GEOMALLAS

Una Solución Tecnológica para los Pavimentos del Futuro

Fernando Cortes Rivera:
Gerente Regional
Fcortes@tensarcorp.com

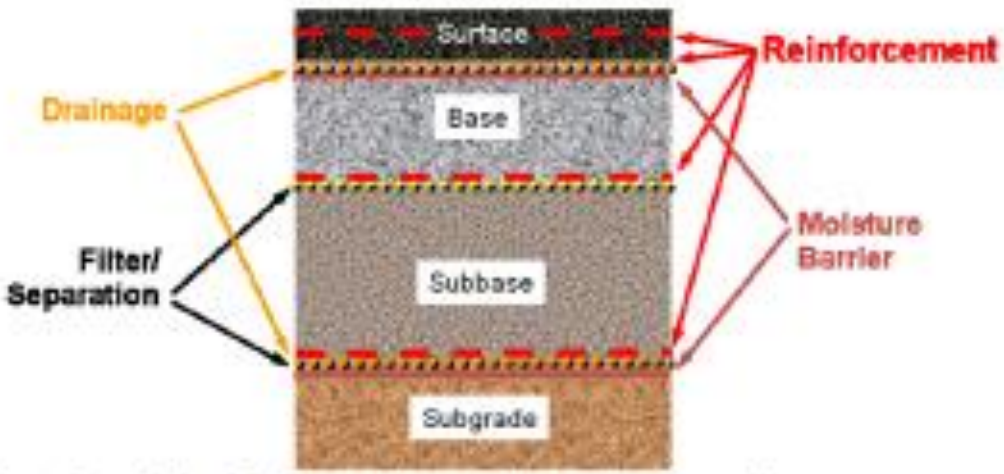


Figure 5-1. Potential applications of geosynthetics in a layered pavement system

Publication No. FHWA NHI-07-092
August 2008

Agenda

- Introducción
- MSL – Estabilización Mecánica
- Evolución de la tecnología
- Casos de aplicación
- Preguntas

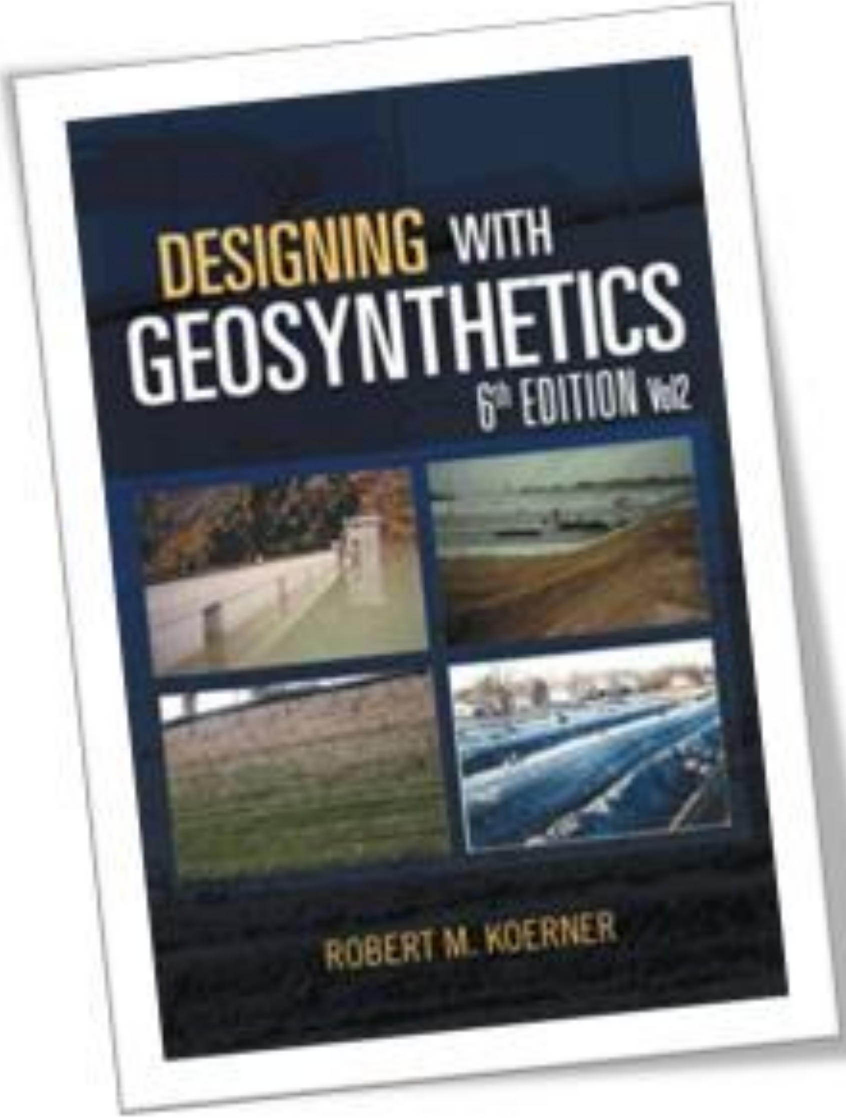
Giroud - Han

AASHTO

Haul Roads

E_{v2}

PCASE



According to ASTM D4439, a geosynthetic is defined as follows:

> **geosynthetic**, *n*—a planar product manufactured from polymeric material used with soil, rock, earth, or other geotechnical engineering related material as an integral part of a human-made project, structure, or system.

"GEOSINTETICO: producto planar, fabricado a partir de materiales polimericos, que se usa con suelo, roca, tierra u otros materiales relacionados con la ingenieria geotecnica, como parte integral de un proyecto, estructura o sistema hecho por el hombre".

Funciones principales de los Geosinteticos

Estabilización!!

1 Filtración

2 Drenaje

3 Separación

4 Refuerzo

5 Protección

6 Impermeabilización

TABLE 1.1 IDENTIFICATION OF THE USUAL PRIMARY FUNCTION FOR EACH TYPE OF GEOSYNTHETIC

Type of Geosynthetic (GS)	Primary Function					Chapter in Book
	Separation	Reinforcement	Filtration	Drainage	Containment	
Geotextile (GT)	✓	✓	✓	✓		2
Geogrid (GG)		✓				3
Geonet (GN)				✓		4
Geomembrane (GM)					✓	5
Geosynthetic Clay Liner (GCL)					✓	6
Geopipe (GP)				✓		7
Geofoam (GF)	✓					8
Geocomposite (GC)	✓	✓	✓	✓	✓	9

Note: This table will be referred to in every chapter of this book.

