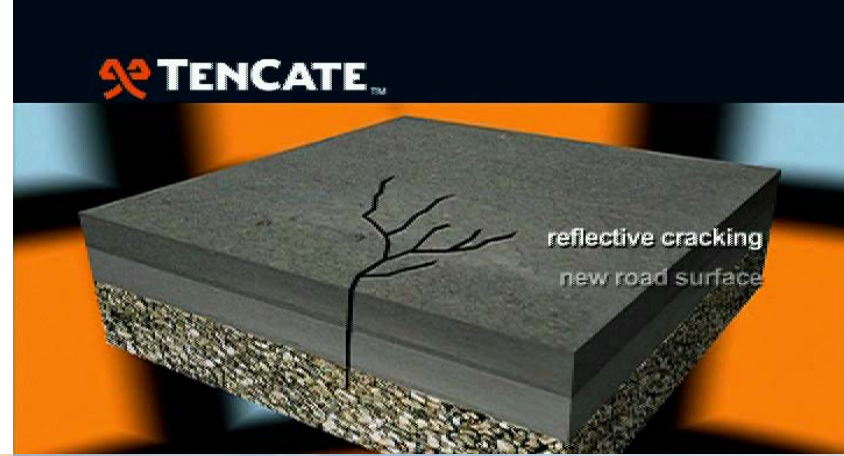
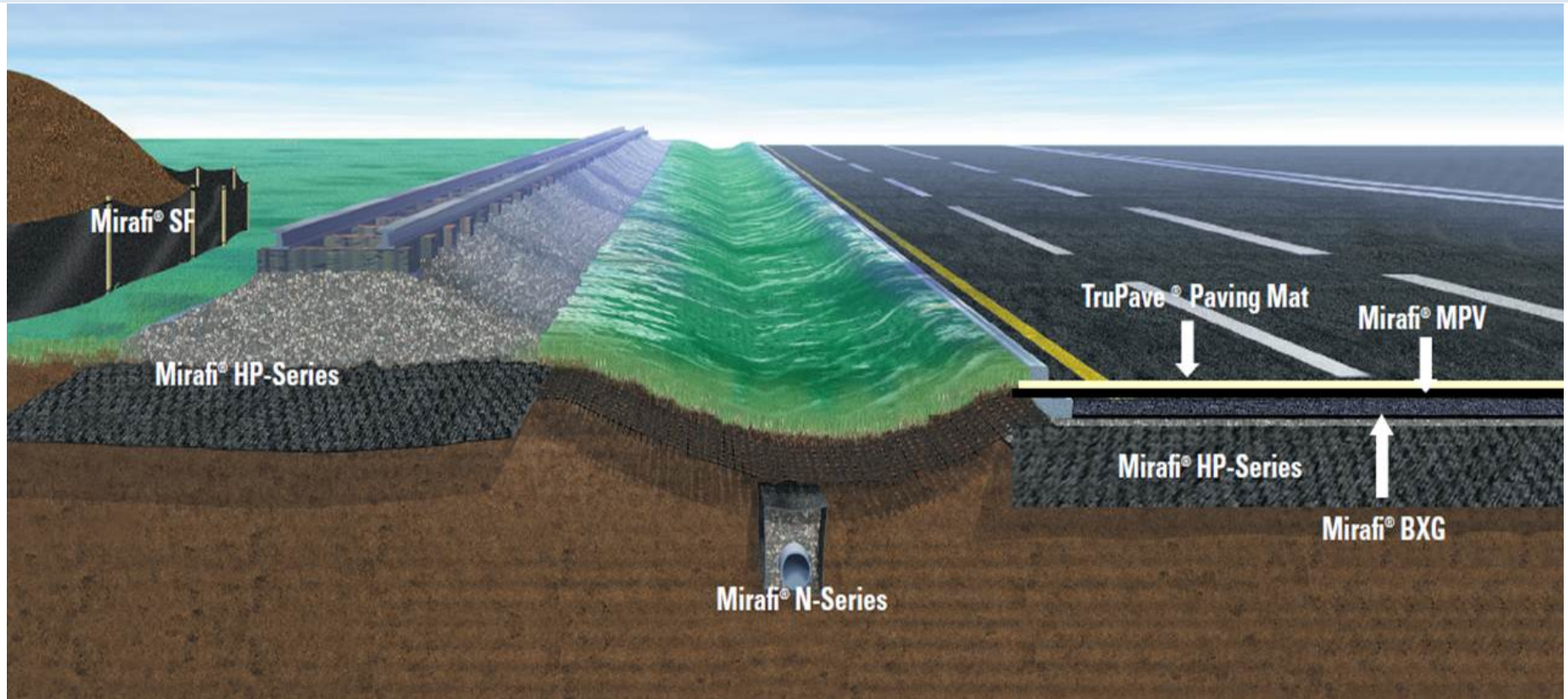


Geosynthetic Pavement Interlayer



 **TENCATE**
materials that make a difference

Geosynthetic Pavement Interlayer



 **TENCATE**

materials that make a difference

Geosynthetic Pavement Interlayer

- 
- ❖ **Your Interlayer Experience**
 - ❖ **Functionality needed to address cracks**
 - ❖ **Interlayer Types & Functionality**
 - ❖ **Cost/Benefit**

Geosynthetic Pavement Interlayer

WHY?...Interlayers Extend Pavement Life


- ✓ Preserve base structural value
- ✓ Delay crack return
- ✓ Add flexural strength to HMA
- ✓ Significant Cost / Benefit ratio
- ✓ Reduce impact of asphalt cost

price volatility and continued escalation Eg. In Dec. 07,
\$175/ton, today...\$650+

Geosynthetic Pavement Interlayer

WHY?.....

**“The road to success is
always under
construction”**

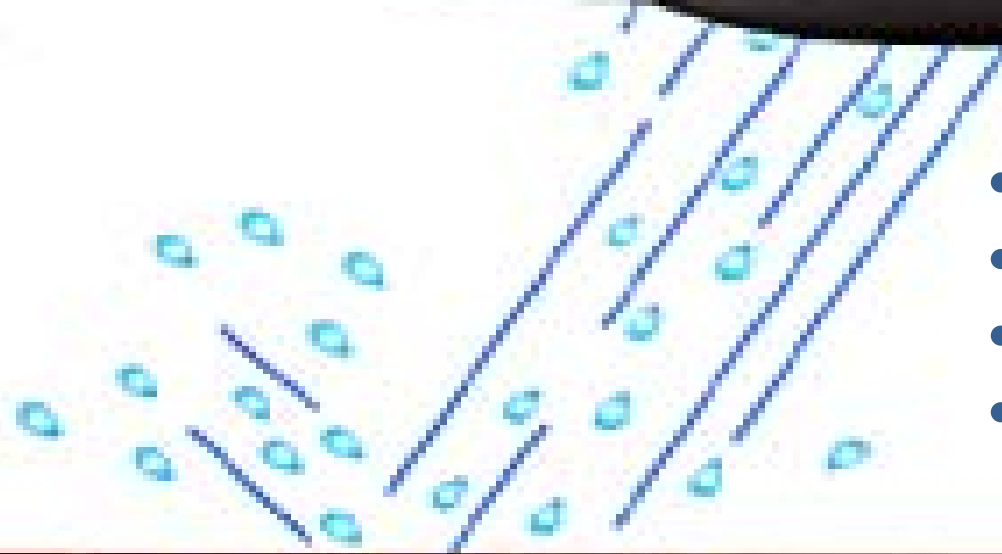
A background image of a road construction site. A large paving machine is in the foreground, spreading material on a road. In the background, there are construction workers in safety vests and another piece of machinery. The scene is slightly hazy, suggesting a dusty or overcast day.

