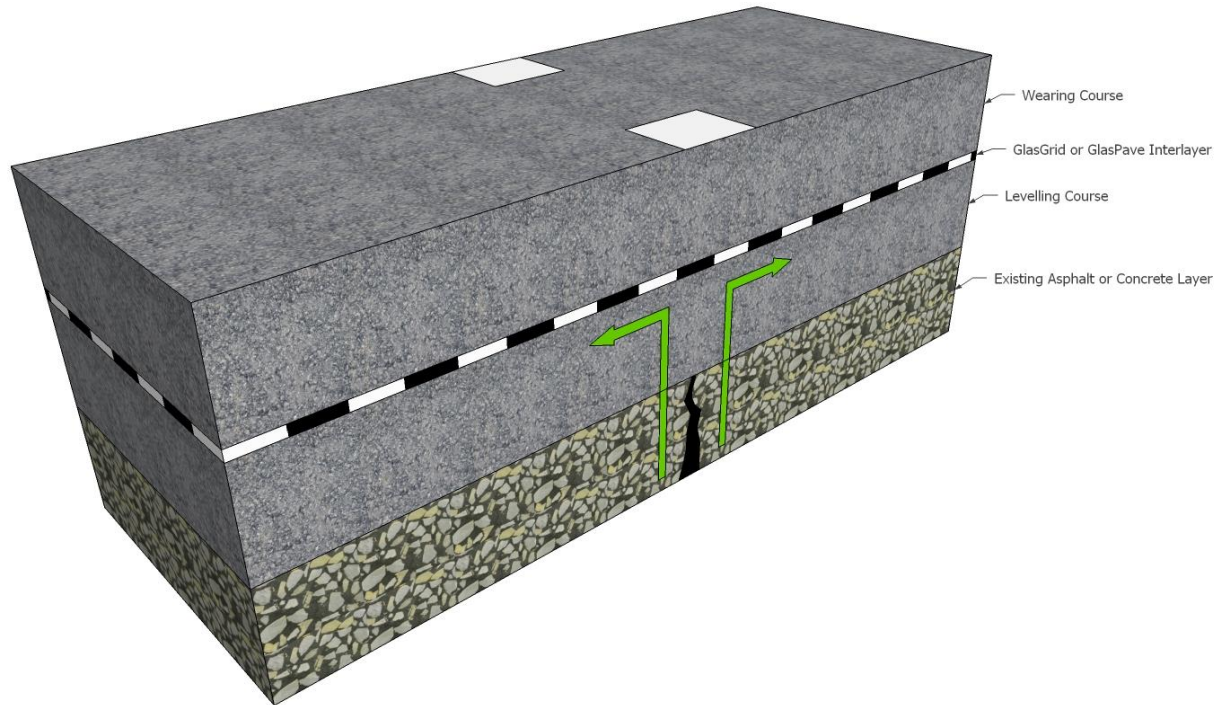
Delay Reflective Cracking



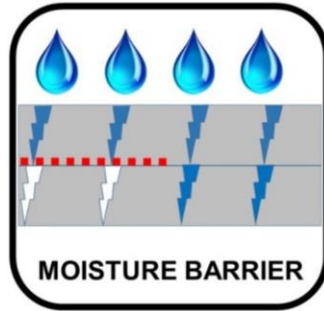
High tensile reinforcement + Low tensile HMA
= Crack Resistant Pavements

Crack Relief

Mitigate reflective cracking in new overlays caused by cracks in the existing pavement



Moisture Barrier



Preserve the traffic bearing capacity of a dry foundation:

Moisture barrier protects base by preventing moisture intrusion which would weaken the base

