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250450 - MOBURB - Urban Mobility

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering

Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering

Academic year: 2015

Degree: MASTER'S DEGREE IN CIVIL ENGINEERING (RESEARCH TRACK) (Syllabus 2007). (Teaching unit Optional)
MASTER'S DEGREE IN CIVIL ENGINEERING (PROFESSIONAL TRACK) (Syllabus 2012). (Teaching unit Optional)
MASTER'S DEGREE IN CIVIL ENGINEERING (PROFESSIONAL TRACK) (Syllabus 2012). (Teaching unit Optional)
MASTER'S DEGREE IN CIVIL ENGINEERING (RESEARCH TRACK) (Syllabus 2009). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: FRANCESC SORIGUERA MARTÍ

Others: FRANCESC SORIGUERA MARTÍ

Opening hours

Timetable: Monday from 16.30 to 18.30h.
Always by appointment by e-mail.

Degree competences to which the subject contributes

Specific:

8169. The ability to plan, manage and operate civil engineering infrastructure.

8234. Knowledge of transport engineering and planning, transport types and functions, urban transport, management of public transport services, demand, costs, logistics, and financing of transport infrastructure and services.

Teaching methodology

The course consists of 3 hours per week of lectures in the classroom (large group).

2 hours are lectures, in which the teacher presents the basic concepts and materials.

1 hour is devoted to present examples and exercises with a greater interaction with students.

Support material will be provided on campus ATENEA: content, programming and evaluation, activities and relevant references.

Learning objectives of the subject

Specialization subject in which knowledge on specific competences is intensified.

Knowledge and skills at specialization level that permit the development and application of techniques and methodologies at advanced level.

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Contents of specialization at master level related to research or innovation in the field of engineering.

The course aims to train students in the planning and management of urban mobility. The focus of the course is conceptual. It gives greater importance to the concepts and ideas to the detriment of facts, statistics and other descriptive aspects. This requires a significant degree of abstraction, which is balanced by the assignments with a more practical focus.

After an introductory session, the course consists of 3 main parts. The first aims to convey the fundamental concepts of planning public transport systems, regardless of their technological support. The conceptual design of the Barcelona new bus network is presented as a paradigmatic case study.

The second section deals with paratransit systems, flexible public transportation systems not subject to routes, and with the more innovative strategies of shared vehicles.

Finally, the third section addresses the urban traffic management.

Study load

Total learning time: 125h	Theory classes:	19h 30m	15.60%
	Practical classes:	9h 45m	7.80%
	Laboratory classes:	9h 45m	7.80%
	Guided activities:	6h	4.80%
	Self study:	80h	64.00%

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Content

1-Introduction to urban mobility

Learning time: 7h 11m

Theory classes: 1h
Practical classes: 1h
Laboratory classes: 1h
Self study : 4h 11m

Description:
Introduction to urban mobility. Key concepts on urban mobility. Urban transportation modes. Door-to-door transportation chain. Urban mobility evolution. Supply and demand management - TSM. Mobility data.
Analysis of the mobility data of the city of Barcelona.
Deliver of Assignment 1.

Specific objectives:
Present the basic concepts.
Understand the data sources and mobility patterns for the city of Barcelona.

2-Collective transportation

Learning time: 40h 48m

Theory classes: 13h
Practical classes: 4h
Self study : 23h 48m

Description:
Definitions. General ideas regarding demand & politics. Standards. Planning & design approaches. Shuttle systems - individual transportation. Time independent demand. Time dependent demand. Adaptive demand. Vickrey model for the morning commute. Shuttle systems - collective transportation. Time independent demand. Time dependent demand. Transit & cars together.
Idealized analysis. Limits to door-to-door speed. What we can do about it? Realistic analysis and optimization.
Assignment 1 correction
Hierarchies. Realistic analysis. Spatio-temporal accessibility. Agency costs & formulation. Solution & discussion. Generalization to simple service. One or two directional service. Local bus routing possibilities.
2D-Systems - Idealized analysis. New role for transfers. Systems with & without transfers.
Assignment 2 correction
Modifications for practical applications. Capacity constraint. Infrastructure cost. Skip stops. Different demand densities. Hybrid grids.
Hierarchies. Feeder systems. Comparison of individual transportation and collective transportation. Economies of scale. Stable and unstable equilibria. Routing flexibility.