Geosynthetic Pavement Interlayer

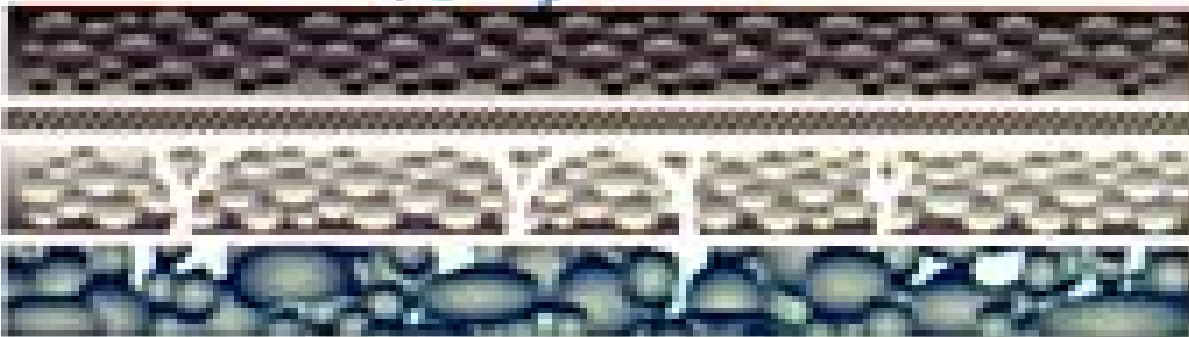
WHY?... Evolution to improved interlayers

- ✓ beyond fabric or glass grids
- ✓ to multifunctional
- ✓ to multi-axial reinforcement
- ✓ to in-place functionality

Distress Interlayers Address

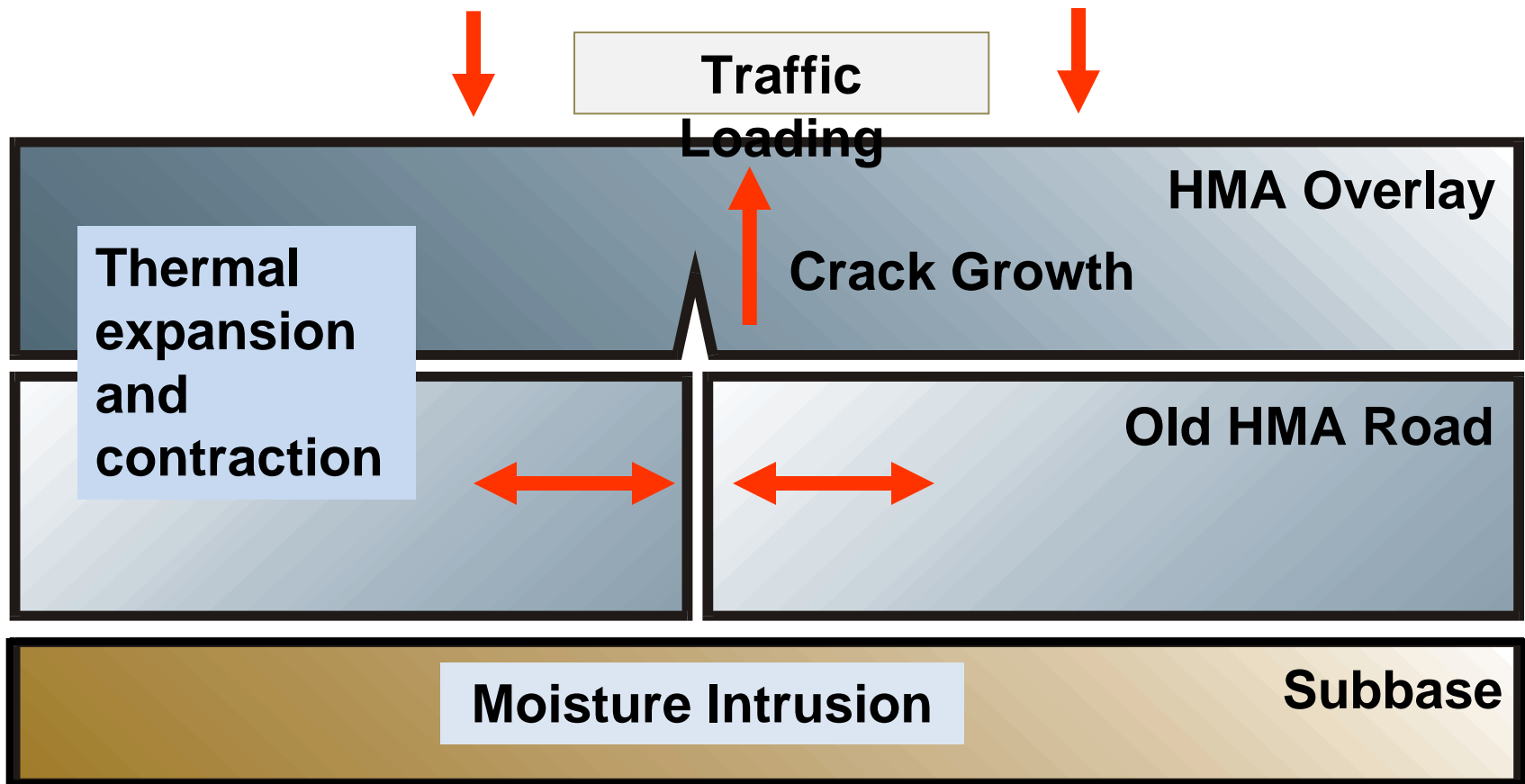


- **Condition of base**
- **Aging**
- **Weather and**
- **Environmental impact**



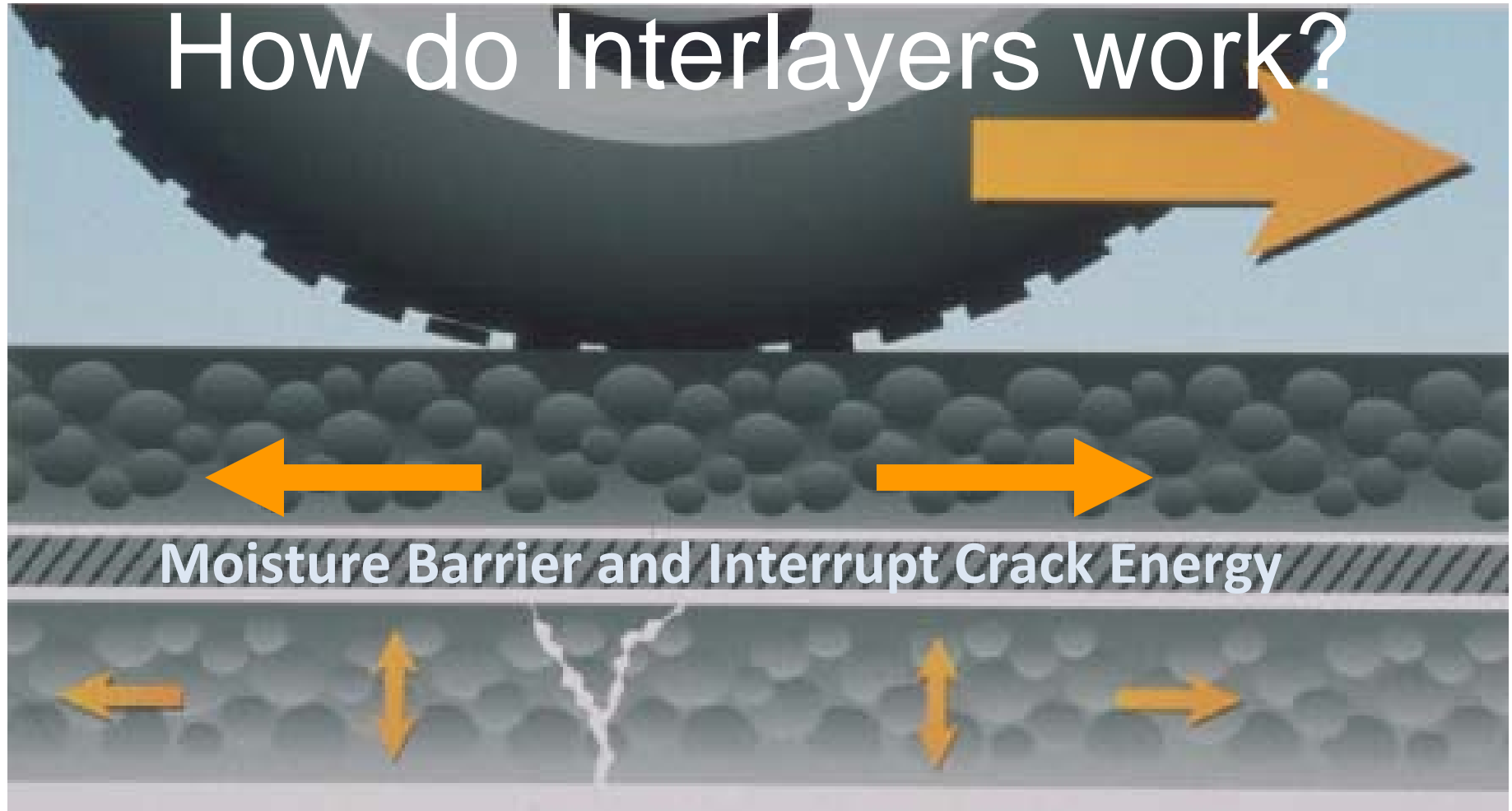
Distress Interlayers Address

Typical Crack Growth



Interlayer Functionality

How do Interlayers work?