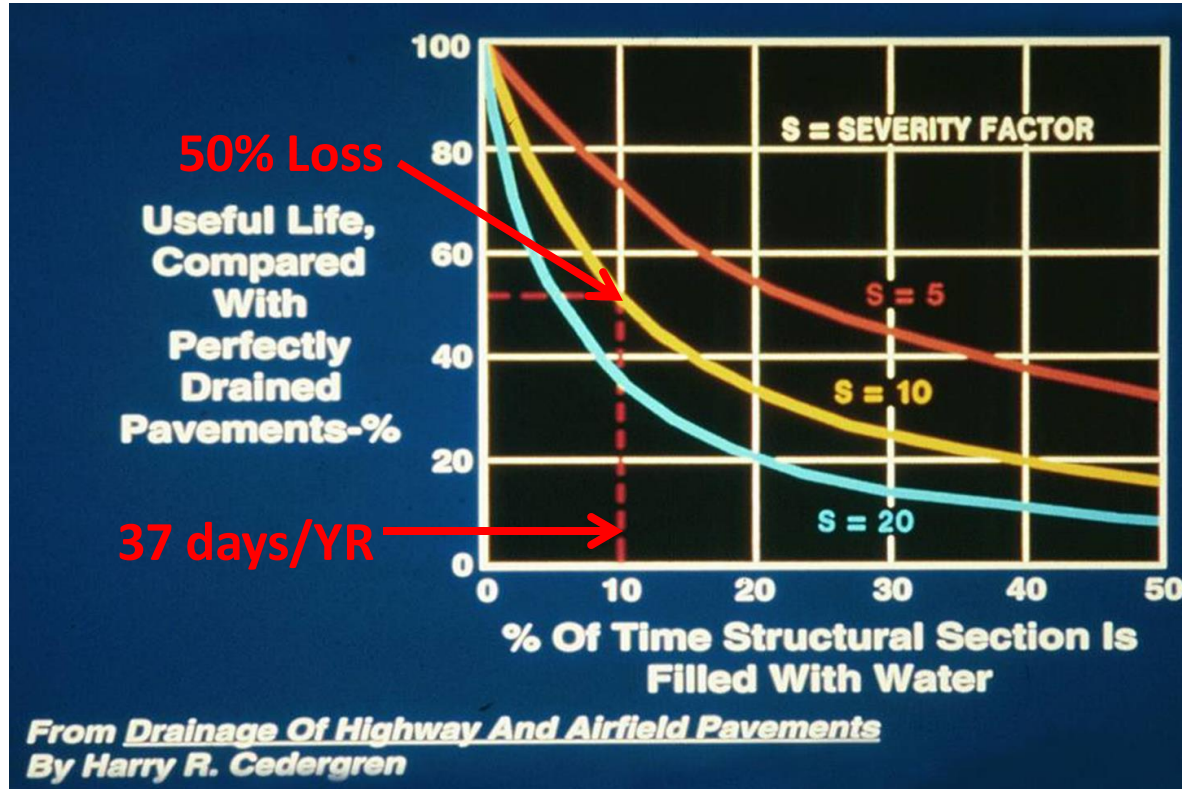
Waterproofing

FHWA Guidelines:

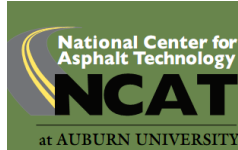
Waterproofing \approx 1.2” asphalt due to drainage improvement

ref. Predoehl, N.H., Evaluation of Paving Fabric Test Installations in California, FHWA/CA/TL-90/02, California Department of Transportation, 1990.

Water in Foundation Deterioration



Ability to Mill, Recycle, and Add to New HMA



The Effect of GlasPave™ in RAP on Asphalt Mixture Performance

RESEARCH SYNOPSIS-NCAT REPORT

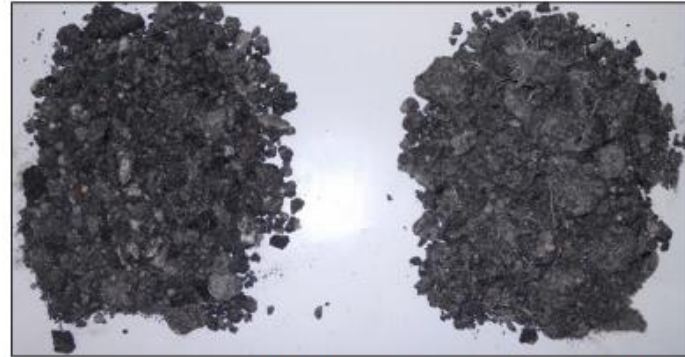


Figure 2 Control RAP mixture (left) and RAP mixture containing GlasPave (right).

New HMA with up to 30% RAP containing it will pass AASHTO testing T281 for rutting and moisture susceptibility + T322 low temp cracking



