

## Course guide

### 2500054 - GECCONSINF - Infrastructure Preservation

Last modified: 01/10/2023

**Unit in charge:** Barcelona School of Civil Engineering  
**Teaching unit:** 751 - DECA - Department of Civil and Environmental Engineering.

**Degree:** BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2020). (Optional subject).

**Academic year:** 2023    **ECTS Credits:** 4.5    **Languages:** Spanish

#### LECTURER

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**Coordinating lecturer:** TERESA LÓPEZ MONTERO

**Others:** TERESA LÓPEZ MONTERO, ADRIANA HAYDEE MARTINEZ REGUERO, JOSE RODRIGO MIRO RECASENS

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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##### Specific:

- 14422. Capacity for the construction and conservation of roads, as well as for the dimensioning, the project and the elements that make up the basic road equipment. (Specific technology module: Urban Transport and Services)
- 14423. Capacity for the construction and conservation of railway lines with knowledge to apply specific technical regulations and differentiating the characteristics of the mobile material. (Specific technology module: Urban Transport and Services)
- 14424. Knowledge of the urban management regulation framework. (Specific technology module: Urban Transport and Services)
- 14425. Knowledge of the influence of infrastructure in the planning of the territory and to participate in the urbanization of urban public space, such as water distribution, sanitation, waste management, transport systems, traffic, lighting, etc. (Specific technology module: Urban Transport and Services)
- 14426. Knowledge of the design and operation of infrastructures for modal exchange, such as ports, airports, railway stations and transport logistics centers. (Specific technology module: Urban Transport and Services)

##### Generical:

- 14380. Scientific-technical training for the exercise of the profession of Technical Engineer of Public Works and knowledge of the functions of advice, analysis, design, calculation, project, construction, maintenance, conservation and exploitation.
- 14383. Ability to project, inspect and direct works, in their field.
- 14385. Ability to carry out territorial planning studies and environmental aspects related to infrastructure, in its field.
- 14386. Capacity for maintenance, conservation and exploitation of infrastructure, in its field.
- 14389. Knowledge of the history of civil engineering and training to analyze and assess public works in particular and construction in general.
- 14390. Identify, formulate and solve engineering problems. Pose and solve construction engineering problems with initiative, decision-making skills and creativity. Develop a systematic and creative method of analysis and problem solving. (Additional school competition).
- 14391. Conceive, project, manage and maintain systems in the field of construction engineering. Cover the entire life cycle of an infrastructure or system or service in the field of construction engineering. (Additional school competition).

## TEACHING METHODOLOGY

The course consists of 3 hours per week of classroom activity.

2.2 hours are devoted to theoretical lectures in which the teacher presents the basic concepts and topics of the subject, 0.6 hours are devoted to show examples and solve exercises.

The remaining hours per week are dedicated to evaluation.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

## LEARNING OBJECTIVES OF THE SUBJECT

Knowledge on surface characteristics of the pavement. Common types of damage and their causes. Typical problems of hydrocarbonated ligators. Auscultation of firm. Conservation actions. Design pavement reinforcements. Extension of mixtures. Extension of pavement design. Introduction to the conservation of railways.

- 1 Ability to analyze the mechanisms and agents of deterioration and the types of pavements and modes of deterioration. Auscultation, visual inspection, evaluation of the functional and structural characteristics of the pavement.
- 2 Capacity to analyze the conservation, surface rehabilitation and structural reinforcement of a pavement.
- 3 Ability to establish firm management systems and fixed vertical signs and road markings.

Knowledge of the road network in Spain, its condition and conservation needs. Knowledge of the structural and surface characteristics of a road network. Analysis of the mechanisms and agents of deterioration and the types of pavements and modes of deterioration. Knowledge of auscultation, visual inspection, evaluation of the functional and structural characteristics of the pavement. Conservation, surface rehabilitation and structural reinforcement concept. Knowledge of pavement management systems and fixed vertical signals and road markings.

Knowledge about surface characteristics of firm. The most common types of damage and their causes. Firm auscultation. Conservation actions. Dimensioning of firm reinforcements. Extension of mixture design. Extension of dimensioning of firms. Introduction to railway conservation. 1 Ability to analyze the mechanisms and agents of deterioration and the types of firms and ways of deterioration. Auscultation, visual inspection, evaluation of the functional and structural characteristics of the firm. 2 Ability to analyze the conservation, surface rehabilitation and structural reinforcement of a firm. 3 Capacity for the establishment of farm management systems. Knowledge of the road network in Spain, its condition and conservation needs. Knowledge of the structural and surface characteristics of a road network. Analysis of the mechanisms and agents of deterioration and the types of firms and ways of deterioration. Knowledge of auscultation, visual inspection, evaluation of the functional and structural characteristics of the firm. Concept of conservation, surface rehabilitation and structural reinforcement. Knowledge of farm management systems.

## STUDY LOAD

Type	Hours	Percentage
Hours large group	22,5	20.00
Self study	63,0	56.00
Hours medium group	22,5	20.00
Guided activities	4,5	4.00

**Total learning time:** 112.5 h

## CONTENTS

### 1. Presentation

**Full-or-part-time:** 2h 24m

Laboratory classes: 1h

Self study : 1h 24m

### 2. Bituminous mixtures

**Description:**

Types of bituminous mixtures. Properties. Characterization tests. Dosage.

**Specific objectives:**

Acquire knowledge about:

**Full-or-part-time:** 19h 12m

Theory classes: 8h

Self study : 11h 12m

### 3. The road network

**Description:**

The road network in Spain. State and conservation needs.

**Specific objectives:**

Acquire knowledge about: The road network in Spain. State and conservation needs.

