

# TenCate Asphalt Interlayers

## Aplicaciones en Carpetas Asfálticas

GEOSYNTHETICS

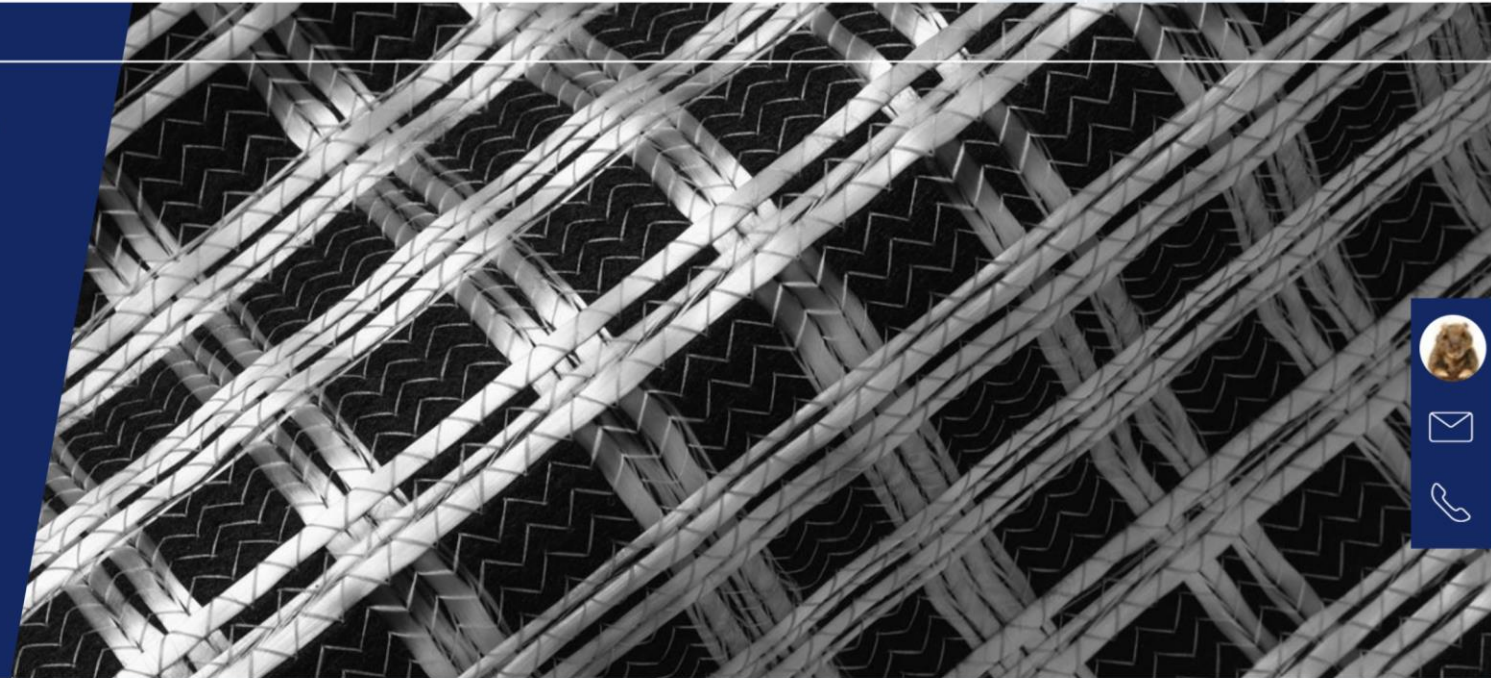
Selección y Diseño con Geocompuestos para Rehabilitación de Carpetas Asfálticas

 **TENCATE**  
**Mirafi®**



### MPG and MPG4

Mirafi® MPG and MPG4 are glass filament reinforced paving composites comprised of fiberglass filament yarn incorporated into a nonwoven polypropylene paving fabric.



**Juan Pablo Broissin López**  
Engineering Business Manager LATAM

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GEOSYNTHETICS



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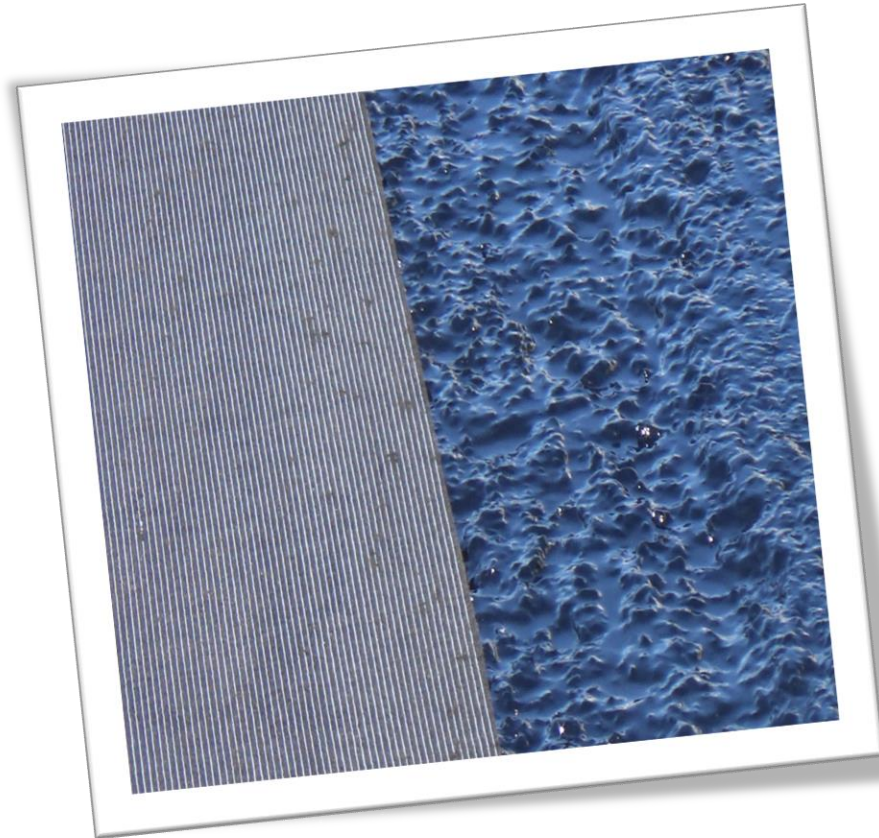
- TenCate Geosynthetics
- GeotechTips – Diseño Mezclas Asfálticas
- Paving Fabric Interlayer as a Pavement Moisture Pavement
- ( Paper Mark L. Marienfeld and Thomas L. Baker, Amoco Fabrics and Fibers Company)
- FHWA 2008 Geosynthetics Overlays
- FHWA Distress Types Manual

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# ¿Qué es un Interlayer?

GEOSYNTHETICS



**Geosintético que se instala a nivel de la superficie de rodamiento en estructuras de pavimento.**

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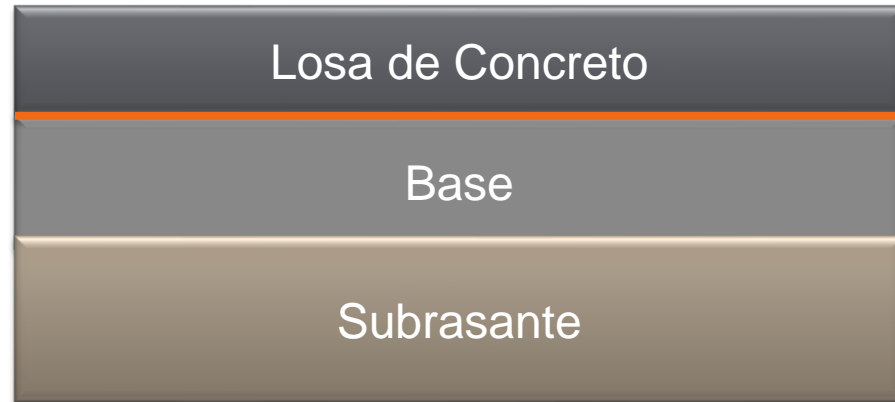
Pavimento **flexible**

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Pavimento **rígido**



**Foto: Mirafi® 1450BondBreaker**

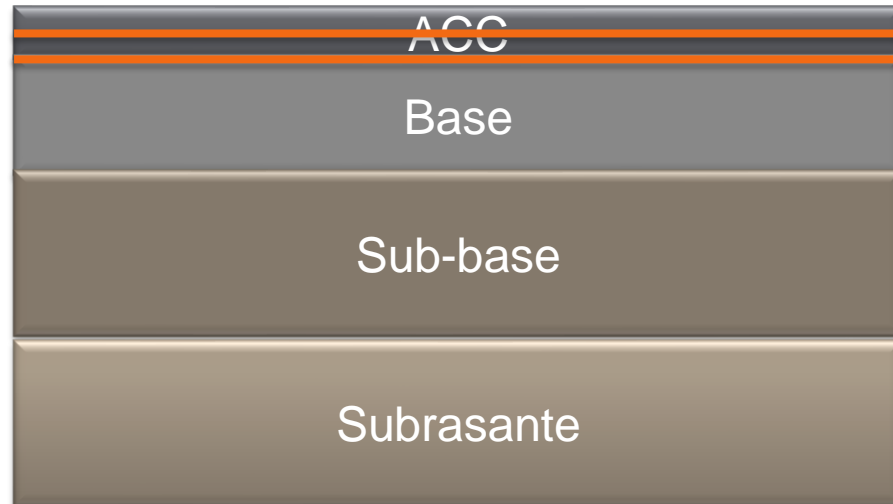


Foto: Mirafi® MPV500

# ¿Qué es una mezcla asfáltica?

Definición – Geotechtips – RAMCODES – Diseño de Mezclas Asfálticas

GEOSYNTHETICS

- Dosificación de Materia Prima ( agregado pétro , cemento asfáltico, aditivos , etc) que cumpla con propiedades volumétricas , mecánicas e hidráulicas requeridas para la especificación.



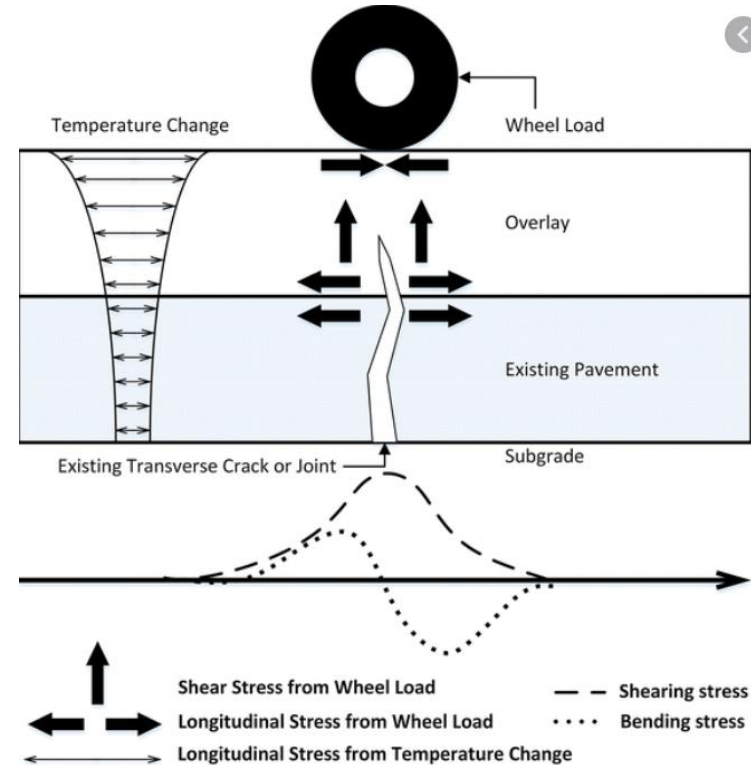
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- Resistente al fenómeno de fatiga
- Resistente a las deformaciones plásticas
- Resistente al daño por humedad