GEOMALLAS

Uniaxiales - Multiaxiales


AASHTO GUIDE FOR
Design of Pavement Structures


Guía de Diseño Mecanístico - Empírico de Pavimentos
Manual Práctico
ICG
INSTITUTO DE LA CONSTRUCCION Y GERENCIA
FONDO EDITORIAL ICG

$$\log_{10}(W_{18}) = Z_R S_o + 9.36\log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2-1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32\log_{10}(M_R) - 8.07$$

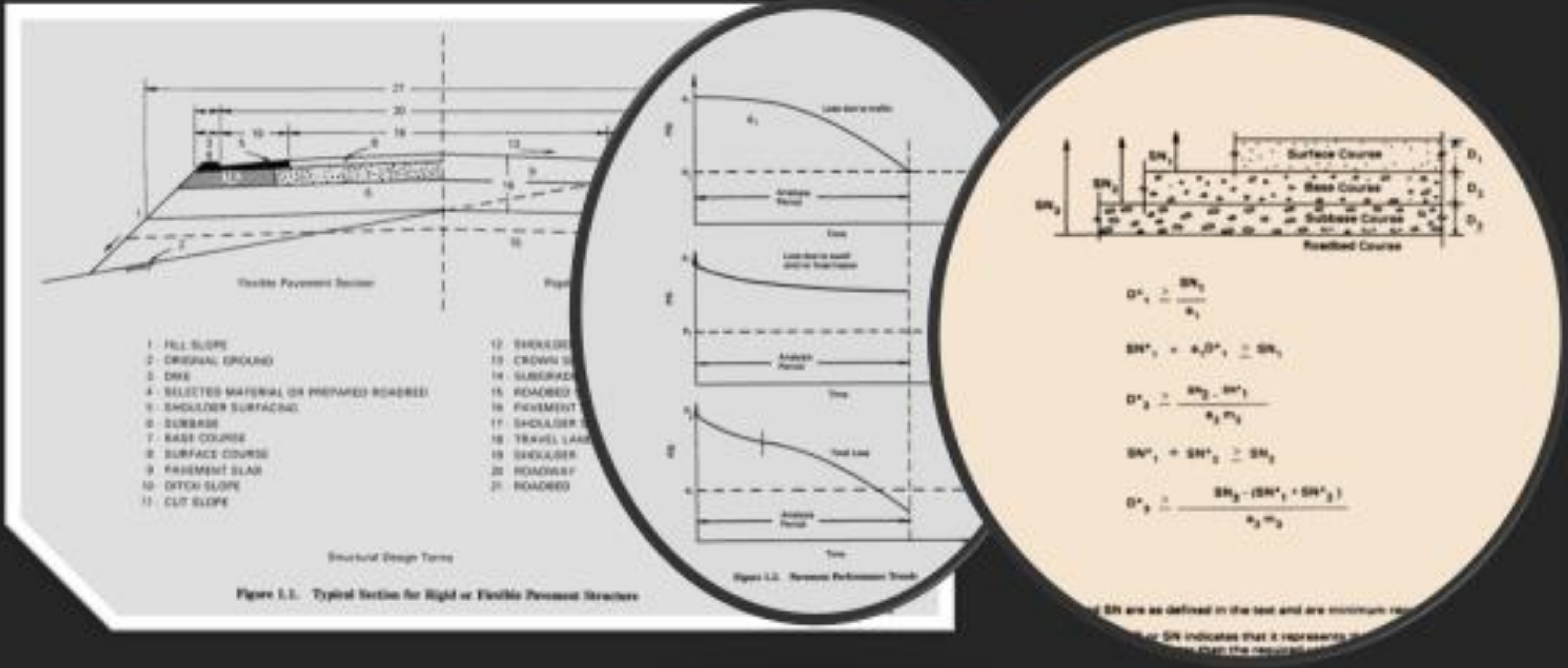
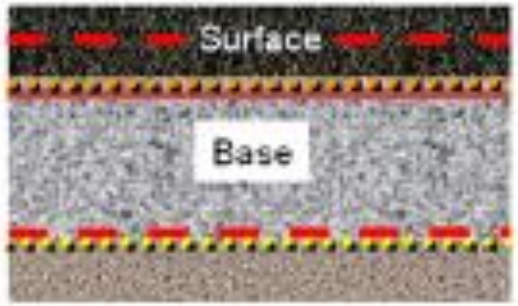


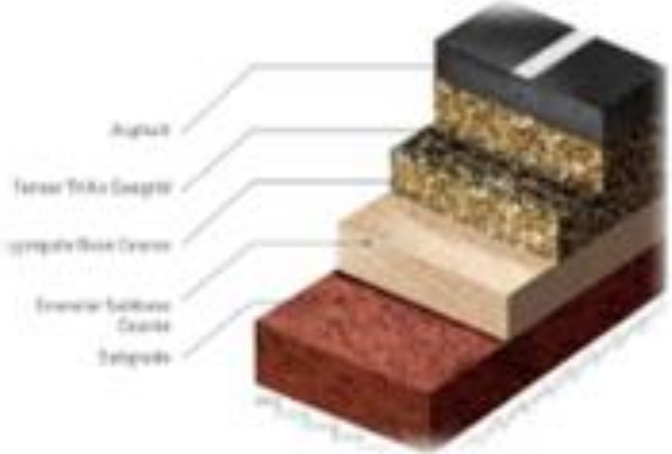
Figure 1.1. Typical Section for Rigid or Flexible Pavement Structure

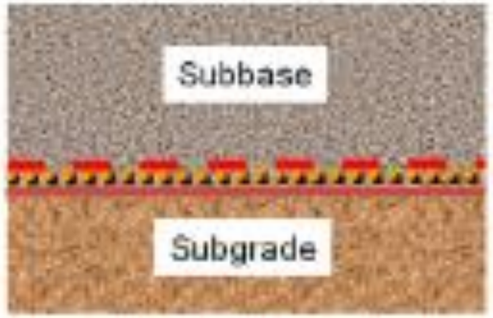

AASHTO GUIDE FOR
Design of Pavement Structures
Standard Practice for
Geosynthetic Reinforcement of the Aggregate Base Course of Flexible Pavement Structures
SCOPE
REFERENCED DOCUMENTS
INTRODUCTION

$$\log_{10}(W_{18}) = Z_R S_o + 9.36\log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2-1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32\log_{10}(M_R) - 8.07$$