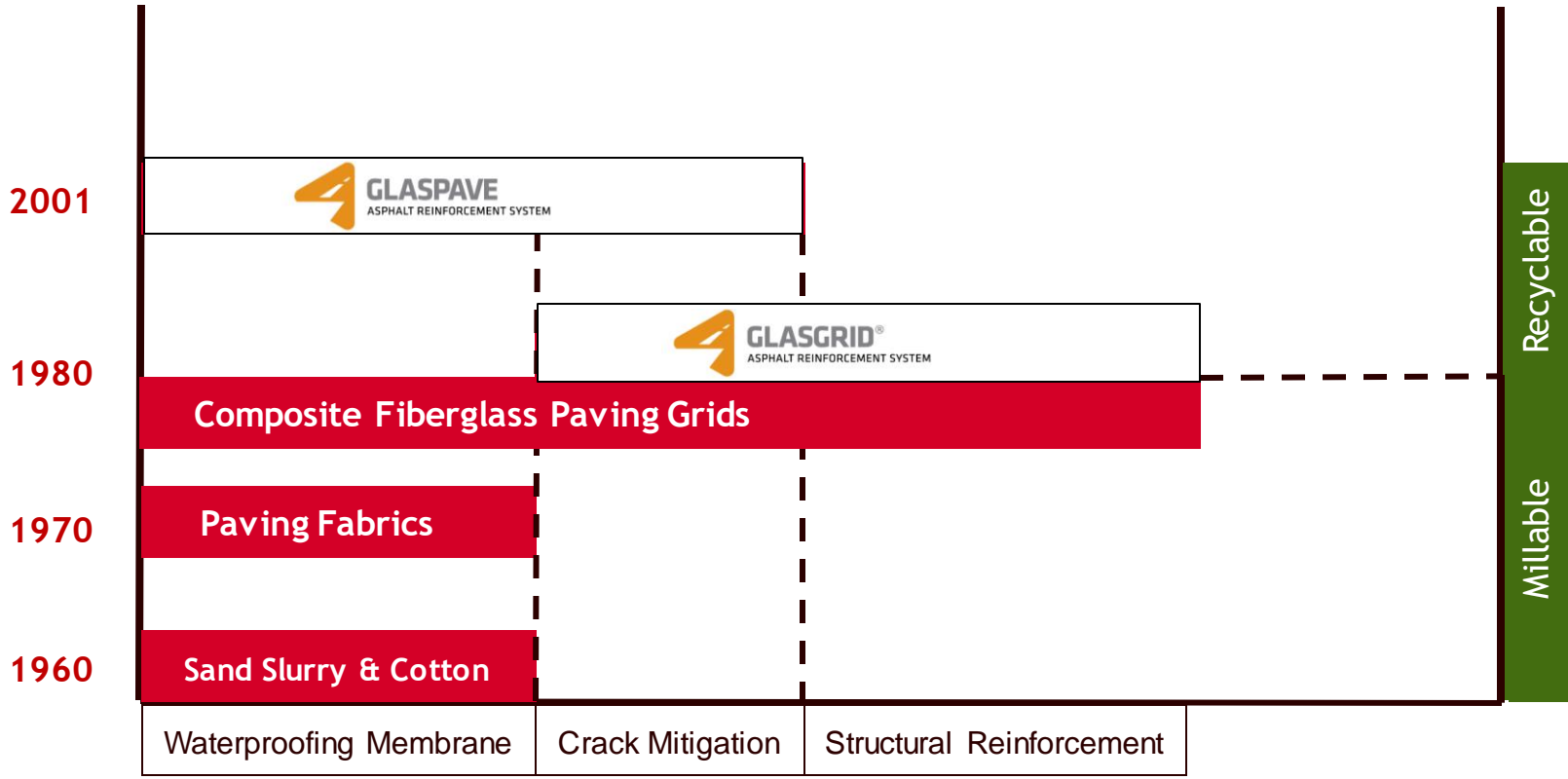
Types of Interlayers

Interlayer Product Types

Key Interlayer product types available:

- Non-woven fabrics (M288)
- Polymer grids
- Fiberglass grids (may be coated with polymer or bitumen)
- Composites (combining polymer or glass grids and non-woven textiles)
- Paving mats
- Peel and stick products

Historical & Functional Evolution of Interlayers



Interlayer Products

Desired Properties:

- High stiffness & creep resistance
- Rapid installation
- Thermally stable coating
- Millable and recyclable

