



2020 Annual Conference
& Innovation Awards

How can we move towards SMARTI?

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UNIVERSITÀ
DEGLI STUDI
DI PALERMO

Why SMARTI?

TODAY

Current Transport Infrastructures are:

- high-impact buildings using very limited amount of secondary materials
- passive structure subject to fast ageing and changes
- requires on-site survey and expensive and extensive maintenance
- not designed to cope with climate and traffic change

IMPACT

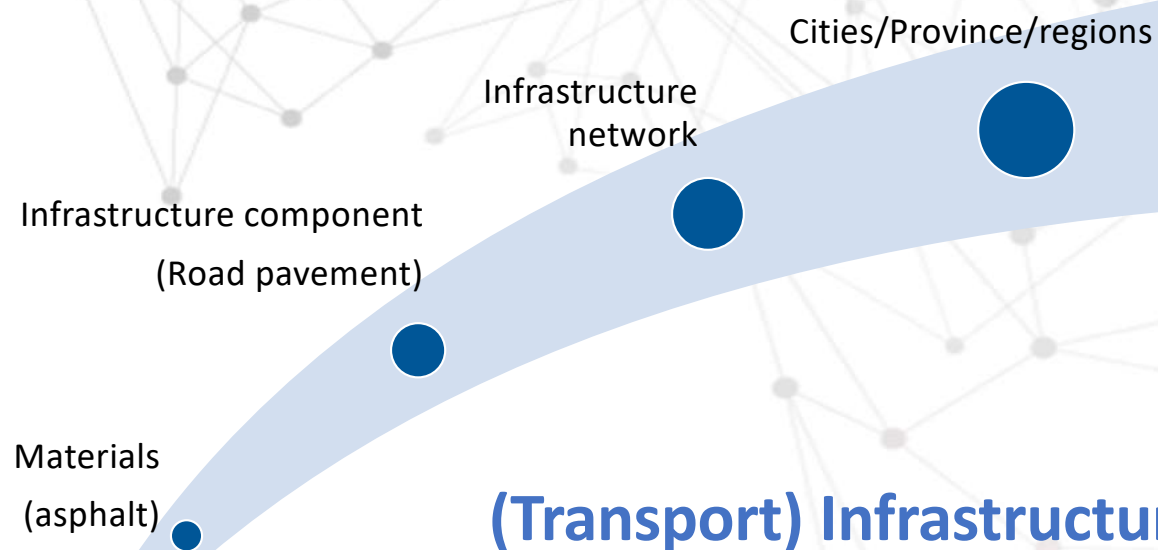
Trained professional, Research products and guidelines of SMARTI:

low impact structures designed-to-last, being self-repairing and adaptable to extreme change, furthermore they will harvest energy to be self-sustaining and eventually provide energy to the surrounding buildings



SMARTI ETN has received funding from the European Union's Horizon 2020 Programme under the Marie Curie-Skłodowska actions for research, technological development and demonstration, under grant n.721493.

Why SMARTI?



**(Transport) Infrastructure
Engineers EcoSystem**

**SMART =
Elegant solutions
(SMART)**



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What is SMARTI?

S

Sustainable

M

Multi-Fuinctional

A

Automated

R

Resilient

Transport Infrastructure

SUSTAINABLE TI:

design to last, maximise recycling, minimise
the impact

MULTI-FUNCTIONAL TI:

*conceived not for transport purposes only
and towards optimization of land use*

AUTOMATED TI:

equipped with sensors to allow pro-active communication towards a more intuitive use and a simplified management

RESILIENT TI:

conceived to self-repair and be adaptable to changes due to natural and anthropogenic hazards

What is SMARTI ETN?

Sustainable
Multi-functional
Automated
Resilient
Transport
Infrastructures

SMARTI
European Training Network
2017-2021



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PARTNER ORGANISATIONS
of Infrastructure managers:
Roads, Railways, Airports

BENEFICIARIES
Experts on Research and Education
Transport and Infrastructure stakehold

PARTNER ORGANISATIONS
Experts and trainers in SMARTening of
systems

15 FELLOWS AND RELATIVE INDIVIDUAL TRAINING-THROUGH-RESEARCH PROJECTS



SMARTi
Prototypes and Guidelines
for early exploitation and dissemination



Culture change through Innovation and Education →

- S**ustainable
- M**ulti-functional
- A**utomated
- R**esilient
- T**ransport
- I**nfrastructures

What is SMARTI ETN?



A3IP (A3IP)
Senceive LTD (SNCV)
Piezonix llc (PZNX)
GHT Photonics Srl (GHT)
ELAB Srl (ELAB)
GreenDelta GmbH (GD)
FIP Industriale (FIP)
REPSOL (REPSOL)
University College Dublin (UCD)
University of California, Davis (UCDAVIS)
Ecole Polytechnique, Paris (LPCIM)
Polytechnic University of Hong Kong (HKPU)

University of NewCastle (UONAUS)
Highways England Company Ltd (HE)
Società per l'Aeroporto Civile di
Bergamo-Orio al Serio (SACBO)
Conference of European Directors of
Roads (CEDR)
Smart Transport Alliance (STA)
Cardno IT Transport (CGNTV)
Comune di Palermo (MUNPA)
Research Driven Solutions (RDS)



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What is SMARTI ETN?