Optimizar la sección de la estructura de pavimento





- **Estabilizar los suelos blandos y construir sobre una fundación firme**

Mecanismos de Trabajo

TMENT OF THE ARM
rmy Corps of Engineer
gton, D.C. 20314-100

GEOGRIDS
CONSTRUC

Según el documento ETL1110-1-189 del Cuerpo de Ingenieros del Ejército de los Estados Unidos, existen varios tipos de geomallas: geomallas extruidas (extruded), geomallas tejidas (woven), geomallas soldadas (welded) y compuestos de geomallas (geogrid composites). Las geomallas extruidas son formadas de láminas de polímero las cuales son perforadas, calentadas y estiradas en dos direcciones para mejorar sus propiedades físicas. Las geomallas tejidas son fabricadas de fibras de polímero tejidas y luego recubiertas para aumentar su resistencia a la abrasión. Las geomallas soldadas son fabricadas soldando las uniones de una malla de cintas extruidas de polímero. Finalmente, los compuestos de geomalla son geomallas formadas en combinación con otro geosintético para resolver una aplicación geotécnica en particular. De acuerdo a la experiencia internacional, las geomallas extruidas han tenido un mejor comportamiento estructural en aplicaciones de refuerzo de pavimentos.

Se han identificado tres mecanismos de refuerzo de las geomallas en el refuerzo de suelos y pavimentos: confinamiento lateral de las partículas, mejoramiento de la capacidad portante del terreno natural y el efecto membrana tensionada (ETL 1110-1-189).

Confinamiento Lateral

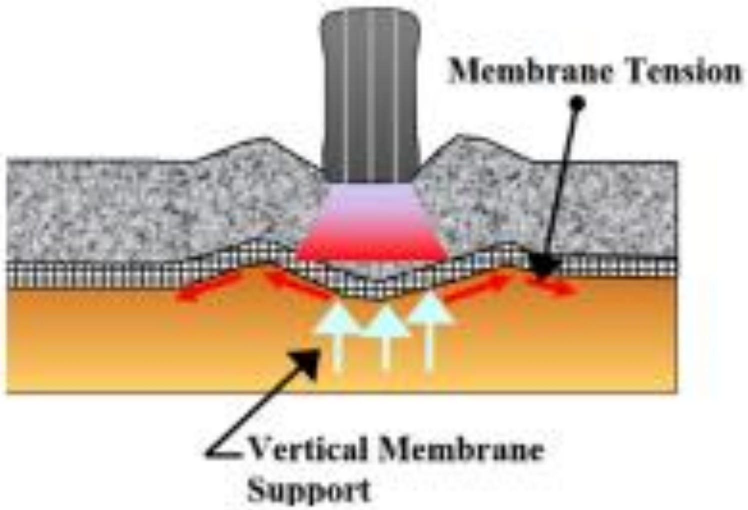
Este mecanismo se logra a través de la trabazón de las partículas granulares con el refuerzo. Las geomallas aumentan el módulo de la capa reforzada al confinar las partículas e impedir su movimiento natural ante la aplicación de las cargas vehiculares. La trabazón mecánica aumenta la rigidez de la base reduciendo las deformaciones verticales en la interfase inferior y los ahuellamientos en la superficie de rodadura.

Manual de Carreteras: Suelos, Geología, Geotecnia y Pavimentos
Sección: Suelos y Pavimentos
Página 110

Source: R.D. No 10 – 2014 – MTC/14

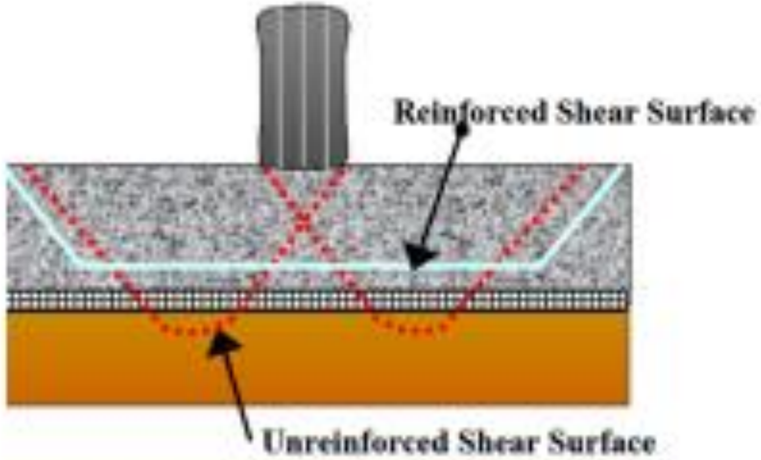
US Army Corps of Engineers.

