Available online at www.sciencedirect.com

ScienceDirect

Transportation Research Procedia 20 (2017) 193 – 199

Transportation Research Procedia

www.elsevier.com/locate/procedia

12th International Conference "Organization and Traffic Safety Management in large cities", SPbOTSIC-2016, 28-30 September 2016, St. Petersburg, Russia

Method for Evaluating Economic Efficiency of Parking Management Tools

Dmitriy Fadeyev *

Irkutsk National Research Technical University (INRTU), 83 Lermontov str., Irkutsk, 664074, Russia

Abstract

Parking policy determined and carried out in today's cities is based on a system of priorities. The main of them is the formation of a comfortable, favorable, safe and environmentally friendly city space. The goal can be reached if a certain city area is forbidden for cars. This study is aimed at economic evaluation of parking management tools, and analysis of users' behavior with a glance to applied management tools. The study allowed obtaining comparative evaluations of efficiency of paid parking and time constraint by the example of Irkutsk. Besides, the study determined the optimum rate and the way how costs of searching for a parking spot influence the efficiency of management tools.

Peer-review under responsibility of the organizing committee of the 12th International Conference "Organization and Traffic Safety Management in large cities"

Keywords: parking; parking policy; payment for parking; parking time constraint; economic efficiency; parking duration

1. Introduction

One of the most serious problems of central parts of big cities is inability to meet the vehicle owners' demand for parking. Various popular objects concentrated on a relatively small area are often located in the historical part of the city with its established pattern and city-planning program.

* Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000 .
E-mail address: fadeevds7@gmail.com*

Peer-review under responsibility of the organizing committee of the 12th International Conference "Organization and Traffic Safety Management in large cities"
doi:10.1016/j.trpro.2017.01.050

In this situation, the parking policy concept should be determined with due consideration for the peculiarities of a certain city, especially in requirements for preserving historical and cultural heritage and public space availability. The world experience in application of parking management tools makes it possible to identify the most common of them: differential payment in different kinds of parking areas; assigning zones for time constraint parking; creating priority groups (for example, according to the place of residence); and minimization the total number of parking spots. Pricing is a powerful tool of parking management in modern conditions. It should be emphasized that money for parking as a rule comes to the municipal budget and often are used by the authorities to maintain and develop the public transport infrastructure and create new livable streets and public places.

The aim of this study is the economic evaluation of parking management tools and analysis of users' behavior with a glance to applied management tools.

The object of this study is the whole of on-street and off-street parking areas for cars in the central part of a big city.

The subject of this study is the range of parking management tools from the viewpoint of efficiency and users' behavior.

2. Methods

In order to achieve the aim of this study, the following steps were determined and made: (1) to choose and justify an economic mathematical model for the economic evaluation of parking management tools, and the assessment of its possibility and consistency; (2) to collect and evaluate the required data; (3) to analyze and interpret the obtained data; (4) to present results of the study.

2.1. The choice and justification of a model

As it is said above, the main instruments regulating the access of cars to the city center are the parking management tools (limited number of parking spots): either by parking payment, or by parking time constraint. The paper of Douglas (1975) shows that the choice of a management tool for parking is of high importance as it influences drivers' behavior, when they search for a parking spot, and their additional costs. Every driver has to find either an on-street parking spot or a direct way to an off-street parking court. According to Brown (1991) and Gillen (1978), if on-street parking areas are free of charge but have a time constraint, while off-street parking courts require payment, drivers as a rule prefer the first type of parking, in spite of the fact that they have to spend time to find a spot. Calthrop (2001), Calthrop et al. (2000) hold the same view. It is noted in papers of Kodransky and Hermann (2011) that this situation creates a serious problem: drivers searching for a parking spot induce 50% of traffic jams.

There are many studies of management strategies for parking. Some authors consider pricing as a means to recover costs generated by street traffic congestion. Glazer and Niskanen (1992) show in their studies that the increase of parking payment together with restricted trips to the city center can lead to transit traffic. Vickrey (1994) describes in his study a mechanism of pricing in on-street parking areas in peak hours. According to this mechanism, the price of empty parking spots is a function of the number of unused areas. The paper of Arnott and Rowse (1999) gives a simulation of the work of parking network aimed at minimizing people's time expenditures for movement to the city center.

In the view of existing aims of the study, a decision was made not to apply models which take into account only one management tool without possibility to assess the balance of different types of parking areas. The most complex model was proposed by Calthrope and Proost (2000). It describes parking management by two tools: payment for parking and time constraint. Table 1 shows the main parameters of the considered model.

Table 1. The main parameters of the model

Parameter designation	Parameter
X	The number of spots in on-street parking areas
Q_X	Total parking time in off-street parking courts in peak hours
Y	The number of spots in off-street parking courts
C	The price of parking per time unit in off-street parking courts
N	The number of drivers who want to park their cars in peak hours