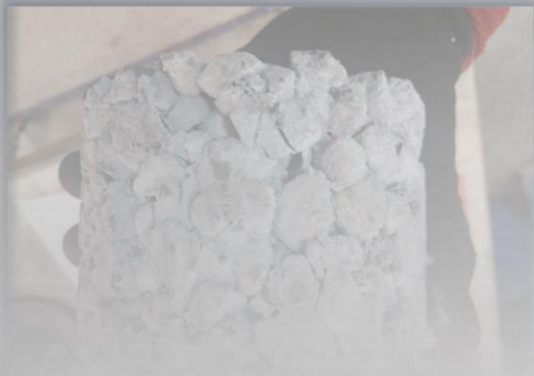


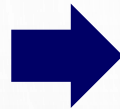


Multifunctional Porous Concrete Urban Pavements for a more Sustainable and Resilient Future.

Eduardo Javier Elizondo Martínez



Urbanization



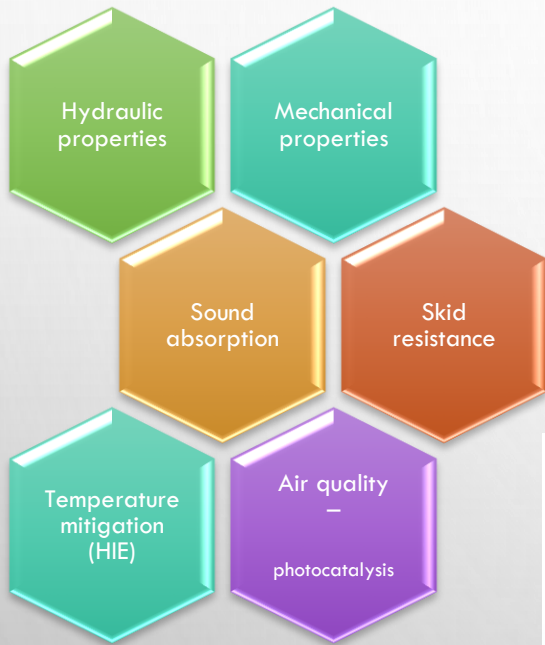
Climate Change



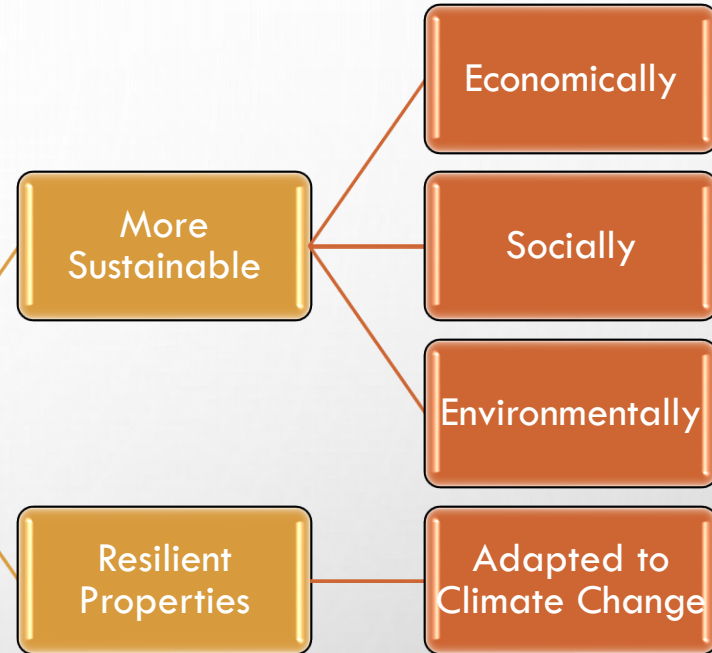
Water cycle obstruction



Characteristics



Obtain an integrated pavement



Porous
Concrete
study

Analysis of new dosages and additives to improve mechanical and hydraulic characteristics.

Integra-
tion of
improve-
ments

Including urban temperature regulation (cool pavements) and pollution mitigation (photocatalysis).

Risk
analysis

To help reduce traffic accidents and acoustic pollution in roads.

Tests

Perform tests on the Porous Concrete Pavements designs obtained.

Multi-
criteria
analysis

Develop a multi-criteria analysis methodology and decision making to study the different alternatives.

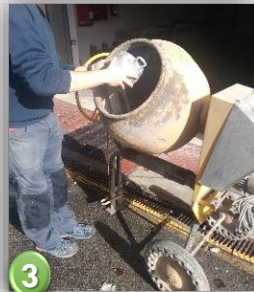
Elaboration Process



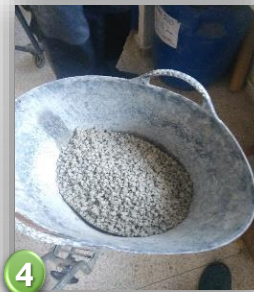
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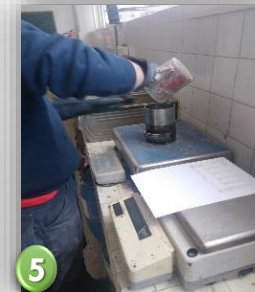
2



3



4



5



6



7

Assessment Guide

Basic Skills		6. Scientific Criticism (SWOT analysis)
CB14	Skill to carry out a critical analysis and assessment and synthesis of new and complex ideas.	✓
CA06	Intellectual criticism and defense of solutions.	✓

Study of different dosages of Porous Concrete.