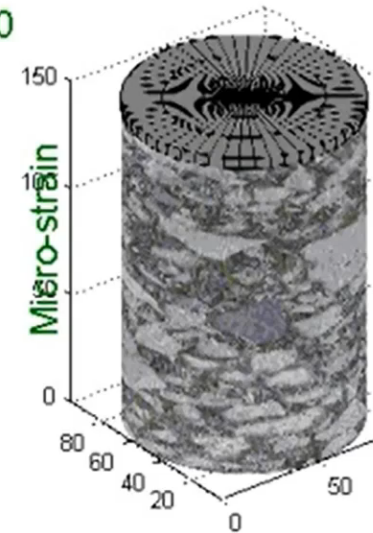
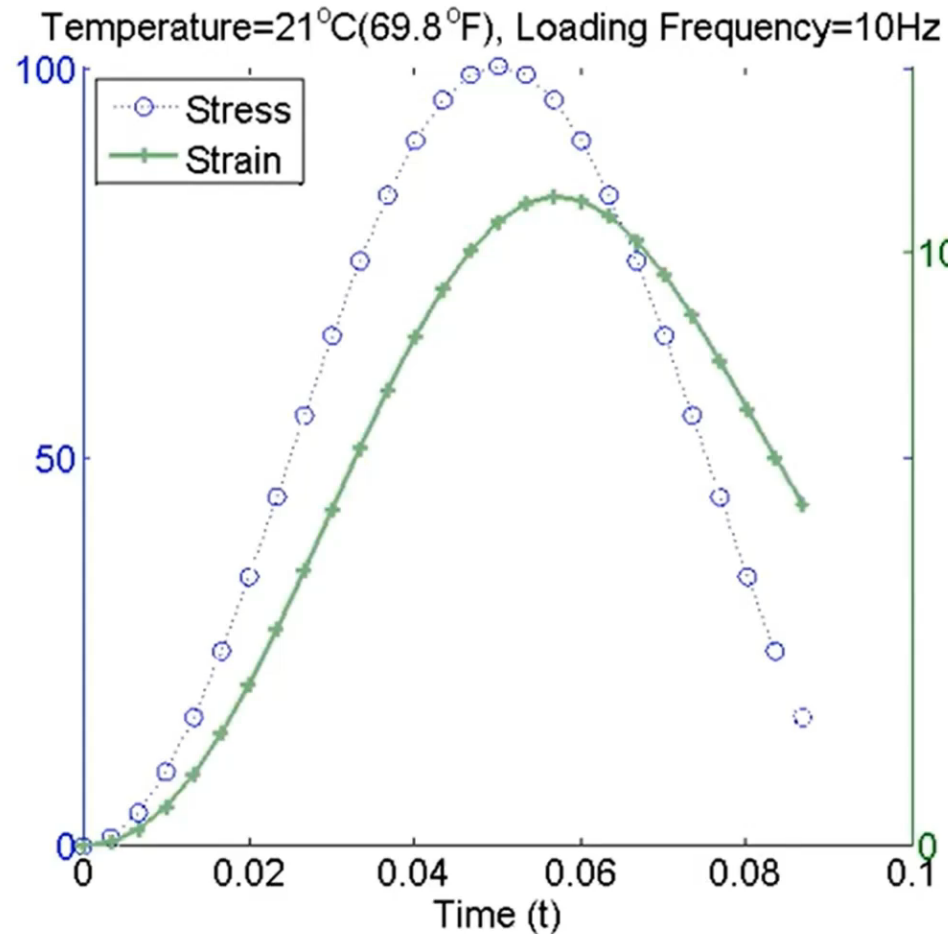


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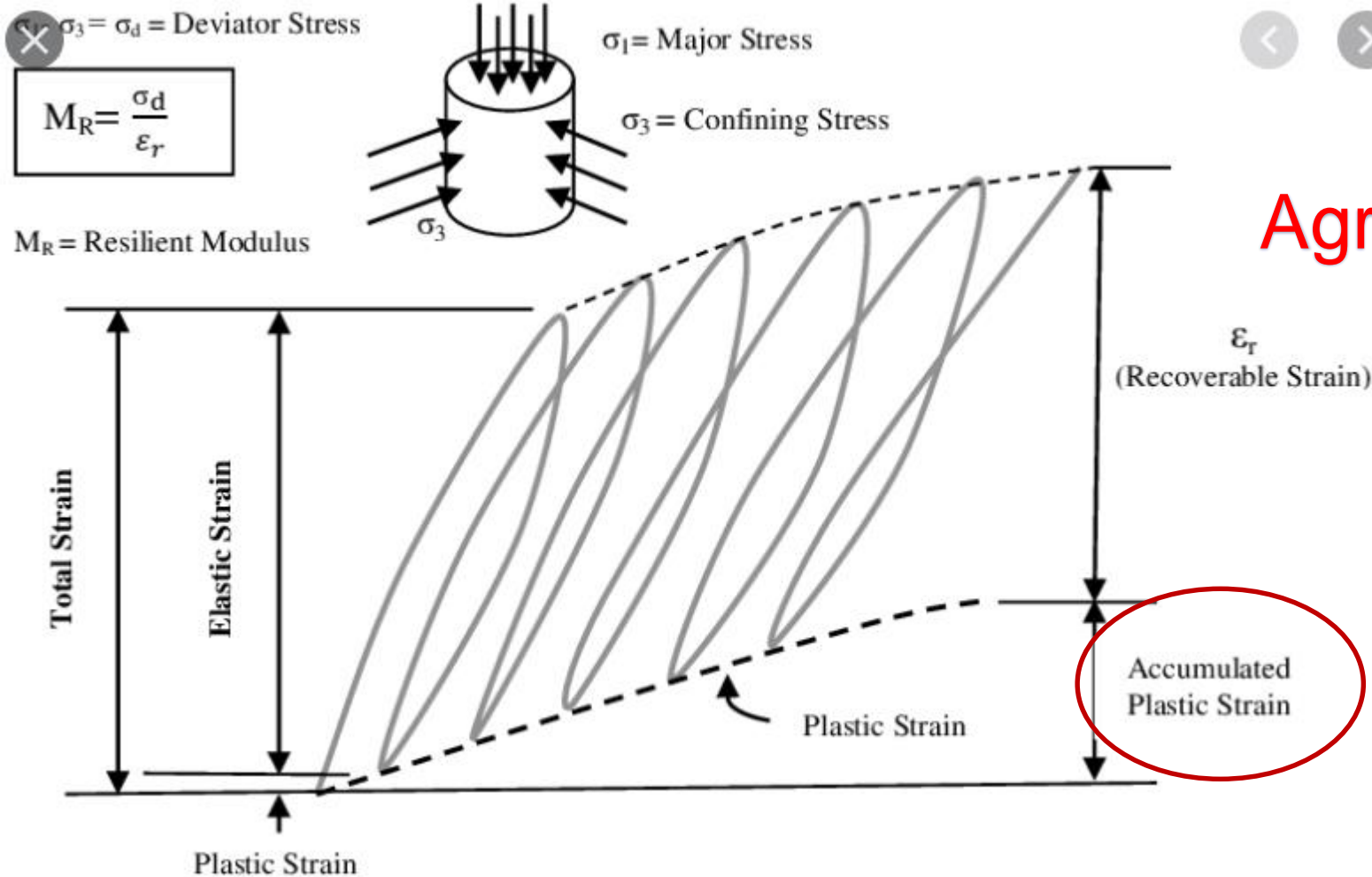
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- El módulo dinámico se divide en dos partes; la parte real, la que representa el comportamiento elástico (Huang, 1993)



s partes; la  
ginaria que  
e viscosa),



## Agrietamiento por Fatiga

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Continua (HMA)

Discontinua (SMA)

Abierta (OGFC)

<b>CAUSAS</b>	<b>EFFECTOS</b>
Exceso de asfalto en la mezcla	Ondulaciones, ahuellamientos y afloramiento o exudación.
Exceso de arena de tamaño medio en la mezcla	Baja resistencia durante la compactación y posteriormente, durante un cierto tiempo; dificultad para la compactación.
Agregado redondeado sin, o con pocas, superficies trituradas	Ahuellamiento y canalización.

# Condiciones Presentes en un ACC

GeotechTips – Diseño de Mezclas Asfálticas

GEOSYNTHETICS

- NO EXISTE UNA MEZCLA REINA

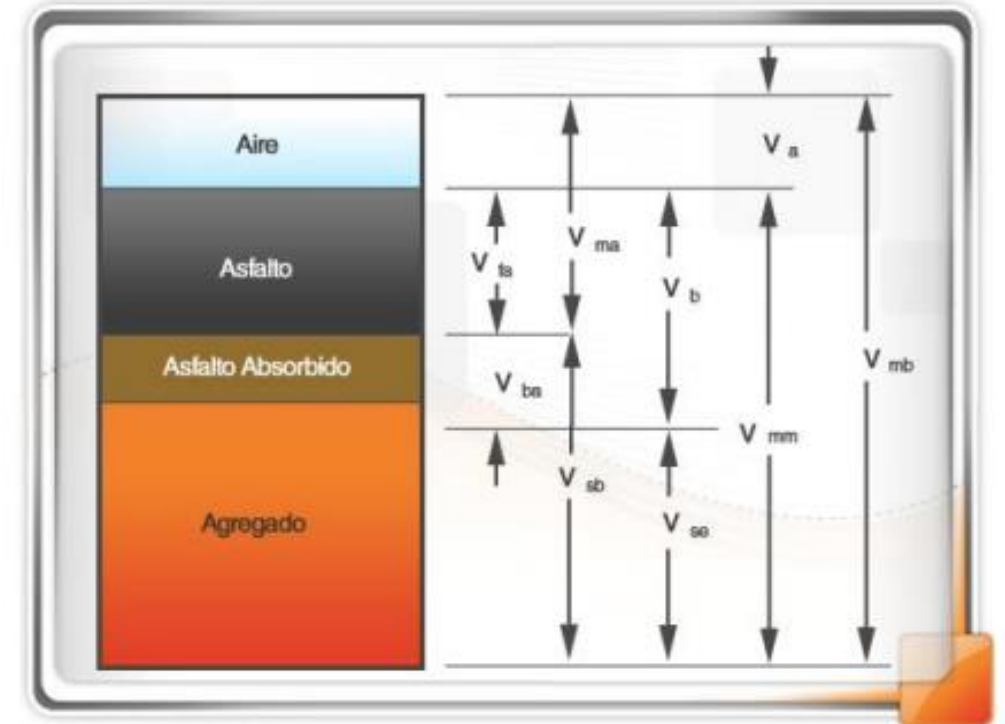


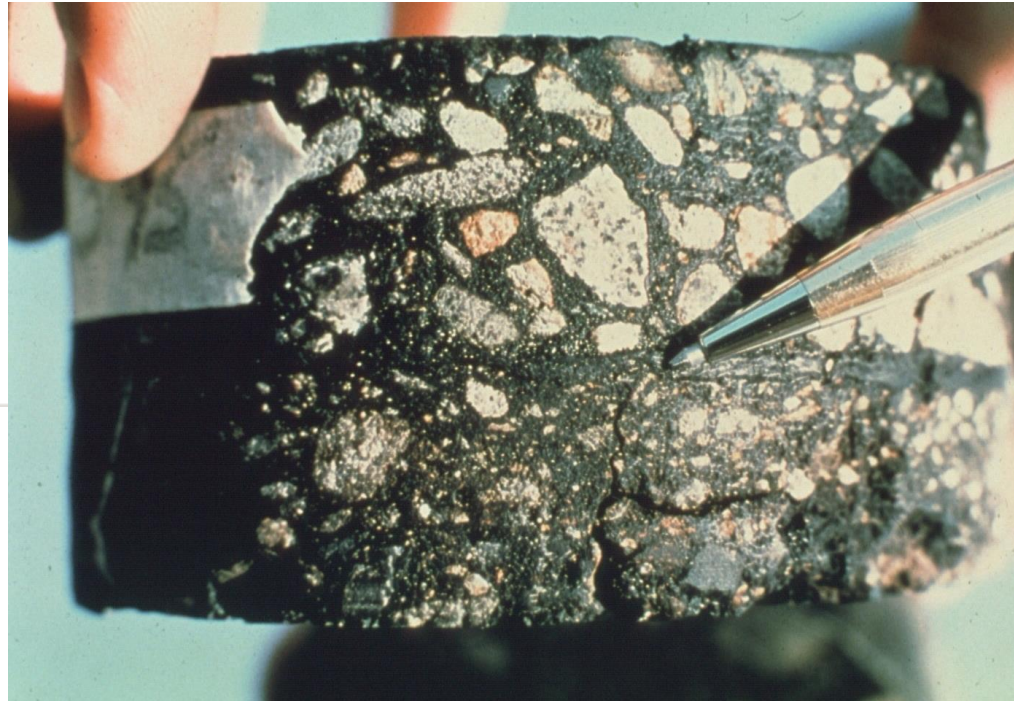
Gráfico IV. 23. Componentes del diagrama de compactación de una HMA.

