Transportation Research Part A 64 (2014) 54–64

Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: www.elsevier.com/locate/tra

Truck parking in urban areas: Application of choice modelling within traffic microsimulation

Mehdi Nourinejad *, Adam Wenneman [1], Khandker Nurul Habib [2], Matthew J. Roorda [3]

Department of Civil Engineering, University of Toronto, 35 St. George Street, Toronto, ON M5S 1A4, Canada

ARTICLE INFO

Article history:
Received 19 July 2013
Received in revised form 2 January 2014
Accepted 12 March 2014
Available online 16 April 2014

Keywords:
Parking
Policy
Choice modelling
Microsimulation

ABSTRACT

Urban truck parking policies include time restrictions, pricing policies, space management and enforcement. This paper develops a method for investigating the potential impact of truck parking policy in urban areas. An econometric parking choice model is developed that accounts for parking type and location. A traffic simulation module is developed that incorporates the parking choice model to select suitable parking facilities/locations. The models are demonstrated to evaluate the impact of dedicating on-street parking in a busy street system in the Toronto CBD. The results of the study show lower mean searching time for freight vehicles when some streets are reserved for freight parking, accompanied by higher search and walking times for passenger vehicles.

1. Introduction

Central business districts (CBDs) are major destinations for goods pickup and delivery in Canada's urban centres. "Last mile" delays in CBDs are one of the most expensive components of urban freight (O'Laughin et al., 2007). In this "last mile", truckers must navigate congested urban streets and search for appropriate parking. When parking is unavailable or inappropriately located, delivery vehicles frequently park illegally, often considering the parking tickets as a cost of doing business. This cost is increasing over time. From 2006 to 2009 parking fines in Toronto increased 70%, and there is little evidence that illegal parking problems are being reduced. In Toronto, FedEx, UPS and Purolator paid an estimated $2.5 M in parking fines in 2009 (Haider, 2009).

The problem is significant and growing. The Toronto CBD, for example, receives a daily average of 81,000 packages from express delivery alone (Haider, 2009). Parking and loading spaces are limited in the CBD because many buildings were constructed before the invention of the automobile. Increasing land values have resulted in the conversion of surface parking lots to high-rise buildings, which in turn are increasing the demands for goods delivery.

Freight parking issues are common in other North American cities as well. The U.S. Department of Transportation (USDOT) together with the Federal Highway Administration (FHWA) and the Office of Freight Management and Operations prepared a series of case studies documenting best practices for urban goods movement. Reports were prepared for

* Corresponding author. Tel.: +1 647 262 6234.
E-mail addresses: mehdi.nourinejad@mail.utoronto.ca (M. Nourinejad), adam.wenneman@mail.utoronto.ca (A. Wenneman), khandker.nurulhabib@utoronto.ca (K.N. Habib), roordam@ecf.utoronto.ca (M.J. Roorda).
[1] Tel.: +1 416 708 0667.
[2] Tel.: +1 416 946 8027.
[3] Tel.: +1 416 978 5976.

http://dx.doi.org/10.1016/j.tra.2014.03.006
0965-8564/

Washington DC, Orlando, New York City, and Los Angeles. The purpose of these studies is to investigate initiatives aimed at mitigating congestion and improving efficiency of commercial vehicle operations, including parking (FHWA, 2009).

Urban policy makers are in need of data and decision support tools to identify impacts of parking policy scenarios such as dedicated on-street parking for commercial vehicles, time restrictions, and pricing policy. Traffic simulation tools are increasingly popular for urban traffic analysis, however, they do not currently provide sufficient representation of parking. Parking simulation models have been developed, but these models are for passenger parking, which is behaviourally different than truck parking. Econometric models of parking choices have also been developed, but again are limited to passenger cars (Habib et al., 2012).