**Full-or-part-time:** 4h 48m

Theory classes: 2h

Self study : 2h 48m

### 4. Pavement condition

**Description:**

Structural characteristics. Surface characteristics: adherence, noise, roughness, optical properties.

Damage mechanisms and agents. Pavement types and modes of distress. Catalogs damage.

Auscultation. Visual inspection. Evaluation of the pavement functional characteristics. Evaluation of the pavement structural characteristics.

**Specific objectives:**

Acquiring knowledge about:

Structural characteristics. Surface characteristics: adherence, noise, roughness, optical properties.

Acquiring knowledge about:

Damage mechanisms and agents. Pavement types and modes of distress. Catalogs damage.

Acquiring knowledge about:

Auscultation. Visual inspection. Evaluation of the pavement functional characteristics. Evaluation of the pavement structural characteristics.

**Full-or-part-time:** 24h

Theory classes: 10h

Self study : 14h

## 5. Conservation techniques

### Description:

Routine maintenance. Surface rehabilitation

Structural reinforcement. Standard 6.3-IC "Rehabilitación de firmes".

Repair of failures. Surface rehabilitation. Structural rehabilitation.

Problems on structural reinforcement of pavements

Analysis of deflections. Tramificación. Deflection characteristic. Calculating of the reinforcement thickness, Standard 6.3-IC.

Road Condition Assessment Problems

Practice of road condition assessment

### Specific objectives:

Acquiring knowledge about:

Routine maintenance. Surface rehabilitation

Acquiring knowledge about:

Structural reinforcement. Standard 6.3-IC "Rehabilitación de firmes".

Acquiring knowledge about:

Repair of failures. Surface rehabilitation. Structural rehabilitation.

Acquire practical knowledge about: structural reinforcement of pavements

Acquiring practical knowledge about:

Analysis of deflections. Tramificación. Deflection characteristic. Calculating of the reinforcement thickness, Standard 6.3-IC.

Gain practical knowledge about: road condition assessment

Acquiring practical knowledge about:

road condition evaluation

**Full-or-part-time:** 50h 24m

Theory classes: 10h

Practical classes: 6h

Laboratory classes: 5h

Self study : 29h 24m

## 6. Pavement Management Systems

### Description:

Definitions. Structure of a pavement management system. Indexes of state. Models.

Inventory. Comprehensive maintenance contracts. Management indicators.

### Specific objectives:

Acquiring knowledge about:

Definitions. Structure of a pavement management system. Indexes of state. Models.

Acquiring knowledge about:

Inventory. Comprehensive maintenance contracts. Management indicators.

**Full-or-part-time:** 7h 11m

Theory classes: 3h

Self study : 4h 11m

## GRADING SYSTEM

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The final grade for the course will be the weighted average of two theoretical exams (each accounting for 50% of the theory grade) and a series of directed activities.

Final score =  $0.8 * \text{theoretical exams score} + 0.2 * \text{directed activities score}$

To pass the course the final grade should be greater than or equal to 5.

Criteria for re-evaluation qualification and eligibility: Students that failed the ordinary evaluation and have regularly attended all evaluation tests will have the opportunity of carrying out a re-evaluation test during the period specified in the academic calendar. Students who have already passed the test or were qualified as non-attending or have not presented all the assigned tasks, will not be admitted to the re-evaluation test. The maximum mark for the re-evaluation exam will be five over ten (5.0) and it will be only given by the mark obtained in the exam. The non-attendance of a student to the re-evaluation test, in the date specified will not grant access to further re-evaluation tests.

Students unable to attend any of the continuous assessment tests due to certifiable force majeure will be ensured extraordinary evaluation periods. These tests must be authorized by the corresponding Head of Studies, at the request of the professor responsible for the course, and will be carried out within the corresponding academic period.

## EXAMINATION RULES.

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Failure to perform a continuous assessment activity in the scheduled period will result in a mark of zero in that activity.

## BIBLIOGRAPHY

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### Basic:

- Ministerio de Fomento. Rehabilitación de firmes: instrucción de carreteras: Norma 6.3 IC [on line]. Madrid: Ministerio de Fomento. Dirección General de Carreteras, 2003 [Consultation: 20/04/2020]. Available on: [https://www.mitma.gob.es/recursos\\_mfom/1020100.pdf](https://www.mitma.gob.es/recursos_mfom/1020100.pdf). ISBN 8449806968.
- Pérez, F.E.; Miró, R.; Martínez, A. Proyecto, conservación y gestión de firmes. Madrid: Asociación Española de la Carretera, 2007. ISBN 975-84-89875-71-5.
- Kraemer, C. Ingeniería de carreteras: v. II. Madrid: Mc Graw Hill, 2003. ISBN 84-481-3998-4.

### Complementary:

- Rashad Islam, M. ; Terefder, Rafiqul A. Pavement design. New York: McGraw Hill, 2020. ISBN 9781260458916.
- Hernán de Solminihaç, Tomás Echaveguren, Alondra Chamorro. Gestión de infraestructura vial [on line]. 3a ed. Santiago, Chile: Ediciones Universidad Católica de Chile, 2018 [Consultation: 05/10/2023]. Available on: [https://search-ebscohost-com.recursos.biblioteca.upc.edu/login.aspx?direct=true&AuthType=ip,uid&db=nlebk&AN=2225766&site=ehost-live&ebv=EB&ppid=pp\\_C](https://search-ebscohost-com.recursos.biblioteca.upc.edu/login.aspx?direct=true&AuthType=ip,uid&db=nlebk&AN=2225766&site=ehost-live&ebv=EB&ppid=pp_C). ISBN 9789561422759.