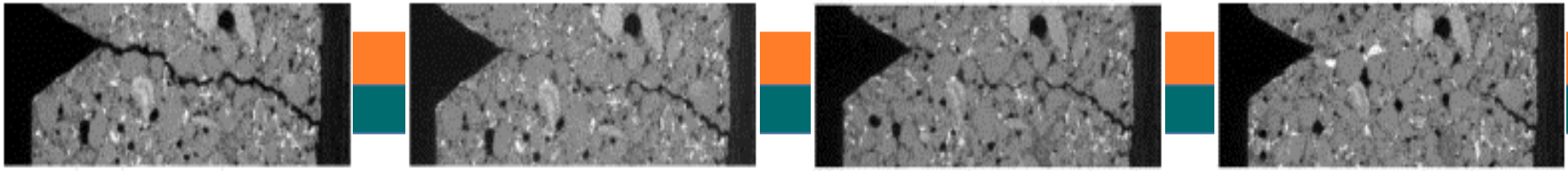

TOWARD AN ECO-FRIENDLIER HEALING OF ASPHALT MIXTURES

(USING ALTERNATIVE AGGREGATES AND FERROMAGNETIC PARTICLES)

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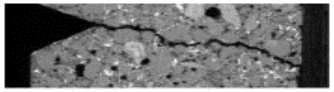
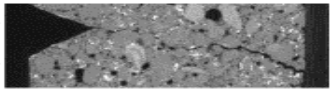
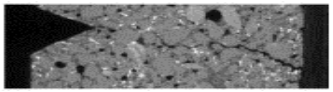
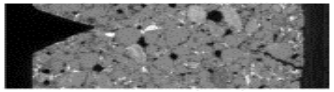
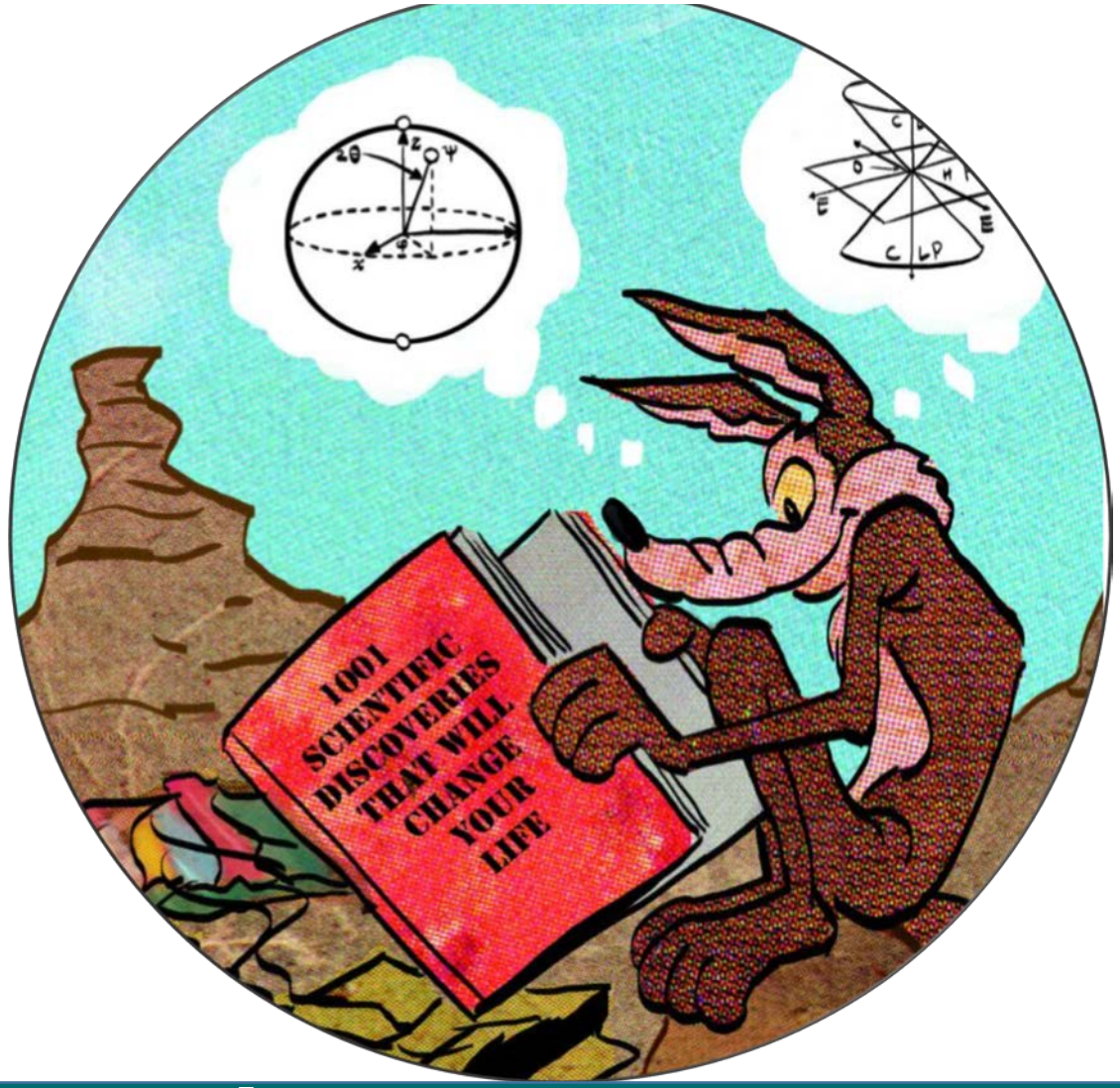