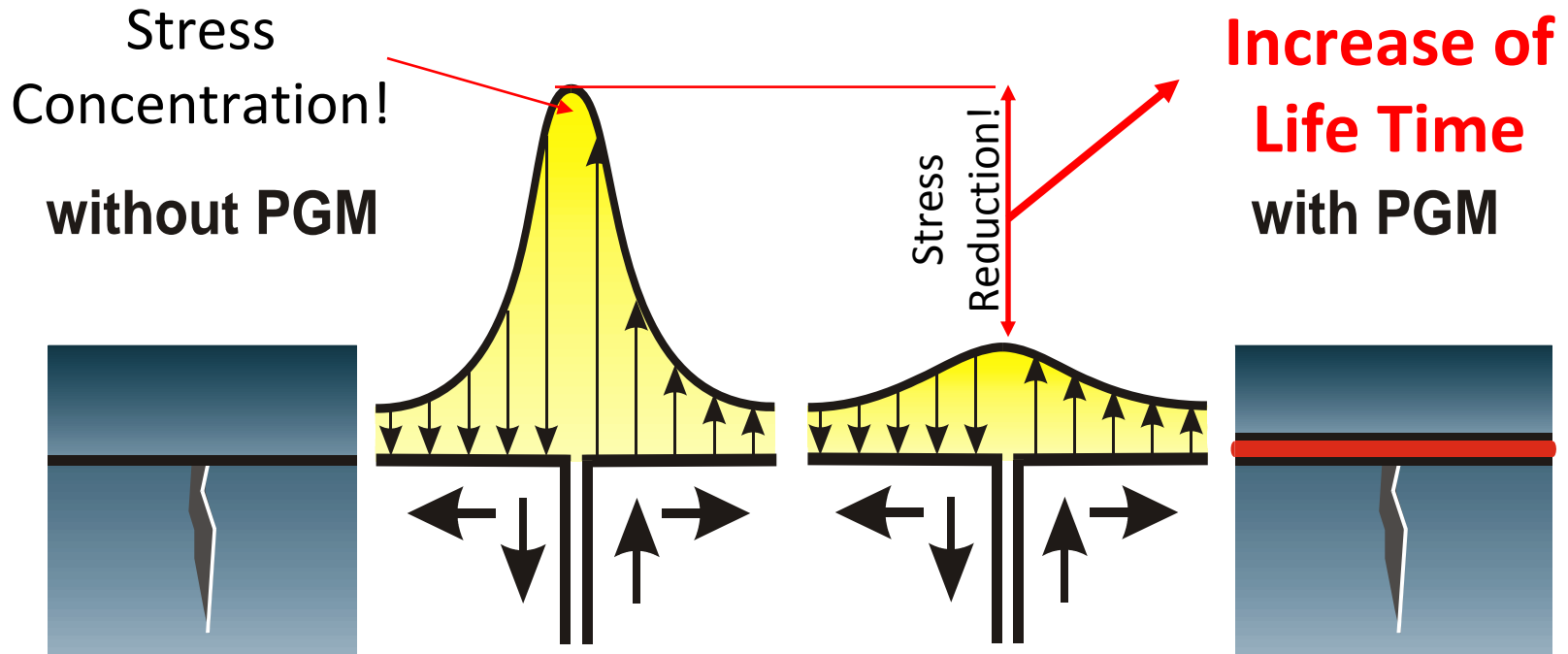


Moisture Barrier and Interrupt Crack Energy

Absorb/Dissipate Low Strain Crack Stress

Interlayer Functionality

Stress Dissipating Interlayer



Interlayer Functionality

Loss of Base Load Bearing Capacity



“One major factor that degrades a roadbed’s ability to function is the infiltration of water into the base material.”

Caltrans Pavement Evaluation Manual
Pavement Condition Survey
John Poppe

Interlayer Functionality

Loss of Base Load Bearing Capacity

- Water intrusion through pavement into base:

33-67%

Federal Highway Admin. (FHWA) RD 73-14, states; “between 33 and 67% of storm water infiltrates through the pavement”

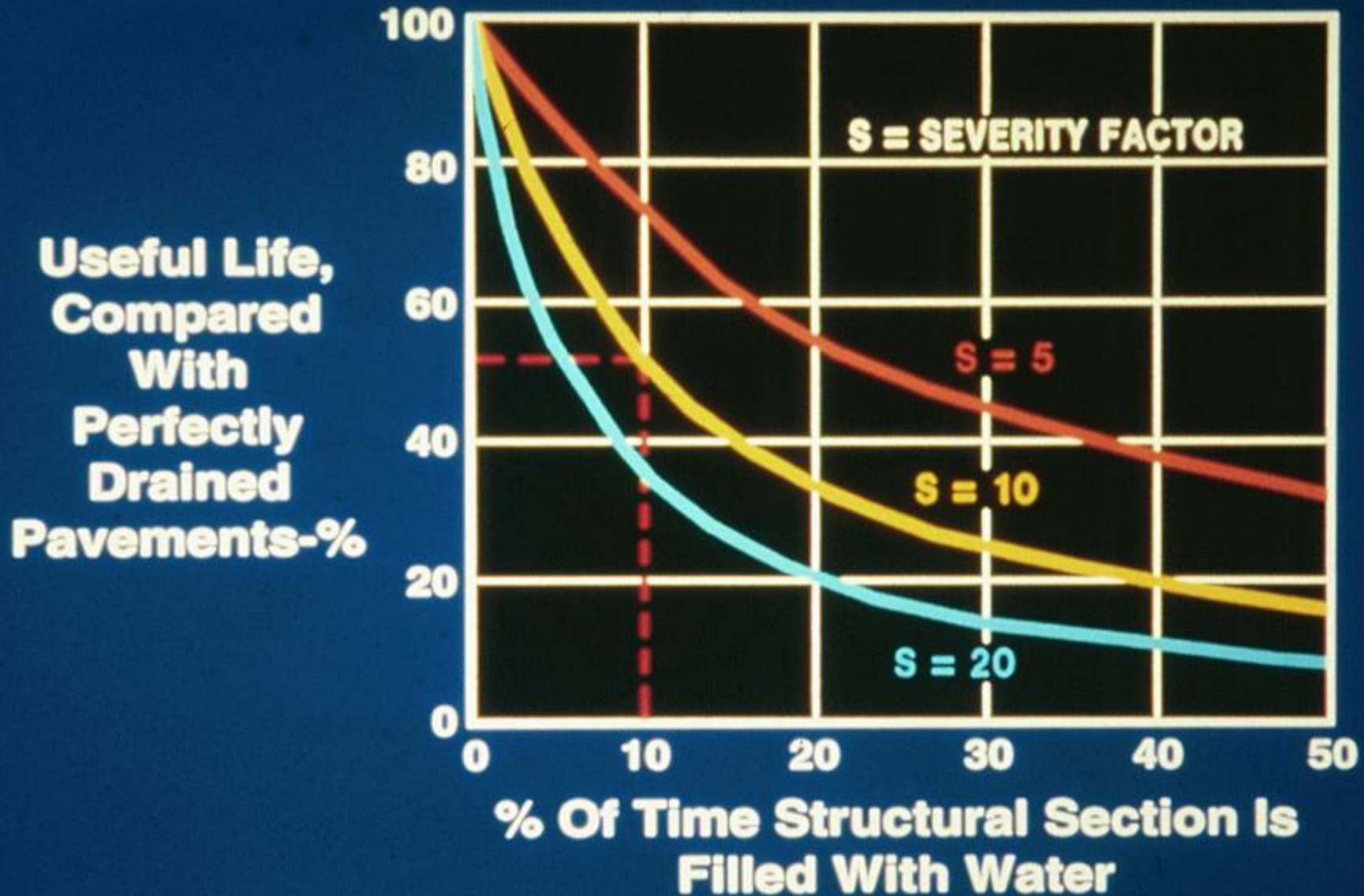
–Asphalt from 33% - 50%

–Concrete from 50% - 67%

- Pavement cracks increase base degradation:

Cracks significantly increase water penetration and base degradation, leading to loss of load bearing capacity.

