MULTI-OBJECTIVE OPTIMIZATION FOR PASSENGERS' ROUTING USING PASSENGER CAR VS. BICYCLE

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Doctoral thesis

The urban transportation network is very complex which leads to a decision regarding modal choice that is equally complex. Furthermore, regarding to the importance of using a bicycle for short distance trips in urban transportation network, this PhD thesis is focused on the main characteristics / impacts of bicycle and passenger car for a proper route selection. Increasing people's awareness regarding to the specifications and consequences of their decision about using a passenger car or a bicycle for their trips can help them to plan their trips in urban areas. Moreover, the bicycle and vehicle users' opinion will play an important role in our decision making process. Survey data gathered by presential and online forms will be used to prioritize the alternatives considering the criteria by Analytic Hierarchy Process (AHP).

The present work combines two main sections: theoretical section of work that aims to propose a multi-objective model for route selection and a practical section. The case study of this thesis is the urban transportation network in Aveiro city and the achieved result can be applied for cities with similar scale.

In this Thesis, two main scenarios will be taken into account to find the optimum solution for short trips where travel distance is less than 30 km; (i) result of route selection for short distance trips using bicycle only, (ii) result of route selection for short distance trips using the passenger car. Then, the options (i) and (ii) were examined in order to find the best multi-objective solution integrating traffic performance, emissions and safety. The novelty of this thesis is related with the use of vehicle routing problems (VRP) with three-dimensional optimization methods and with the focus on the role of bicycle.

Traffic operation of selected urban transportation network was videotaped and the necessary data were extracted to calibrate and validate VISSIM microscopic traffic model. Vehicle Specific Power (VSP) methodology was used to estimate global and local pollutant emissions produced by vehicles and Surrogate Safety Assessment Methodology (SSAM) was used to assess the safety concerns. Traffic performance, emissions and safety were optimized using the fast Non-Dominated Genetic Algorithm (NSGA-II).

KEYWORDS*:* Microscale modeling, Multi-objective optimization, Passenger car-bicycle routing, Traffic, Safety, Emissions
PERIOD: 1st of January 2015 – 30th of November 2018
ACKNOWLEDGEMENTS: FCT Project @CRUiSE, funded under Project 9471 - Strengthening Research, Technological Development and Innovation (Project 9471 - RIDTI) and supported by the European Community Fund ERDF, and to the Strategic Project UID-EMS-00481-2013.

http://www.getransportes.com/Fatima_2017%28index-314.html%29/GEt2017_FINAL.pdf (under publication).