
A macroscopic off-street parking decision model

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Off-street parking has been gaining attention in recent research, but its interdependency with searching-for-parking traffic and demand-responsive on-street parking pricing is still unknown. In this paper, we develop a macroscopic formulation to model off-street parking dynamically and its interaction with cruising vehicles and on-street parking. The methodology builds on a previous dynamic macroscopic parking pricing study, whose model is extended with off-street parking to better replicate reality.

This study focuses on the decision model of parking searchers between paying the on-street parking cost, deciding to use off-street parking, or continuing the parking search to obtain a lower on-street parking cost. The decision for off-street parking is affected by its cost, the off-street parking fee, the users' driving cost to the off-street parking garage, and the users' walking distance to their final destination. If drivers decide to use an off-street parking garage, they can access it depending on its current capacity, or alternatively move back into searching-for-on-street-parking traffic state. In other words, the model describes the trade-offs users make between a longer cruising time, a lower price for either on- and off-street parking, a shorter driving distance to the off-street parking location, and a shorter walking distance to their final destination.

Compared to most literature, this macroscopic parking model has rather low data requirements, mostly related to average values and probability distributions across time at the network level. Hence, this macroscopic approach saves on data collection efforts and reduces the computational costs significantly.

The model provides a preliminary idea for city councils regarding the interdependency between on- and off-street parking pricing, the impacts of off-street parking on the searching-for-on-street-parking traffic (cruising), the congestion in the network (traffic performance), the total driven distance (environmental conditions), and the revenue created by on- and off-street parking fees for the city.

Keywords: Macroscopic off-street parking model; Demand-responsive on-street parking pricing; Parking-related traffic state; Cruising-for-on-street-parking.