3



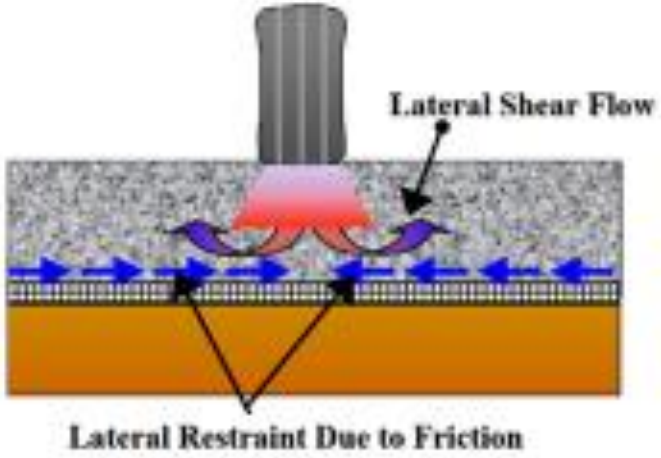
Mecanismo de membrana tensionada

2



Mecanismo de mejora de la capacidad de carga

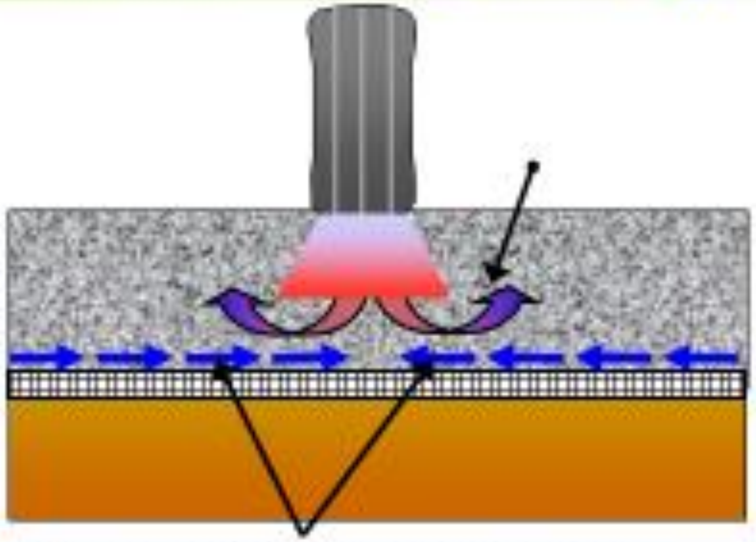
1



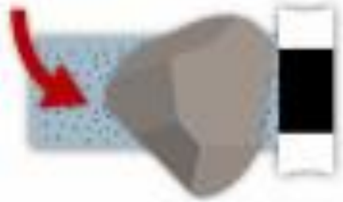
Mecanismo de restricción lateral

Geotextile

Iinteracción: Fricción

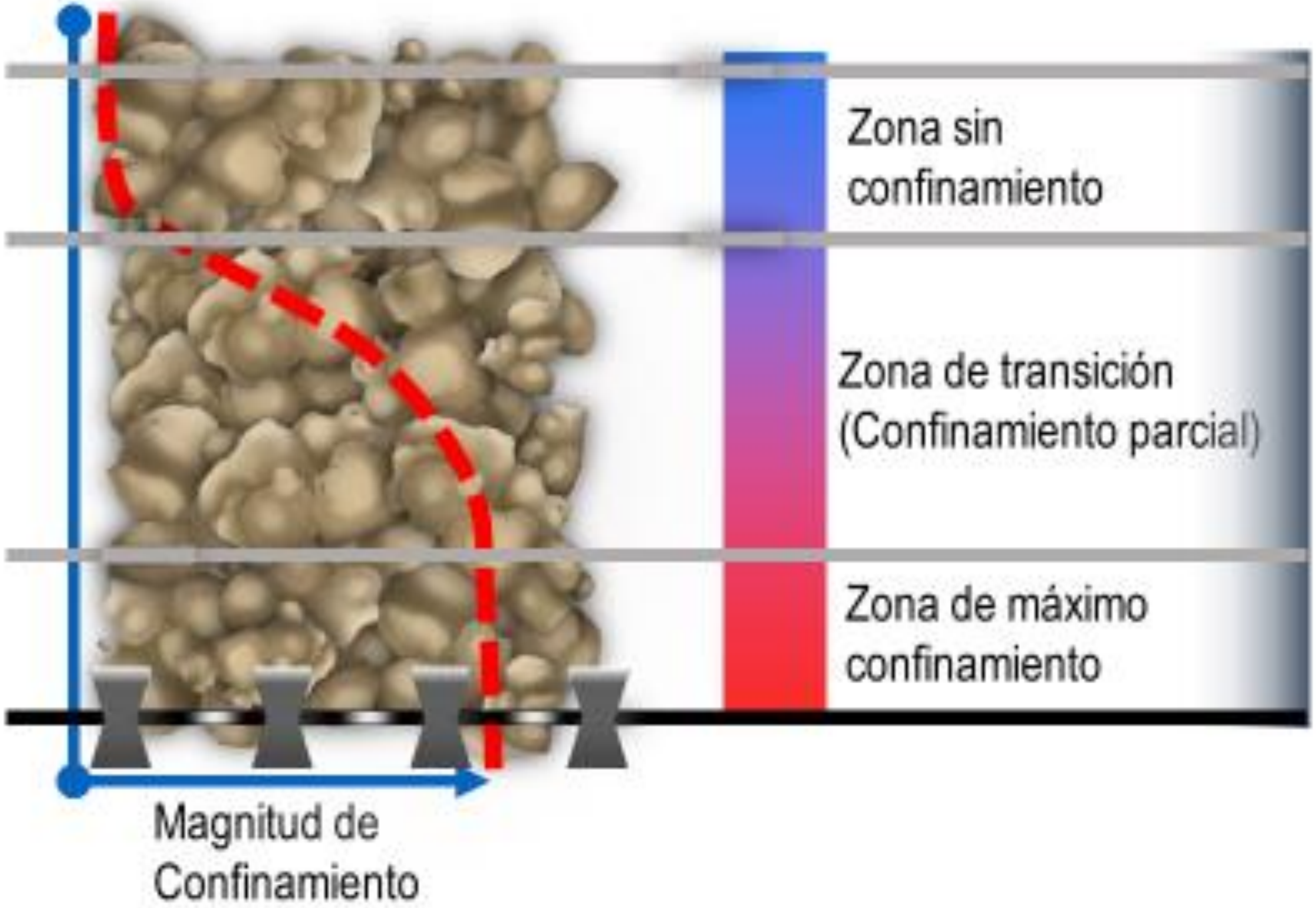


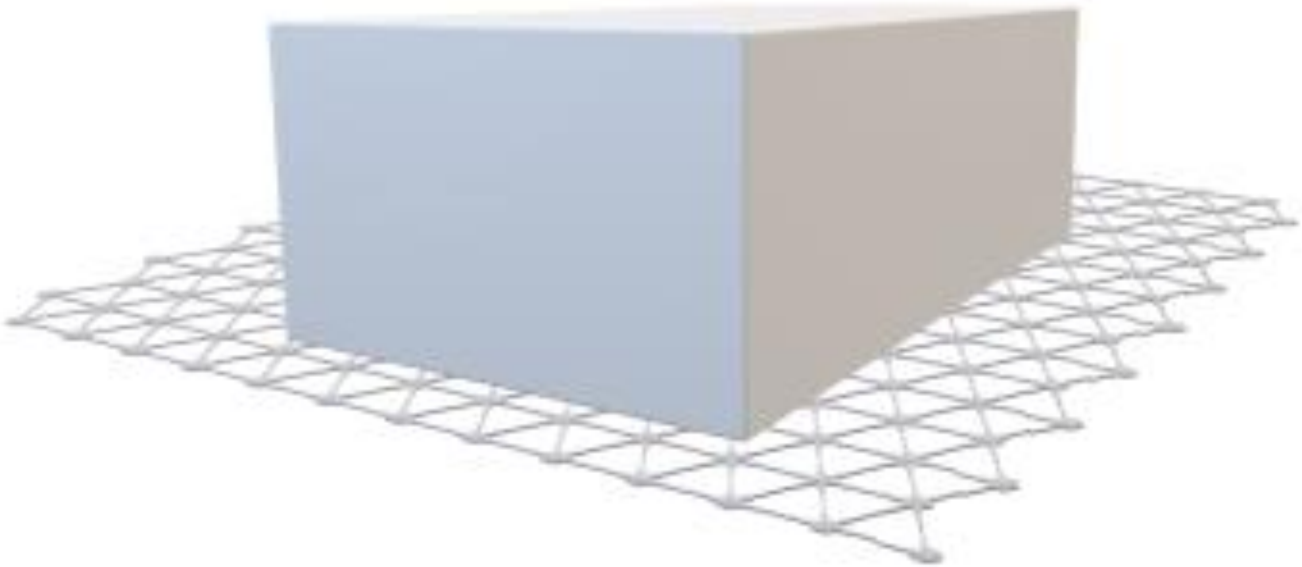
Restricción lateral y trabazón con el agregado (Confinamiento)