Loss of Base Load Bearing Capacity



*From Drainage Of Highway And Airfield Pavements
By Harry R. Cedergren*

Interlayer Functionality

Keeping Water out of the Base



No Moisture Barrier



With Moisture Barrier

Interlayer Functionality

Geosynthetic Pavement Interlayers

OVERVIEW




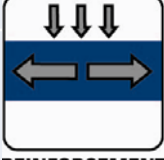


Interlayers Types

FABRICS	MATS	GRIDS
		Continuous Strand Fiberglass

How Do They Work




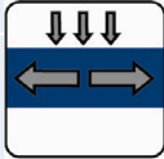


STRAIN ABSORBING	STRESS DISSIPATING
Mass to soak up (Sponge)	Tensile strength and efficiency to disperse low strain crack energy (Rebar)
Tighter bond, thicker/more mass = greater ability to absorb = better reflective crack retardation	Tighter bond, higher, more efficient tensile strength, more homogeneous the structure = greater ability to dissipate crack energy = better reflective crack retardation

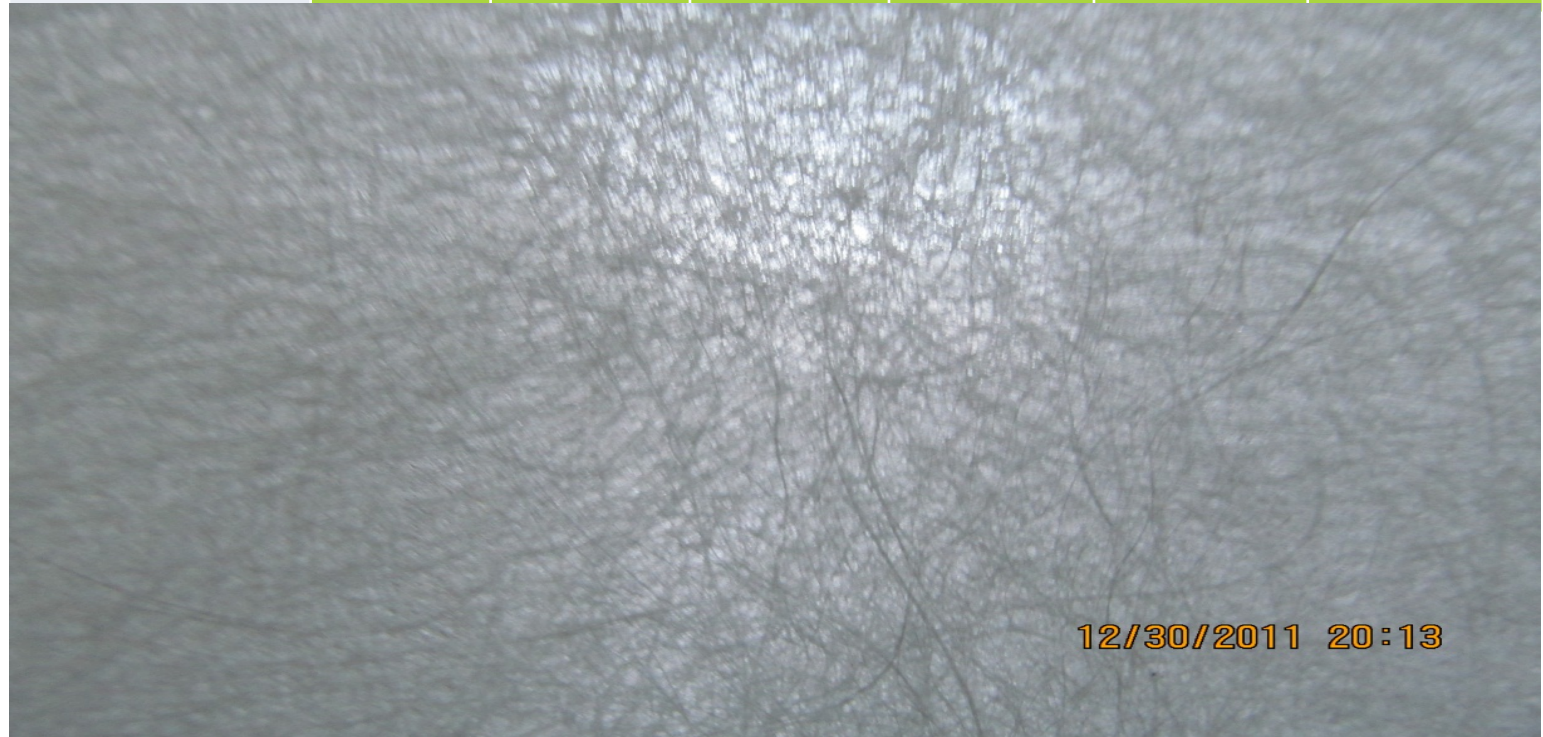
Interlayer Functionality - Fabric

FUNCTIONALITY						
	SEALING	STRESS RELIEF	REINFORCEMENT	REINFORCEMENT	ADHESIVE BONDING	RECYCLABLE
Description	With Asphalt forms Moisture Barrier	If thick and filled with asphalt	Multi-Axial, multi-directional Reinforcing	Bi-Axial, 2 way reinforcing	With hot tack forms a strong between layer bond	Mills completely and can be added back into new mix
Paving Fabric	YES	CAN	NO	NO	YES	CAN BE




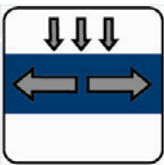


12/30/2011 20:14

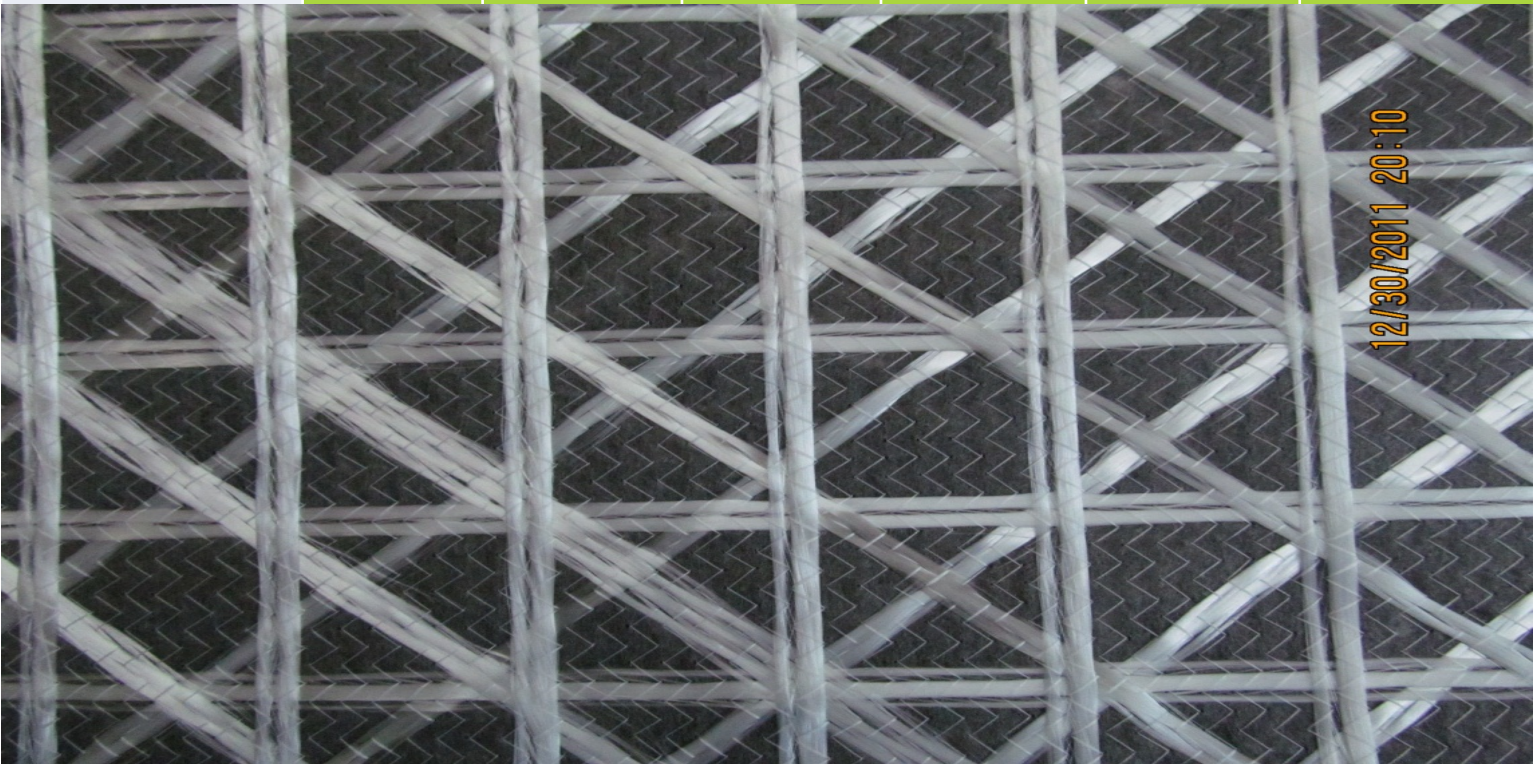
Interlayer Functionality - Multi-Axial Mat