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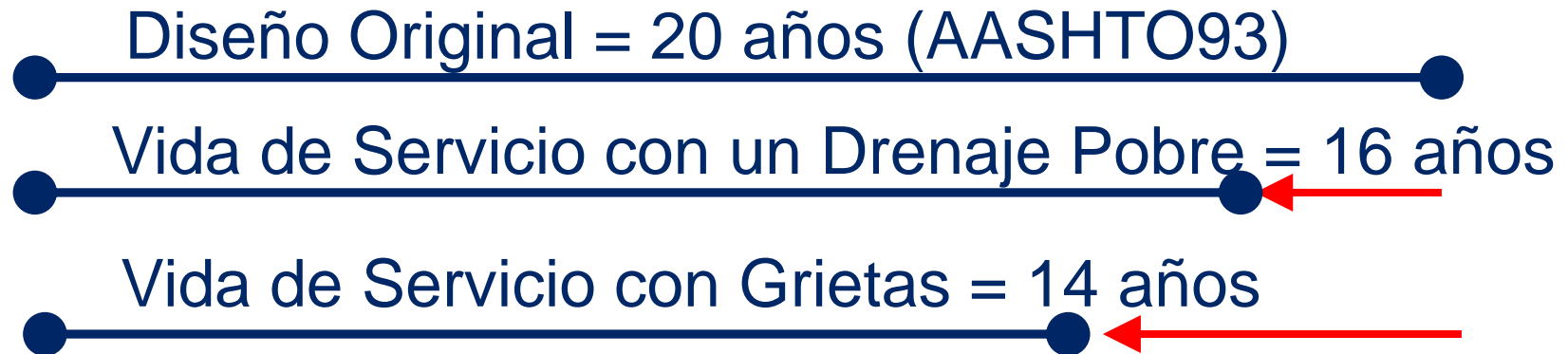
 **TENCATE**  
GEOSYNTHETICS

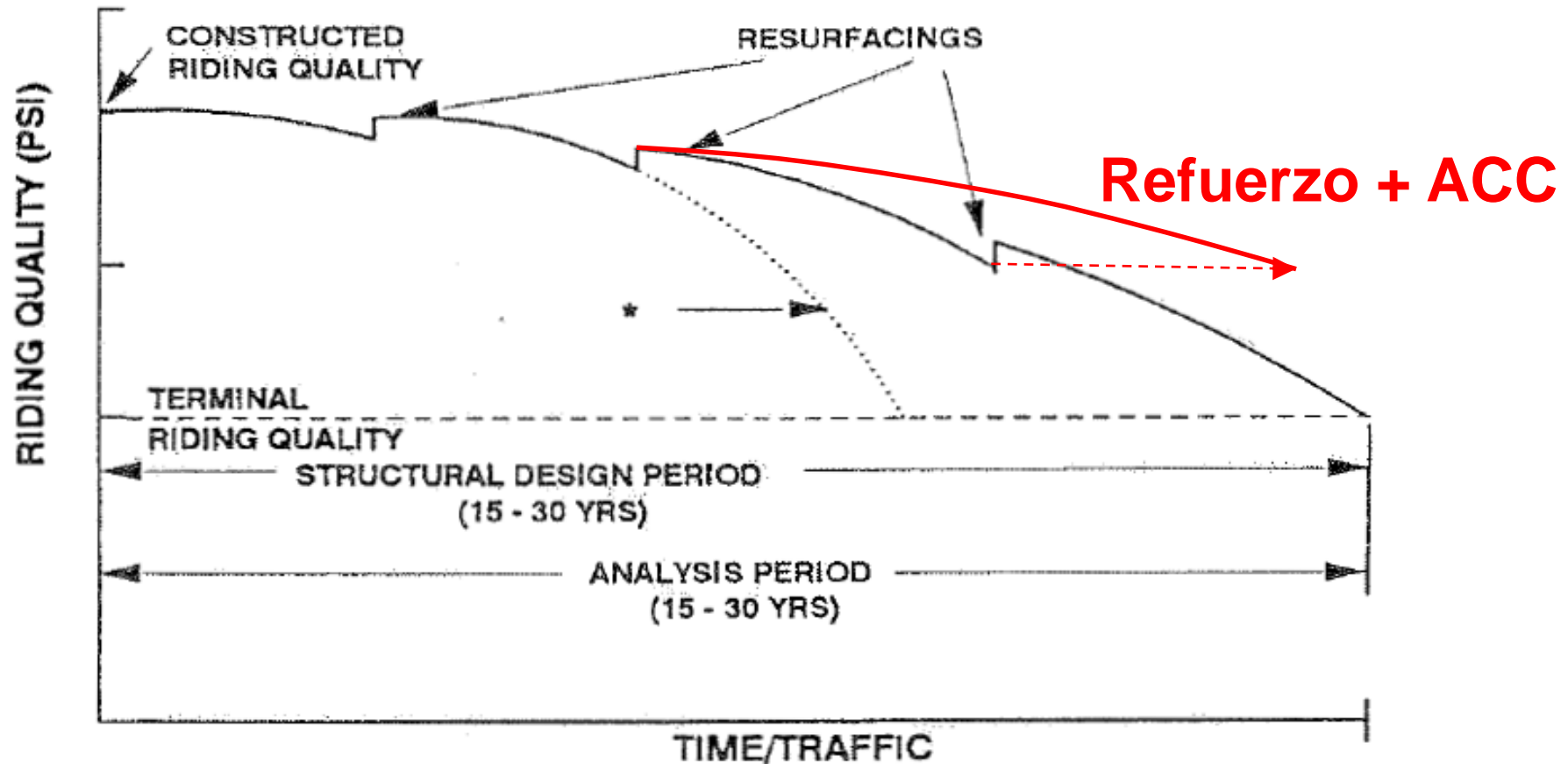
- Se necesita un sistema que retarde la reflexión de grieta
- Reducir la severidad de la grieta una vez que suceda
- Proveer otra solución como barrera de humedad o reducción de espesor



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La vida de servicio (AASHTO 93) se logra solo si mantienes la estructura de pavimento...justo como tu auto. **Lo tienes que mantener.**





**Si la superficie de rodamiento no se mantiene y si hay agua esto provoca deterioro inminente**



## Solución 1 : Usa más asfalto



- ↓ Costo
- ↓ Elevación – Señalización
- ↓ Elevación - Seguridad

**Solución 2 : Pavimentar frecuentemente – gastas más.**

**Solución 3 : La MEJOR Es usar un geosintético para ACC**



## Funciones de los Interlayers

▶ Barrera de Humedad



▶ Reflexión de Grietas

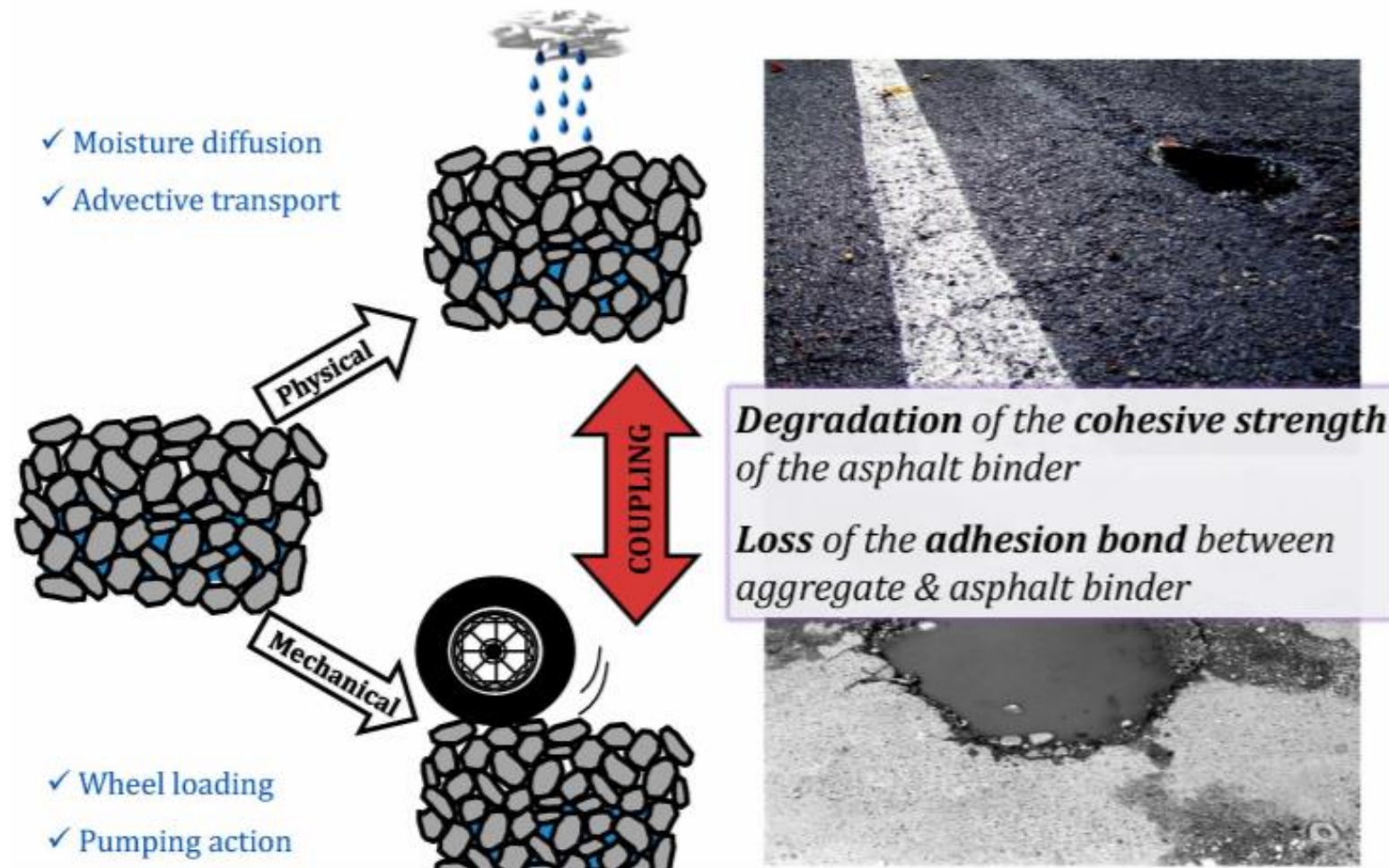


▶ Mejoramiento de Vida de Servicio



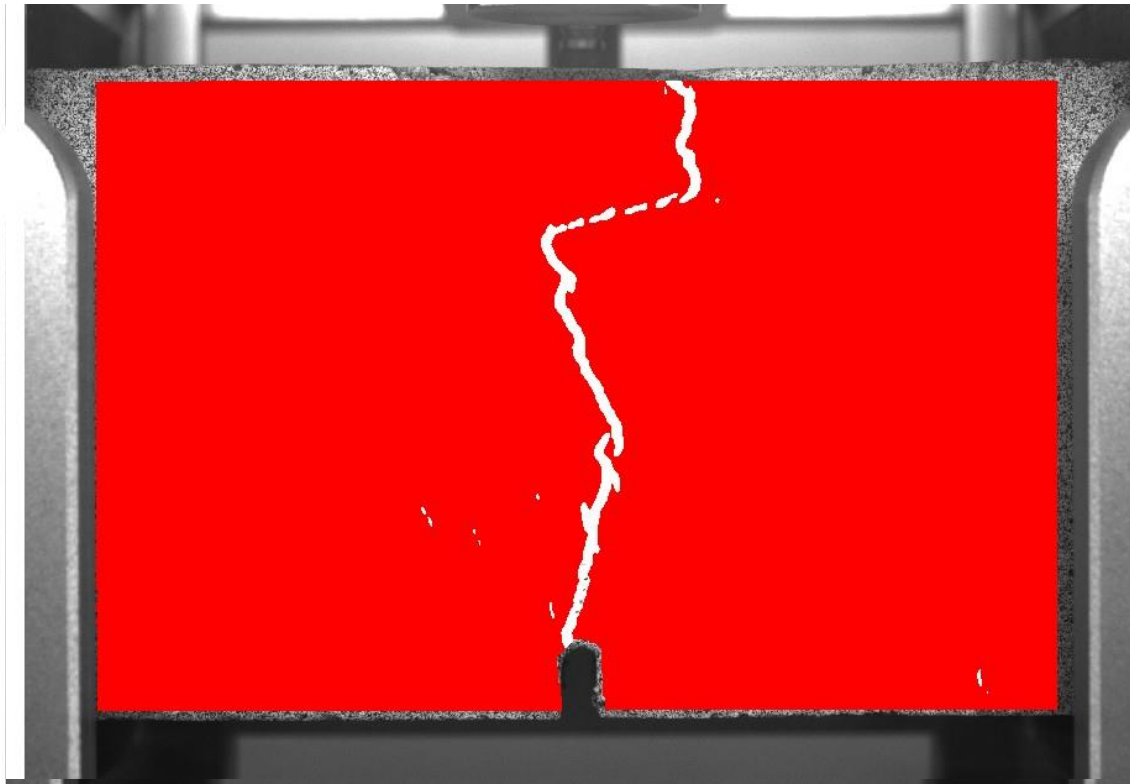
# Barrera de Humedad

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Las grietas suceden antes de verlas! (ref. NCSU 4 Pt Beam Tests)