Iinteracción: Trabazón

Multiaxial Geogrid
affic-Effects-Subgrade-Deformation-Unstabilized-VS-Stabilized
Soft Subgrade
Soft Subgrade


Zona sin
confinamiento
Zona de transición
(Confinamiento parcial)
Zona de máximo
confinamiento
Magnitud de
Confinamiento



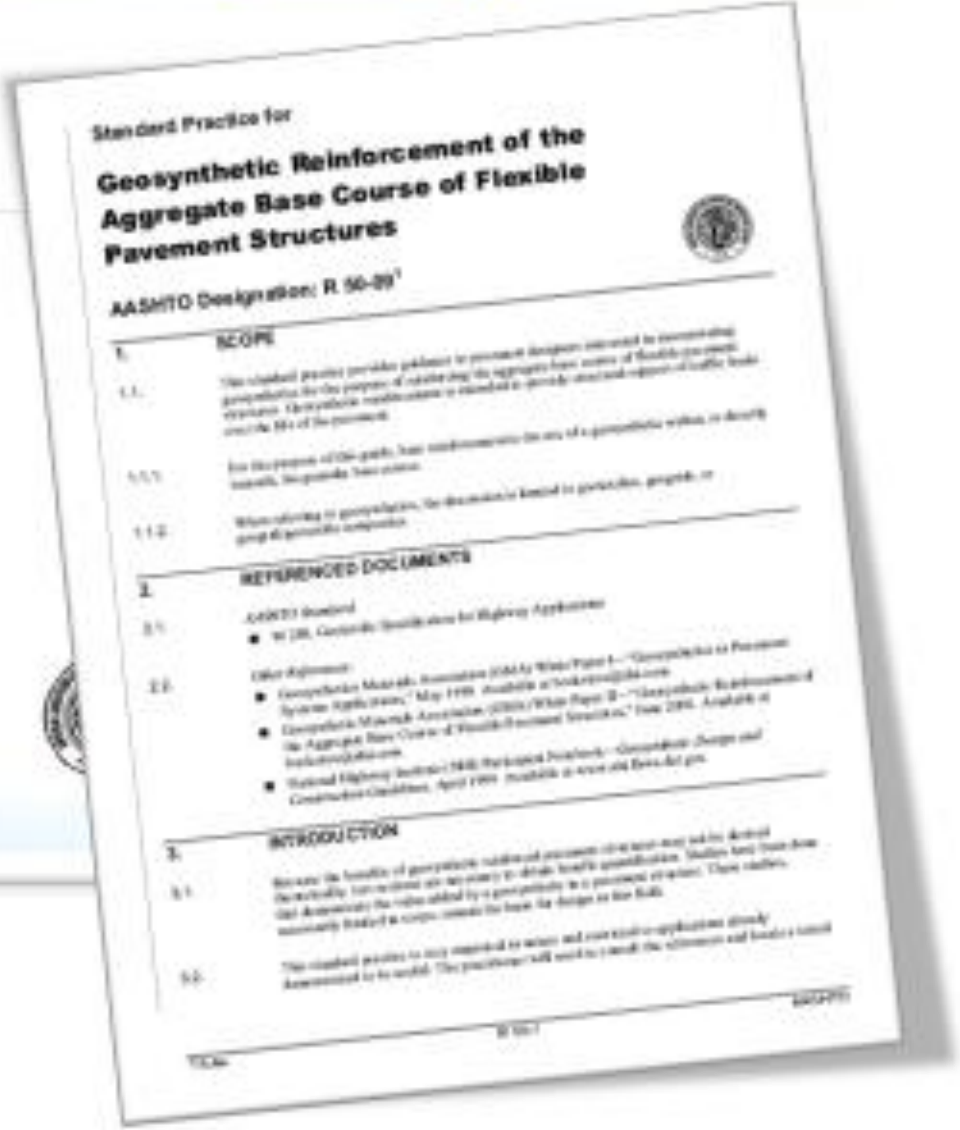
Mechanically Stabilized Layer (MSL)

AASHTO Standard Practice

Standard Practice for

Geosynthetic Reinforcement of the Aggregate Base Course of Flexible Pavement Structures

AASHTO Designation: R 50-09[1]




Práctica estandar para
Refuerzo Geosintetico de la Capa de Base Granular en Estructuras de Pavimento Flexible.
AASHTO Designación: R50-09[1]

- Guía para diseño incorporando geosinteticos.
- Geosintetico en contacto con la BG
- Geosintetico: Estabilización
- Los beneficios no se derivan teóricamente, se obtienen exclusivamente de pruebas a gran escala