Steel is to
concrete
---as---
Glass is to
asphalt---

Through
Hole
Bonding

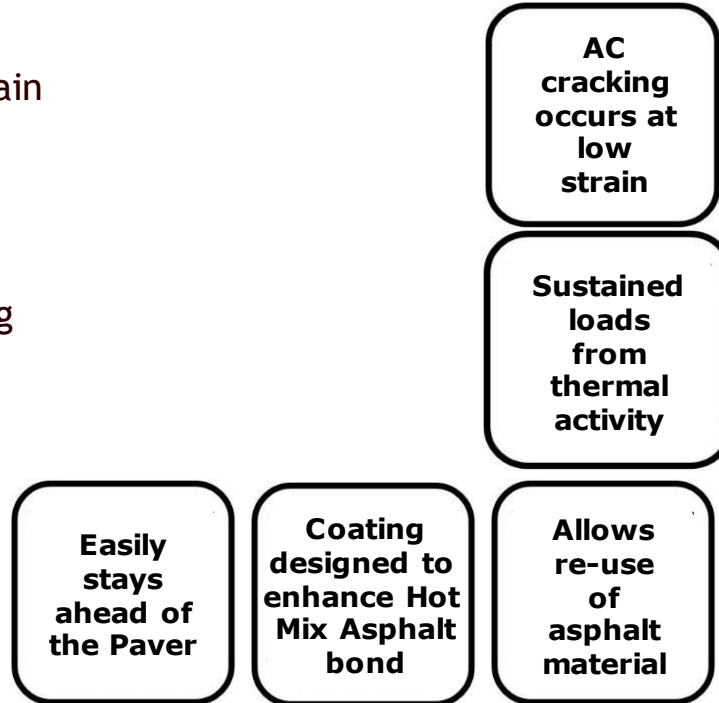
Stay
ahead of
the paver

Coating
must not
soften

Cost of
asphalt
increasing

Fiberglass - The Right Choice

- Desired properties
 - High stiffness at low strain
 - High creep resistance
 - Rapid installation
 - Thermally stable coating
 - Millable and recyclable





Tensor Interlayer Solutions

GlasPave™

GlasGrid®

GlasGrid® TF

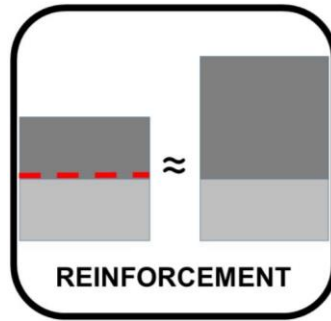
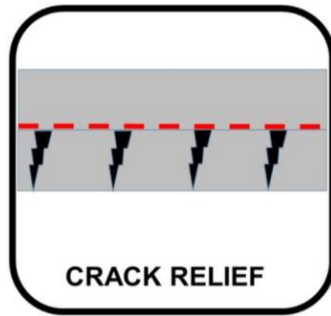


GlasGrid Asphalt Reinforcement System

- More than 25 years of project experience
- Self-adhesive
- Higher modulus than asphalt at all temperatures
- Open aperture
- Extends reflective crack life of overlays by up to 300%

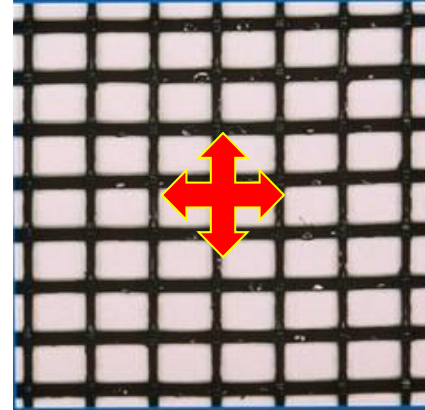
GlasGrid®

Provides reflective crack protection and reinforcement



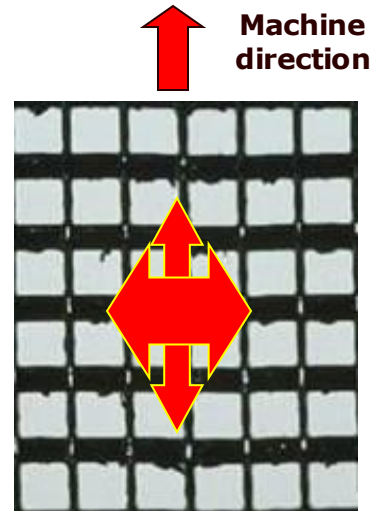
GlasGrid Complete Road System

- 8501 : 100 x 100 kN/m (560 x 560 lbs/in)
- 8511 : 100 x 100 kN/m (560 x 560 lbs/in)
- Full lane width applications



GlasGrid Detail Repair System

- 8502 : 100 x 200 kN/m (560 x 1,120 lbs/in)
- 8512 : 100 x 200 kN/m (560 x 1,120 lbs/in)

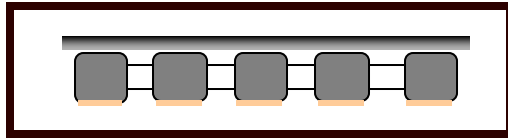


GlasGrid TF Complete Road System

- 8501TF : 100 x 100 kN/m (560 x 560 lbs/in)
- 8511TF : 100 x 100 kN/m (560 x 560 lbs/in)
- Full lane width applications