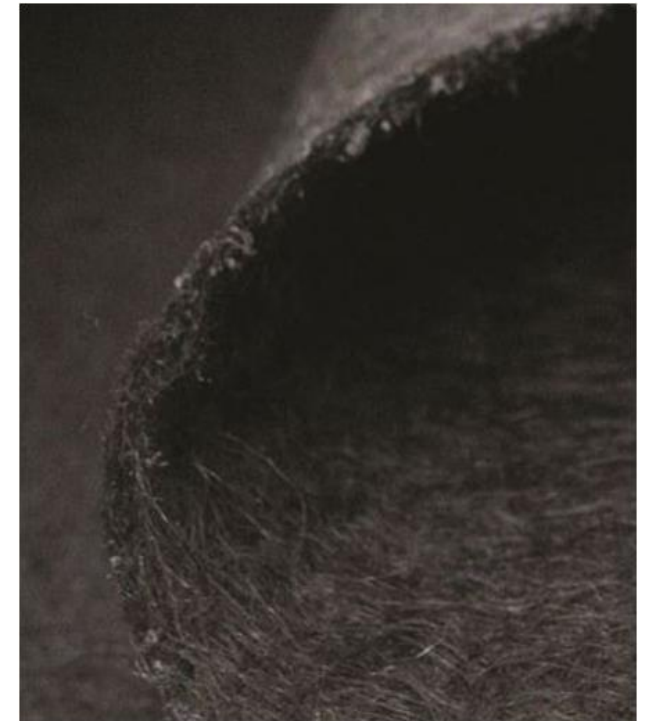
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# Geotextil Planchado TenCate MPV600

Barrera de Humedad

GEOSYNTHETICS



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### Pruebas en Laboratorio

- Bushey, 1976 (13)
- Guram, 1983 (14)
- Smith, 1984 (15)
- Lancaster, 1994 (6)
- Baker, 1997 (16)

### Pruebas en Campo

- Pourkhosrow, 1985 (18)
- Button, 1989 (19)
- Sutherland and Phillips, 1990 (20)
- Phillips, 1993 (21)
- Rahman et al., 1996 (3)
- Al-Qadi, 1997 (22)

El sistema de Geotextil Planchado es ampliamente reconocido por extender la vida útil de la rehabilitación de ACC.

Caltrans ha realizado una extensa investigación sobre esto.

Basado en la evaluación de numerosos sitios de prueba, sus hallazgos indican que el uso de geosintéticos para repavimentación (ej. MPV600) puede proporcionar una vida útil prolongada equivalente a colocar 30 mm (1,2 pulgadas) adicionales de espesor de recubrimiento de concreto asfáltico.

La mayor preocupación con los sistemas para barrera de humedad con geosintéticos es que el **geosintético se instale con suficiente ligante asfáltico** para volverse impermeable, lo cual es esencial para el **desempeño de los sistemas de pavimento.**



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# Producto Ideal



TENCATE GEOSYNTHETICS  
Americas



## Mirafi® MPV600

Mirafi® MPV600 is a heat-set polypropylene nonwoven geotextile specifically designed for asphalt overlay applications. Mirafi® MPV600 is inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids.

TenCate Geosynthetics Americas Laboratories are accredited by Geosynthetic Accreditation Institute – Laboratory Accreditation Program ([GAI-LAP](#)). [NTPEP Listed](#)

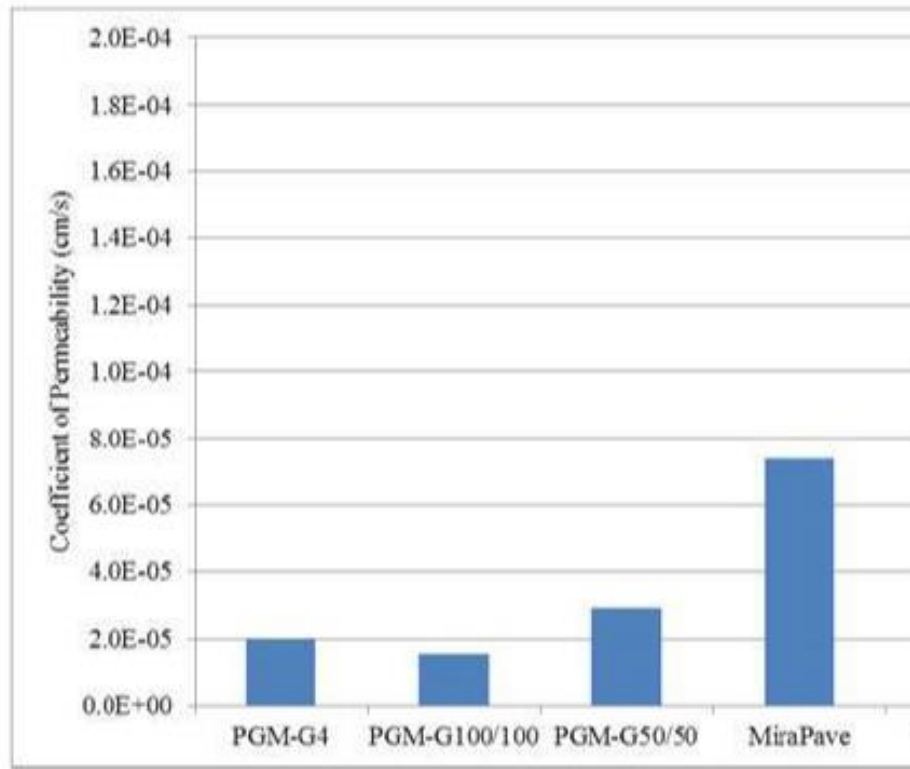


Figure 2.10 Permeability testing results

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Grab Tensile Strength	ASTM D4632	lbs (N)	125 (556)
Grab Tensile Elongation	ASTM D4632	%	50
Mass/Unit Area	ASTM D5261	oz/yd <sup>2</sup> (g/m <sup>2</sup> )	4.6 (156)
			<b>Minimum Test Value</b>
Asphalt Retention	ASTM D6140	gal/yd <sup>2</sup> (l/m <sup>2</sup> )	≥ 0.22 (1.0)
Melting Point <sup>1</sup>	ASTM D276	F° (C°)	325 (163)
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	70

<sup>1</sup> Based on Peak Temperature results from TRI.

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Physical Properties	Unit	Typical Value
Roll Width	ft (m)	12.5 (3.8)
Roll Length	ft (m)	360 (110)
Roll Area	yd <sup>2</sup> (m <sup>2</sup> )	500 (418)
Estimated Roll Weight	lbs (kg)	169 (77)

# Caso de Estudio

Carretera Chihuahua

GEOSYNTHETICS



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**MTK**



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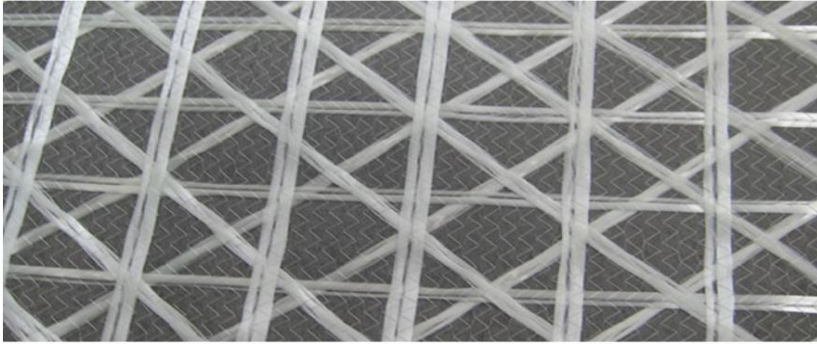




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# Reflexión de Grietas

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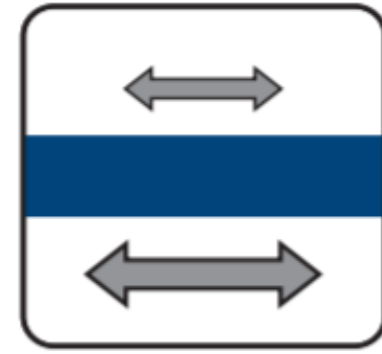
**Foto: Mirafi® MPG4**