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“The research presented in this presentation was carried out as part of the H2020-MSCA-ETN-2016. This project has received funding from the European Union’s H2020 Programme for research, technological development and demonstration under grant agreement number 721493”



Self-healing asphalts

- Better recovery of road quality
- Automated crack reparation (avoiding traffic jams)
- Existence of environment-friendly bitumen rejuvenators
- Quick response to the cracking and roads' lifespan prolongation



MULTI-FUNCTIONAL TI:

RA2ROAD



The idea

Realize an hybrid system able to harvest energy from the sun



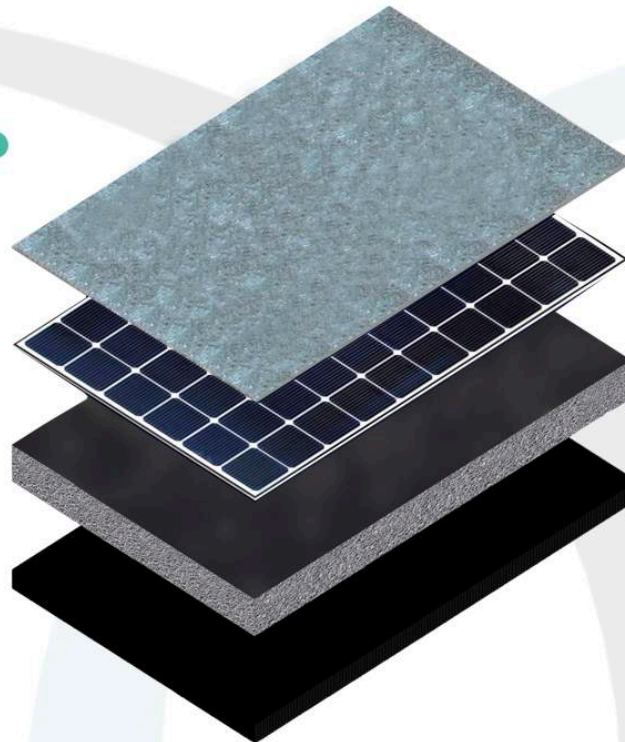
Domenico Vizzari

ESR3

"RA2ROAD"



