ASSESSMENT OF TRADEOFFS AMONG MULTIPLE VEHICLE CLASSES FOR URBAN DELIVERIES

by

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ABSTRACT

Effective intermodal corridor management, as its name suggests, must be aimed at ensuring an optimal use of the existing network. However, in order to achieve a quasi or optimal use, transportation agencies must be able to quantify the economic costs and benefits associated with the traffic of different vehicle classes.

In the case of commercial freight traffic, there is a severe lack of knowledge about the comparative advantages of fostering the use of small vs. large trucks. As it is widely known, a large truck generates more pollution and congestion than a small truck which is an obvious consequence of its larger size. However, what it is not frequently taken into account is that if the amount of cargo to be transported by each truck type is the same, large trucks are more efficient than small trucks. This is because, while the average payload for a semitrailer is 20 tons, the one for a single unit truck is 7 tons (Vehicle Inventory and Use Survey, 2002). As a consequence of this, transporting a given amount of cargo using single unit trucks would necessitate almost three times more traffic than if semitrailers are used. This leads to a situation in which, although the contribution to congestion and pollution of an individual small truck is smaller than that of a semi-trailer, their total impact may be greater because of the larger truck traffic.

This research is intended to be one of the first to shed light into the overall economic benefits and costs associated with different combinations of truck traffic. This was done by conducting micro-simulation, statistical modeling, valuation and optimization of a hypothetical network. The simulations are performed for different levels of demands with different combinations of traffic for passenger cars, small and large trucks in order to estimates the externalities as a function of a multimodal vector of traffic flow. Cost functions were generated to provide insight into the relative contributions to congestion pavement damage and pollution associated with the traffic. The costs obtained with these functions were used to find optimal combinations of truck traffic that minimize the total cost of externalities. The results demonstrate that heavy trucks are more optimal for minimum costs only if the payload of a small truck with respect to the payload of a heavy truck is 62.5% or less.