FORESEE PROJECT

Future proofing strategies FOr RESilient transport networks against Extreme Events

H2020-MG-7-1-2017: Resilience to extreme (natural and man made events)

Advances in resilience enhancing readiness and management for extreme events: Slope stabilization protection systems and improved permeable asphalt pavements

Laura Castañón & Pedro Lastra, GITECO (Universidad de Cantabria)

Smart and integral slope stabilization protection systems

3 actions

1	2	3
Problems		
Installation time for the flexible systems	Too simple numerical simulations	Monitoring of slopes
Solutions		
Design of a flexible system for slope protection with integrated primary and secondary membrane	Numerical models of the behaviour of the complete system during the soil detachment.	Laboratory testing of an innovative way to monitor the slopes using Fibre bragg grating.

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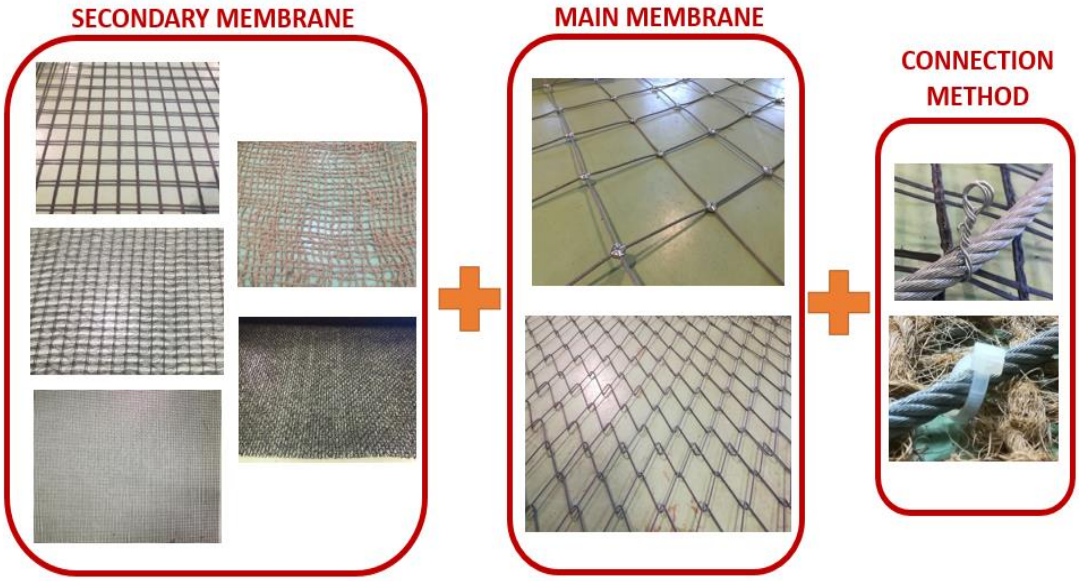
1. Design of a flexible system

- MULTICRITERIA DECISION MAKING ANALYSIS



- SOLUTION

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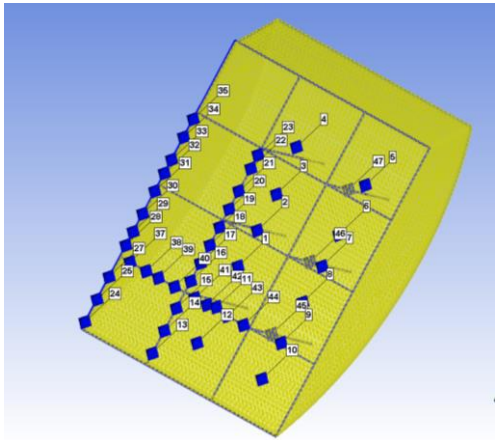
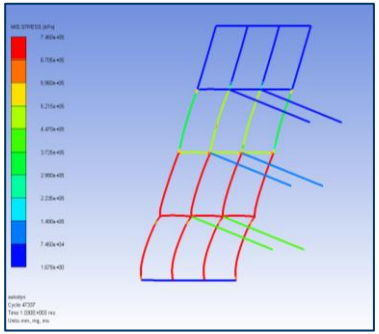
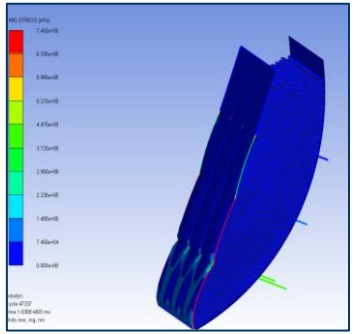
2. Numerical models of the behaviour of the complete system