domenico.vizzari@ifsttar.fr



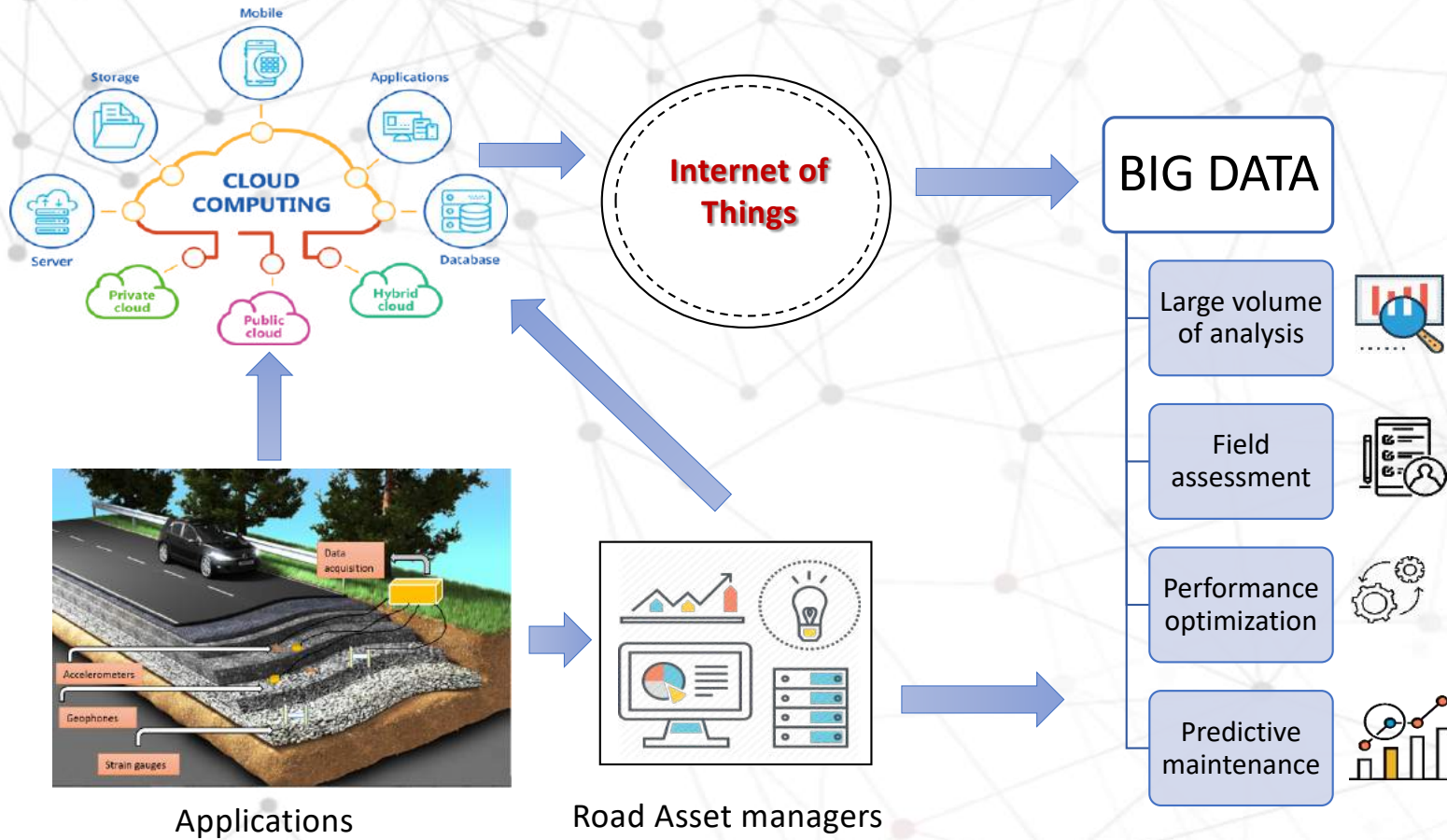
Semi-transparent top layer

Electrical layer

Porous layer

Base layer

AUTOMATED TI



Applications

Road Asset managers

BIG DATA

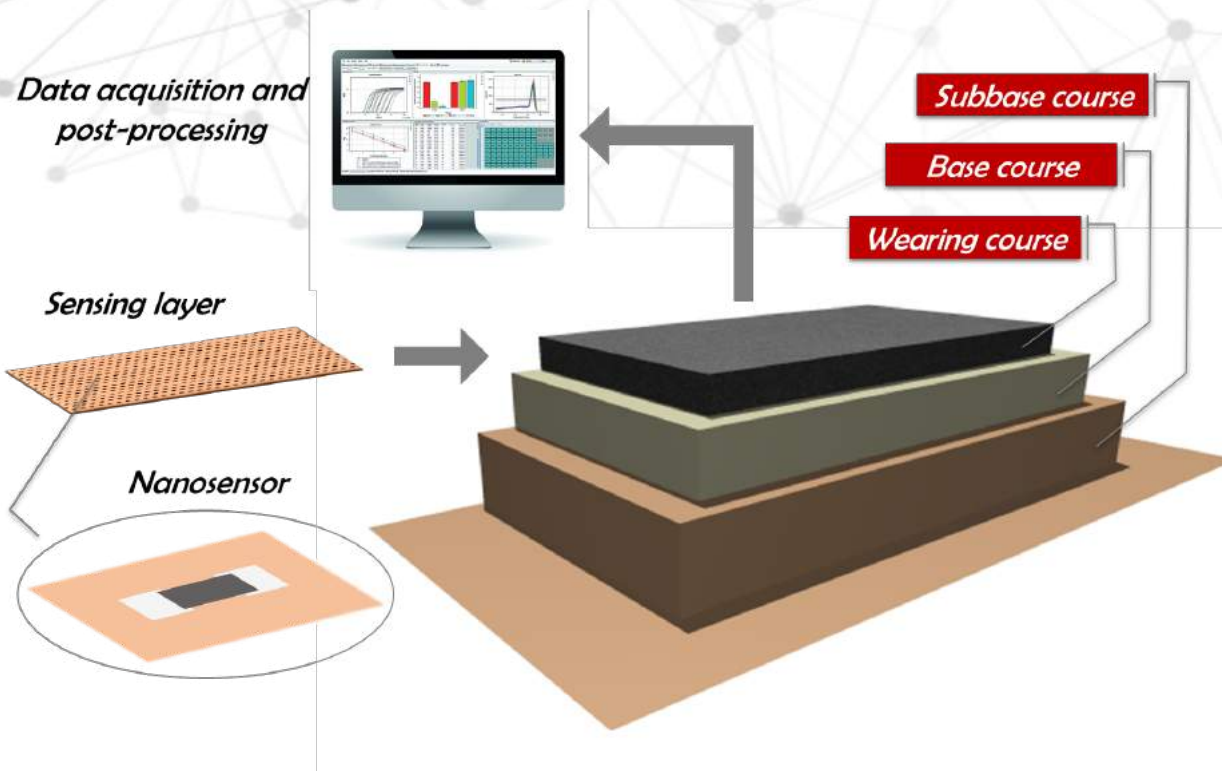
Large volume of analysis

Field assessment

