Available online at www.sciencedirect.com

ScienceDirect

Transportation Research Procedia 6 (2015) 313 – 324

Transportation Research Procedia

www.elsevier.com/locate/procedia

4th International Symposium of Transport Simulation-ISTS'14, 1-4 June 2014, Corsica, France

On-street parking search time modelling and validation with survey-based data

Sylvain Belloche [a]*

[a]*Cerema, 25 Avenue François Mitterrand CS 92803, Bron cedex 69674, France*

Abstract

Multimodal journey planners tend to develop in cities so as to help a traveller to choose the most appropriate mode or modal combination according to the foreseen journey. However, multimodal journey planners do seldom take into account the time needed to park a car whereas it includes waiting and transfer times for public transport. This results in an underestimation of car travel time favouring this mode when compared to others such as public transport. In literature, car parking is mostly seen in a strategic point of view, dealing with the impacts assessment of parking policies. There is little knowledge about modelling the user's behaviour and the time needed to park a car. Axhausenet al. (1994) have experimented modelling off-street parking search time in Frankfurt. The model appears robust, but it has not been experimented for on-street parking.

Therefore, the focus of this paper is on modelling on-street parking search time. The modelling starts from Axhausen'sproposal for off-street parking, but specificities of on-street parking allow for taking into account several models to estimate on-street parking search time. These models are then confronted to a survey done in several districts of Lyon. The results of this confrontation give interesting conclusions about on-street parking search time modelling, validation and further research needs in order to improve the model robustness

Selection and/or peer-review under responsibility of the Organizing Committee of ISTS'14

Keywords: on-street parking; search time; multimodality; modelling;

1. Introduction and literature review

Several modes of transportation are available in a city, enabling a traveller to choose one or a combination of several of them to achieve a journey. In order to help these travellers in their choice, multimodal journey planners

* Corresponding author. Tel.: +33-472-745-938; fax: +33-472-745-960.
E-mail address: sylvain.belloche@cerema.fr

Selection and/or peer-review under responsibility of the Organizing Committee of ISTS'14
doi:10.1016/j.trpro.2015.03.024

have been developed during the last past years. These planners often give as a result to a user's request the time needed to the traveller to achieve the foreseen journey, and the mode or the modal combination that is to be considered. However, if a journey planner does take into account transfer times or waiting time for public transport, it seldom takes into account the time needed to park a car. The main reason for that is the little knowledge about the car parking issue and the lack of models that give an accurate estimation of parking search time, especially when considering on-street car parking. However, there is evidence that the car parking search time is far from being inconsiderable: a survey in a few districts in three French cities shows that the average on-street car parking search time is often higher than several minutes, e.g. 10 minutes in the Commerce district in Paris (Gantelet & Lefauconnier, 2006). Moreover, the literature review of twentieth-century cruising for parking studies (Shoup, 2006) indicates that the average searching time goes from 3.5 to 13.9 minutes. Therefore, this parking search time may influence the journey planner result, and consequently the traveller's choice when considering the modal alternatives to achieve a journey.

If car parking search time has to be taken into account so as not to favour the car in comparison with other modes, few models dealing with on-street car parking search time have been suggested in the literature, and even fewer have been validated thanks to on-field data. Indeed, the car parking search time is the result of individual experiments and therefore depends either on individual strategies or on parking-related variables. As for individual strategies, Polak & Axhausen (1990) have classified them in seven categories, with five of them dealing with on-street parking. The strategy in which drivers are supposed to circle around their destination to find a vacant on-street space is often admitted to be the most used strategy when on-street parking is full (Spitaels & Maerivoet, 2008), and the longer the driver searches, the greater the radius of the circle goes (Gantelet & Lefauconnier, 2006). Other strategies, such as looking for an on-street space next to the destination before going to an off-street facility or choosing illegal parking are other strategies in use (Polak & Axhausen, 1990). The driver's knowledge of the district, the destination and the trip purpose (Spitaels & Maerivoet, 2008) (Hualiang et al, 2002) also have an influence on the on-street parking strategy and search time.

On-street parking search time may also depend on parking-related variables, such as the occupancy ratio, the parking capacity (i.e. the number of parking spaces in the vicinity of the destination), the turnover rate and the place fee (Spitaels & Maerivoet, 2008). As suggested by Polak & Axhausen (1990) but also by Hualiang et al (2002), these variables are dynamic, depending on the time and the day of arrival of a driver, and therefore quite difficult to measure in practice (Spitaels & Maerivoet, 2008). Other parameters may influence the search time, such as traffic conditions (Polak & Axhausen, 1990), but a few studies show that the average search speed is nearly constant at about 10 to 12 km/h (Benenson et al, 2008) (Levy et al, 2012).

On-street parking space search also differ from off-street parking space search in at least two ways. First, and even if a few experiments have recently been carried out, there is seldom information given to drivers about vacant spaces in the street: drivers have therefore to find a vacant space by themselves quite always, and according to Hualiang et al (2002), this lack of information influences significantly the parking search time. Second, illegal parking is to be considered since it is noticed in practice in surveys (Gantelet & Lefauconnier, 2006) (Benenson et al, 2008) and considered as a strategy (Bifulco, 1993), especially for short stays (Spitaels & Maerivoet, 2008).

Models in literature often simplify these differences and specificities. Axhausen et al (1994) have introduced a very simple model that gives the search time function for off-street parking: see equation (1) below, where t is the average search time experienced by drivers, α is a structural parameter, Occ is the estimated occupancy of the parking facility and K is the total capacity of the facility. This model can be easily transposed to on-street parking since it only considers the occupancy ratio and a structural parameter α.

$$t = \frac{\alpha}{1 - \frac{Occ}{K}} \tag{1}$$

The model has been confronted to on-field data in Frankfurt, but only for an off-street parking facility (Axhausen et al, 1994).