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Sustainable urban freight systems and freight demand management

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Abstract

The paper defines the field of Freight Demand Management (FDM) and positions it in the broad range of public sector initiatives aimed at improving urban freight activity. To illustrate the magnitude of the impacts of FDM, the paper estimates the contributions to freight traffic by the various industry sectors in a sample of metropolitan areas, establishes the role of freight behavior research, and summarizes the performance of a number of FDM initiatives. The paper ends with a discussion of policy implications and conclusions.

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1. Introduction

The vast majority of the public sector initiatives that target urban freight aims at reducing its negative social and environmental impacts, which typically are the result of the freight vehicular activity. To this effect, transportation policy makers have enacted multiple initiatives that tend to focus on the physical infrastructure, the vehicular traffic, the vehicles, or the underlying logistical activity. This focus is a natural response to the involvement of freight vehicles in the generation of negative externalities.

However, on close inspection, research has revealed that the agent interactions at the core of supply chains play a fundamental role in shaping and generating the vehicle traffic that produces the undesirable effects (Holguín-Veras et

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al., 2015b). For instance, the freight traffic that produces congestion is the direct result of the delivery time decisions made by the receivers of supplies. Without receivers that demand their supplies during the peak traffic periods, the freight vehicles would not travel in congestion. If it were up to the carriers, they would travel in the least congested periods of the day. Truck idling is another example. This practice is routinely cited as a contributor to urban pollution and, as a result, a number of transportation agencies have enacted ordinance banning it. As in the previous case, the carriers have no incentive to idle, which is unproductive time. Quite frequently, trucks idle because the receivers are not ready to accept the shipments. Faced with the prospect of losing a customer for not making a delivery, or idling the truck to keep the cabin or the contents at a reasonable temperature, most carriers select the latter.

The key insight is that the roots of carrier behavior are frequently found in the decisions made by shippers and receivers. Central to this idea is the recognition that the participants in a supply chain are intrinsically linked by a common operational strategy, where the primary decisions are not always the carriers'. The agreement on a common operational strategy is essential to ensure the smooth transfer of the supplies that connect the dozens, and even hundreds, of production-consumption links that comprise modern production systems. At these links, a producer/shipper manufactures and ships the cargo that a receiver/consumer uses as an intermediate of final good. In between them, the carriers act as economic conduits that connect producers/shippers to receiver/consumers. The carriers' customers have a strong influence on how the deliveries are made.

From the standpoint of sustainability, the receivers play a critical role as they are the ones that generate the demand that, in turn, creates the traffic that produces the externalities. The receivers are a highly heterogeneous group that encompasses from small food vendors to large manufacturing sites in highly diverse industry sectors. As a result, the receivers exhibit great heterogeneity of operational practices and their responses to public policy. At the same time, the receivers are bound to play a key role in sustainability efforts because they: have the power to control how and when deliveries are made, are typically located where congestion is most acute, and are sensitive to public support for sustainable cities. Engaging receivers in the quest for sustainable cities is essential.

The main objective of this paper is to establish the rationale and potential of Freight Demand Management (FDM). To this effect, the authors position FDM within the broad range of public sector initiatives, discuss freight trip generation estimates to provide a clear picture of the contribution to congestion by the various industry segments found in urban areas, define the role that freight behavior research should play, discuss the experiences of a handful of FDM initiatives that have taken place, and identify the chief conclusions.

2. Overview of public sector initiatives

In this paper, the term *initiative* refers to the wide range of public sector interventions (e.g., strategy, program, project, policy) used to influence the urban freight system. As established by the authors (Holguín-Veras et al., 2014b, Holguín-Veras et al., 2014a) there is a wide range of initiatives that span the entire domain, from the supply to the demand side. A succinct discussion of the eight major groups follows.

Infrastructure management focuses on initiatives that improve freight facilities. This group includes construction and upgrade of ring roads to reduce the impacts of through-traffic, roads and intermodal terminals, freight clusters to relocate large freight generators, acceleration and deceleration lanes for trucks, the removal of geometric constraints at intersections, and building ramps for handcarts and forklifts. Large improvements tend to increase capacity in specific corridors, which primarily benefits large freight generators such as ports. Minor improvements seek to improve local conditions and alleviate congestion in specific corridors. In the case of the ramps for handcarts and forklifts, the initiative benefits the delivery activities serving small receivers (e.g., retailers, restaurants). Although increasing capacity may be necessary to ease traffic, the experience with passenger transportation shows that it may also induce demand.

Parking/loading areas management tries to improve the way in which the freight vehicles use urban spaces for pick-ups/deliveries. It includes the introduction of loading and parking restrictions, peak-hour clearways to increase the capacity of roads, vehicle parking reservation systems, the enhancement of building codes to handle current truck size, parking timeshare, upgrade of parking areas and loading docks, among others. Although these initiatives are generally beneficial, parking/loading management is not sufficient to solve all parking problems. There are cases where the parking supply is simply not sufficient to accommodate the demand from freight vehicles (Jaller et al.,