GlasGrid TF



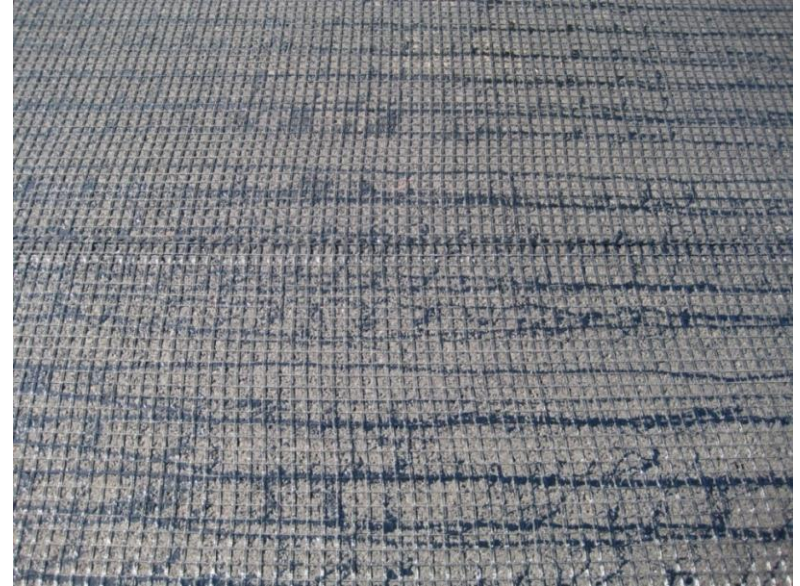
Thermal tack film

- Optimized thermal reaction
- Enhanced adhesion
 - Asphalt Placement Temperature = 140C (284F)
 - Existing Pavement Temperature = 21C (70F)

Polymer coating on fiber glass mesh

- Engineered chemical blend
- Chemical link to asphalt

Elimination of Conventional Tack Coat



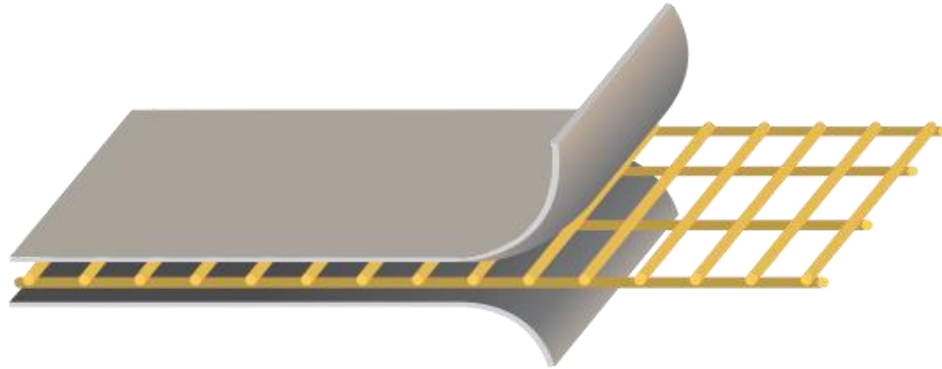
Benefits/Features of GlasGrid® TF



GlasPave Product Composition

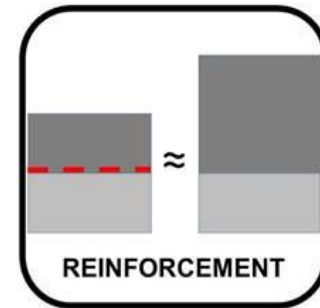
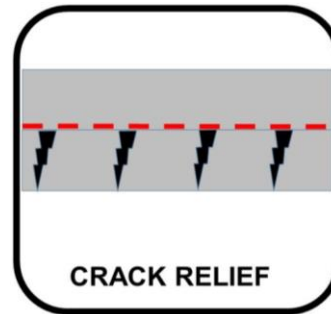
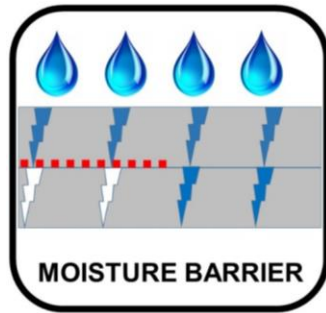
Fiberglass mesh embedded between two layers of lightweight polyester geotextile

- GlasPave 25 - Tensile strength 25 x 25 kN/m
- GlasPave 50 - Tensile strength 50 x 50 kN/m