FUNCTIONALITY						
	SEALING	STRESS RELIEF	REINFORCEMENT	REINFORCEMENT	ADHESIVE BONDING	RECYCLABLE
Description	With Asphalt forms a moisture barrier	Dissipates crack stress in all directions	Multi-directional Reinforcing	Bi-Axial, 2 way reinforcing	With hot tack forms a strong between layer bond	Mills completely and can be added back into new mix
Fiberglass Multi-Axial Mat	YES	YES	Up to 80N	YES	YES	YES






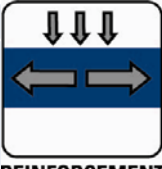
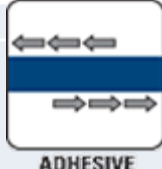

Interlayer Functionality - Multi-Axial Grid

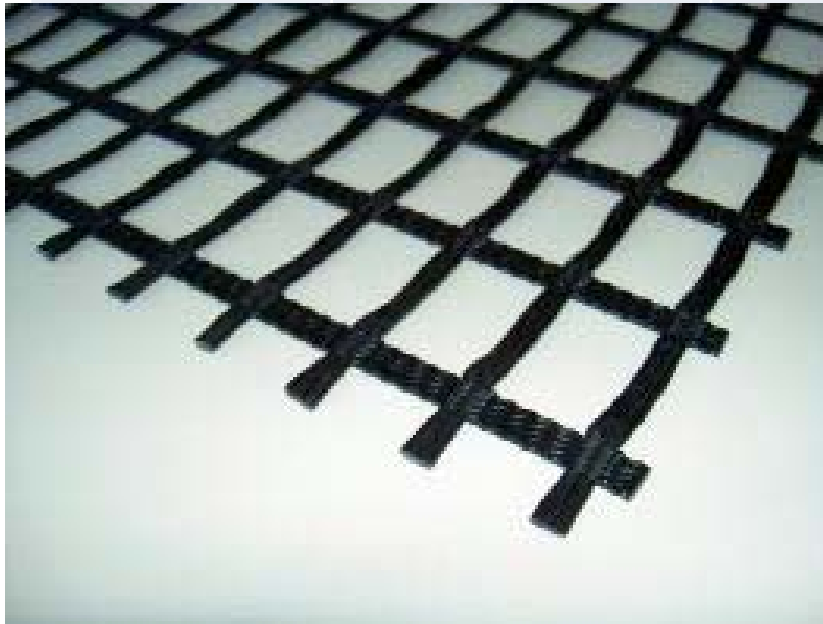
FUNCTIONALITY						
	SEALING	STRESS RELIEF	REINFORCEMENT	REINFORCEMENT	ADHESIVE BONDING	RECYCLABLE
Description	With Asphalt forms a moisture barrier	Dissipates crack stress in all directions	Multi-directional Reinforcing	Bi-Axial, 2 way reinforcing	With hot tack forms a strong between layer bond	Mills completely and can be added back into new mix
Fiberglass Multi-Axial Mat	YES	YES	Up to 100kN	YES	YES	YES






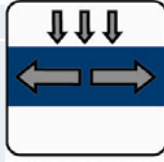


12/30/2011 20:10

Interlayer Functionality - Bi-Axial Grid

FUNCTIONALITY						
	SEALING	STRESS RELIEF	REINFORCEMENT	REINFORCEMENT	ADHESIVE BONDING	RECYCLABLE
Description	Self stick or thin scrim - No Moisture Barrier	High tensile for biaxial energy dispersion	Multi-Axial, multi-directional Reinforcing	Bi-Axial, 2 way reinforcing	No or low asphalt tack – High risk of reduced bond	Mills completely blends into new mix
Bi-Axial Grids-Self Adhesive or Thin Scrim	NO	YES	NO	Up to 100kN	NO	YES






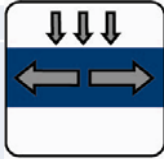


Interlayer Functionality - Bi-Axial Composite Grid

FUNCTIONALITY	 SEALING	 STRESS RELIEF	 REINFORCEMENT	 REINFORCEMENT	 ADHESIVE BONDING	 RECYCLABLE
Description	With Asphalt forms a moisture barrier	High tensile for biaxial energy dispersion	Multi-Axial, multi-directional Reinforcing	Bi-Axial, 2 way reinforcing	Hot tack forms a strong bond	Mills completely and can be added back into new mix
Composite Bi-Axial Grids	YES	YES	NO	Up to 100 kN	YES	CAN BE



12/30/2011 20:17



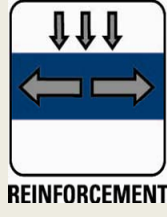



Interlayer Functionality - Bi-Axial Grid

FUNCTIONALITY						
	SEALING	STRESS RELIEF	REINFORCEMENT	REINFORCEMENT	ADHESIVE BONDING	RECYCLABLE
Description	With Asphalt forms a moisture barrier	High tensile for biaxial energy dispersion	Multi-Axial, multi-directional Reinforcing	Bi-Axial, 2 way reinforcing	With hot tack forms a strong between layer bond	Mills completely and can be added back into new mix
Composite Bi-Axial Grids	YES	Up to 100kN	NO	YES	YES	CAN BE



12/30/2011 20:16

Interlayer Functionality Summary

FUNCTIONALITY	 SEALING	 STRESS RELIEF	 REINFORCEMENT	 REINFORCEMENT	 ADHESIVE BONDING		Constructibility Ease of Installation		
Description	Moisture Barrier Membrane	Crack Stress Relief	Bi-Axial	Multi-Axial	Monolithic bond	Mills + Recycles into new mix	Wide Vs Narrow Rolls	Uncoated, Flexible Rolls	

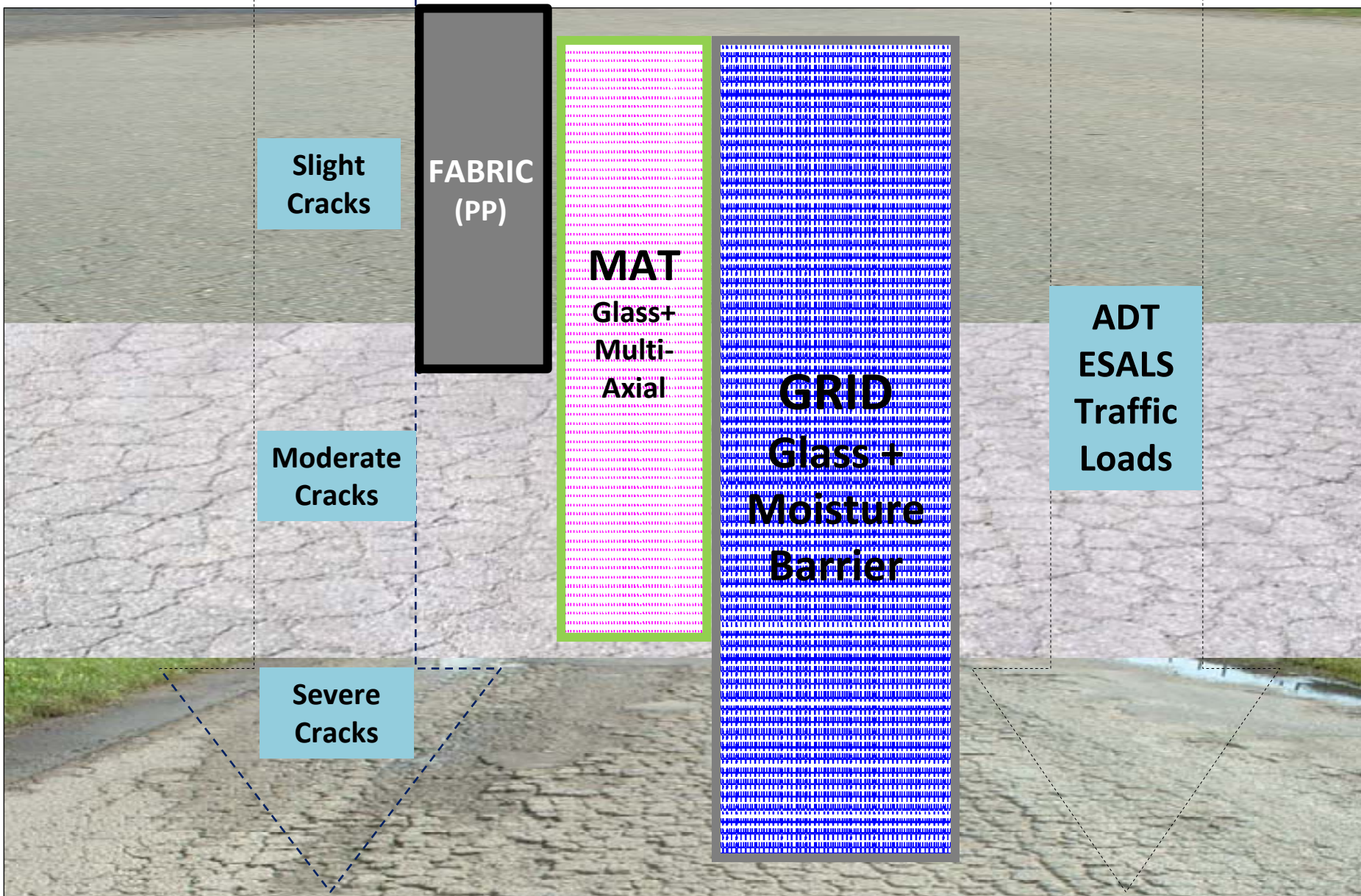
SAMI Type Geosynthetic Interlayer

Fabric	Polypropylene Fabric	YES	CAN	NO	NO	YES	Can Be	YES	YES
---------------	----------------------	-----	-----	----	----	-----	--------	-----	-----

