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Influence of Different Route-choice Decision Modes

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Abstract

More and more drivers use GPS based tools (GNSS) to plan their route in order to choose the optimum route (shorter, faster or the most economical). These GNSS devices can operate offline or online. Off-line, when the GIS database is installed in the device and there is not any information regarding the actual traffic flow, in that case the program always calculates the same route between two places. Online, when the actual traffic flow information is available, in that case there is the possibility of the calculation of the optimal route in real time. Based on the above options, the driver's route-choice decision can be static, dynamic or informed. Static, when the driver always follows the same route: either without using a GNSS device (choosing the usual way) or with an offline device. Dynamic, when the driver chooses the way conforming to only real time visual information on the spot without any navigation tool or external information, and decides according to traffic density. Informed, when the GNSS device calculates the optimal route in line with the current traffic flow information.
The aim of this study is the present the influence of the proportion of different route-choice decision modes.

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Keywords: Route-choice method; Traffic simulation; Travel time

1. Introduction

Travelers' route choice methods are important research fields in the point of view of traffic flow optimization on the road network. The aim is to improve intelligent traffic control. There are a lot of studies focusing on route choice theory, Zhang and He published a prospect theory which is based on psychological research. Lindsey and al. studied

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the effects of pre-trip information on route-choice decisions when travel conditions are congested and stochastic. He and al. propose a day-to-day route choice model based on traveler's behavioral characteristics.

In recent years route-choice modeling has been the topic of several theoretical studies. Yang and Jiang developed an enhanced route choice model based on cumulative prospect theory. This model can realistically identify risk attitudes and time reliability demands. Smith and al. presented idealized natural general and special dynamical models of day-to-day re-routing and of day to day green-time response. Hess and al. tested an application in route-choice modelling using Global Positioning System (GPS) data, focusing on heavy goods vehicles which typically make longer journeys with decisions potentially underpinned by different priorities from those used by car drivers. The route-choice model of Manley and al. regarded the nature of human cognitive ability, memory and preference. Jayasinghe and al. investigated the relative importance of metric distance, topological distance and geo-metrical distance in determining the route choice behavior of motorized travelers by mode. Their study is based on data which has traced the travelers' actual movements by using mobile GIS applications.

Wahle and al. studied expected effects of the use of actual traffic information on travelers' route choice, but they based their assumption on the fact that the information gets to all drivers, so they can pay attention to them.

Nowadays, car dealers offer built-in navigation devices for all new cars. Besides, drivers can use portable navigation gadgets, moreover, mobile phones have numerous navigation applications, which make planning the optimal route easier taking the different optimum criteria into consideration.

These devices calculate the length of the route, the estimated travel and arrival time, and trace the car during the journey and recalculate if needed.

Navigation devices are classified into three groups according to function:

1. Offline, when data needed for navigation are stored in the device and there is no online information about the actual traffic condition for calculating the optimal route.
2. Semi-online, when road network data are stored in the device and the actual traffic condition is available online via GSM, RDS.
3. Online, when the optimal route calculation is made by the service provider and sent to the driver's mobile device, on which there is such an application that can show and use it for navigation.

The aim of this paper is to present the study of a practical approach of route choice methods and process by using different navigation devices and their service levels, furthermore, the influence of the different distribution of the route choice methods on traffic flow and travel time.

Nomenclature

v	vehicle speed (km/h)
D	traffic density (vh/km)
V	traffic volume (vh/h)
VMS	Variable-messaging Sign

2. Method

One of the most suitable methods of examining the effects of route choice, traffic flow and travel time is computer simulation, as we can collect data from optional road network, at different traffic volume and with the proportion of different route choice methods.

The two main elements of the simulation model, the road network and the vehicle (including the driver) both have several general and particular characteristics. The applied model only includes the most important characteristics and manoeuvers from the point of view of the examination. Detailing the microscopic simulation is not necessary for determining the average travel time of the vehicle, there is no need for determining detailed movement/motion of all vehicles (e.g. acceleration) according to simulation cycle, and to register overtaking and changing lanes of each vehicle.