Accepted Manuscript

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Please cite this article as: Małecki K, A computer simulation of traffic flow with on-street parking and drivers' behaviour based on cellular automata and a multi-agent system, *Journal of Computational Science* (2018), https://doi.org/10.1016/j.jocs.2018.07.005

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A computer simulation of traffic flow with on-street parking and drivers' behaviour based on cellular automata and a multi-agent system

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Highlights

- A parking model based on cellular automata and agent-based technology, considering drivers' behaviour, was developed.
- Actual traffic data has been taken into account.
- Patient drivers have a positive impact on traffic flow.
- The use of a Parking Guidance System for on-street/curb parking has a positive effect on traffic flow.

Abstract

Urban traffic is becoming more and more intensive, but the amount of space available for parking along city streets is not increasing at a rate commensurate with the rising number of new vehicles. This study looks at on-street/curb car parks, i.e., parking spaces located along streets or in one lane of a street. This article describes a simulation of the behaviour of various drivers in the process of on-street parking, and the impact of such parking on traffic flow, speed and travel time in the studied street fragment. This study is the first among other research studies on curb and on-street parking to consider driver behaviour such as patience, perceptivity and the use of indicators (turn signals). It also considers the impact of vacant parking-space marking. The study was performed on the basis of field research data. Drivers' behaviour was simulated in the form of agents' logic in a multi-agent system. The structure of the road, car park and vehicle traffic were reproduced on the basis of cellular automata, extending the known and proven Nagel-Schreckenberg, STCA, F-STCA and other models. Research results are helpful in teaching motorists how to park on-street or on the curb. Paying attention to the aspects of effective and streamlined parking may significantly improve traffic flow efficiency.

Keywords: computer simulation, cellular automata (CA), multi-agent system, on-street parking, traffic flow

1   Introduction

The issue of parking has been discussed in the literature for more than 40 years. The first studies concerned the principles of correct on-street parking [1,2], and were followed by empirical studies on the factors that determine the choice of a parking space [3,4], the impact of parking fees on travel costs [5], and the stochasticity of vacant parking spaces [6]. Unfortunately, urban traffic is becoming more