Location of gauges



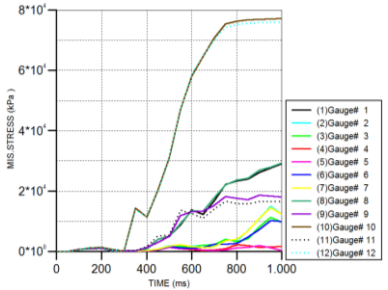




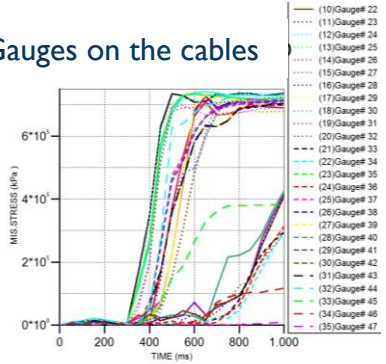
ANSYS®

- Soil→ SPH
- Flexible system components→ FEM

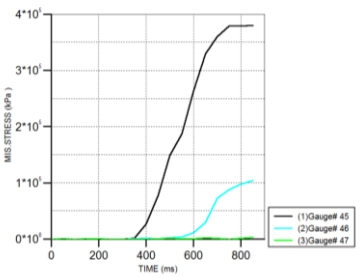
Gauges on the membrane



Gauges on the cables



Gauges on the bolts



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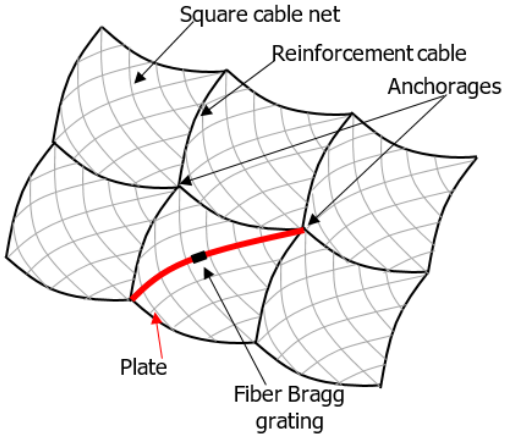
3. Monitoring using Fibre bragg grating

DISTRIBUTED LOAD TEST

Location of the plate with the Bragg sensors

Installation on a real flexible system



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1. Target

Advantages

Mark Buncher, Asphalt Institute, USA

Keizo Kamiya, C.E.R.I., Japan

Disadvantages

Ravelling by traffic Joëlle De Visscher, Ann Vanelstraete

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1. Target

Increase the resilient capacity of the roads to improve the management of extreme weather events.

Design a new PA mixtures to be laid in specific locations with:

Resilience

- Maximized drainage capacity with the same thickness (PA16)
- Mitigated problems associated with clogging
- Maintaining the mechanical behaviour of conventional PA mixtures

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2. PA Foresee mixtures

Materials

PMB 45/80-65

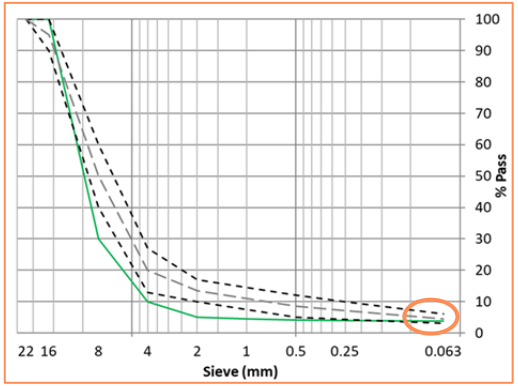
Natural aggregates

Hydrated lime

Aramid fiber

PA16 dosage

Experimental particle size distribution



Binder content (%): 5.0 – 5.3

Fiber content (%): 0.05 – 0.15

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2. PA Foresee mixtures

Mechanical properties

- 27 – 28% of total air voids, and around 21 – 22% of interconnected voids.
- Resistance against raveling under dry and wet conditions are similar to traditional PA.
- Water damaged should be carefully controlled by dosing filler, bitumen and fiber ratios.

Functional properties

- Experimental mixtures double the permeability.
- Experimental mixtures at least double the clogging resistance.
- The resistance against fuel spills is almost the same than control PA.

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3. Main points

Experimental Foresee mixtures increase very significantly the drainage capacity of traditional PA mixtures

> They are specially suitable for located areas with flooding troubles in extreme events
>
> - Improving skid resistance as surface layer under worse conditions
> - Managing water run-off as surface layer, as part of a permeable pavements, or working together with other S.U.D.S. tools

Clogging resistance is very significantly increased by experimental Foresee mixtures.

> Draining capacity is maintained despite the PA mixture has higher quantities of dust particles within

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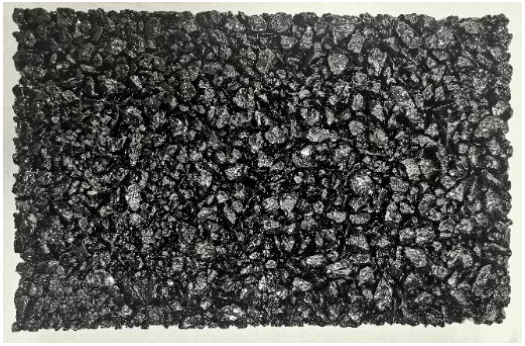

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