**Foto: Mirafi® MPM**



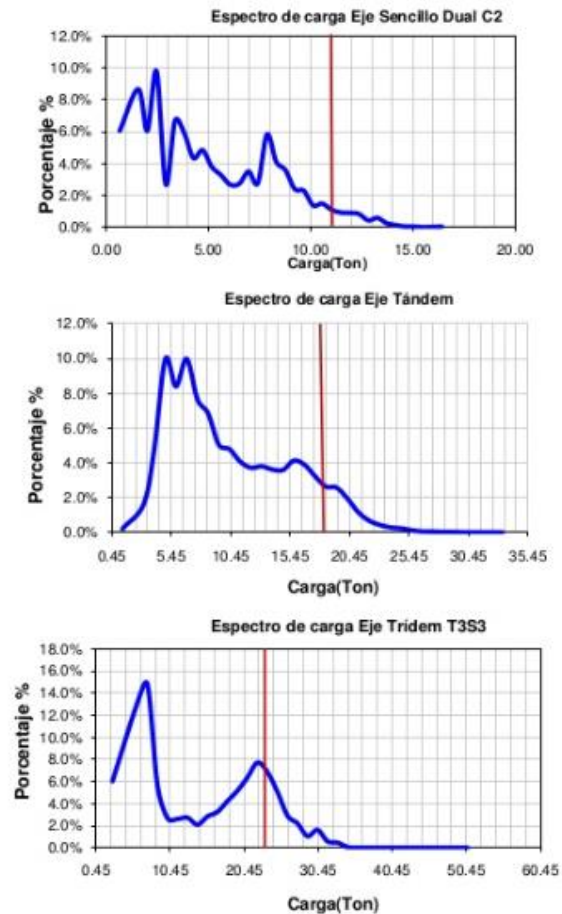
**SEALING**



**STRESS RELIEF**

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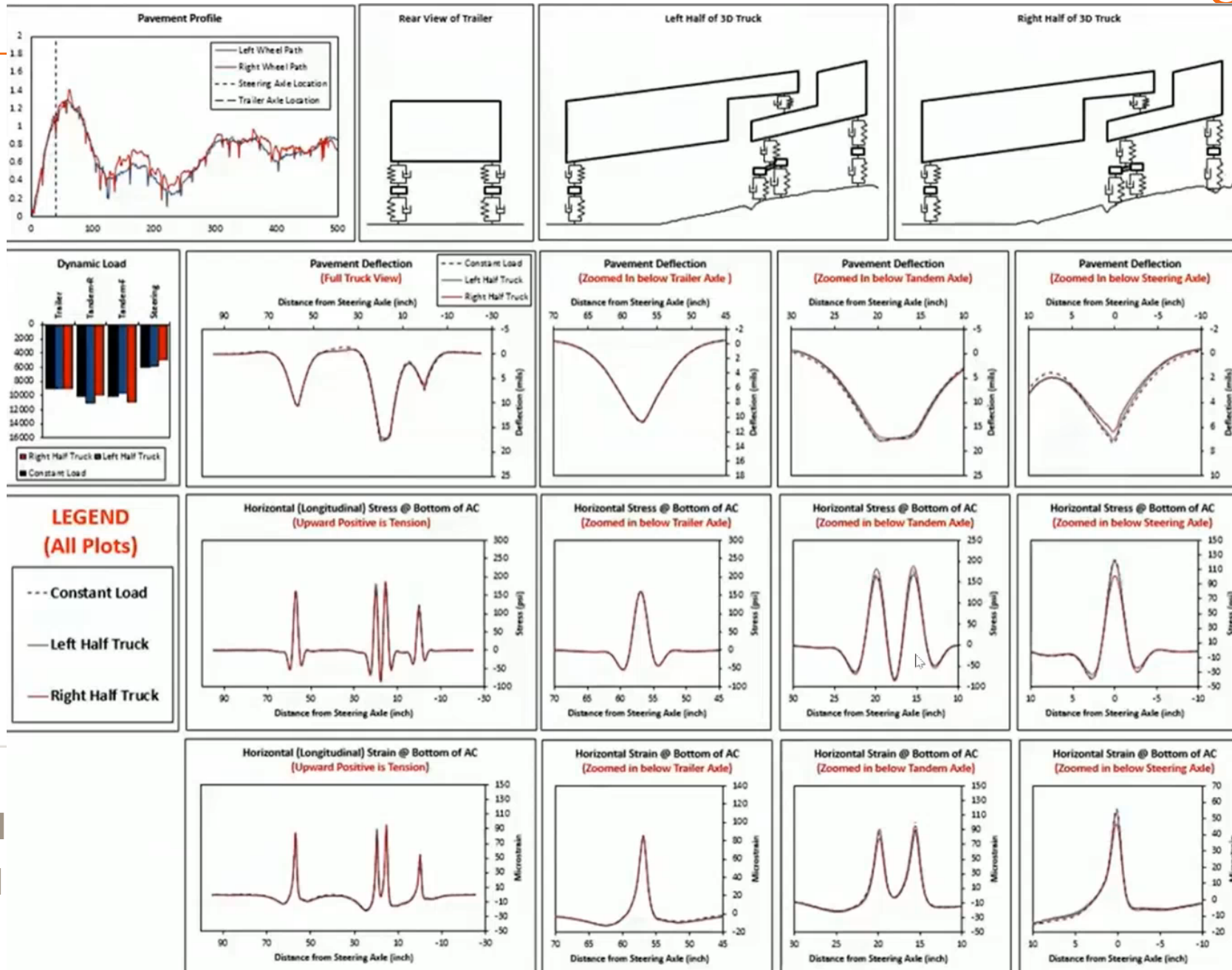
PhD Paul Garnica

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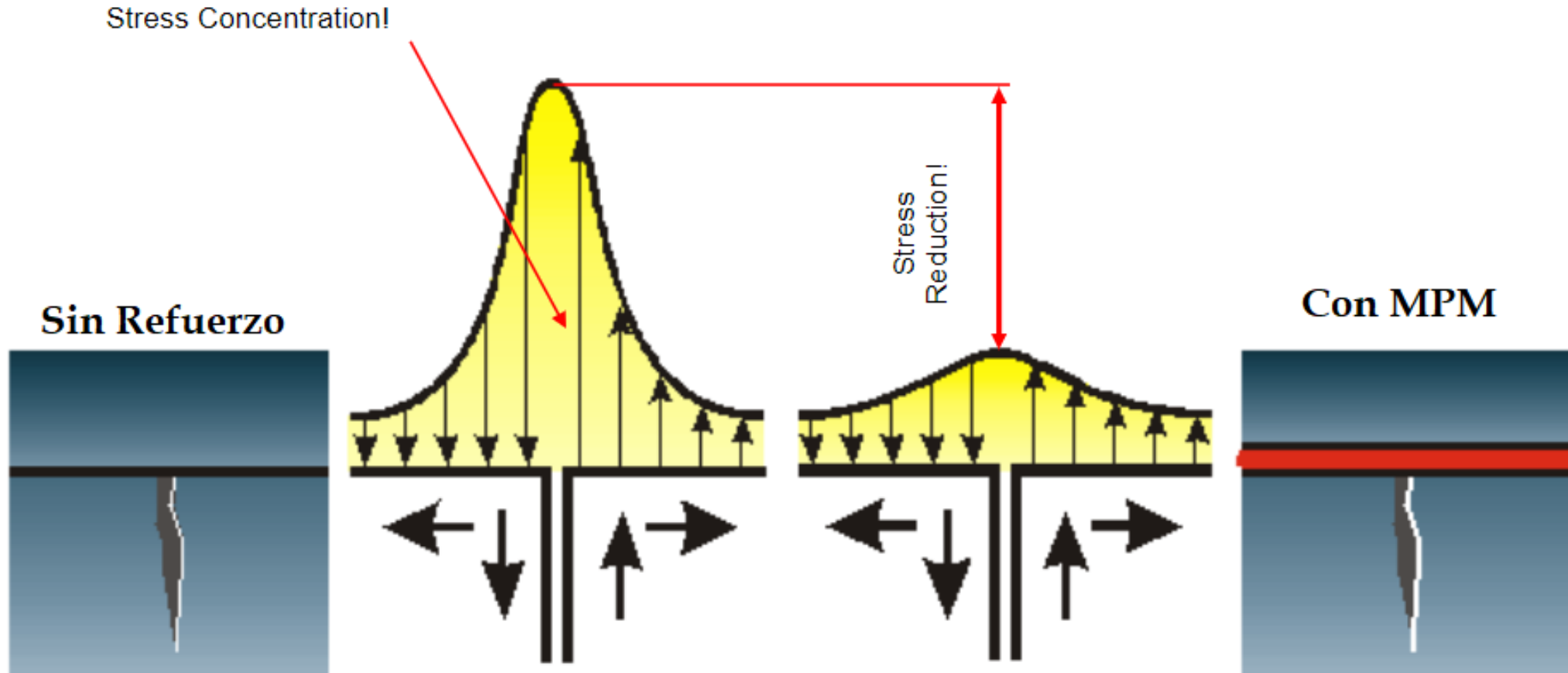
# Deflexiones en el Pavimento

GEOSYNTHETICS

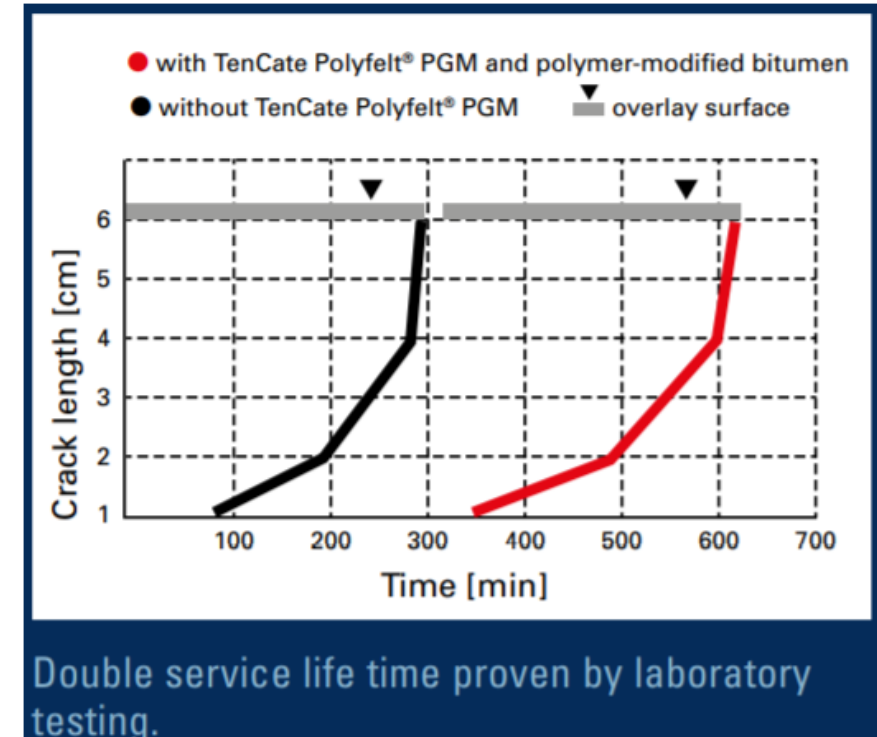


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OSYNTHETICS



- **Brindar “alivio” a las Tensiones** .- Las tensiones generadas por la grieta son absorbidas por el geocompuesto antes de crearse en el asfalto.
- **Resistencia a la Tensión** .- Si ya existe grieta un alto módulo a la tensión resiste el esfuerzo a tensión.



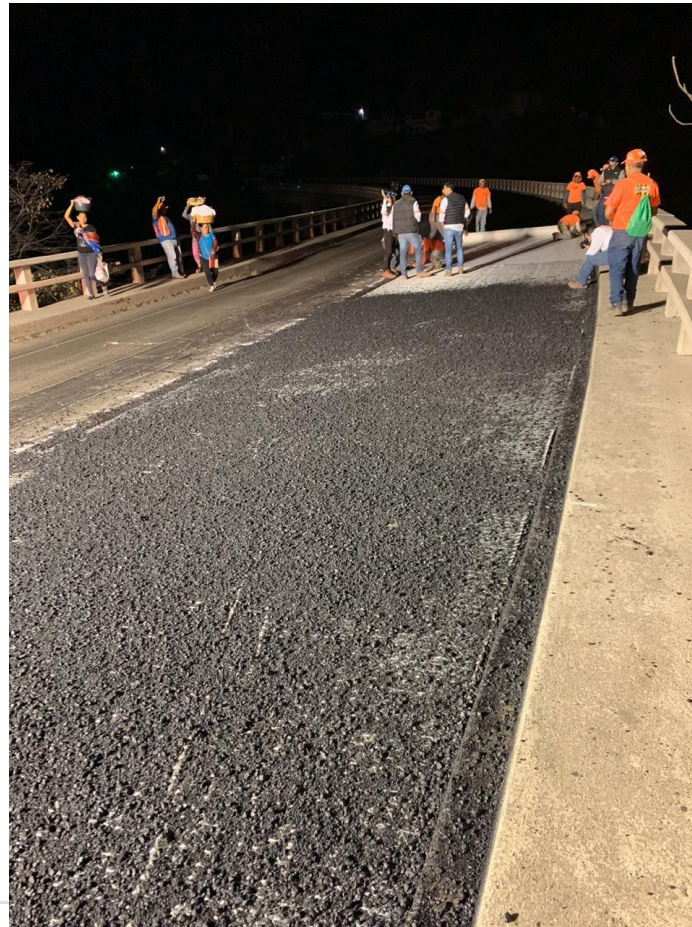
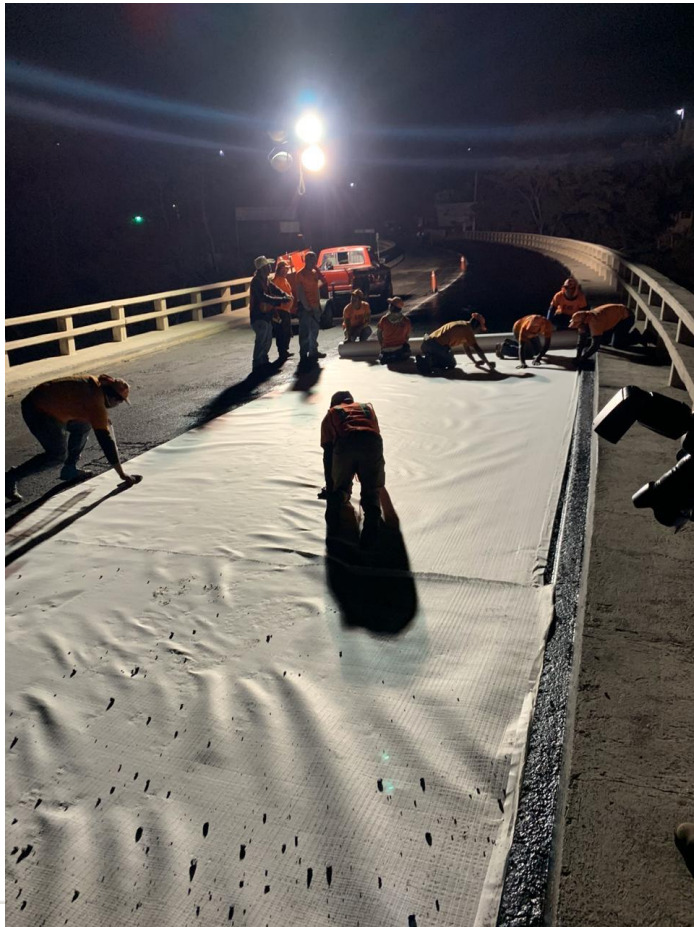


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# Levantamiento Fotográfico de Alta Definición Georeferenciado y Odometrado. GEOSYNTHETICS