GlasPave

Provides water proofing, crack relief and reinforcement



GlasPave Asphalt Reinforcement System

High Strength Paving Mat



Rapid Repair - Peel and Stick

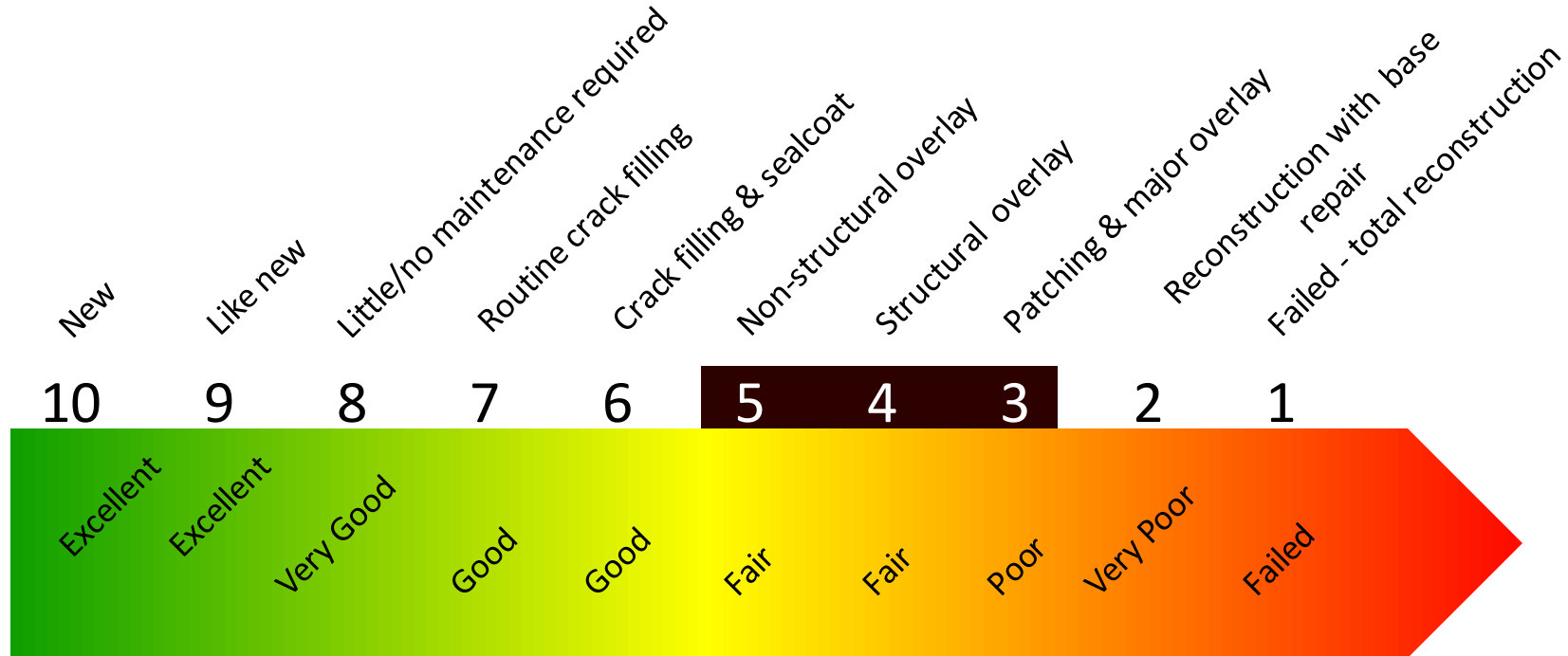
Combination of GlasPave or GlasGrid and a mastic backing with a quick release liner





Interlayer Selection

When to use an interlayer



Use interlayer here

Not all conditions interlayer appropriate



Mix Rutting



Slab Fracture/Uneven



Base Failures



Extreme fatigue cracking/unstable base

Extreme Pavement and Base Failures

GlasGrid Boundary Conditions - Structural

- For flexible pavements, structural deficiencies and/or base failures must be addressed prior to designing for reflective cracking
- For rigid pavements, PCC Slab Lengths < 6 m (20')
 - Load Transfer Efficiency > 70% (Falling Weight Deflectometer)

Route Type	Traffic (ESALS)	Waterproofing Required	Product Selection Table by Crack/Distress Type*							
			Alligator Cracking (Aging)	Block Cracking (Cold)	Block Cracking (Warm)	PCI Joint Reflective	Thermal Cracking (Warm)	Thermal Cracking (Cold)	Lane Widening Cracks (Sand)	Lane Widening Cracks (Clay)
Product is Applied:		Full Width	Full Width		Detail Repair			Detail Repair		
Tennis Courts, Bile Tron Golf Cart Paths, Res Streets, Parking Country Roads	300K <1% Heavies	GlasPave25	GlasPave25 GG8550	GlasPave25 GG8550	GlasPave25 GG8501 GG8511	GG8501 GG8511	GlasPave25 GG8501 GG8511	GG8502 GG8512	GlasPave25 GG8501 GG8511	GlasPave25 GG8501 GG8511
County or Municipal Connector Roads	300,000 – 1,000,000 1–5% Heavies	GlasPave25	GlasPave25	GlasPave25 GG8501 GG8511	GG8501 GG8511	GG8502 GG8512	GG8501 GG8511 GG8502 GG8512	GG8502 GG8512	GG8501 GG8511 GG8502 GG8512	GG8501 GG8511 GG8502 GG8512
Inter-Urban Roads or Interstate Highways	>1M >5% Heavies	GlasPave25	GG8501 GG8511							GG8502 GG8512
Airports – Private/Municipal	General Aviation Traffic	GlasPave25	GlasPave25 GG8501 GG8511							GG8502 GG8512
Airports – Regional/In	Commercial Traffic	GlasPave25	GG8501 GG8511	GG8502 GG8512	GG8501 GG8511	GG8502 GG8512	GG8502 GG8512	GG8502 GG8512	GG8502 GG8512	GG8502 GG8512
Industrial Ports or Intermodal Facilities	Axle Loads >20kIip	GlasPave25	GG8501 GG8511	GG8502 GG8512	GG8501 GG8511	GG8502 GG8512	GG8502 GG8512	GG8502 GG8512	GG8502 GG8512	GG8502 GG8512