ASUNCIÓN 2022

4TO CONGRESO PARAGUAYO Vialidad y Tránsito

APC

PIARC

ure 2: 3-D printed Smart Rocks

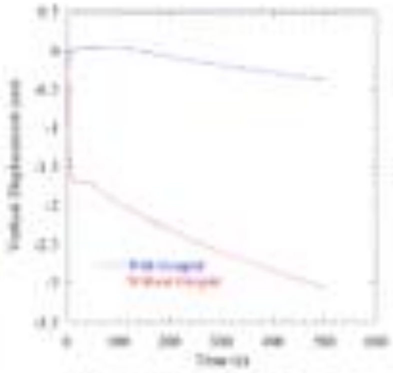


Figure 4: Vertical Displacement

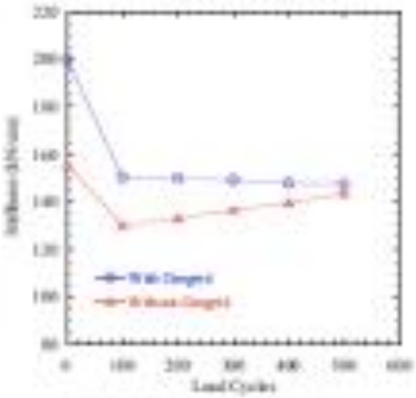
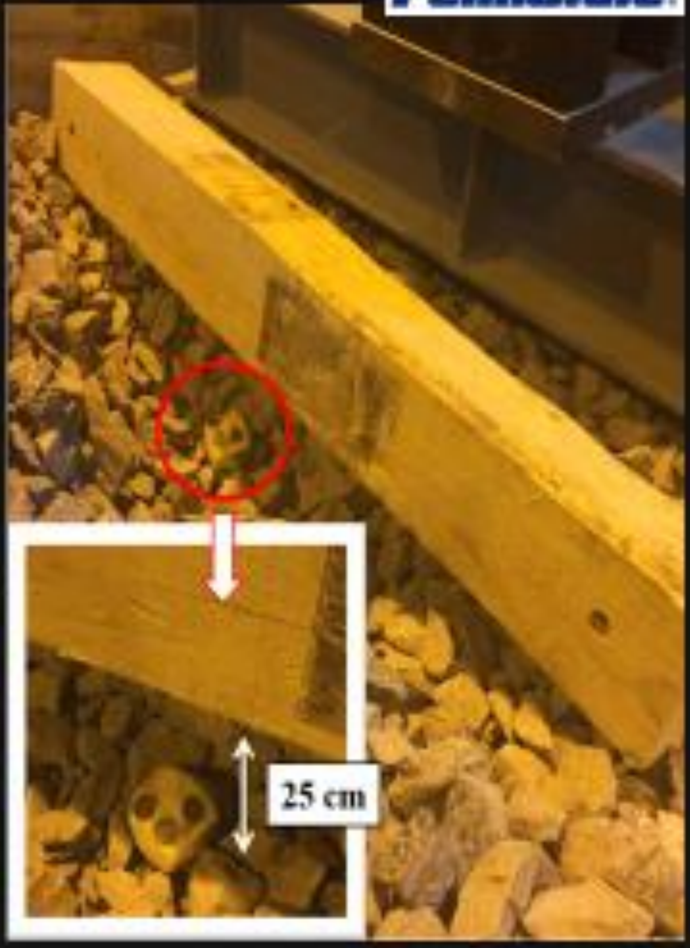
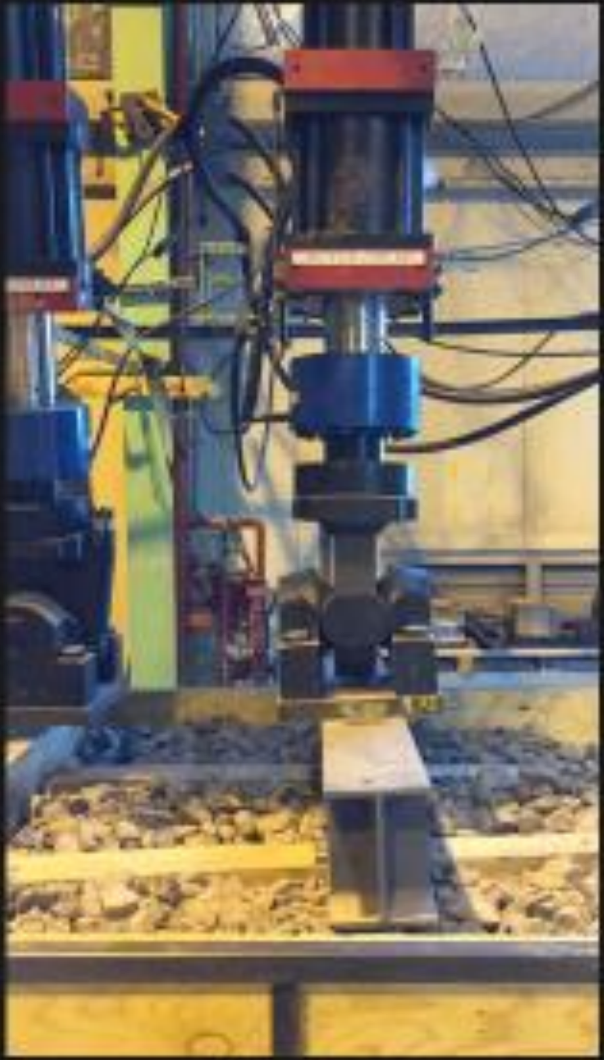


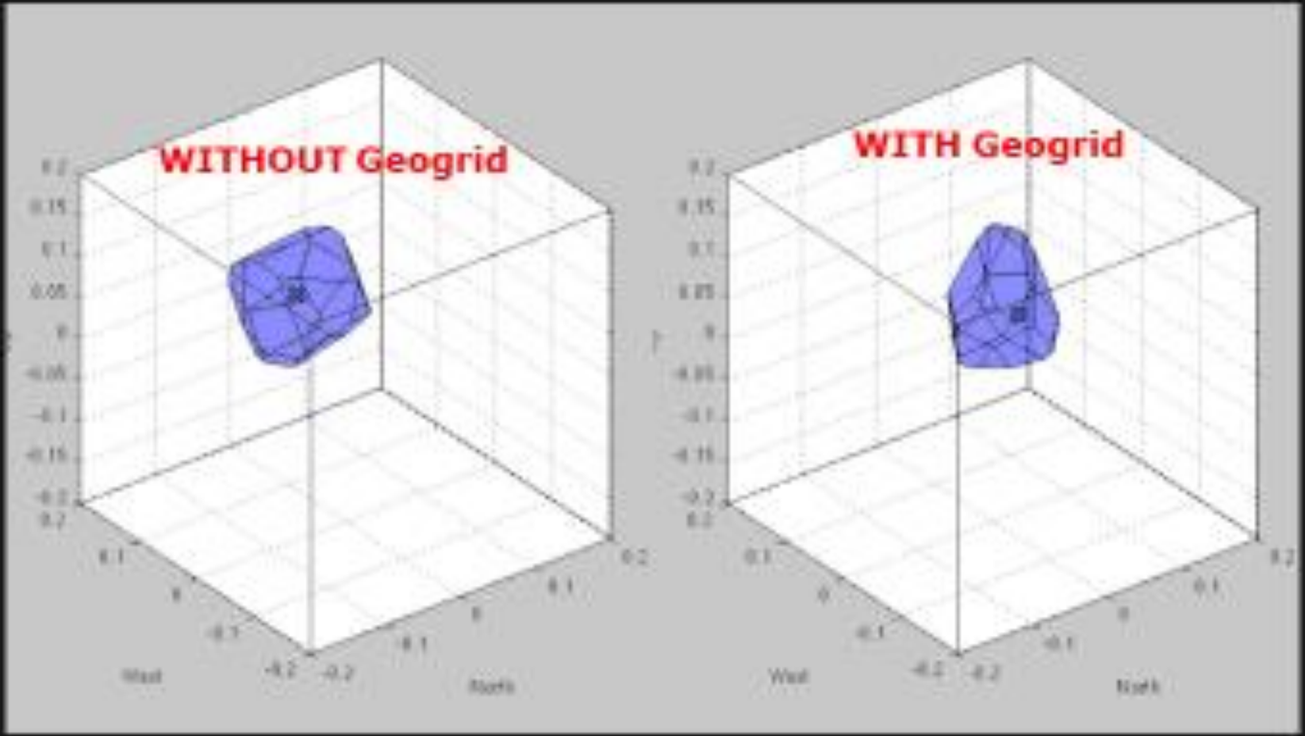
Fig. 8. Stiffness of ballast layer vs load cycles

