



20th EURO Working Group on Transportation Meeting, EWGT 2017, 4-6 September 2017,
Budapest, Hungary

Heuristic approach in a multimodal travel planner to support local authorities in urban traffic management

Grzegorz Sierpiński ^{a*}, Marcin Staniek ^a

^a Department of Transport Systems and Traffic Engineering, Faculty of Transport, Silesian University of Technology,
Krasińskiego 8 Street, Katowice 40-019, Poland

Abstract

Effective urban traffic management requires knowledge about current situation and tools to transfer information between local authorities and transport systems users. From this point of view, individual user route planning should correspond with general traffic flow management. During recent years significant increase of interest of web-based travel planners was observed. Authors suggest to connect the above issues. For this reason, Green Travelling Planner (GT Planner) was implemented. What the tool allows, among others, is optimum route planning (four optimisation criteria: quicker, shorter, cheaper and greener) using one of the eleven travel modes (including multimodal combinations). It may be used as an official urban multimodal travel planner and can be controlled by local authorities. The heuristic approach which was implemented in GT Planner makes it possible to support urban traffic management by adding specified factors as attributes of links in the graph of transport network. This solution can also be used to optimise the transport systems and public transport planning based on actual travel needs collected as Big Data as GT Planner is used.

Examples provided in the article are based on partial results of the international project entitled “A Platform to analyse and foster the use of Green Travelling options” implemented under the ERA-NET Transport III Future Travelling programme and financed by the National Centre for Research and Development.

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Peer-review under responsibility of the scientific committee of the 20th EURO Working Group on Transportation Meeting.

Keywords: management of transport systems; route planning; heuristic methods in optimization; travel behavior; traffic flow modeling, real-time urban travel planning, dynamic control of traffic by travel planner, urban traffic management support

* Corresponding author. Tel.: +48-32-603-4150.

E-mail address: grzegorz.sierpinski@polsl.pl

1. Introduction

In times of increasing mobility, contemporary cities are faced with intensifying problems when attempting to maintain smooth traffic flow. Congestion increases the probability of collisions in road traffic, it is primarily responsible for growing noise levels, fuel consumption and emission of harmful substances into the environment. Moreover, the prevalence of passenger cars in the modal split of traffic translates into reduced efficiency of urban space utilisation. This issue has recently been experienced more and more severely, particularly in city centres and areas densely developed with public utility features (Marshall and Kanister (2000)). Various guidelines prepared by such institutions as the European Union (White Paper (2011) and Clean Power for Transport (2013)) imply that mobility should not be limited, but rather transformed in terms of how it is pursued (means of transport). The concept of modal shift represents a trend proposed as one of the solutions to the problem of more efficient use of public space and a measure to reduce the negative environmental impact of transport. Another difficulty tackled in cities is to attain appropriate distribution of traffic streams in the transport network. Some streets become congested, while others (offering only slightly longer times to reach the destination point) retain considerable unused traffic flow capacity. Users of passenger cars prefer more familiar routes, even though they force them to wait in long queues and face congestion, which only makes the situation worse. Another problem is the information transfer. Contemporary cities should pursue integration in every domain, also in the sphere of transport processes. What is needed in this respect is good communication between the travelling population and local authorities. On the one hand, information transfer should encompass acquisition of data concerning travelling persons, which contributes to identification of their actual needs. On the other hand, a person who intends to make a trip should receive comprehensive information from the municipality about the possibilities to complete it. The foregoing comprises means of transport (including public transport services) as well as comparisons of costs, time etc. Consequently, travel planners are becoming increasingly popular services supporting the travelling population (among others Esztergár-Kiss and Csiszár (2015) and Borkowski (2017)). Furthermore, existing travel planners still have some functionality deficiencies (a review of them can be found in Földes and Csiszár, (2015)). Both the multitude of solutions available in this respect and the fact that local authorities are not involved in consultations cause that the tools in question transfer information in one direction only, taking the travellers' interest into consideration. Meanwhile, what seems equally important in this case is data standardisation and identification of a single information service for the given area. It should be emphasised that only under the foregoing conditions may the information transfer be considered complete in both directions, and all decisions made by local authorities can be directly delivered to the travelling population.

The potential to support local authorities in more efficient management of urban traffic by affecting the choice of routes and travelling modes made by the travelling population has been described in the article. The multimodal travel planner known as Green Travelling Planner (GT Planner) is one of deliverables of the international project entitled "A platform to analyse and foster the use of Green Travelling options" implemented under the ERA-NET Transport III Future Travelling programme and co-financed by the National Centre for Research and Development (Project Proposal (2013)). The following sections of the article describe the heuristic approach applied in the planner, extending its features beyond those offered by other route planning systems. The heuristics added to the solution may find practical application in many different situations tackled by local authorities while managing urban traffic. The article ends with a collation of results of numerical studies which followed implementation of specific heuristics over an area of 19 cities forming the Upper Silesia Conurbation (Poland).

2. Methodology

2.1. *Green Travelling Planner*

The main deliverable of a project entitled "A Platform to analyse and foster the use of Green Travelling options" is an expanded system that supports local authorities in decisions making concerning the incentives and restrictions applied to different groups of users (travelling population). As an outcome of these activities, it is possible to shape the travelling population's behaviour patterns. The system components include a tool for simulation of changes in the distribution of traffic streams caused by local authorities undertaking specific actions (prepared by project

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