1. Why a PhD?.
   - Motivation
2. PhD Topic.
   - Introduction.
   - Objectives
     - What is new?
3. Steps to follow
   - Materials
     - Industries research
   - Mixture design
     - Laboratory tasks
   - Healing Test Design
     - Fracture-healing test
   - Statistic Analyses


1001
SCIENTIFIC
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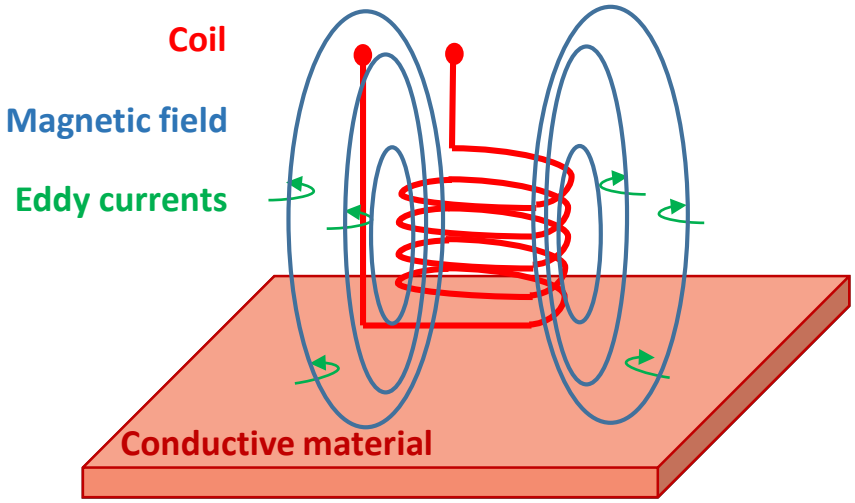
Asphalt mixtures.

Hydrocarbon binder (≈ 5%) + aggregates (≈ 95%) + additives (≥ 0%)

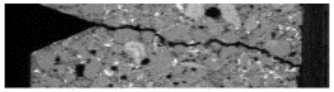
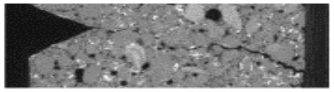
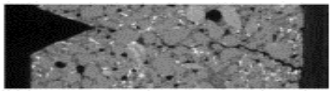
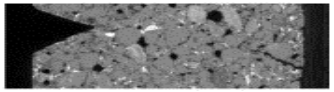
Cold Asphalt	Half Warm Asphalt	Warm Asphalt	**Hot Asphalt**
< 40˚C	40˚C - 100˚C	100˚C - 150˚C	**>150˚C**

Magnetic induction.