Laboratory setup



Movimiento visualizado de SmartRock en el balasto





Presented at TRB2016 conference,
"Effect of Geogrid on Railroad Ballast Studied by SMART ROCK"

Full-Scale Accelerated Testing of Multi-axial Geogrid Stabilized Flexible Pavements

Constructed over Very Stiff Soils

Full-Scale Accelerated Testing of Multi-axial Geogrid Stabilized Flexible Pavements

Constructed over Very Soft Soils

Scope

- Construction, instrumentation and trafficking of test sections with TriAx stabilized bases and compare them to a control section.
- Testing to be conducted using highly controlled and monitored Accelerated Pavement Testing (APT) to gather response data, limit the risk of variability and ensure proper comparisons.

Control Section (Unstabilized) | Geogrid 1 | Geogrid 2

Automated Plate Load Test (APLT)

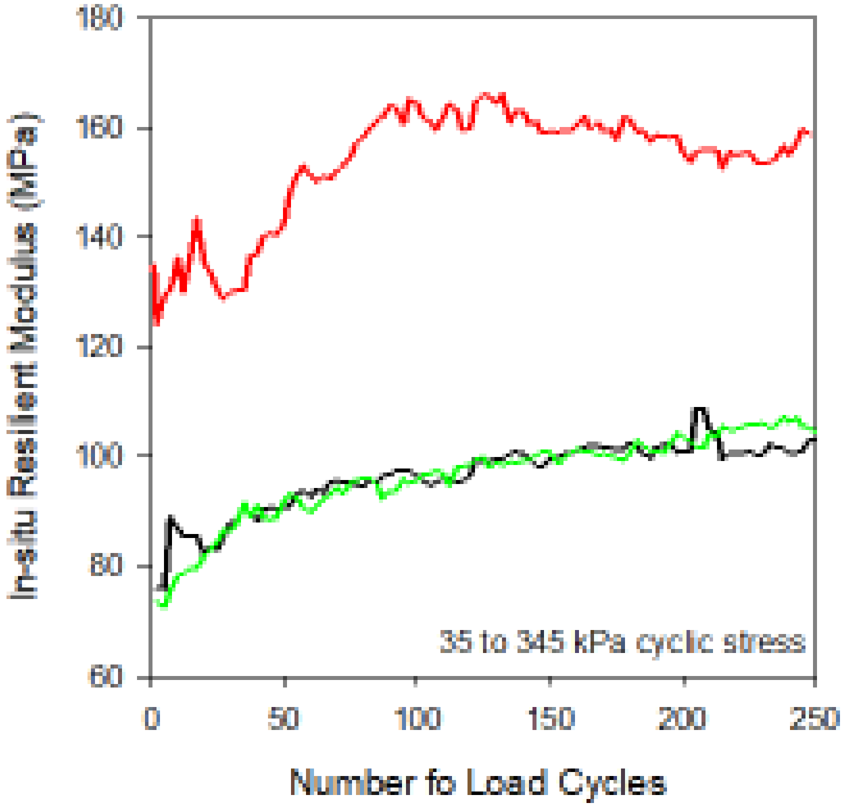
Cyclic stress test

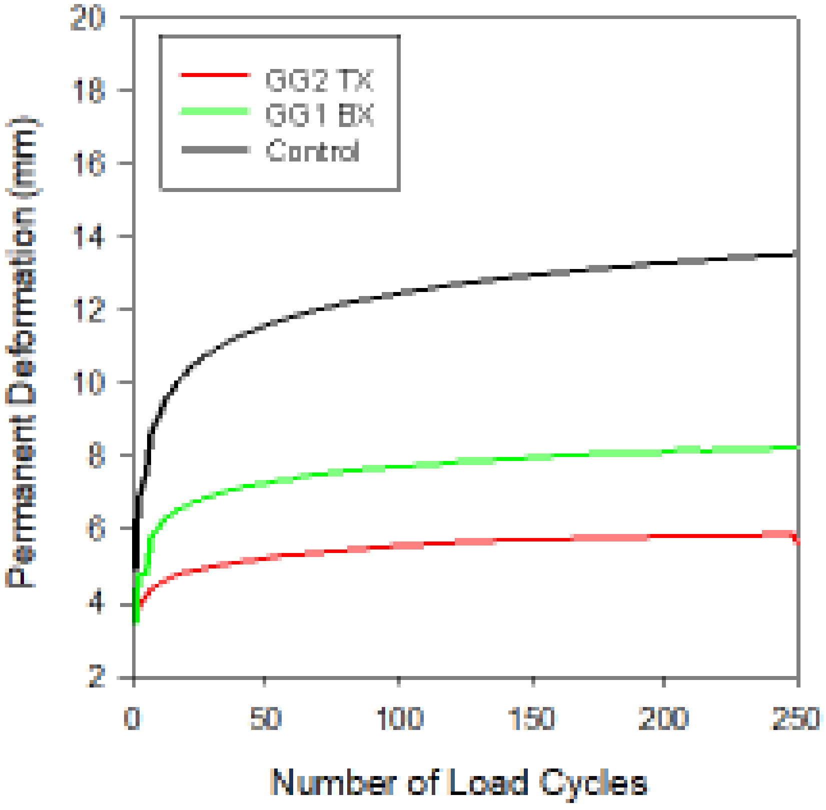
- Preconditioning: 50 cycles of high stress (550kPa)
  - Simulates construction traffic loading

- 10,000 cycles of moderate stress (310 kPa).
  - Simulates in service traffic loading

