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# Impacts of time restriction on heavy truck corridors: The case study of Mexico City

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## ABSTRACT

This paper presents a macroscopic analysis of the impact that a time restriction policy for heavy trucks on the main access corridors in Mexico City has on traffic congestion and local pollutant emissions (NO<sub>x</sub> and CO). The time restriction is a heavy truck ban at the morning rush hour.

Four groups of scenarios (15 scenarios) are analyzed, taking into consideration the reactions from carriers, which were obtained from a survey. These reactions are changes to truck paths, truck size and operational schedule (off-peak operations), and the use of consolidation centers. Some scenarios also consider road infrastructure improvement as a complementary policy. This paper describes data collection and statistical analysis, the O-D matrix obtained from each scenario and the traffic assignment process. The comparison of scenarios indicates that: (1) The time restriction policy for heavy trucks on the main access corridors has a negative impact on the whole city's total congestion and local emissions; and (2) The implementation of consolidation centers beyond the area of restriction to available land without adequate road infrastructure does not reduce the impact of the time restriction policy.

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## 1. Introduction

Usually, public policies applied to freight transportation in urban areas of developing countries are reactive; they are implemented to solve an urgent problem such as traffic congestion. That is the case of Mexico City, where a high volume of freight trucks travel on the main urban corridors. Trucks share these corridors with passenger vehicles (cars and buses), contributing to high congestion at rush hours. For this reason, local authorities have decided to implement a time restriction policy for large and medium trucks (over 3.5 tons) at the morning rush hour on the major access corridors in the Metropolitan Zone of Mexico City (MZMC) and also they have considered complementary policies that could mitigate the impact of this policy. One of these complementary policies is the expansion of internal freeways and the improvement of additional access corridors. This paper presents a macroscopic analysis of the impacts on traffic congestion and local pollutant emissions (NO<sub>x</sub> and CO) the ban of large and medium trucks on the main access corridors of MZMC at the morning rush hour could have. The analysis also takes into account the responses from carriers, which were obtained through interviews with

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operational and logistics managers of large fleet companies. These responses are the following: (1) the replacement of trucks with unrestricted sized vehicles; (2) changes to heavy trucks paths; (3) the use of consolidation centers and, (4) the modification of operational truck schedules (off-peak operations).

## 2. Literature review

Research over the last few years has considered the effects and impacts of diverse public policies on freight transportation in urban areas through case studies and different methodologies. Quak (2006) discusses that there is not enough research on the effects of public policies to reduce the impact of freight transport and the response of carriers and cargo owners to them or on the impact to the transport system and environment. Quak and De Koster (2007) analyze a case in the Netherlands related to the impact of time window policies on distribution and find that time window policies have a negative impact on retailer distribution costs and on the environment because the restriction generates an increase in the amount of global (CO<sub>2</sub>) and local emissions (PM<sub>10</sub>, NO<sub>x</sub> and CO) and also a rise in retailer distribution costs. Later, Quak and De Koster (2009) analyze the impact of sustainability regulations (time windows and vehicle restrictions) on retailer distribution in case studies and they find that time restrictions have an important impact on retailers with many deliveries on a path and vehicle restrictions have an important impact on retailers with long paths and vehicle capacity constraints.

Nakamura et al. (2008) analyze, by means of macroscopic simulation, a truck-forbidden corridor policy in Osaka City and its impact on traffic and emissions. They find that the total travel time and emissions decrease on the banned corridor, but increase on the total network.

Filippi et al. (2010) propose and evaluate a methodology for ex ante assessment of policies on freight transport focused on pollutant emissions in the central urban area of Rome. The application of the methodology to this particular zone shows that an urban distribution center can be more effective in reducing environmental externalities than policies based on vehicle fleet renewal.

Lyons et al. (2011) analyze the impact, on traffic and local emissions (NO<sub>x</sub> and CO), of a heavy truck prohibition on the Bus Rapid Transit (BRT) and trolleybus corridors in Mexico City, by means of a macroscopic flow analysis. They do not find significant impacts on congestion and emissions, but do on total travel times. Holguín-Veras et al. (2011) analyze the effects on social costs of a policy of replacing heavy trucks with small trucks in the urban area of Oakland, California; the paper shows that one consequence of this substitution is the cost increase in terms of traveled miles, which is greater than the reduction of social costs in this particular case.

## 3. Time restriction on heavy truck corridors

The Metropolitan Zone of Mexico City (MZMC) does not have a comprehensive policy related to urban freight transportation, their impacts and externalities. There are punctual actions to mitigate evident problems such as traffic congestion or local pollutant emissions. These actions are usually restrictive and are not preceded by methodological ex ante evaluations. Some imposed measures to heavy trucks are the result of different actions from passenger vehicles policies, and these measures make trucks move their paths from the traditional corridors. That is the case with the ban on heavy trucks on the BRT and trolley corridors. These corridors include large segments of the main road network, hence heavy trucks have had to change their paths using unsuitable roads or streets within residential zones, often on longer paths. Lyons et al. (2011) find that a heavy trucks restriction on the roadways used by BRT and trolley bus in the MZMC produces an increase in travel time for these trucks during the morning rush hour.

Recently, due to the high traffic congestion on main entrance/exit corridors of the MZMC, local authorities have begun to restrict large and medium trucks (over 3.5 capacity tons) at morning rush hours (7:00–9:00 AM). These corridors are important for the freight transportation network because they connect the MZMC with the other central states and they are part of the freight supply system of Mexico City. These corridors present high congestion at rush hour, and are shared by passenger vehicles (cars and buses) and trucks.

Besides this time restriction policy, authorities are considering complementary policies which try to reduce the impact of the time restriction policy. The complementary policies include some projects to build freeways and improve the capacity of other access roads within the MZMC. The idea is that these new roads have positive impact on freight truck paths and total traffic congestion. Hence, a set of scenarios is formulated that include the time restriction policy and include or do not include complementary policies (network improvement).

## 4. Methodology

A traffic assignment analysis is used for studying the effects on traffic congestion and local pollutant emissions (NO<sub>x</sub> and CO) produced by the time restriction policy on large and medium trucks at the morning rush hour in the MZMC, taking into consideration reactions from carriers. The procedure is described below.

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