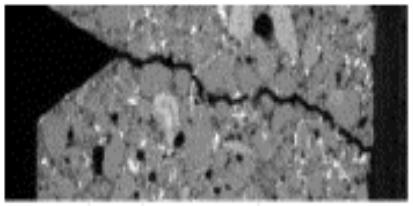
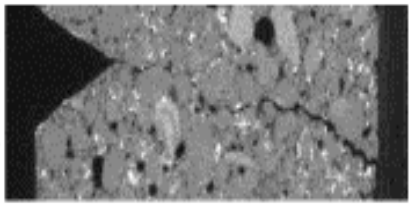
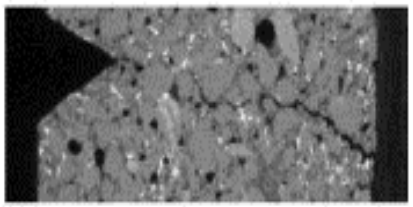
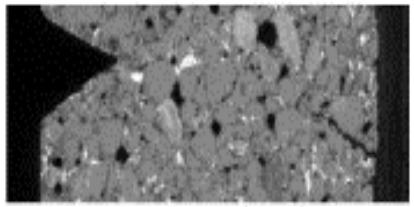
When AC current flow pass through a coil a magnetic field is created.

The magnetic field sends eddy currents through the metal. **The resistance of metal to eddy currents heats the metal** without heating anything else around

Application of magnetic induction over asphalt mixtures.

Bitumen softening temperature + heated metallic particles = Healing of mixture

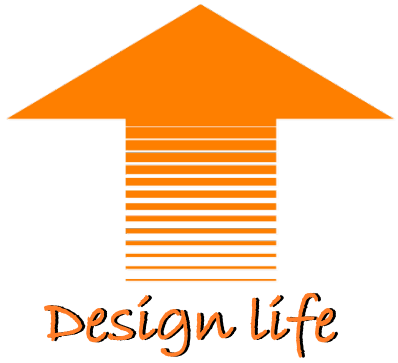





¿What is the problem of this technic?

Quantity of ferromagnetic particles needed to reach induction in a short time.

➢ More **sustainable** and more **durable** pavements.

1. Use of **magnetic induction** technology.
2. Use of **recycled ferromagnetic particles** to:
   - Keep the price of mixture.
   - Avoid sending them to landfill.
3. Use of industrial **by-products** to:
   - Decrease raw materials' use.
   - Avoid sending by-products to landfill and its cost.



Metal shots

Steel wool

Metallic fibres

Ophite **(2mm-16mm)**

Limestone **(< 2mm)**

Industrial by-products

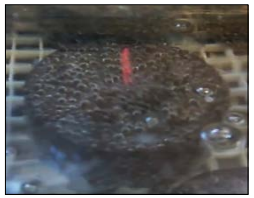
- Deburring wastes
- Steel Shots wastes
- Swarf from machining processes
- ELT fibres

Industrial by-products

- Slags
- RAP

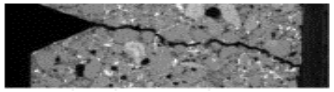
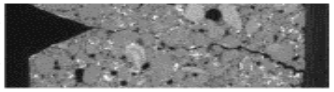
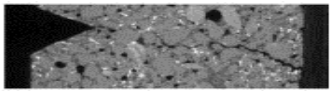
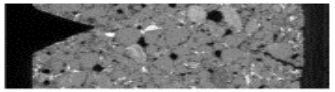
- Sand's by-products processes.
- Slags

1. Different combination of materials will be choosen.
   - Dosage
   - Mechanical and dynamic characterisation of each mixture

Voids in mixture **(UNE 12697-8)**	Water sensitivity **(UNE 12697-12)**	Wheel tracking Test **(UNE 12697-22)**	Loss particle Test **(UNE 12697-17)**
			  

Stiffness Test **UNE-EN 12697-26**	Fatigue Test **UNE-EN 12697-24**	Workability Test **(EN 12697-10)**
		

2. Select **up to three** mixtures to continue the research.

1. Design a method to calculate **healing ratio** over different shaped samples
   - Fracture- Healing- Fracture Test
     - Pre-cracked Marshall's specimens
   - Fatigue -Healing- Fatigue Test
     - Beam's shaped samples
     - Cylindrical samples
2. **Optimize** healing process.
   - Crack size
   - Time needed to heal
3. Every test result will be **statistic analysed** to validate the conclusions drawn from the laboratory tests.

- This study will be possible by:

1. **Spanish** Government **and European funds** (FEDER) .

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2. Construction Technology Applied **Research Group**

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3. **Enterprises** involved by now:

CASUSO propellers
FAED fundiciones de aceros especiales
Focs
hergom
Ecnmesa
NISSAN Innovation that excites

4. **PDIC**

Escuela de Doctorado

THANK YOU FOR LISTENING

TOWARD AN ECO-FRIENDLIER HEALING OF ASPHALT MIXTURES

ANY QUESTION

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