This paper explores the potential of truck parking policies and develops a novel tool for assessing the impacts of parking policy. In Section 2, we provide a review of strategies for dealing with truck parking. In Section 3, we develop a truck parking selection model using data from a truck parking survey conducted in the summer of 2010. In Section 4, we develop a traffic simulation model for a small study area in the Toronto CBD. The model specifically represents on-street parking, off-street surface parking lots, parking garages, truck loading docks, and alleyways suitable for truck loading/unloading. A binary logit model for parking selection is incorporated in this simulation environment that is capable of assessing the traffic impact of changes in parking policy on truck parking choice. The model is applied to test the impact of two simple truck parking scenarios on measures of effectiveness such as time to find parking, walking distance to the final destination, and total network travel time. In Section 5, we present the conclusions of this research and suggest future research directions.

2. Literature review

The literature can be usefully divided into three parts: freight parking policies, parking simulation models, and parking choice models. In Section 2.1, we describe policies targeting freight vehicle operations and in Sections 2.2 and 2.3 we review the literature on simulation methods and choice models of parking policy analysis, respectively. Section 2.4 summarizes the findings of the literature review and identifies the research gap this work is intended to address.

2.1. Freight vehicle parking policies

In dense CBDs, curb space is a scarce resource with high demands from a variety of users. In these locations, commercial vehicles are competing directly with passenger vehicles for spaces to park. Curb space management policies impact road congestion, business vitality, urban aesthetics, and pedestrian safety and comfort (Zalewski et al., 2011). On-street parking is often the focus of parking management practices where there is not ample supply to fulfill the demand. Policy makers have generally responded to this problem by promoting parking turnover using control time limits and parking pricing. Higher meter rates, on the other hand, are endorsed by those who believe time limitations are challenging to monitor and enforce. Shoup argues that parking meters can create curb vacancies by directing a portion of drivers to off-street parking facilities (Shoup, 2006). This would reduce cruising for curb parking which can reduce congestion. Nevertheless, the generated revenue from parking meters can be spent on public improvement in the metered neighbourhoods. Pasadena is an example where charging market prices (off-street prices) for curb parking has reduced congestion and made the area safer and cleaner from the generated parking revenue (Kolozsvari and Shoup, 2003). Clearly, implementation of any passenger vehicle parking policy indirectly affects the operations of freight vehicle deliveries even if they are not the targeted group. Any policy that produces more vacant spaces on the curbside creates better opportunities for on-street freight parking.

In addition to the indirect effect of passenger vehicle parking policies on freight vehicles, loading zone regulations and freight restrictions directly impact freight deliveries. In response to recent freight vehicle operations issues, the Federal Highway Administration developed case studies in some of the major cities of the United States (Los Angeles, New York City, Washington, DC, and Orlando) to document prominent goods movement strategies (FHWA, 2009). Freight parking strategies employed in these cities included time restrictions, pricing strategies, parking space management, and parking enforcement.

2.1.1. Time restrictions

A common freight parking strategy used in many cities is time of day loading zone restrictions. The goal of such time restrictions is to separate commercial vehicles and passenger vehicles in urban areas temporally instead of spatially. In Manhattan, the New York City Department of Transportation (NYCDOT) is planning to implement delivery windows to designate curbside parking for freight vehicles in the morning and create better parking opportunities for passenger vehicles later in the day. They have learned that 65% of all deliveries occur before 12 PM and granting exclusive parking access to freight vehicles during these hours can reduce traffic congestion. A similar strategy is used in Philadelphia where loading zone restrictions (subject to parking enforcement) encourage local businesses to receive any deliveries before 10:00 AM (Zalewski et al., 2011). Jaller et al. (2013) estimated that, in Manhattan, shifting approximately 20% of freight traffic to off-peak hours would minimize the number of over capacity parking locations.

2.1.2. Pricing strategies

Pricing strategies, in general, can encourage greater turnover of both passenger and freight vehicles to create better parking opportunities for newly arriving vehicles. The District Department of Transportation (DDOT) in Washington, DC