Fiberglass Tensile Reinforcing Interlayers

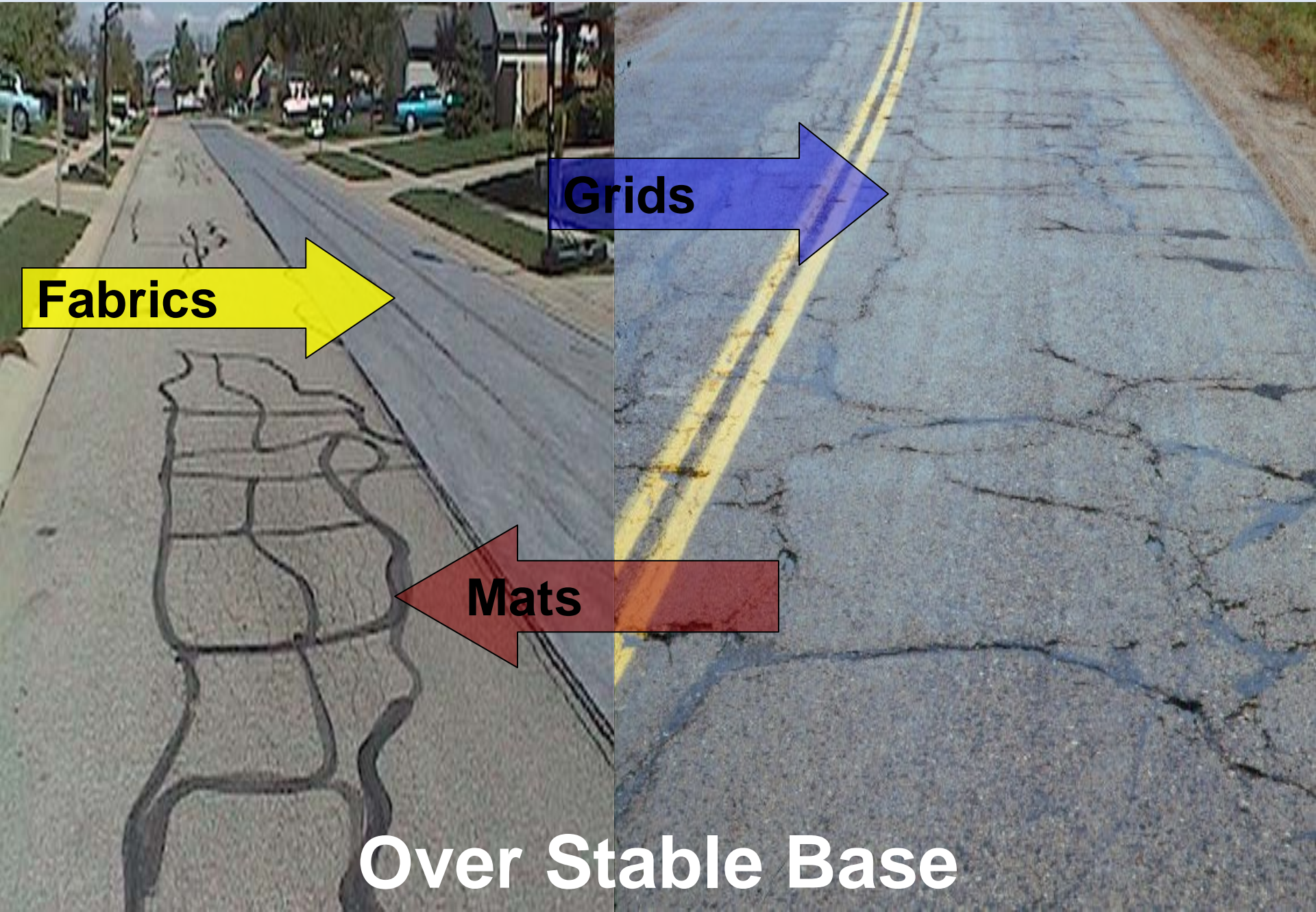
Mat	Multi-Axial	Multi-Axial Mat	YES	YES	YES	Up to 80N	YES	YES	YES	YES
		Multi-Axial Composite	YES	YES	YES	Up to 100kN	YES	YES	YES	YES
Grids	Bi-Axial	PreCoated Self Stick/Scrim	NO	YES	Up to 100kN	NO	NO	YES	NO	NO
		PreCoated Composite	YES	YES	Up to 100kN	NO	YES	Can Be	NO	NO
		Composite	YES	YES	Up to 100kN	NO	YES	Can Be	YES	YES