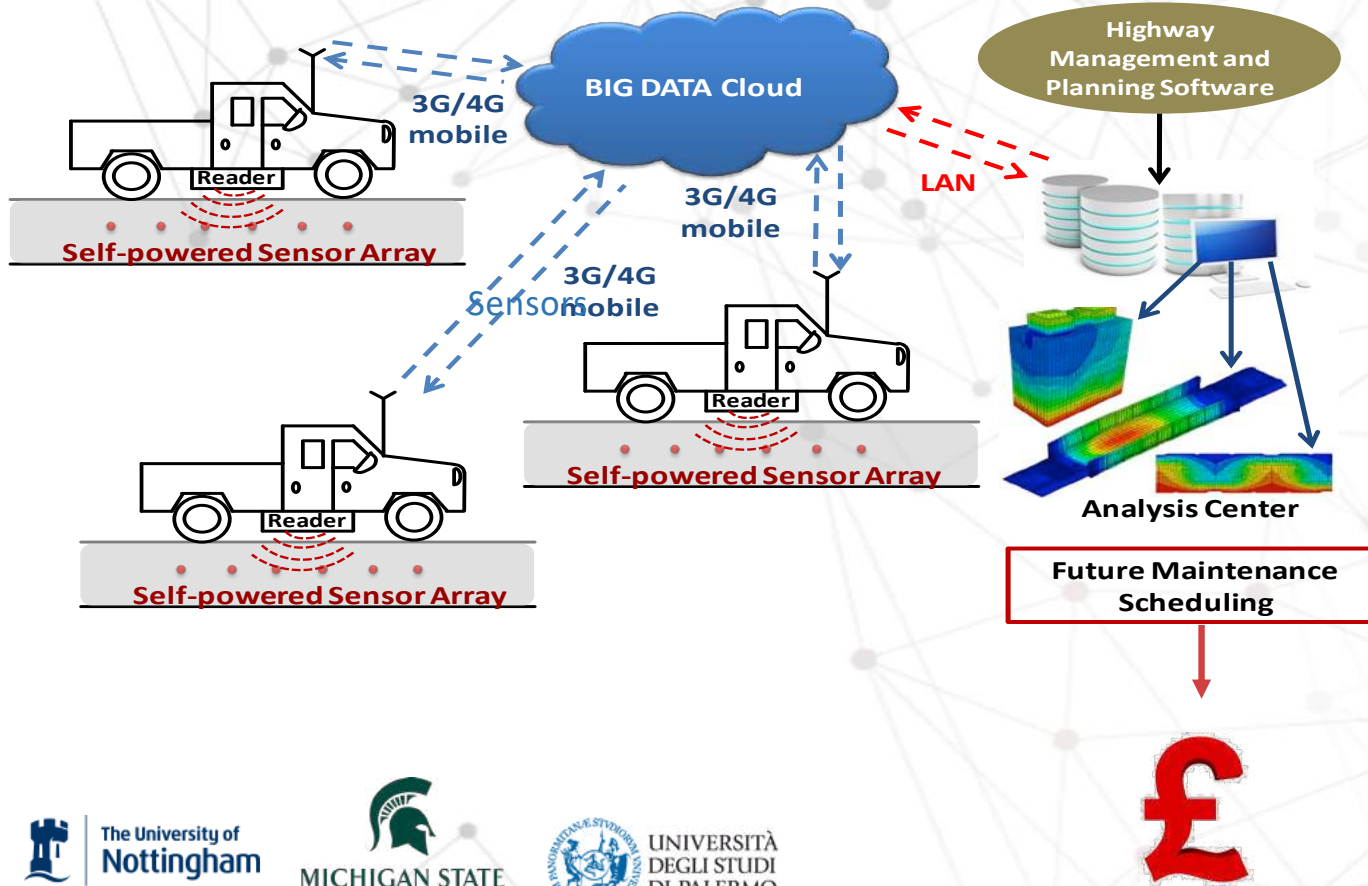
Performance optimization

Predictive maintenance

ESR2 project - Nanoasphalt



SmartEcoPave/Track – ESR 7



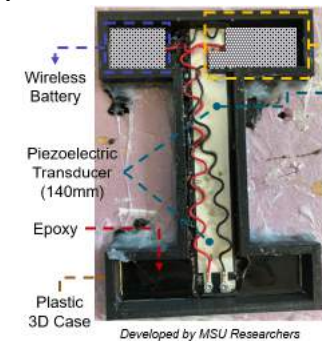
Mario Manosalvas Paredes

ESR 7

"SMARTECOPAVE"



Self-Powered Wireless Piezo-Floating-Gate (W-PFG) Sensor.