- Cortesía: Rodrigo Rubio



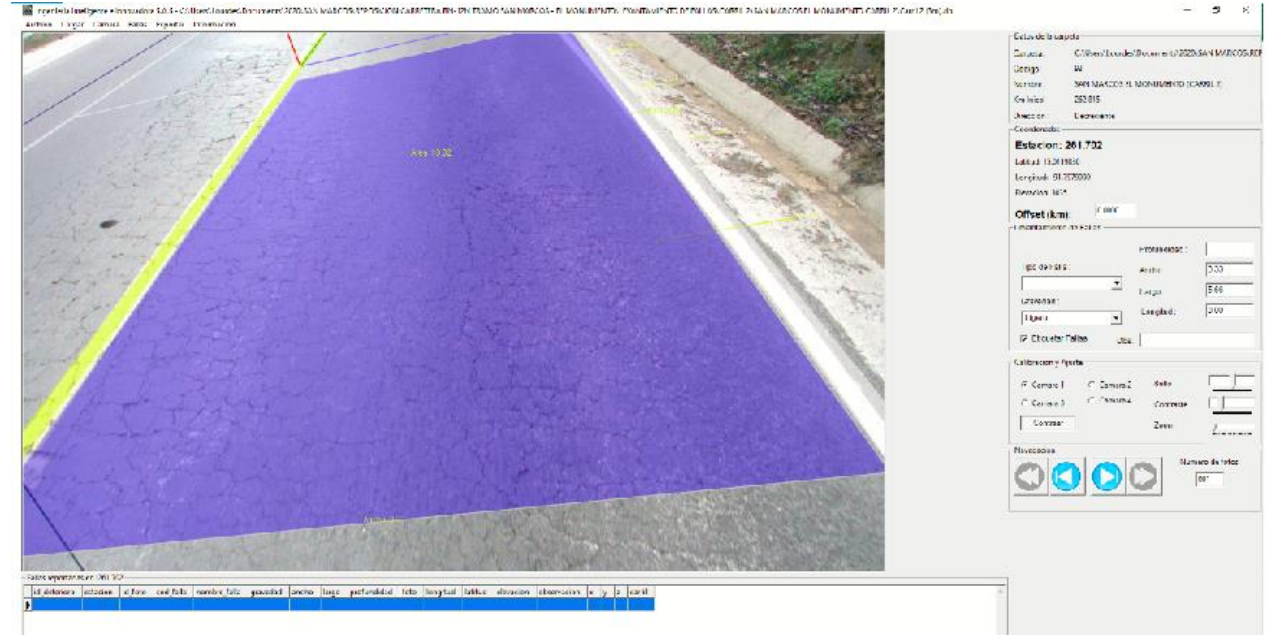
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# Código de Falla por Estación

Procesamiento de Imágenes

GEOSYNTHETICS

ID	estacion		cod_falla	nombre_falla	gravedad
	(km)				
1	262.800		FPC	Piel de cocodrilo	Severo
2	262.795	0.005	FPC	Piel de cocodrilo	Severo
3	262.790	0.005	FPC	Piel de cocodrilo	Severo
4	262.769	0.021	FPC	Piel de cocodrilo	Severo
5	262.764	0.005	FPC	Piel de cocodrilo	Severo
6	262.759	0.005	FPC	Piel de cocodrilo	Severo
7	262.724	0.035	FPC	Piel de cocodrilo	Severo
8	262.719	0.005	FPC	Piel de cocodrilo	Severo
9	262.709	0.010	FPC	Piel de cocodrilo	Severo
10	262.653	0.056	FPC	Piel de cocodrilo	Severo
11	262.643	0.010	FPC	Piel de cocodrilo	Severo
12	262.608	0.035	PUL	Pulimiento de agregados	Moderado
13	262.582	0.026	FPC	Piel de cocodrilo	Severo
14	262.562	0.020	HUE	Huecos	Moderado
15	262.512	0.050	PUL	Pulimiento de agregados	Moderado
16	262.491	0.021	FPC	Piel de cocodrilo	Moderado
17	262.466	0.025	FPC	Piel de cocodrilo	Moderado
18	262.461	0.005	FPC	Piel de cocodrilo	Moderado



Cortesía: Rodrigo Rubio  
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# Guía Reflexión de Grieta

Reflective Cracking Index

GEOSYNTHETICS

RCI	Tipos de Grieta	Recommended Interlayer Type	
		Tráfico Liviano	Tráfico Elevado
81 – 100	Oxidation Cracking Paving Seam Block Cracking	MPV 400 MPV 500	MPM30 MPV 600 MPV 700
61 – 80	Longitudinal Cracking Transverse Cracking	MPM 30 MPV 600 MPV 700	MPM 50 MPV 700
41- 60	Alligator Cracking 1& II PCC Load Transfr. > 80	MPM 50 MPG4	MPG4 MPG100
21 – 40	PCC Load Transfr < 80 PCC Load Transfr > 60	MPG4 MPG100	MPG100 MTK
0 - 20	PCC Load Transfr < 60 Thermal Cracking Lane Widening	MTK MPG100	MPG100 & Saw & Seal MTK & Saw & Seal

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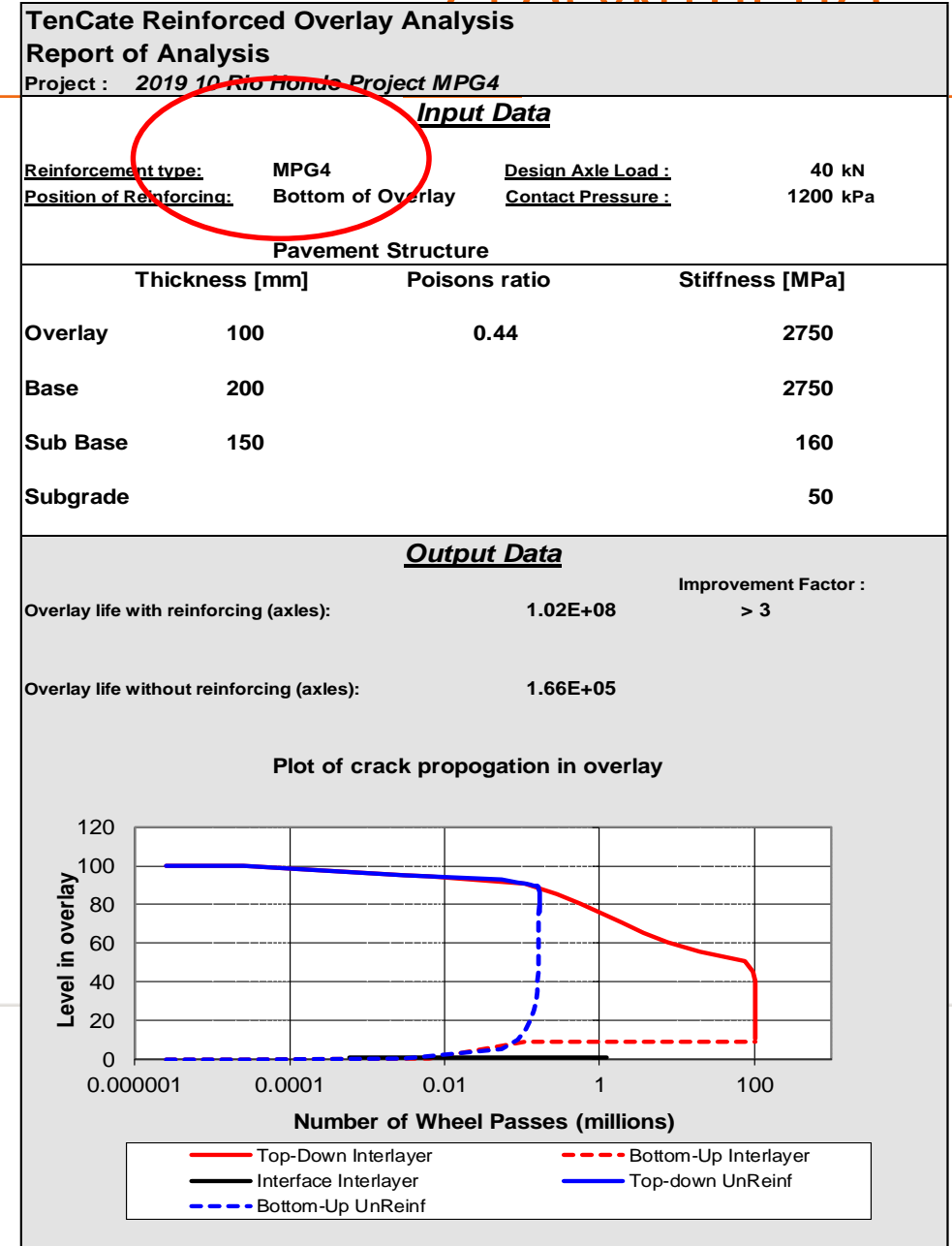
GEOSYNTHETICS

# Análisis para Reflexión de Grietas

- Tipo de Capa & Espesor
- Propiedades por Capa
- Cargas
- Tipo de Grieta & Producto

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# Incremento de Vida de Servicio Reducción de Espesor Diseño con Geocompuestos

# Herramientas de Análisis

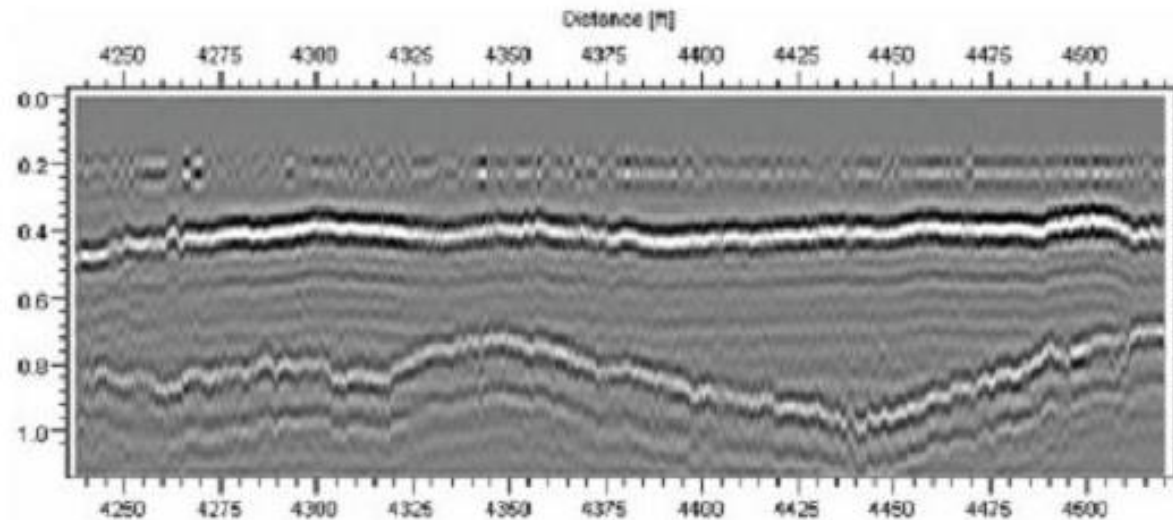
## ME Determinar la Capa Crítica:

- Tipo de Capa & Espesor
- Características de la Capa
- Cargas

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Pavement Situation At Start of Phase 1 of 1											
<b>Method: Distinct Phase Calculation Without Adjustment For Incremental Damage</b>											
<b>Design Name: [Not Provided]</b> [No Description Provided]											
<b>Detailed view for axle type: 80 kN Axle, Dual 750 kPa, 350 mm Spacing</b> <b>Total Capacity for All Phases is 25.92 million</b> <b>Applied Cumulative axles of this type at phase end is 26.28 million</b> <b>Critical layer for this phase and axle: Layer 2</b> <b>Phase starts in year 0 and ends in year 17.75</b> <b>Note: Damages &amp; critical parameters shown are for this axle type only.</b>											
	<table border="1"> <tbody> <tr> <td>Thickness = 150 Millimetres; Continuously Graded Asphalt Stiffness = 2750 MPa; Poisson = 0.4; Criterion: Asphalt Institute AC Fatigue None</td> <td>Max. Horizontal Tensile Strain: 36.2 Microstrain Position: Load Centreline/Bottom of Layer Axle Capacity: &gt; 100 million (Effective: &gt; 100 million) Cum. Damage, Phase Start to End: &lt; 0.01 to 0.05</td> </tr> <tr> <td>Thickness = 150 Millimetres; Black Base Stiffness = 2750 MPa; Poisson = 0.4; Criterion: Asphalt Institute AC Fatigue None</td> <td>Max. Horizontal Tensile Strain: 91.2 Microstrain Position: Between Loads/Bottom of Layer Axle Capacity: 25.92 million (Effective: 25.92 million) Cum. Damage, Phase Start to End: &lt; 0.01 to &gt; 1.0</td> </tr> <tr> <td>Thickness = 150 Millimetres; Sandy Silt with Gravel Stiffness = 200 MPa; Poisson = 0.35; Criterion: Granular Materials Cat B Cohesion = 27.7 kPa; Angle of Friction = 38.5</td> <td>Shear Safety Factor: 3.43 Position: Between Loads/Middle of Layer Axle Capacity: &gt; 100 million (Effective: &gt; 100 million) Cum. Damage, Phase Start to End: &lt; 0.01 to 0.03</td> </tr> <tr> <td>Thickness = 150 Millimetres; Sandy Lava Silt with Gravel Stiffness = 120 MPa; Poisson = 0.35; Criterion: Granular Materials Cat B Cohesion = 23.1 kPa; Angle of Friction = 32.5</td> <td>Shear Safety Factor: 4.04 Position: Between Loads/Middle of Layer Axle Capacity: &gt; 100 million (Effective: &gt; 100 million) Cum. Damage, Phase Start to End: &lt; 0.01 to 0.03</td> </tr> <tr> <td>Thickness = Semi-Infinite; Sandy Lava Silt Stiffness = 54.7 MPa; Poisson = 0.35; Criterion: Shell Subgrade Rut 85% None</td> <td>Vertical Compressive Strain: 219 Microstrain Position: Between Loads/Top of Layer Axle Capacity: 84.98 million (Effective: 84.98 million) Cum. Damage, Phase Start to End: &lt; 0.01 to 0.31</td> </tr> </tbody> </table>	Thickness = 150 Millimetres; Continuously Graded Asphalt Stiffness = 2750 MPa; Poisson = 0.4; Criterion: Asphalt Institute AC Fatigue None	Max. Horizontal Tensile Strain: 36.2 Microstrain Position: Load Centreline/Bottom of Layer Axle Capacity: > 100 million (Effective: > 100 million) Cum. Damage, Phase Start to End: < 0.01 to 0.05	Thickness = 150 Millimetres; Black Base Stiffness = 2750 MPa; Poisson = 0.4; Criterion: Asphalt Institute AC Fatigue None	Max. Horizontal Tensile Strain: 91.2 Microstrain Position: Between Loads/Bottom of Layer Axle Capacity: 25.92 million (Effective: 25.92 million) Cum. Damage, Phase Start to End: < 0.01 to > 1.0	Thickness = 150 Millimetres; Sandy Silt with Gravel Stiffness = 200 MPa; Poisson = 0.35; Criterion: Granular Materials Cat B Cohesion = 27.7 kPa; Angle of Friction = 38.5	Shear Safety Factor: 3.43 Position: Between Loads/Middle of Layer Axle Capacity: > 100 million (Effective: > 100 million) Cum. Damage, Phase Start to End: < 0.01 to 0.03	Thickness = 150 Millimetres; Sandy Lava Silt with Gravel Stiffness = 120 MPa; Poisson = 0.35; Criterion: Granular Materials Cat B Cohesion = 23.1 kPa; Angle of Friction = 32.5	Shear Safety Factor: 4.04 Position: Between Loads/Middle of Layer Axle Capacity: > 100 million (Effective: > 100 million) Cum. Damage, Phase Start to End: < 0.01 to 0.03	Thickness = Semi-Infinite; Sandy Lava Silt Stiffness = 54.7 MPa; Poisson = 0.35; Criterion: Shell Subgrade Rut 85% None	Vertical Compressive Strain: 219 Microstrain Position: Between Loads/Top of Layer Axle Capacity: 84.98 million (Effective: 84.98 million) Cum. Damage, Phase Start to End: < 0.01 to 0.31
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<b>Standard Axle Load Details:</b> Setup: 80 kN Axle, Dual 750 kPa, 350 mm Spacing; Daily Count = 2700; Growth Rate = 4 (%) Description: 80 kN Axle Dual Tyres. Contact pressure of 750 kPa, 350 mm Spacing											
Pavement Notes:											
	<b>Rehabilitation of RN-20 Santa Cruz - Rio Hondo</b> <b>Stations 126+500 to 136+600 - Critical Layer Analysis</b>										



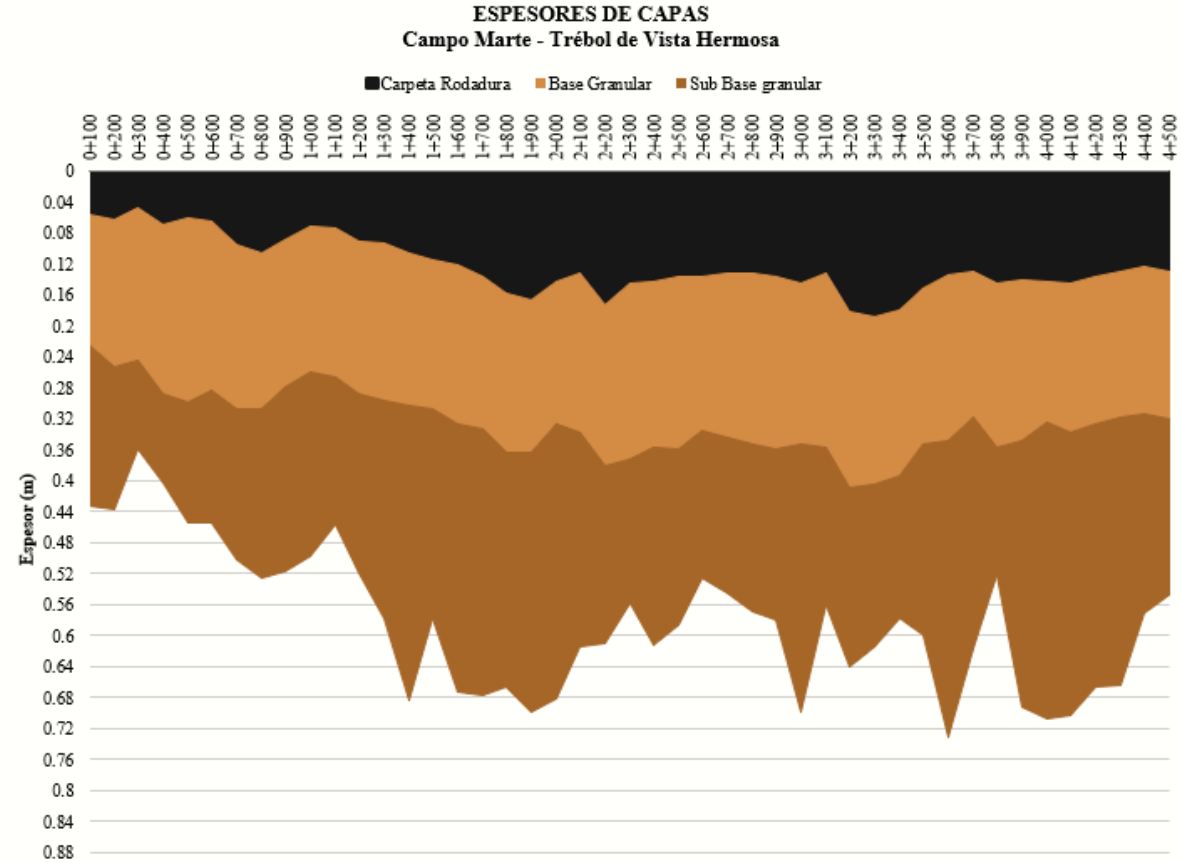
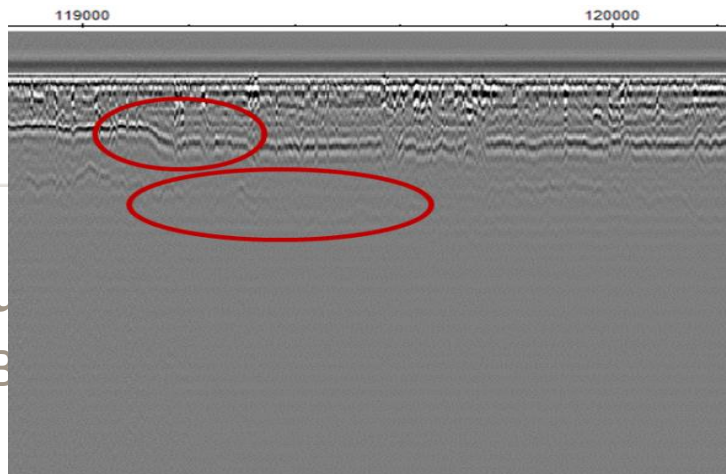
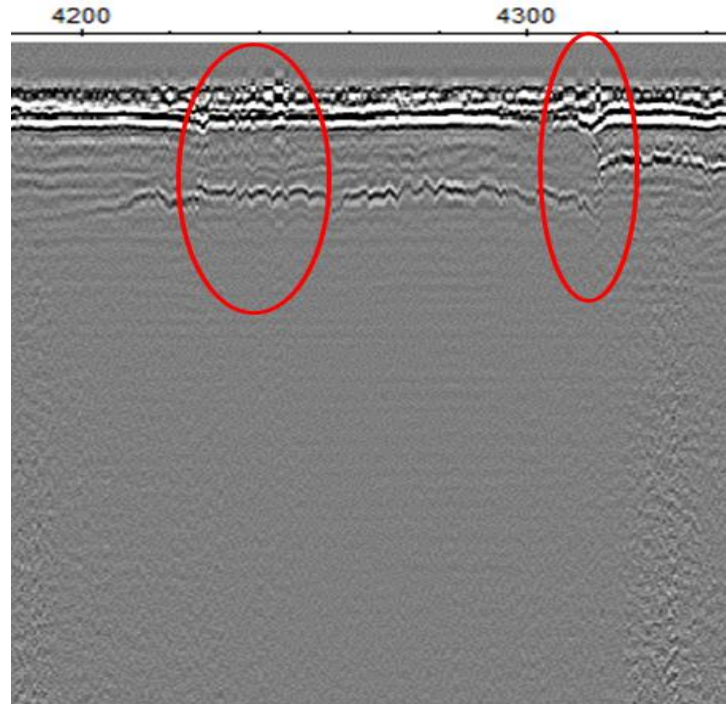
Radargram

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Juan Pablo Broissin L.  
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# Georadar (GPR), perfil estratigráfico y detección de anomalías.