Interlayer Selection by Functionality



Over Stable Base

Interlayer Selection by Functionality



Fabrics

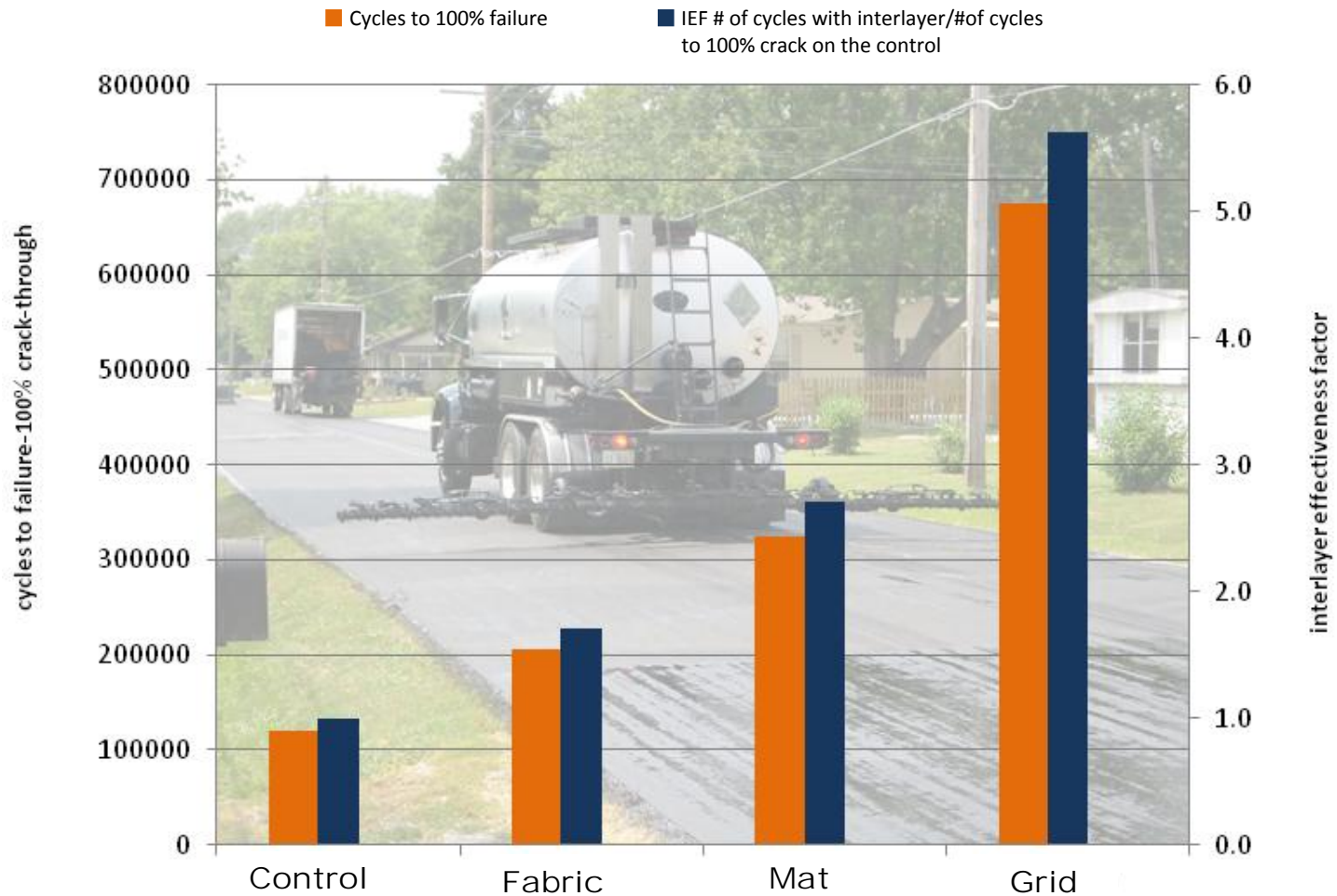
Grids

Mats

Over Stable Base

Interlayer Selection by Functionality

Interlayer Effectiveness and Total Life Averages



Interlayer Cost / Benefit

DRAFT Calculating Cost/Benefit of Interlayers **DRAFT**

Adj. local cost of Hot Mix Asphalt (HMA) in [Cell B4]

Density can be adjusted as needed in [Cell E4]

HMA Cost:	\$75.00	Ton	HMA Density	140	Lbs/Inch	Tons	0.07	SY	
							1" HMA Cost	\$5.25	SY

These are Budgetary numbers based on logistics allowing for Min. of 7000 SY's daily install rate and will vary depending on job conditions and staging that impact the rate at which interlayers can be installed.

**Validation Based on:
PRI Actual Study¹ Results**

Milling Cost not included			\$ SY	HMA + Interlayer Cost/SY	Reflective Crack Effective- ness Factor*	Yrs to Crack Return[^]	SY Cost Per Year
PAVING INTERLAYER TOTAL INSTALLED COST PER SY							
OPTIONS							
Thickness in Inches:	3.0	Inches of HMA Overlay	\$15.75	-	1	3	\$5.25

Add local Installed Cost for Interlayers ↓↓↓

MPV500 4.1 Oz PP Fabric	\$2.20	\$17.95	1.6	4.8	\$3.74
Multi-Axial Fiberglass Mat	\$3.50	\$19.25	2.75	8.25	\$2.33
Multi-Axial Fiberglass Grid	\$6.60	\$22.35	5.5	16.5	\$1.35

¹PRI study of Interlayer effectiveness using APA Crack testing, (**SEE ATTACHED GRAPH on 2nd tab**)

[^]Crack return rate on HMA control with no interlayer = 1

*Interlayer Effectiveness Factor (IEF) = Amount of Reflective Crack delay the Interlayer provided compared to the Control

Interlayer Sample Job Performance City of Santa Cruz Profile

In 2004 the City of Santa Cruz did a three test sections of 2" HMA over concrete using three different options.

- Section #1 - no interlayer
- Section #2 - Paving Fabric
- Section #3 - Paving Mat



2006



2008



2012

Section #1
NO INTERLAYER

Installed 2004

2006



Paving
Fabric

Section #2

Installed 2004



2012

2008

Installed 2004

2012



Section #2
Paving Fabric

Installed 2004



2006

Section #3
TruPave
Paving Mat
(Fiberglass)



2012

City of Hollister 2007 Overlay



**Overlay
done 4/07:
Heavy
cracking, but
good base.**



Before

**Updated
7/22/10:
No reflective
cracking
found. Street
is still in great
condition.**



After

7/22/10

**NOTE: Other
streets in the
same project
with Paving
Fabric and SAMI
as their
interlayer are
both already
showing cracking
and fatigue.**

Interlayer Sample Job Performance

Boones Ferry - BEFORE



Boones Ferry – AFTER



**Lake Oswego-Boones Ferry
TruPave Paving Mat**

Interlayer Sample Job Performance

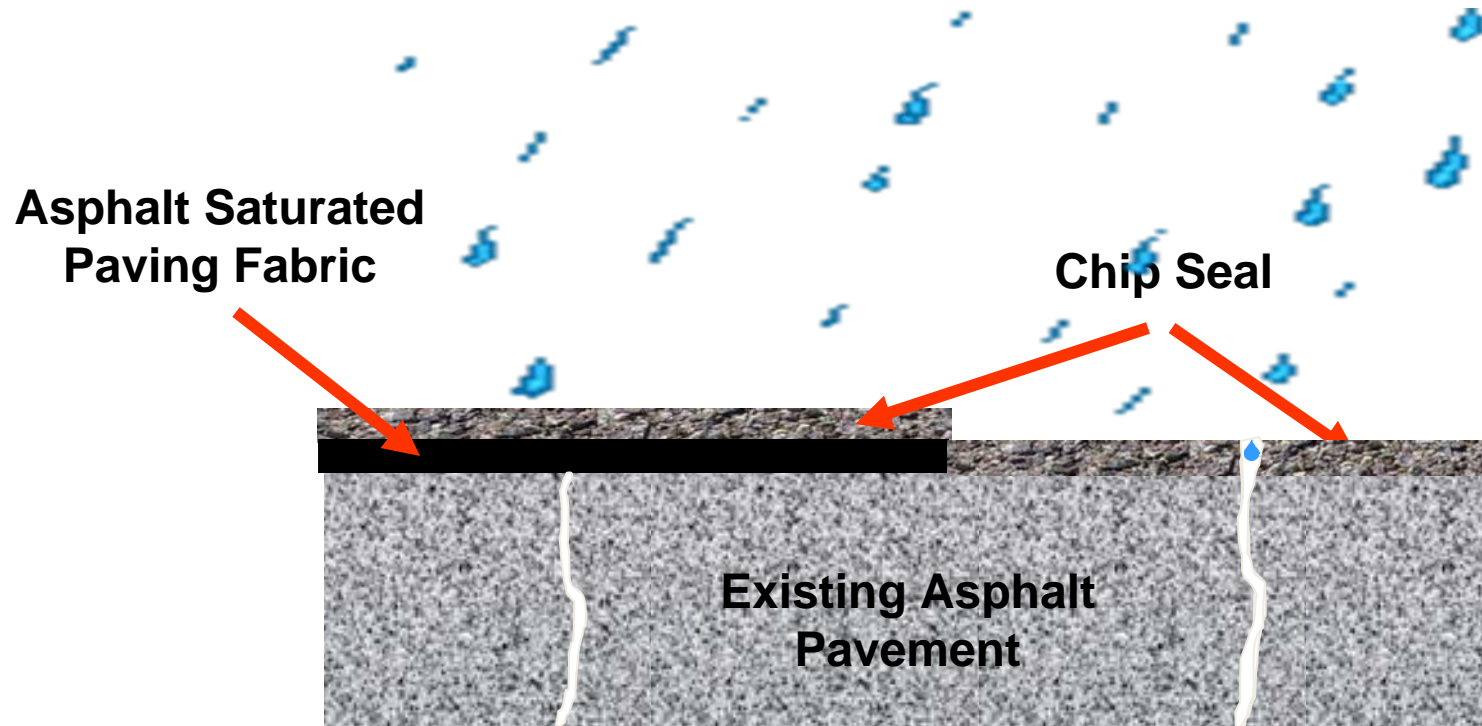


Lake Oswego-Boones Ferry
TruPave Paving Mat

Chip Seal with Fabric Application

Paving Fabric under Chip Seal

What is this new tool used for ?