W-PFG Sensor – Validation Study

WP5: Full Scale Experiment



SMARTi
European Training Network

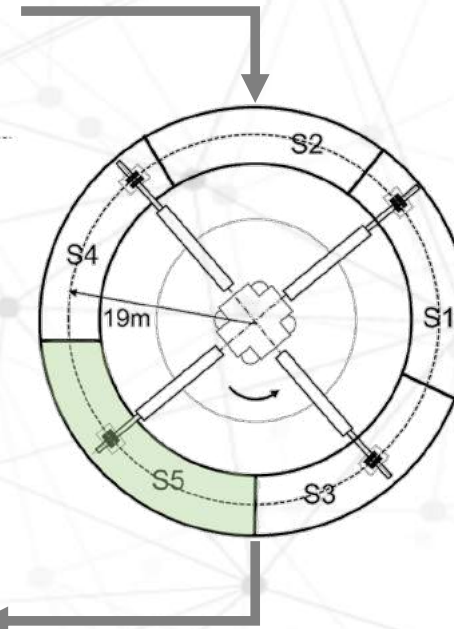
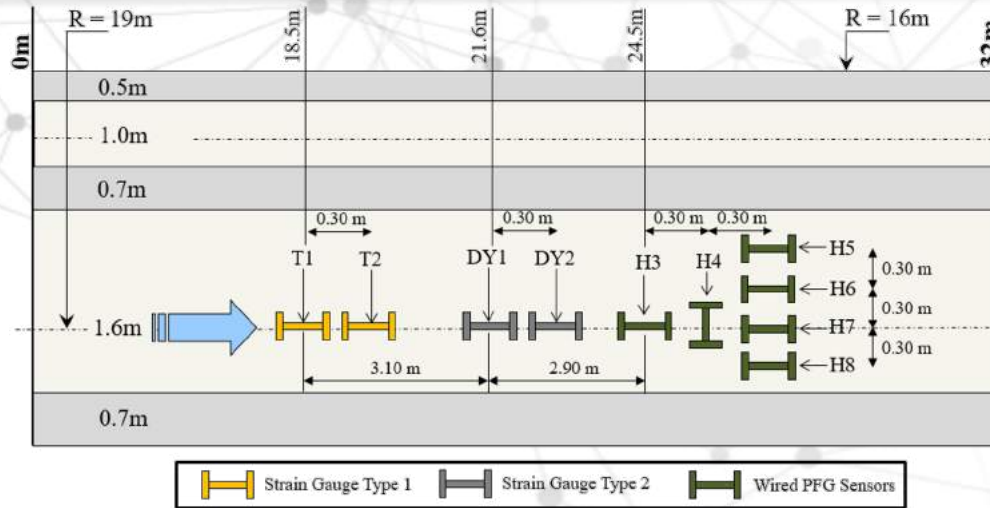
 **BioRePavation**

