

Direct impacts of off-hour deliveries on urban freight emissions

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Abstract

The most significant negative environmental impacts of urban trucking result largely from travel in congested traffic. To illustrate the potential of innovative solutions to this problem, this paper presents new research on the emission reductions associated with off-hour freight deliveries (OHD). The paper uses fine-level GPS data of delivery operations during regular-hours (6 AM to 7 PM), and off-hours (7 PM to 6 AM), to quantify emissions in three major cities in the Americas. Using second-by-second emissions modeling, the paper compares emissions under both delivery schedules for: reactive organic gases, total organic gases, carbon monoxide, carbon dioxide, oxides of nitrogen, and particulate matter. The results show that the magnitude of the emission reductions depends on the extent of the change of delivery time. In the case of the “Full” OHD programs of New York City and São Paulo—where the deliveries were made during the late night and early morning periods (7 PM to 6 AM)—the emission reductions are in the range of 45–67%. In the case of the “Partial” OHD used in Bogotá (where OHD took place between 6 PM and 10 PM), the reductions were about 13%. The emission reductions per kilometer are used to estimate the total reductions for the cities studied, and for all metropolitan areas in the world with more than two million residents. The results indicate the considerable potential of OHD as an effective—business friendly—sustainability tool to improve the environmental performance of urban deliveries. The chief implication is that public policy should foster off-hour deliveries, and all forms of Freight Demand Management, where practicable.

Keywords

Carbon Dioxide; Carbon Monoxide; Emission Control; Environmental Management; Organic Carbon; Supply Chains; Sustainable Development; Truck Transportation; Trucks; Urban Planning.