- 41 samples made.
- 3 different water-cement (W/C) relations (0.30, 0.35, 0.40).
- 3 different sand-cement (S/C) relations (0, 0.5, 1).
- 4 different aggregate gradations (2-4mm, 4-8mm, 4-12mm, 8-12mm).
- 2 different compaction levels (%AV obj) (44.3%, 47.0%)

Tests:

- Indirect Tensile Test
- ICP infiltrometer

Comparison/Analysis

- AHP method



2-4mm



4-8mm



4-12mm



8-12mm

AHP analysis

s/c	Cement	-Three s/c ratios (0.00, 0.50, 1.00)	
		-Three w/c ratios (0.30, 0.35, 0.40)	
		-Different %AV (21.2, 21.4, 22.3, 22.8, 20.0, 20.8, 18.8, 16.9, 18.0, 16.0)	
	w/c	AG	-One s/c ratio (0.50)
			-Three w/c ratios (0.30, 0.35, 0.40)
		AG	-No s/c ratios
			-Three w/c ratios (0.30, 0.35, 0.40)
		AG	-One s/c ratio (1.00)
			-Three w/c ratios (0.30, 0.35, 0.40)
	AV	AG	-No s/c ratios
			-Four gradations (2-4, 4-8, 4-12, 8-12mm)
		AG	-One s/c ratio (1.00)
			-Four gradations (2-4, 4-8, 4-12, 8-12mm)
		AG	-No s/c ratios
			-Two compaction levels (44.30, 47.00%)
AG		-One s/c ratio (1.00)	
		-Two compaction levels (44.30, 47.00%)	
AG		-One s/c ratio (0.50)	
	-Two compaction levels (44.30, 47.00%)		
AG	-One w/c ratio (0.30)		
	-Three s/c ratios (0.00, 0.50, 1.00)		
	-No s/c ratios		
AG	-Different %AV (18.8, 18.00, 20.00%)		
	-One s/c ratio (1.00)		
	-Different %AV (21.20, 20.00%)		
AG	-One s/c ratio (0.50)		
	-Different %AV (21.40, 20.00%)		



- Sand influence
- w/c influence
- Gradation influence
- Air voids influence
- Cement influence

Hydraulic and
mechanical properties

Assessment Guide

	Basic Skills	2. Science and Technique (bibliographic study)	3. Technology (tools and instruments)
CB11	Systematic understanding of a field of study and command of the skills and research methods related to the field.	✓	✓
CA01	Cope in contexts in which there is little specific information.	✓	✓
CA05	Integrate knowledges, face complexity and formulate judgements with limited information.	✓	✓

1

- A Review of Porous Concrete Mixtures Mechanical, Hydraulical and Multifunctional Characteristics

Under Review.

2

- Study of Porous Concrete Behavior employing different dosages

Analysis and writing phase.

3

- A comparative between ACI 522R and NRMCA methodology with a new one.

Laboratory phase.

4

- Lightweight Porous Concrete with thermal isolation, high friction and sound absorbing.

5

- Study of photocatalytic polymers in Porous Concrete

Investigation Plan.

6

- Integration of improvements

Assessment Guide



Basic Skills		5. Results (publications)
CB12	Skills 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.	✘
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.	✘
CA02	Find the key questions to be answered to solve a complex problem.	✘

Introduction

Objectives

Results So far

Publications
(Research
Plan)

International
Stays
(Research
Plan)

International
Congresses
(Research
Plan)

Courses and
seminars

University

Universidad Nacional Autónoma de México (UNAM)

Università di Bologna



City/Country

Mexico City, Mexico

Bologna, Italy

Date

February 2019 – June 2019

October 2019 – January 2020

Activities during stay

Photocatalytic Polymers in Porous Concrete

Porous Concrete with recycled geopolymers

Assessment Guide

Basic Skills		8. Mobility
CB12	Skills to conceive, design or create, implement and adopt a substantial process of research or creation.	x
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.	x
CA04	Work both in teams and individually in an international or multidisciplinary context.	x



International Congresses

World of Concrete

**2nd International Research Conference
on Sustainable Energy, Engineering,
Materials and Environment.**



**Las Vegas Convention Center, Las Vegas,
U.S.A.**

**Polytechnic School of Mieres, University
of Oviedo, Spain.**

January 21-25 2019

July 25-27 2018

**Application under review (results on
June 2018)**

Application accepted

Assessment Guide



Basic Skills		7. Work Plan
CB12	Skills to conceive, design or create, implement and adopt a substantial process of research or creation.	✓
CA03	Design, create, develop and undertake new and innovative projects in the knowledge scope.	✓
Basic Skills		10. Ethics
CB16	Skill to encourage, in academic and professional contexts, the scientific, technological, social, artistic or cultural progress in a society based on knowledge.	✓
Basic Skills		9. Funding
CA03	Design, create, develop and undertake new and innovative projects in the knowledge scope.	✗

Compulsory Multidisciplinary Training



	Total Hours	Hours completed
Block I		
Basic Formation	6	6
Advanced Formation	3	3
Block II		
Basic Formation	20	31
Advanced Formation	20	12
Block III		
Basic Formation	14	16
Advanced Formation	17	6

- At may 16th 2018.
- Other courses have already been requested to complete blocks.

Assessment Guide

Basic Skills		4. Educational Activities (courses and seminars)
CB11	Systematic understanding of a field of study and command of the skills and research methods related to the field.	✓
CA01	Cope in contexts in which there is little specific information.	✓
CA04	Work both in teams and individually in an international or multidisciplinary context.	✓
CA05	Integrate knowledges, face complexity and formulate judgements with limited information.	✓