Specific objectives:
Understand the shuttle systems.
Extending the model to corridors.
Generalize the ideas of simple service to a service with hierarchies.
Understand the two-dimensional systems.
Constraints for practial implementations.
Final discussion on 2D systems

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3-Transit network design - Barcelona case study

Learning time: 9h 36m

Theory classes: 1h
Practical classes: 3h
Self study : 5h 36m

Description:
The hybrid concept. LCF & constraints. Solution.
Transit networks for different cities (Barcelona case study). Spatial coverage. Effects of demand intensity and city size. The role of metro and LRT. Implementation issues. Multiple transit systems. Hierarchy in 2D (feeder systems).
Assignment 3 correction

Specific objectives:
Understand in more depth the concept of the hybrid network.
Present concepts that support the design of the new bus network in Barcelona.

4-Paratransit - Flexible transit and vehicle sharing strategies

Learning time: 21h 36m

Theory classes: 7h
Practical classes: 2h
Self study : 12h 36m

Description:
Benefits of flexible routes. Ways of delivering flexibility.
Model. Solution and discussion. Taxi with a buffer of pax. Dial-a-ride. Model. Comments.
Vehicle sharing. System types. Analysis of 1-way with periodic balancing. Discussion.
Mini - Project solution

Specific objectives:
Introduction to transportation systems on demand.
Modeling taxis and dial-a-ride systems.
Modeling shared vehicle systems.

5-Urban traffic management

Learning time: 7h 11m

Theory classes: 2h
Practical classes: 1h
Self study : 4h 11m

Description:
Macroscopic approach to urban traffic regulation. Gridlock concept. Macro fundamental diagram. Future traffic signals: MFD regulation. AB control rule. Empirical analysis: on the existence of the MFD. Simulation. Multiple zones extensions. On the allocation of city space to multiple transport modes. The role of parking.
MFD - Example for the city of San Francisco (CA).

Specific objectives:
Understand the regulation according to the MFD.
Application of the method.

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6-Final Exam	Learning time: 7h 11m Laboratory classes: 3h Self study : 4h 11m

Qualification system

The grade of the course is obtained from the marks of 3 homework assignments (each one accounts for 15% of the final mark), 1 group mini-project (20% of the final mark) and a final exam (open notes, open book, 35% of the final mark).

These assignments and mini-project will be held during the course (outside class). All of them will be corrected during class hours.

The final exam will be held the during the last programmed lecture for the subject.

Regulations for carrying out activities

If any of the evaluation activities is not handed in in the scheduled period, it will be marked with zero.

Bibliography

Basic:

Daganzo, C.F.. Public Transportation Systems: Basic Principles of System Design, Operations Planning and Real-Time Control. 1. Berkeley, California, USA.: Institute of Transportation Studies, University of California, Berkeley., 2010.

Complementary:

Meyer, M. and E. Miller. Urban Transportation Planning. 2. Mc Graw Hill., 2001. ISBN 978-0071200004.

Transit Cooperative Research Program. Transit Capacity and Quality of Service Manual. 2. Washington D.C. USA: Transportation Research Board, 2003. ISBN CRP-CD-02.

Vuchic, V. Urban Transit Operations, Planning and Economics. 1. Wiley, 2005. ISBN 978-0471632658.

Vuchic, V. Urban Transit Systems and Technology. 1. Wiley, 2007. ISBN 978-0471758235.

Hall, R.W.. Handbook of Transportation Science.. 2. Springer, 2003. ISBN 978-1-4020-7246-8.