

Course Unit	Transport Infrastructures	Field of study	Transport Infrastructures
Master in	Construction Engineering	School	School of Technology and Management
Academic Year	2020/2021	Year of study	1
Type	Semestral	Semester	1
Level	2-1	ECTS credits	6.0
Code	5024-419-1102-00-20		
Workload (hours)	162	Contact hours	T 30 TP 30 PL - TC - S - E - OT - O -

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Eduarda Cristina Pires Luso, António Augusto Nogueira Prada

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Understand the types of mobility and the organization of road networks;
2. Evaluate and choose, either in design or in the work process, the appropriate solutions for paving;
3. Evaluate and choose the construction appropriate technologies to different work situations and design, particularly in the manufacture, commissioning work and quality control of materials of pavement;
4. Define the main loads at which the transportation infrastructures are subject, for structural design of a road pavement;
5. Perform an empirical and mechanistic design of pavement structures and their structural rehabilitation;
6. Understand the tools needed to design drainage systems and acoustic barriers on roads.

Prerequisites

Before the course unit the learner is expected to be able to:

1. Know the geotechnical tests for soil foundation, particularly the soil compaction tests;
2. Study adequately a corridor of the transport infrastructures;

Course contents

Traffic, Signs, Security, Dimensioning of Drainage Organs and Acoustic Barriers. Considered loads in transport infrastructures. Geotechnics of roads - earthworks and foundations of the infrastructure of transport. Technologies of construction and rehabilitation of infrastructures of transport. Structural Design of road pavements. Models of behavior and design principles. Design Methods.

Course contents (extended version)

1. Framework
 - Framework of the transport infrastructures in the context of Civil Engineering - Road Engineering;
 - Introduction to road pavements. Functions. Loads. Behaviour;
 - Pavement types. Constitution of each type of pavement.
2. Study of traffic
 - Characterization and evaluation of traffic;
 - Observation of traffic data. Means of assessment. Traffic Counts. Traffic forecast;
 - Traffic flow (intensity). Conversion into equivalent axle load for pavement design;
 - Conditions of application of traffic loads.
3. Mobility and organization of road networks
 - Organization, modal and functions of the transportation system;
 - Organization of the road networks and types of roads;
 - The urban infrastructure of circulation;
 - Transversal profile of the different roads;
 - The soft mobility mods.
4. Study of the intersections
 - Turn movements and conflict points;
 - Uncontrolled and controlled intersections;
 - Intersections from traffic circles. Traffic signals;
5. The foundation of Pavement
 - Stability, durability, flexibility, fatigue, adhesion, impermeability and others. Composition;
 - Support capacity of the pavement foundation based on the CBR index and the FWD test;
 - Stabilization of pavement bed soils: mechanical, with lime, with cement and with asphalt bitumen;
6. Paving materials
 - Aggregates. Classification. EN 13242 e NP EN 13043 standards;
 - Binders. Asphalt bitumen. Testing. Viscosity. Cut-back. Bitumen emulsion. Modified bitumen.
 - Pavement layers. Unbound granular subbases and bases and layers with bituminous materials.
 - Concrete cement for pavement layers. Soil-cement layers. Structural cement concrete layers.
7. Bituminous mixes
 - Main types of hot mix asphalt. Formulation of hot mixes asphalt. Marshall method;
 - Cold mixes asphalt.
8. Pavement design based on empirical methods.
 - General principles. Establishment of the mechanical characteristics of the layers;
 - MACOPAV method.
9. Conservation of Road Pavements
 - Pavement degradation mechanisms;
 - Anomalies observation in pavements; Degradation Catalog (JAE);
 - Conservation and rehabilitation techniques.
10. Design of Drainage Organs and Acoustic Barriers
 - Surface drainage; Underground drainage;
 - Noise Analysis - Environmental Impact of the Roads; Sound Barrier Materials.
11. Signaling, Safety and Traffic Calming
 - Markings, traffic signs and temporary signage;
 - Crashes characterization and intervention;
 - Typologies and infrastructure problems; Rules and design solutions;
 - Traffic calming measures.
12. Parking
 - Traffic supply and demand; Intervention and management of supply;
 - Parking sizing; Bus/taxi and delivery places.

Recommended reading

1. Pavimentos Rodoviários. Pereira, P. A. A. , Picado Santos, L. G. , Branco, F. . Outubro, 2005. Edições Almedina. Coimbra-Portugal;
2. Pereira, Orlando Almeida. 1995. Pavimentos Rodoviários – Volumes I, II, III e IV– LNEC. Lisboa
3. Modern Railway Track. ESVELD, COENRAAD. Ed. MRT-Productions. Zaltbommel, Neetherland, 2001

Teaching and learning methods

The unit will be taught using a combination of theoretical classes, self guided learning oriented by teacher, and practical exercises must be resolved. The practical work involves the application of the contents of the theoretical and practical classes to a real case of road design.

Assessment methods

- Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
- Final Written Exam - 100%

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

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29-10-2020	30-10-2020	30-10-2020	03-11-2020