Delays reflective cracking

Eliminates surface water infiltration

30 years of placing double chip seal over fabric

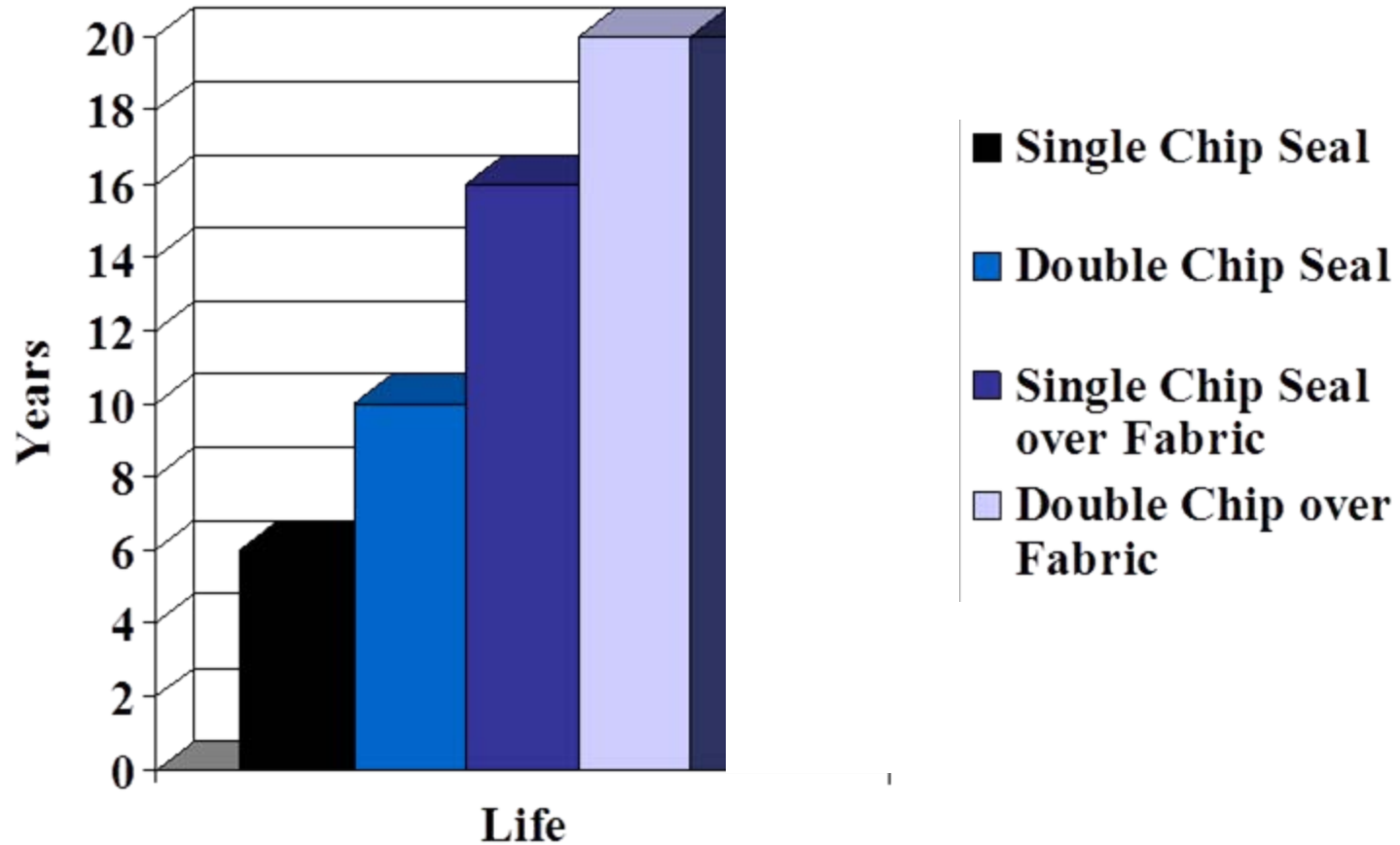
Chip Seal with Fabric Application

Paving fabric interlayers are the Engineer's tool for preserving what was once impossible to preserve...

14-year old project (1996) (No maintenance to date)

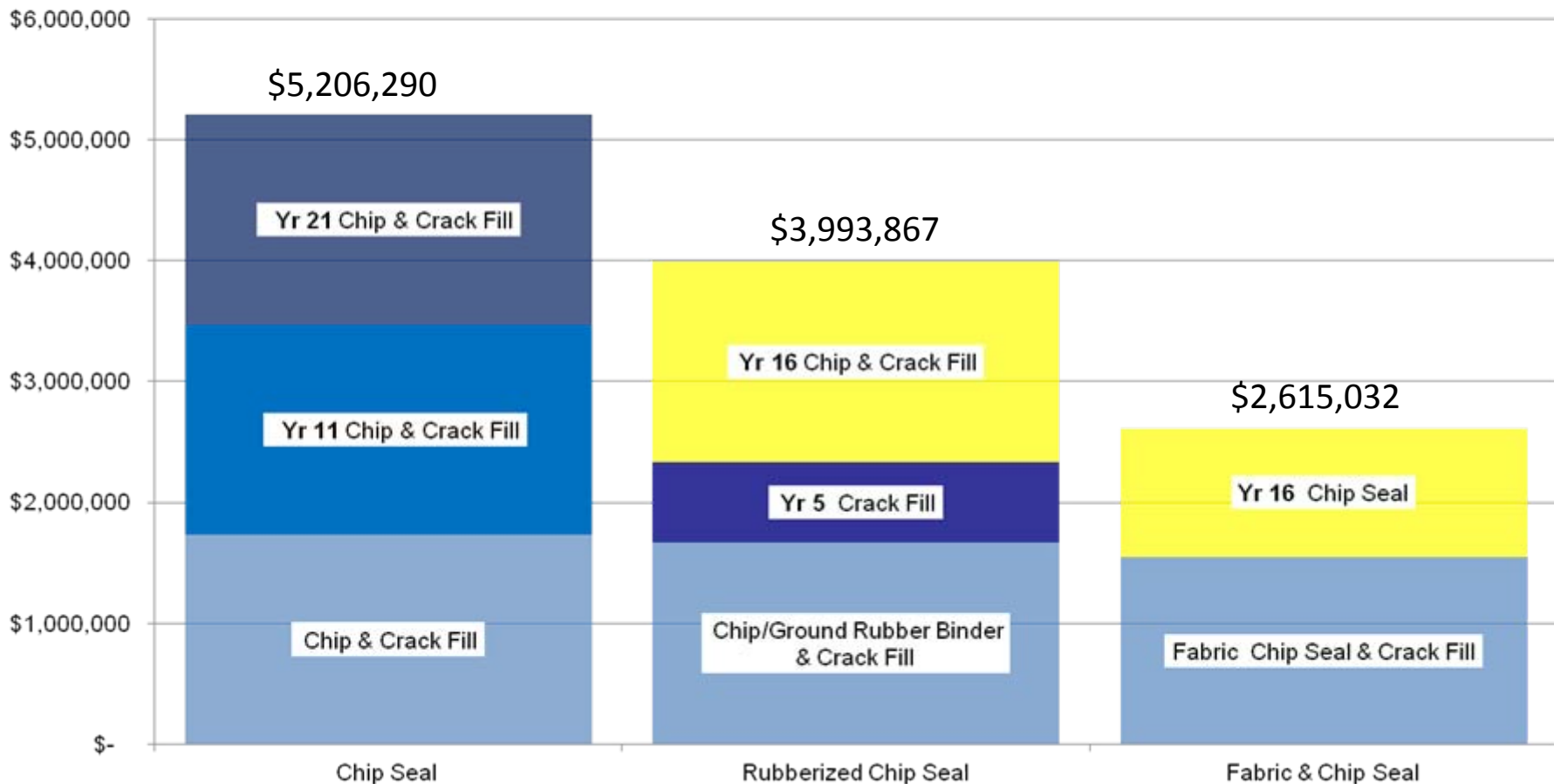


Chip Seal with Fabric Application



Chip Seal with Fabric Application

San Diego County Chip Seal Life Cycle Cost Analysis 30 Yr



Chip Seal with Fabric Application

DRAFT Calculating Cost/Benefit of Chip Over

Adj. local cost of Hot Mix Asphalt (HMA) in [Cell B4]

Adjusted Density in [Cell E4]

HMA Cost:	\$75.00	Ton	HMA Density	140	Tons	0.07	\$5.25	1" HMA/SY
-----------	---------	-----	-------------	-----	------	------	--------	-----------

Budgetary numbers based on logistics allowing a Min. 7000 SY's daily install rate. Will vary depending on anything that delays the daily installation rate.

	\$ SY	Yrs to Crack Return^	SY Cost Per Year
OPRION TOTAL INSTALLED COST PER SY			
HMA Overlay Thickness : 2.0 Inches	\$10.50	2	\$5.25
2" HMA over 4.1 Oz PP Fabric	\$12.70	3.2	\$3.97
Double Chip over 4.1 Oz PP Fabric	\$7.00	20	\$0.35

^Crack return rate on HMA control with no interlayer = 1

Interlayer Use Summary

- ❖ Extend pavement life
- ❖ Preserve structural value of base
 - ❖ Delay Crack Return
- ❖ Decreased Maintenance Cost
- ❖ Increase asphalt flexural strength
- ❖ Reduce Asphalt Cost Impact
 - ❖ Better Cost/Benefit

THANK YOU!

QUESTIONS?



materials that make a difference

Pavement Solutions

Dennis Rogers

Business Manager, West

Tel: 760 548 0384

Cell: 916 240 0200

d.rogers@tencate.com