Infravation
An Infrastructure Innovation Programme

TEST TRACK
CONSTRUCTION

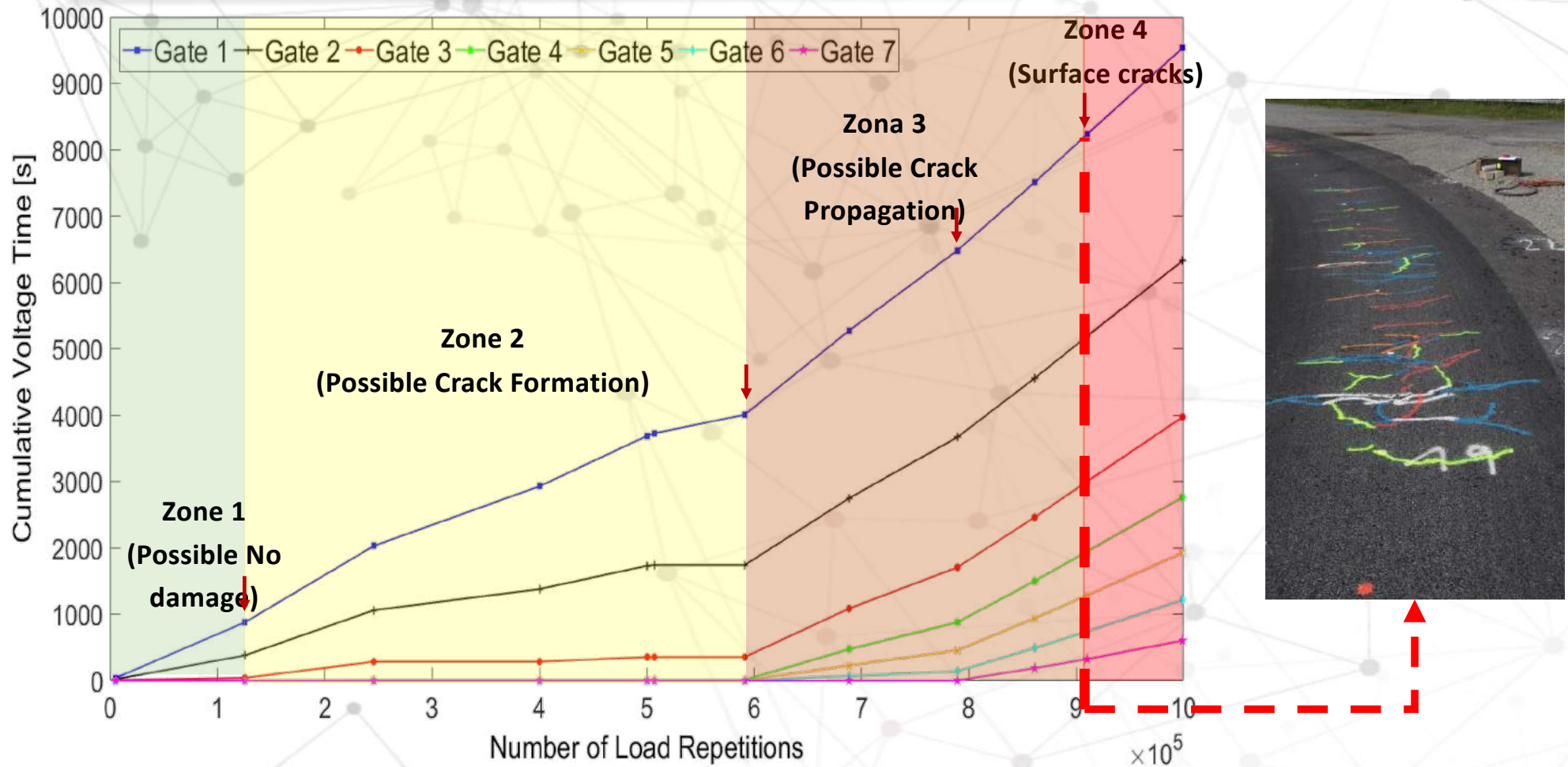
<https://youtu.be/OVhHcR9SHKo>

W-PFG Sensor – Validation Study



Parameter	Phase I	Phase II
Date	Nov/14/17 to Feb/15/18	Feb/15/18 to Mar/23/18
Number of Loads	Up to 999,200.00	Up to 1,408,000.00
Tyre / Axle	Dual / Single	Dual / Single
Semi-axle load (kN)	65.0	75.0
Speed (rounds/min)	10.0	8.0
Wandering (positions)	11.0	11.0

W-PFG Sensor – Validation Study



Mechano-Mutable Materials

Conventional AM + Magnetic particles + Magnetic Field
= SMART MATERIAL (MAM)

Aggregate (coarse)

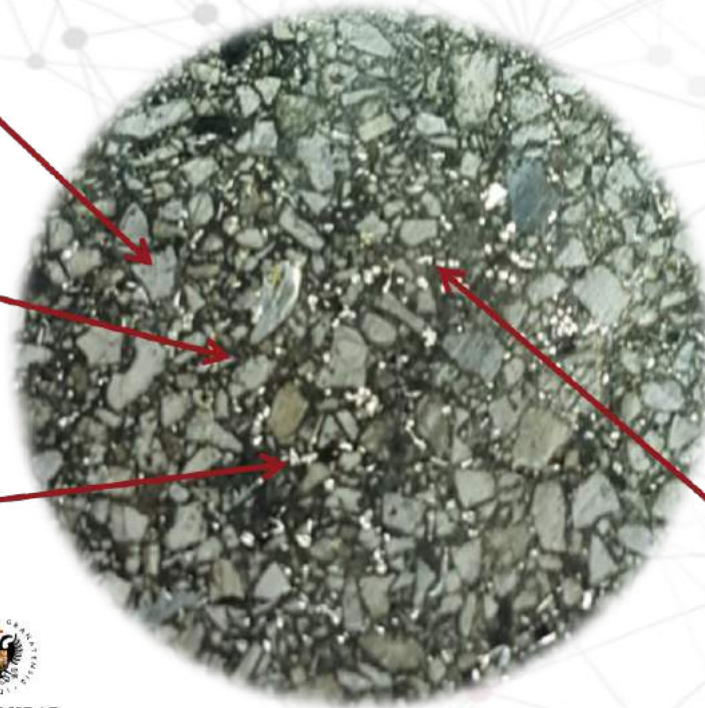
- Mechanical performance: lineal-elastic.

Filler (fines)

- Mechanical performance: lineal-elastic.

