



MEETING OF THE DOCTORAL
PROGRAM IN CIVIL ENGINEERING

EIDEIC 2018

Durability study of bituminous mixtures incorporating alternative materials by mechanical calculation methods

Israel Rodríguez Fernández

May, 2018

Supervisor: Daniel Castro Fresno

Moisés Bueno

Tutor: Pablo Pascual Muñoz

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WORK PLAN

Activity 1. State of the art.

Activity 2. Study of the alternative materials.

Activity 3. Asphalt mixtures development.

Activity 4. Mechanical performance evaluation (laboratory).

Activity 5. Mechanical performance evaluation (simulations).

Activity 6. Results dissemination, internationalisation and knowledge transfer.

Activity	2016				2017				2018				2019			
A1	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
A2			█	█	█	█	█	█								
A3					█	█	█	█	█	█	█	█				
A4									█	█	█	█	█	█		
A5											█	█	█	█	█	█
A6					█	█	█	█	█	█	█	█	█	█	█	█

BASIC SKILLS

CB11 – Systematic understanding of a field of study and command of the skills and research methods related to the field.

CB12 – Skill to conceive, design or create, implement and adopt a substantial process of research or creation.

CB13 – Skill to contribute to the enlargement of the knowledge limits through an original research.

CB14 -Skill to carry out a critical analysis and assessment and synthesis of new and complex ideas.

CB15 – Skill to communicate with the academic and scientific community and with society in general about the scope of knowledge in the ways and languages of common use in the international scientific community.

CB16 – Skill to encourage, in academic and professional contexts, the scientific, technological, social, artistic or cultural progress in a society based on knowledge.

CAPACITIES AND PERSONAL ABILITIES

CA01 – Cope in contexts in which there is little specific information.

CA02 – Find the key questions to be answered to solve a complex problem.

CA03 – Design, create, develop and undertake new and innovative projects in the knowledge scope.

CA04 – Work both in teams and individually in an international or multidisciplinary context.

CA05 – Integrate knowledges, face complexity and formulate judgements with limited information.

CA06 – Intellectual criticism and defense of solutions.

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Basic skills

	Science and Technique	Technology	Educational Activities	Results	Scientific Criticism	Work Plan	Mobility	Funding	Ethics
CB11	X	X	X						
CB12				X		X	X		
CB13				X					
CB14					X				
CB15				X			X		
CB16				X					X

Capacities and personal abilities

CA01	X	X	X						
CA02				X					
CA03						X		X	
CA04			X				X		
CA05	X	X	X						
CA06					X				

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SCIENCE AND TECHNIQUE / TECHNOLOGY / SCIENTIFIC CRITICISM / WORK PLAN

Research Plan (PI) sections

- Section 2: Science and technique
- Section 3: Technology
- Section 6: SWOT Analysis
- Section 7: Work plan



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	Science and Technique	Technology	Educational Activities	Results	Scientific Criticism	Work Plan	Mobility	Funding	Ethics
Basic skills	CB11	✓	✓	X					
	CB12				X	✓	X		
	CB13				X				
	CB14					✓			
	CB15				X		X		
	CB16				X				X
Capacities and personal abilities	CA01	✓	✓	X					
	CA02				X				
	CA03					✓		X	
	CA04			X			X		
	CA05	✓	✓	X					
	CA06					✓			

EDUCATIONAL ACTIVITIES

Courses

- Statistics for research in construction engineering I and II
- EDUC basic training course
- Introduction to sustainable construction
- Technical English For Civil Engineers
- Workshop on entrepreneurship for researchers
- EDUC advanced training course

Seminars

- Research journals and Databases
- Safety and health at laboratory
- Patents

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Basic skills	CB11	✓	✓	✓					
	CB12				X	✓	X		
	CB13				X				
	CB14					✓			
	CB15				X		X		
	CB16				X				X
Capacities and personal abilities	CA01	✓	✓	✓					
	CA02				X				
	CA03					✓		X	
	CA04			✓			X		
	CA05	✓	✓	✓					
	CA06					✓			

RESULTS

Conference Papers

- "ALTERPAVE - Use of end-of-life materials, waste and alternative binders as useful raw materials for pavements construction and rehabilitation". **1st European Road Infrastructure Congress**. Leeds (2016).
- "Design for the maximization of the amount of reclaimed asphalt pavement (RAP) and by-products in asphalt mixtures". **World Conference on Pavement and Asset Management**. Milan (2017).
- "Development of greener and climate resilient roads". **7th Transport Research Arena TRA 2018**. Vienna (2018).

Articles

- "Effects of rejuvenators on asphalt mixtures containing reclaimed asphalt pavement and industrial by-products". J. Clean. Prod. (Under review)
 - "Recyclability potential of asphalt mixes containing reclaimed asphalt pavement and industrial by-products" (95% complete)
 - "Performance evaluation of a new nanomaterial-enhanced binder into a sustainable warm mix asphalt" (95% complete)
 - "Mechanical performance of asphalt mixes developed with a new nanomaterial-enhanced binder" (60% complete)
 - "Impact of climate change on the rutting performance of asphalt pavements" (40% complete)
- } In progress

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	CB12				✓	✓	X		
	CB13				✓				
	CB14					✓			
	CB15				✓			X	
	CB16				✓				X
Capacities and personal abilities	CA01	✓	✓	✓					
	CA02				✓				
	CA03					✓		X	
	CA04			✓			X		
	CA05	✓	✓	✓					
	CA06					✓			

MOBILITY

Attendance at conferences and meetings

- | | |
|---|---------------------|
| ➤ 1st European Road Infrastructure Congress. Leeds (2016). | Oral presentation |
| ➤ World Conference on Pavement and Asset Management. Baveno (2017). | Poster presentation |
| ➤ 7th Transport Research Arena. Vienna (2018). | Poster presentation |
| ➤ ALTERPAVE project. Workshop. Milan (2018). | Oral presentation |

Research stay

- Swiss Federal Office for Material Science and Technology (EMPA). Dübendorf (Switzerland).
 - Duration: 6 months (06/15/18 – 12/15/18)

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	CB12				✓	✓	✓		
	CB13				✓				
	CB14					✓			
	CB15				✓			✓	
	CB16				✓				X
Capacities and personal abilities	CA01	✓	✓	✓					
	CA02				✓				
	CA03					✓		X	
	CA04			✓			✓		
	CA05	✓	✓	✓					
	CA06					✓			

FOUNDING / ETHICS

Research Plan (PI) sections

➤ Section 9: Founding

- Thesis project founded by the FPU Programme of the Spanish Ministry of Education, Culture and Sport [grant number FPU-14/06997].
- Support of the GITECO research group.
- Research stay founded by the FPU Programme of the Spanish Ministry of Education, Culture and Sport.

➤ Section 10: Ethics

- Code of Good Practices of the Doctoral School of the University of Cantabria (EDUC).

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	CB12				✓	✓	✓		
	CB13				✓				
	CB14					✓			
	CB15				✓			✓	
	CB16				✓				✓
Capacities and personal abilities	CA01	✓	✓	✓					
	CA02				✓				
	CA03					✓		✓	
	CA04			✓			✓		
	CA05	✓	✓	✓					
	CA06					✓			



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