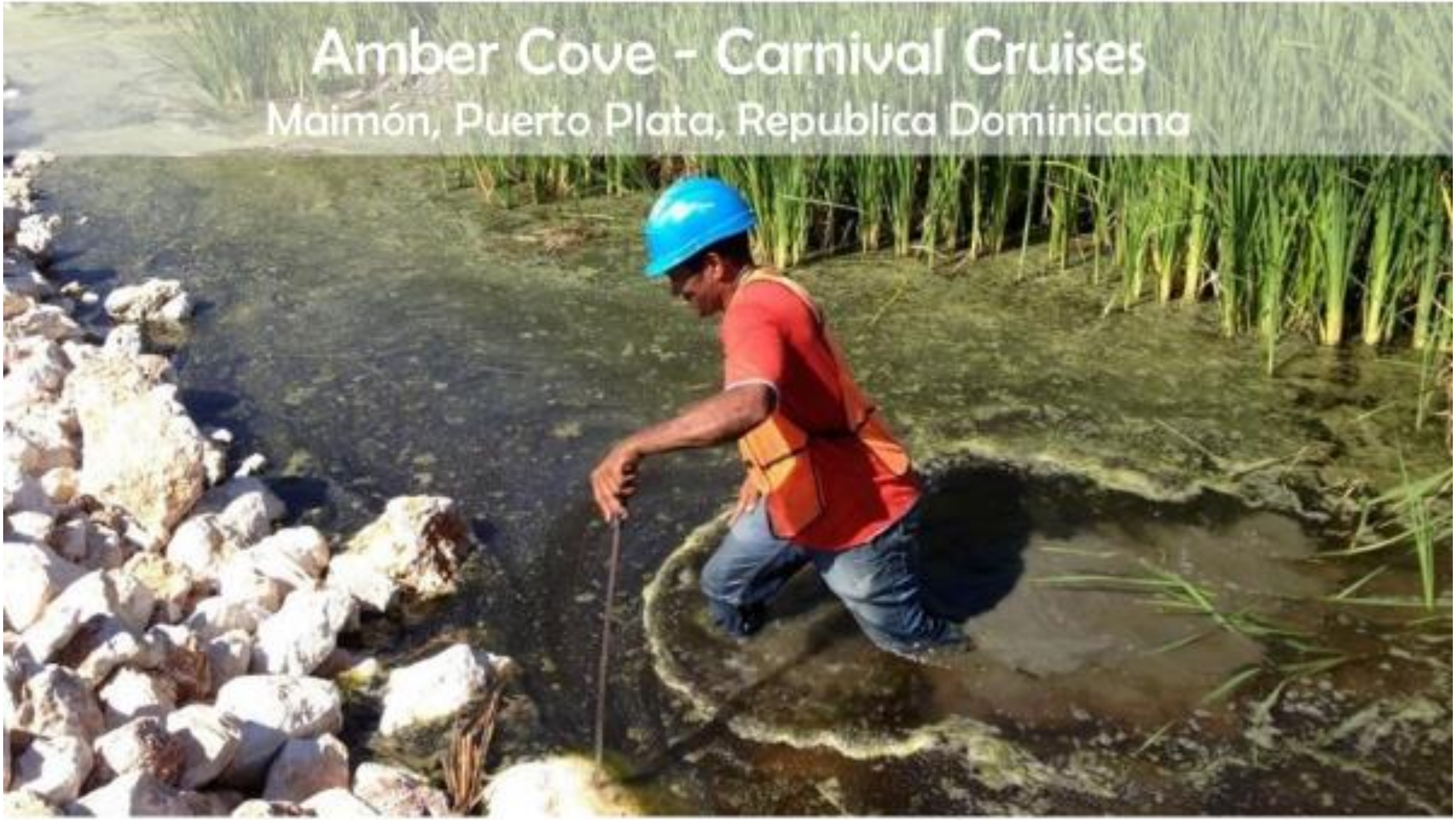
In-situ Resilient Modulus

Test Program A. Influence of load cycles






Amber Cove - Carnival Cruises
Maimón, Puerto Plata, Republica Dominicana
EDiAFiLMS


Amber Cove - Carnival Cruises
Maimón, Puerto Plata, Republica Dominicana


Amber Cove - Carnival Cruises
Maimón, Puerto Plata, Republica Dominicana

Taylor & Francis

International Journal of Pavement Engineering

ISSN: 1029-8436 (Print) 1477-268X (Online) Journal homepage: http://www.tandfonline.com/loi/gpav20

In situ performance verification of geogrid-stabilized aggregate layer: Route-39 El Carbón–Bonito Oriental, Honduras case study

Pavana K. R. Vennapusa, David J. White, Mark H. Wayne, Jayhyun Kwon, Alex Galindo & Luis García

To cite this article: Pavana K. R. Vennapusa, David J. White, Mark H. Wayne, Jayhyun Kwon, Alex Galindo & Luis Garcia (2018): In situ performance verification of geogrid-stabilized aggregate layer: Route-39 El Carbón–Bonito Oriental, Honduras case study, International Journal of Pavement Engineering, DOI: 10.1080/10298436.2018.1442576

To link to this article: https://doi.org/10.1080/10298436.2018.1442576

GeoAmericas 2020

Pavement Performance Evaluation of Geogrid Stabilized Roadways

Prajwol Tamrakar, Mark H. Wayne and Mariana Stafford, Tensar International Corporation, 2500 Northwinds Pkwy, Suite 500, Alpharetta, GA 30009, USA

Alex Galindo, Geotechnical Services of Honduras, ICA Inversiones S de RL, Tegucigalpa, Honduras

Coady Cameron, Total Pave Inc., 2 Garland Court, Fredericton, NB, Canada

Luis F. Garcia, Department of Transportation, InvEst Honduras (InvEst-H), Tegucigalpa, Honduras

ABSTRACT

Pavement surface roughness, one of the indicators of pavement performance, is affected by the structural stability of the pavement layers. Some commonly used indices of surface roughness are Present Serviceability Rating (PSR) and International Roughness Index (IRI). In the last decade, several advanced techniques were introduced to measure IRI cost-effectively and rapidly. This paper describes the use of smartphone-based technology for measuring IRI of pavements. A section of Highway Route-39 between El Carbón and Bonito Oriental in Olancho and Colón, Honduras was constructed with a mechanically stabilized aggregate base course layer. Such mechanical stabilization was achieved by using a multi-axial triangular aperture geogrid. Mechanical stabilization contributes to preserving material stiffness for an extended service period and offers an opportunity to pavement designers to optimize pavement layers to attain the same or higher targeted pavement life. The conventional design of pavement with a layer of aggregate base over a cement-

Conclusion

ASUNCIÓN 2022

Fernando Cortes Rivera:
Gerente Regional
Fcortes@tensarcorp.com
+57 311.452.5871