Asphalt binder

- Mechanical performance: viscoelastic

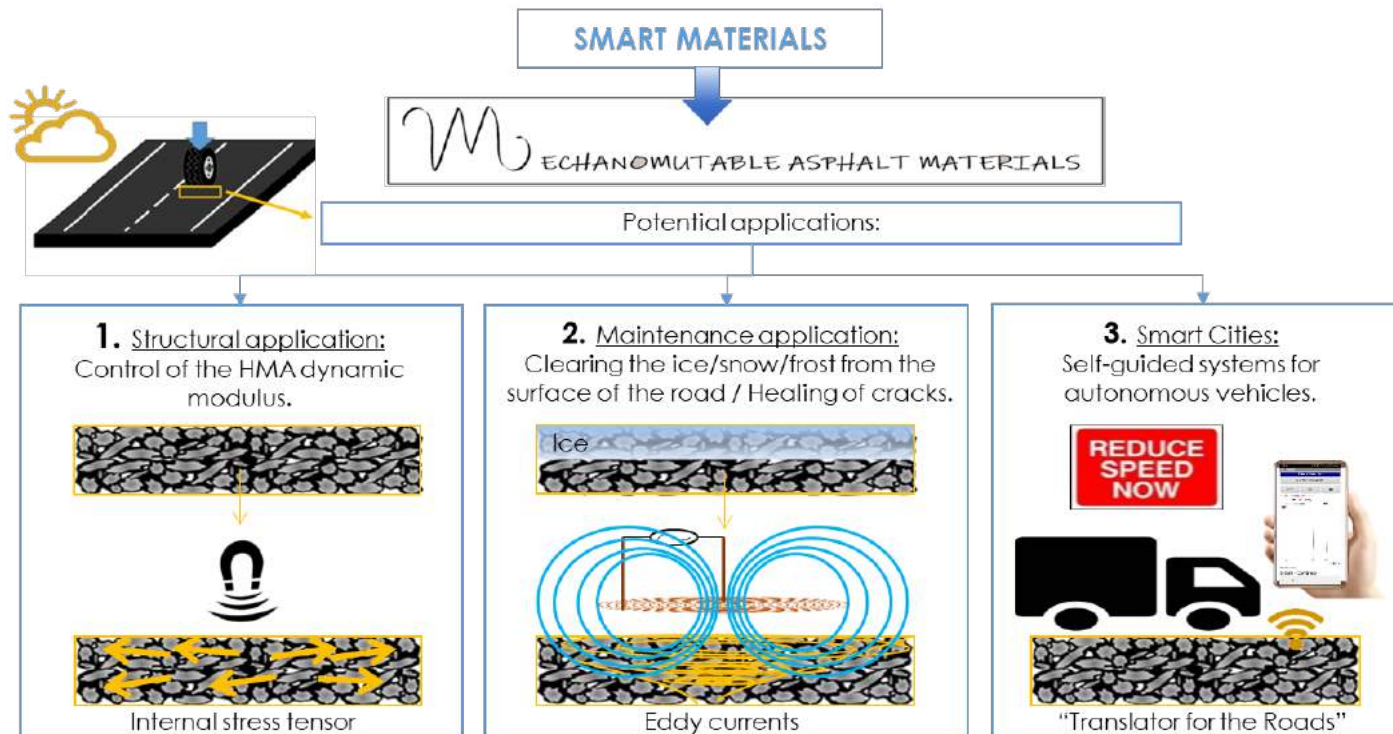


Magnetic particles

- Mechanical performance: magnetic (under activated fields).