Cortesía Rodrigo Rubio

GEOSYNTHETICS





# Herramientas de Análisis

## ME Cálculo de Deformaciones:

- Tipos de Capa y Espesores
- Propiedades de la Capa
- Carga

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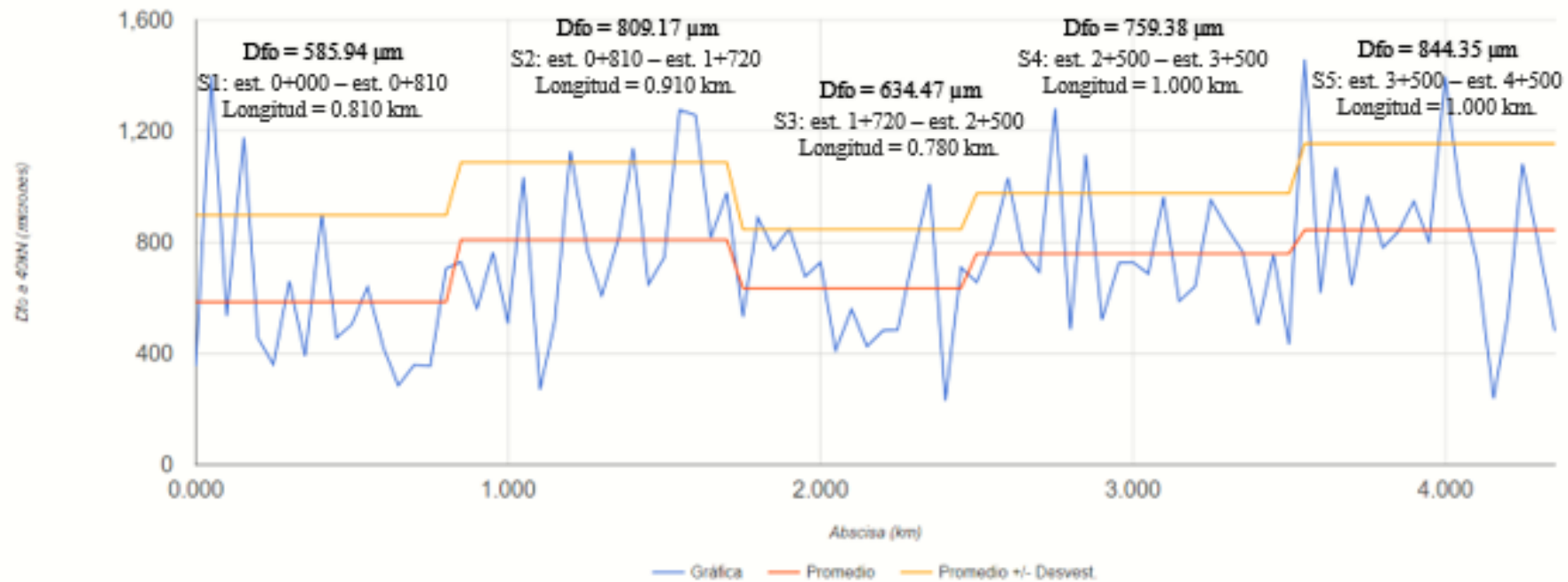
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Pavement Situation At Start of Phase 1 of 1		
<b>Method: Distinct Phase Calculation Without Adjustment For Incremental Damage</b>		
<b>Design Name: [Not Provided]</b> [No Description Provided]		
<b>Detailed view for axle type: 80 kN Axle, Dual 750 kPa, 350 mm Spacing</b> <b>Total Capacity for All Phases is 25.92 million</b> <b>Applied Cumulative axles of this type at phase end is 26.28 million</b> <b>Critical layer for this phase and axle: Layer 2</b> <b>Phase starts in year 0 and ends in year 17.75</b> <b>Note: Damages &amp; critical parameters shown are for this axle type only.</b>		
	Thickness = 150 Millimetres; Continuously Graded Asphalt Stiffness = 2750 MPa; Poisson = 0.4; Criterion: Asphalt Institute AC Fatigue None	Max. Horizontal Tensile Strain: 36.2 Microstrain Position: Load Centreline/Bottom of Layer Axle Capacity: > 100 million (Effective: > 100 million) Cum. Damage, Phase Start to End: < 0.01 to 0.05
	Thickness = 150 Millimetres; Black Base Stiffness = 2750 MPa; Poisson = 0.4; Criterion: Asphalt Institute AC Fatigue None	Max. Horizontal Tensile Strain: 91.2 Microstrain Position: Between Loads/Bottom of Layer Axle Capacity: 25.92 million (Effective: 25.92 million) Cum. Damage, Phase Start to End: < 0.01 to > 1.0
	Thickness = 150 Millimetres; Sandy Silt with Gravel Stiffness = 200 MPa; Poisson = 0.35; Criterion: Granular Materials Cat B Cohesion = 27.7 kPa; Angle of Friction = 38.5	Shear Safety Factor: 3.43 Position: Between Loads/Middle of Layer Axle Capacity: > 100 million (Effective: > 100 million) Cum. Damage, Phase Start to End: < 0.01 to 0.03
	Thickness = 150 Millimetres; Sandy Lava Silt with Gravel Stiffness = 120 MPa; Poisson = 0.35; Criterion: Granular Materials Cat B Cohesion = 23.1 kPa; Angle of Friction = 32.5	Shear Safety Factor: 4.04 Position: Between Loads/Middle of Layer Axle Capacity: > 100 million (Effective: > 100 million) Cum. Damage, Phase Start to End: < 0.01 to 0.03
	Thickness = Semi-Infinite; Sandy Lava Silt Stiffness = 54.7 MPa; Poisson = 0.35; Criterion: Shell Subgrade Rut 85% None	Vertical Compressive Strain: 219 Microstrain Position: Between Loads/Top of Layer Axle Capacity: 84.98 million (Effective: 84.98 million) Cum. Damage, Phase Start to End: < 0.01 to 0.31
<b>Standard Axle Load Details:</b> Setup: 80 kN Axle, Dual 750 kPa, 350 mm Spacing; Daily Count = 2700; Growth Rate = 4 (%) Description: 80 kN Axle Dual Tyres. Contact pressure of 750 kPa, 350 mm Spacing		
Pavement Notes:		
	<b>Rehabilitation of RN-20 Santa Cruz - Rio Hondo</b> <b>Stations 126+500 to 136+600 - Critical Layer Analysis</b>	

## RESULTADOS DE RETROANÁLISIS DE MÓDULOS CON DEFLECTÓMETRO DE IMPACTO

### A. CALZADA 1 (Tránsito en dirección de Paso a Desnivel Guardia de Honor – Trébol de Vista Hermosa)

#### Deflexión Máxima con una carga de 40 kN, (Dfo) micrómetros



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# Herramientas de Análisis

## Cálculo mediante AASHTO

- Tipos de Capa & Espesores
- Propiedades de Cada Capa
- Cargas
- **Coeficiente Estructural 0.6-0.8**

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TenCate Traffic Improvement Analysis  
Report of Analysis  
Project : *Rio Hondo Project in Guatemala*  
Date : *Oct-19*

### Input Data

Reinforcement type: MPG4  
Position of Reinforcing: Bottom of Overlay  
Design Axle Load : 80 kN

### Pavement Structure

	Thickness [cm]	Layer Coefficient	Subgrade
Overlay	10	0.4	
B/Base	20	0.25	
ABC	6	0.12	
SBC	6	0.08	
SG	31	N/A	CBR 5

### Output Data

Overlay life with reinforcing (axles): 2.65E+07 ESALS  
Overlay life without reinforcing (axles): 7.89E+06 ESALS

Additional Overlay to Achieve Same Performanc 5 cm

### Application Boundary Conditions Have Been Met

1. The Asphalt is the critical layer and this drives long term performance
2. The MPG4 is located in a tensile zone at a depth of 10cm from the surface.

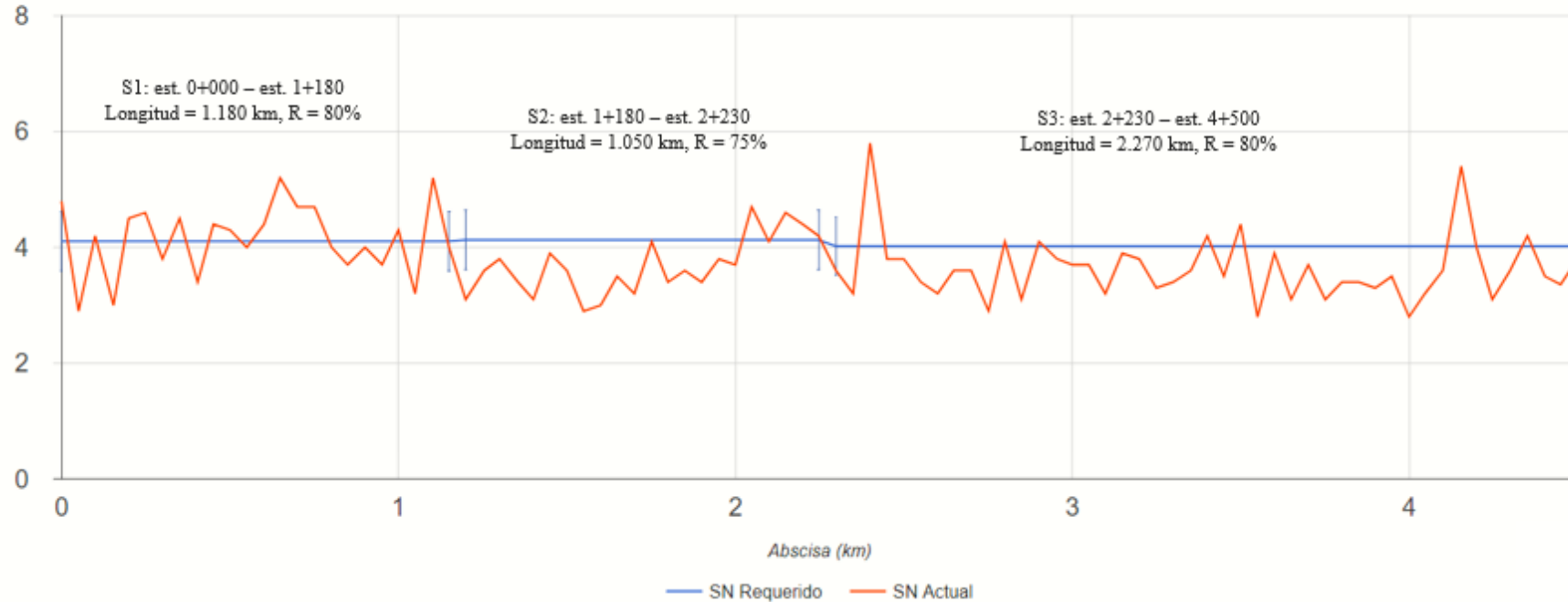
# Diseño de la Estructura con Tecnología

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## A. ESTADO ACTUAL:

Número Estructural Actual (Rojo) vs. Número Estructural Requerido (Azul) para 5 años de servicio



Intervalo	SN Requerido	Mr (psi)	ESAL	Confiabilidad R%	So	Po	Pt
		6490	4138169	0.75	0.47	4.0	2.0
0.000-1.150	X 4.106	6600	4138169	0.80	0.47	4.0	2.0
Ju 1.200-2.247	X 4.13	6000	4138169	0.75	0.47	4.0	2.0
EBI 2.299-4.500	X 4.13	6490	4138169	0.80	0.47	4.0	2.0

Factor carril 0.6  
Factor direccional 1

ESAL para 1 año	810,763
ESAL para 2 años	1,656,388
ESAL para 3 años	2,538,375
ESAL para 4 años	3,458,288
ESAL para 5 años	4,417,757
ESAL para 10 años	9,870,605
ESAL para 15 años	16,601,067
ESAL para 20 años	24,908,492

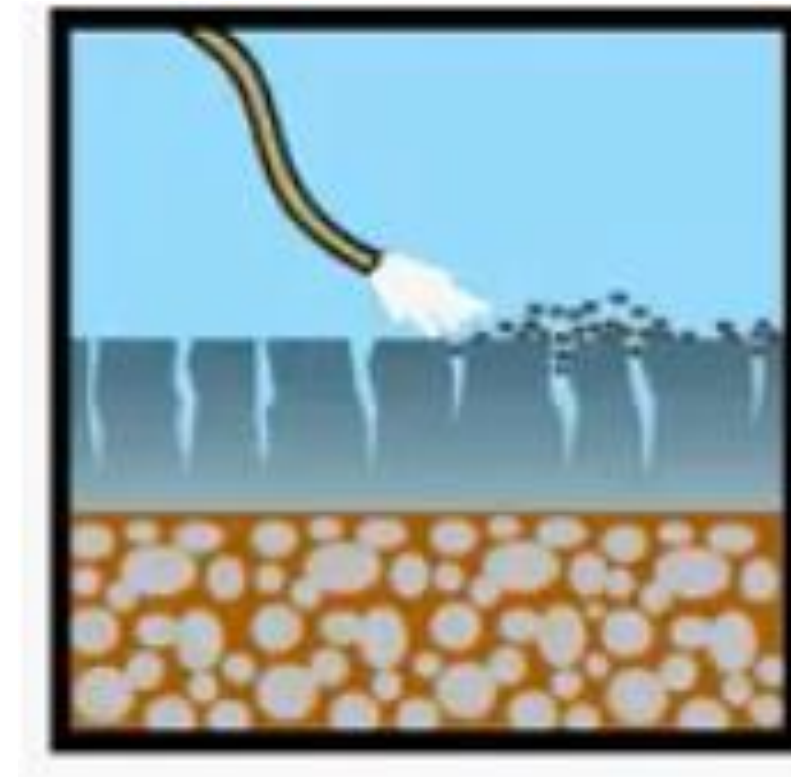
# Instalación

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# Soplador de Hojas Lo Mejor!

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## Ligantes Asfálticos Emulsiones

Table 1: Recommended Asphalt Binders for Mirafi® MPM Paving Mat

	PG Grades	Polymer Modified	Typical Use
Asphalts for Mirafi® MPM	PG 70	SBSPG 76-22	T <sub>ambient</sub> > 90°F (32° C)
	PG 67	SBSPG 70-22	T <sub>ambient</sub> > 80°F(27° C)
	PG 64		Most Common
	PG 58		
	PG 52	HPSPG76	

# Colocación Geocompuestos

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# Conducir sobre el Interlayer

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***Muchas Gracias***

***¿Preguntas?***

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