

# ABSTRACT OF HABILITATION THESIS

## Urban mobility - a main theme of the sustainable development

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The thesis summarizes scientific and academic results from 2011 to 2021, after awarding the PhD in Engineering Sciences. The thesis aims to prove the professional experience and competencies that recommend me for PhD supervising in the domain of Transport Engineering.

The thesis is structured in two parts. The first section presents results of the activity performed during the postdoctoral program, and national and international research projects, issued in ISI indexed specialized journals and proceedings of prestigious conferences. The second part emphasizes the main stages of the academic, and scientific activity in the Transport, Traffic and Logistics Department and the Transportation Research and Consulting Centre. Further, future research directions are highlighted.

Following the interest in the understanding of the complex characteristics of the mobility demand, and the designing of strategies for the development of traffic infrastructures and sustainable mobility solutions integrated into land-use and urban planning, the first part of the thesis aggregates achievements regarding urban mobility. The selected research followed the next main objectives:

1. Conceptual clarification of mobility and emphasizing the necessity of the interdisciplinary study of mobility.
2. Identifying solutions to increase public transport performances.
3. Development of models for urban logistic schemes implementation to reduce the negative effects of freight transport.
4. Assessing the risk related to road traffic and identifying solutions to increase the intrinsic safety performance on urban traffic networks.
5. Development of a methodology for timing the transport/traffic investments based on additional socio-economic assessments.

According to these objectives, the first section of the thesis is organized in five chapters in which the presented concepts, models and case studies are complemented by developed methodologies revealing the complexity of topics, the stimulating feature of the defined problems, and, also, future research directions.

My research activity carried out during and after the doctoral study has been marked out by implication in multidisciplinary teams focus on comprehension of the complex interconnections between land-use/urbanism and travel/transport. As a synthesis of that activity, but also as motivation for future interdisciplinary research directions, *the first chapter* of the thesis

emphasizes the role of contemporary mobility in sustainable development, its broad fields, and its particularities.

**The second chapter** summarizes the results of the research on the increase of performances of urban public transport, which is an important component of solutions for sustainable urban mobility. The issues regarding the correct definition of indicators for assessing the economic, social, and environmental role of public transport systems, the analysis of the correlations between commercial efficiency and productive efficiency, the solutions for integration of different types of services to improve public transport performances are presented.

The recent research on transport logistics, founded on PhD Thesis "*Research on medium distance multimodal transport network. Mathematical and simulation models for terminal location and development*" and activity in the international projects have continued to focus on identifying solutions for the freight transport and transfer of goods in line with the sustainable development goals. I have been constantly involved in studies regarding city logistics. Thus, during 2007 – 2017, I had the opportunity to attend (as co-author) International Conferences organized by City Logistics Institute – Kyoto University. **The third chapter** presents a selection of these results, describing the methodology for identifying logistics strategies that could increase the efficiency of freight transport, reduce fuel consumption and environmental effects. For the presented logistic schemes, the problem of urban distribution centres location is further analysed. Additionally, the benefits of mutualization between the logistics platforms of one or more distributors are demonstrated. Three scenarios for grouping/consolidating the flow of goods specific to urban distribution are exemplified. The results of the case study emphasize that mutualization solutions need to be particularized function of local relationships between transport and spatial planning (geographical locations, configurations of connections on existing infrastructures between logistics platforms).

Generally, the road safety impact has been seldom included in the urban traffic project assessment, even if the social costs of crashes are evaluated as being very high. Recently, road traffic safety is recommended as an additional criterion in the selection of urban planning alternatives, aiming to prior minimizing the number of crashes. Although Sustainable Urban Mobility Plans (SUMP) define road safety as one of the objectives of designing scenarios for the development of mobility supply, no appropriate methods have been available for assessing the road traffic risk for different urban structures and traffic flows patterns. Starting from this framework, I initiated and coordinated multidisciplinary research on the estimation of the safety performance for the road network in Bucharest. The results are synthesized in **Chapter 4**. Defining and identifying the concept of "risk situation" in a geographic information system (GIS), in a relevant model for spatial and functional analysis, criteria can be established for representing different aspects of road traffic risk linked to urban activities. In this way, road risk assessments can be included "ex-ante" in the ranking of funding of land-use and urban development projects. The presented models refer only to intrinsic road safety factors, i.e. those characterizing the urban area and the road network features (factors related to the traffic user behaviour are not included in that research).

**Chapter 5** contains topics regarding the assessment of investment projects for traffic infrastructure. It presents a model for investment timing function of time of project implementation, amount of works, and supplementary social costs produced during works. Generally, the present methodologies applied to assess the socio-economic efficiency of investment projects ignore the additional costs incurred during the execution of the works (supported by infrastructure users, transport beneficiaries and /or riparian). Therefore, the assessment conclusion could be inaccurate.

Considering investment costs, and global social costs before, during and after project implementation, the proposed methodology estimates the starting and the completion of the works for minimum losses. It recommends the timing of yearly investments, and consequently, solutions for the planning of transport infrastructure works.

*The second part of the thesis* presents the results of the academic and research activity and the main future research directions. Considering scientific research as an intrinsic component of the educational activity, I have been constantly concerned with the upgrading of the course content accordingly to the fundamental requirements of future jobs. Based on so far scientific achievements, future activity will be focused on the following research directions:

- Research on sustainable mobility solutions in large congested urban areas under multiple restrictions
- Holistic appraisals of the transport system to increase global performances
- Research on the integration of innovative technologies for passenger and freight transport
- Research on the increase of traffic safety and transport security
- Research for the technical, economic and financial substantiation of transport and traffic investment projects.