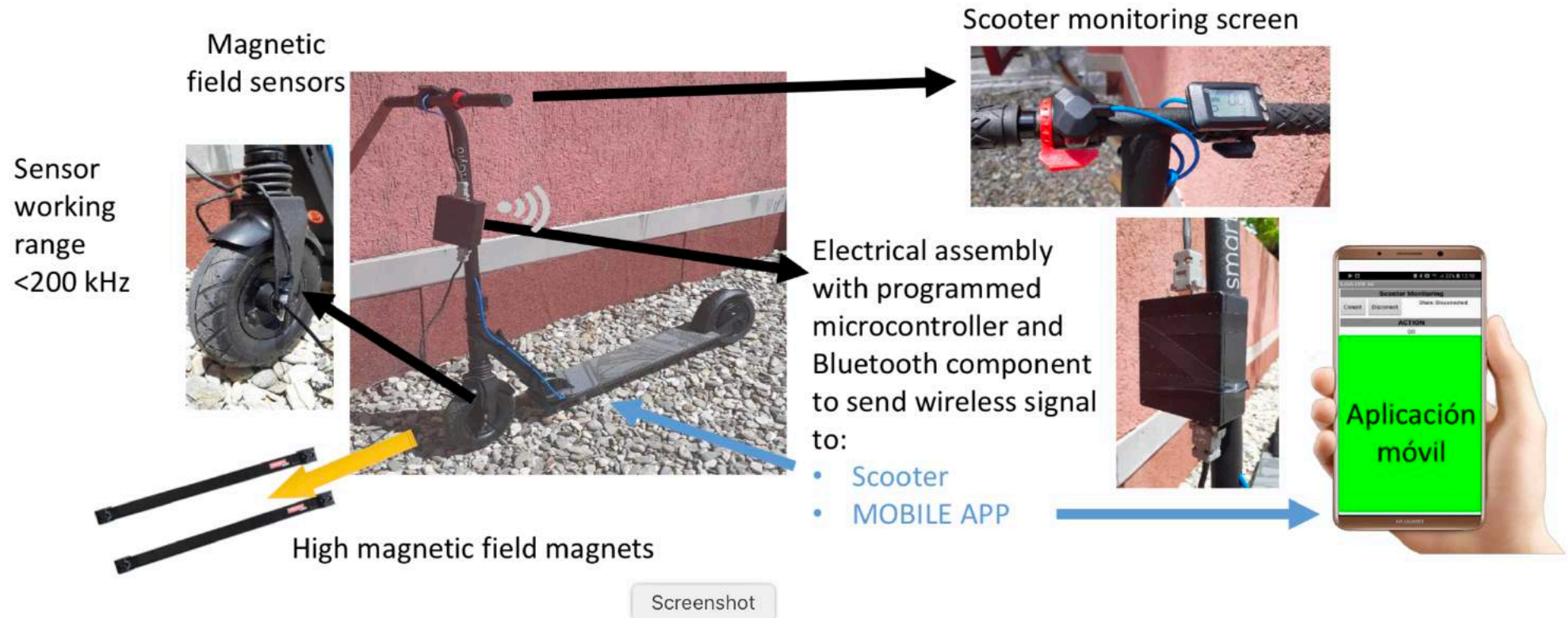
Mechano-Mutable Materials

ROADS OF FUTURE: SMART structures that require of:

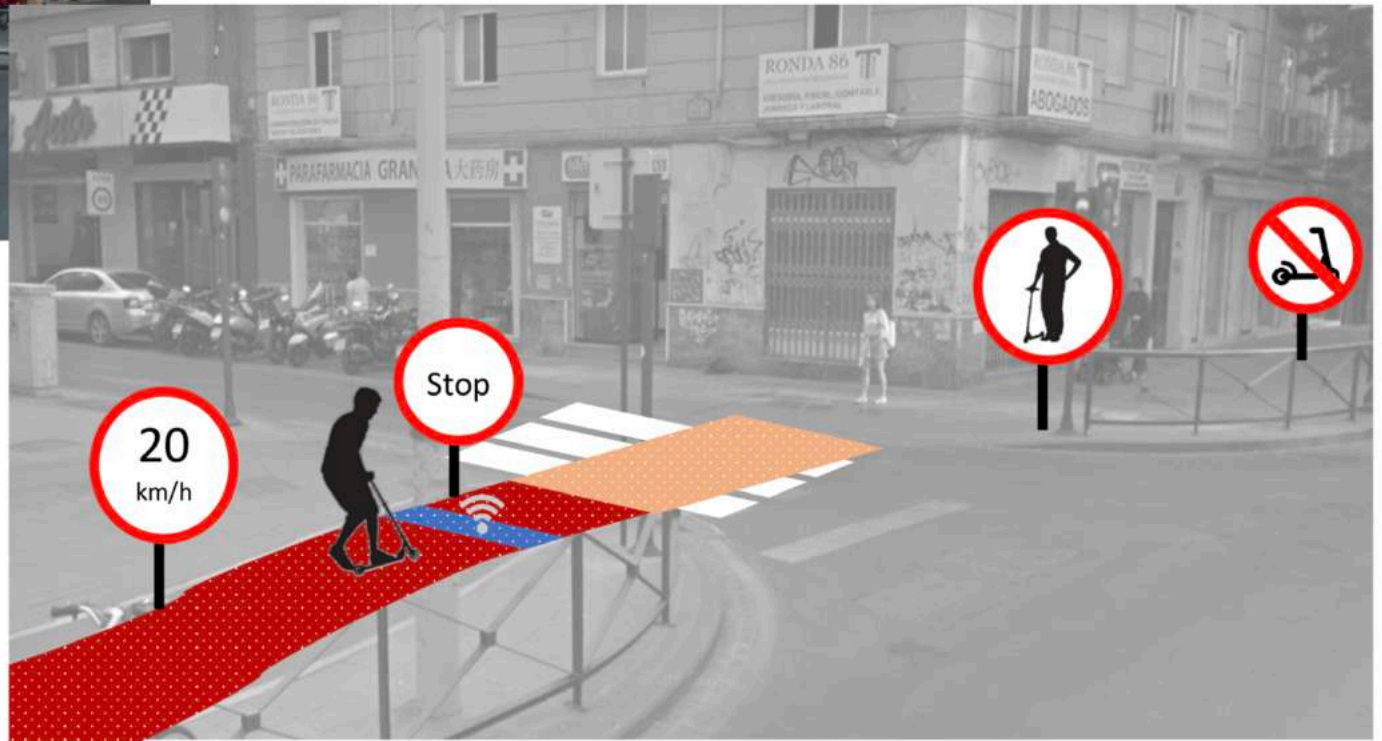


Mechano-Mutable Materials

Scooter Concept test 1



Mechano-Mutable Materials





***Engineering has no better choice than investing in
its sustainable development embracing innovation
and new technologies to effectively support healthy
society and respecting the environment***

(Lo Presti, 2018)

SMARTi

European Training Network

For more information check smartietn.eu



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For information about **SMARTI ETN** program please
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**THANK YOU
FOR YOUR ATTENTION**

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