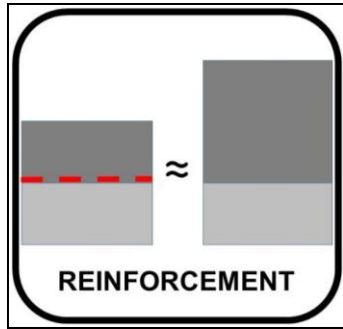


Select Interlayer Type for the Crack Type and Traffic/Road Type



Design

Traffic Capacity Improvement

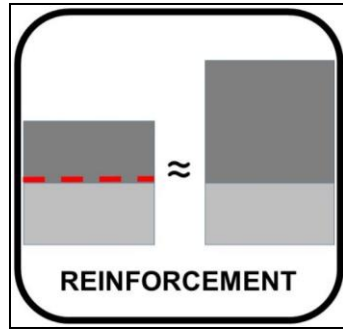


Structural Reinforcement

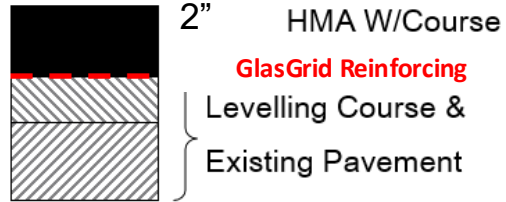
Design to requirements increase traffic capacity with high tensile interlayer:

1. HMA section must be critical layer
2. Must be placed in the tension zone of the pavement

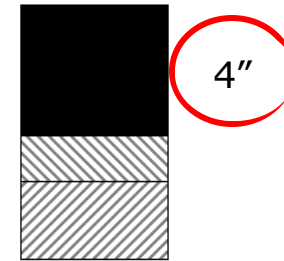
Equivalent ESAL Design with Reinforcement



Reinforced
Option



Thicker Equivalent
Option



The Structural Advantages of the GlasGrid® Family of Asphalt Reinforcement Systems

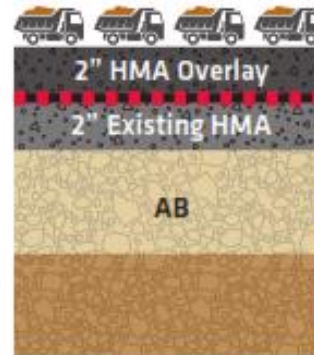
Sample design with precoated high tensile fiberglass (PHTF) reinforcement



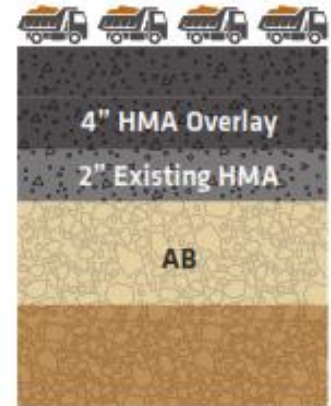
Existing
4,266 ESAL's



2" Mill with 2" HMA
41,143 ESAL's



2" Mill with 2" HMA
With PHTF Mat
83,604 ESAL's



2" Mill with 4" HMA
Added HMA needed
83,604 ESAL's

When to Use Interlayers over HMA

- Increase Traffic Capacity for Existing Pavement Sections
- Limited by curb and gutter



GlasGrid Performance Validation

Influence of GlasGrid on
Asphalt Pavement Performance.

- NCAT ongoing full-scale research
- 2018 Update: 18 years and 60 million ESALs of traffic loading



NCAT Test Facility



GlasGrid Performance Validation



GlasGrid Reinforced Section after 60 Mil ESALs and 18 Years (2018): Still no cracks in mainline - only at cold joint.



Installation

Installation

- Good installation is key to achieving the design service life
- Use an experienced installation contractor



Surface Preparation

- Repair surface defects before installing the interlayer
 - Fill all potholes
 - Cracks wider than $\frac{1}{4}$ in. must be sealed
- Surface should be clean and dry

Surface Preparation



Filling excessive voids after milling the surface

GlasGrid Installation Requirements

- No installation on milled surfaces
- A leveling course is strongly recommended
- The pavement surface must be clean and dry
- If a tack coat is specified without grid, one should also be used with the grid
- Minimum overlay thickness of 4 cm (1.5 in.)



GlasGrid Installation

- A single laydown unit should be able to install sufficient product ahead of the paver
- A second laydown unit can be used if required - arrange at the preconstruction meeting between the contractor and the interlayer laydown crew





Tensor.





Tensor.

GlasGrid GlasPave Installation



GlasGrid TF Installation



GlasGrid GlasPave Installation



GlasPave - Product Installation

- Asphalt Cement Tack Coat
 - PG 64-XX is recommended
 - For ambient temperatures above 32°C (90°F), use PG 70-XX
- Tack coats should be applied to a width equal to the width of the paving mat plus 2.5 cm (1”) on each side
- Asphaltic emulsions are not recommended for use with paving mats

GlasPave - Installation on Milled Surfaces





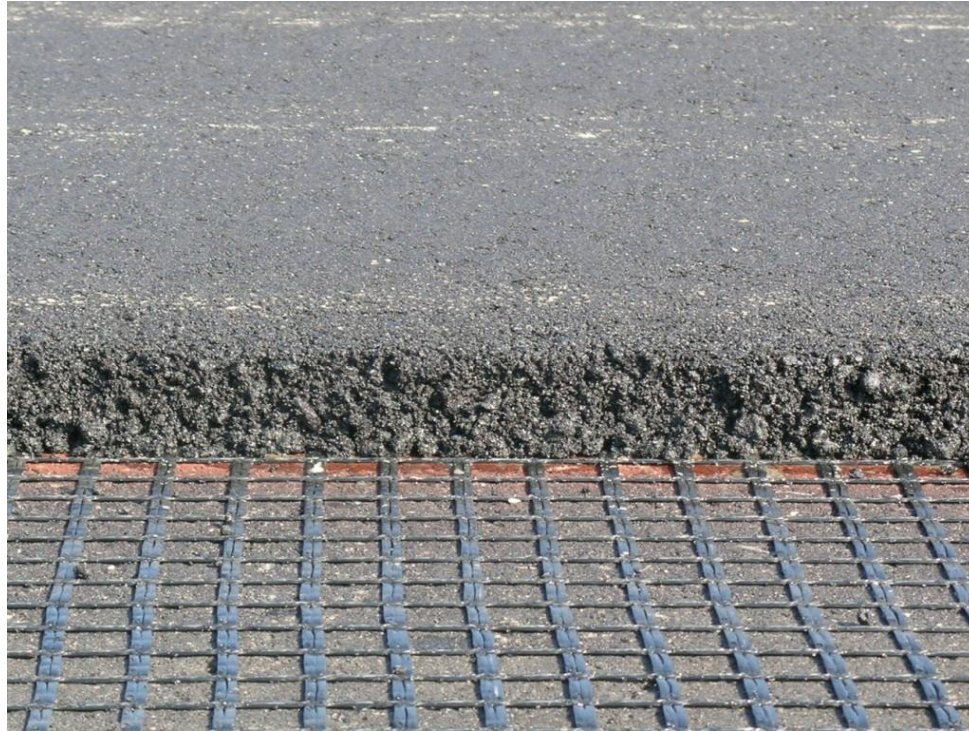
Tensar.



Tensor.



Minimum Asphalt Thickness



Overlay thickness should be a *minimum of 1.5" compacted asphalt*

Summary

- With increased ESAL capacity, delayed cracks, and a dry foundation we can:
 - More rapidly improve network PCI
 - Reduce maintenance costs and extend intervals
 - Reduce downtime, work zones, liability
 - Deliver better ride, better looks, longer life
- Geosynthetic interlayers let you design and build pavement structures to last longer and cost less

References for Review and More Info

- *Distress Identification Manual for The LTPP (Fourth Revised Edition) FHWA-RD-03-031*
- www.pavementinteractive.org
- Tensar Website and Blog - www.tensarcorp.com
- Your Local Tensar Regional Manager or Distributor
- Jeff Rasche - jrasche@tensarcorp.com



Thank You

Attendees will receive a follow up email and PDH certificate

800-TENSAR1

www.tensarcorp.com