

Commercial Goods Transport, Mexico City

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Introduction

Relative to urban freight transportation, Mexico City typifies very large and fast growing metropolises of emerging economies. Its logistics features relate both to developed and developing urban economies.

Mexico City is a logistics gateway to and from Central and South America and a place with many regional headquarters of multinational companies and associated advanced services. Mexico City also accounts for a third of the country's manufacturing output. Among the successful industrial sectors are the pharmaceutical industry, the manufacturing of automotive parts, the printing and publishing industry. All this brings logistics needs on a level comparable to developed countries. In parallel, Mexico City is also a place of informal economic activities. A very important feature of Mexico City's economy, and one which typifies the situation of many cities of developing countries, is its high number of very small firms. 42 per cent of the active population is employed in micro-firms, of which only half are businesses which have an established workshop, while the rest are home-based or street-based (OECD, 2004). This makes for specific movements of goods, not necessarily transported by regular trucking companies.

A survey among 1,650 truck drivers (Lozano et al, 2006c) demonstrates the challenges of urban freight operations in Mexico City: the congestion, the lack of space for loading and unloading, the complexity of legislation, the corruption of police, the risk of theft and the lack of safety are among the highest concerns raised by the drivers. The OECD (2004) also points to inadequate infrastructure in Mexico City, leading to poor regional accessibility, which hinders market extension and international integration, maintaining high logistic costs. Congestion is a very acute issue. It can take up to four hours for many trucks to cross the city (Lozano et al, 2006c).

All these features make Mexico City a good example of the challenges for urban freight management existing in very large cities in emerging economies. Few data had been collected on freight and logistics in Mexico City prior to a major survey done in 2006 (Lozano et al, 2006c). Building on this survey and other sources, this study provides both information and an assessment of urban freight management in Mexico City. In the first section, geographic and economic data are presented showing their relationship with freight flows. In the next section, the city's freight flows and their environmental and social impacts are detailed. The last section presents public policies related to freight flows and logistics activities implemented in the metropolitan area.

Background

Country profile: Mexico

Mexico is a country extending on nearly two million km² and occupying a strategic location between the main world economy, the US, and Central, South America. Classified as a newly industrialized country by the IMF, it is the second economy in Latin America and is ranked 14th in the world, with an estimated Gross Domestic Product (GDP) of US\$875 billion (IMF, 2010). Its population was 103 million inhabitants in 2005 (INEGI, 2005). Mexico's GDP is divided as follows: 4 per cent coming from the primary sector, 32 per cent from the secondary

sector and 64 per cent from the tertiary sector (INEGI, 2008). The transportation sector represents 7 per cent of the GDP (SCT, 2009).

Transport infrastructure and corridors

Mexico has 366,000 kilometres of roads, of which only 36 per cent are paved and 41 per cent have a lining (SCT, 2009). About 2 per cent of them correspond to toll highways (SCT, 2009). There are 14 main corridors in the country (see Maps 1 and 2). The network shows the importance of the road flows between Mexico and the US (six corridors) and Mexico and Central America (two corridors).

Map 1 and 2: Main corridors of the National Infrastructure Programme 2007–2012



Source: SCT, 2007.

The Mexican trucking industry

The trucking industry in Mexico was deregulated in the 1980s and 1990s. The obligation to belong to ‘centrales de carga,’ or freight central organisations, was abandoned. Truck operators hold a permit to operate, whereas before deregulation they were ‘concesionarios’ (private contracting parties with a delegation to run a public service on specified routes and with fixed freight rates) (Ruiz, 2007). Permits to operate a truck are still identified by the government as a ‘public service’ and for statistical purposes (and because they still represent quite different ways of operating), trucks are still classified according to the type of service - federal, local or private - they provide (see below). Deregulation contributed to ‘break privileges, reduce tariff and stimulate the creation of new companies’ (Martínez, 2009) but road transportation prices are still 20 per cent higher today than they are in the US (Martínez, 2009).

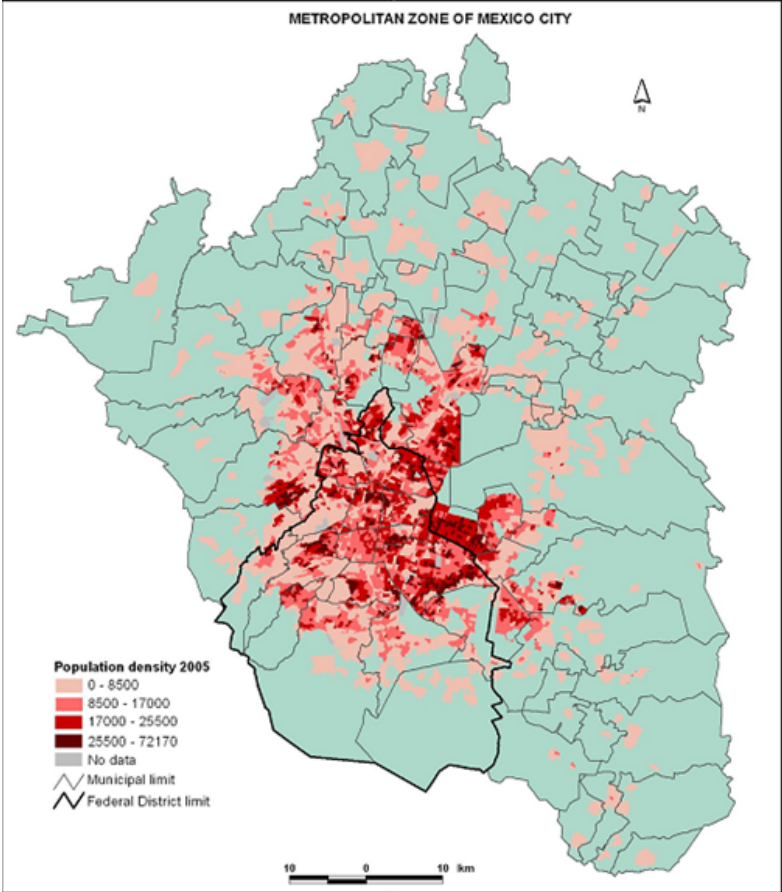
The Metropolitan Zone of Mexico City

The Metropolitan Zone of Mexico City (MZMC) is located within the central region of Mexico. Approximately 18 per cent of Mexicans live in the MZMC, within an area of 7,804 km² where 2,226 km² are urban (INEGI, 2005). Map 3 shows population densities.

The MZMC is formed of 76 municipalities located in three states (16 in the Federal District, 59 in Mexico State and one in Hidalgo State). Of the 19 million people living in the MZMC, nine live in the Federal District and nearly ten in Mexico State (only 60,000 live in Hidalgo). The most populated areas are located on the eastern part. The states and municipalities can design their own regulations. This makes metropolitan planning difficult, a process exacerbated by the multiplicity of political parties with often diverging agendas.

Approximately 25 per cent of the national GDP is generated in the MZMC. The area generates 3.5 per cent, 16 per cent and 31 per cent respectively for primary (agriculture), secondary (industry) and tertiary (services) sectors of the national GDP (INEGI, 2008).

Map 3: Population density in the Metropolitan Zone of Mexico City, 2005



Source: INEGI, 2005.

Congestion from freight flows

Eight of the national road corridors (Maps 1 and 2) service the MZMC, connecting seven points in the northern border (US) with two points in the southern border (Guatemala and Belize). This shows the importance of the MZMC for the road flows in Mexico and those between the US and Central America.

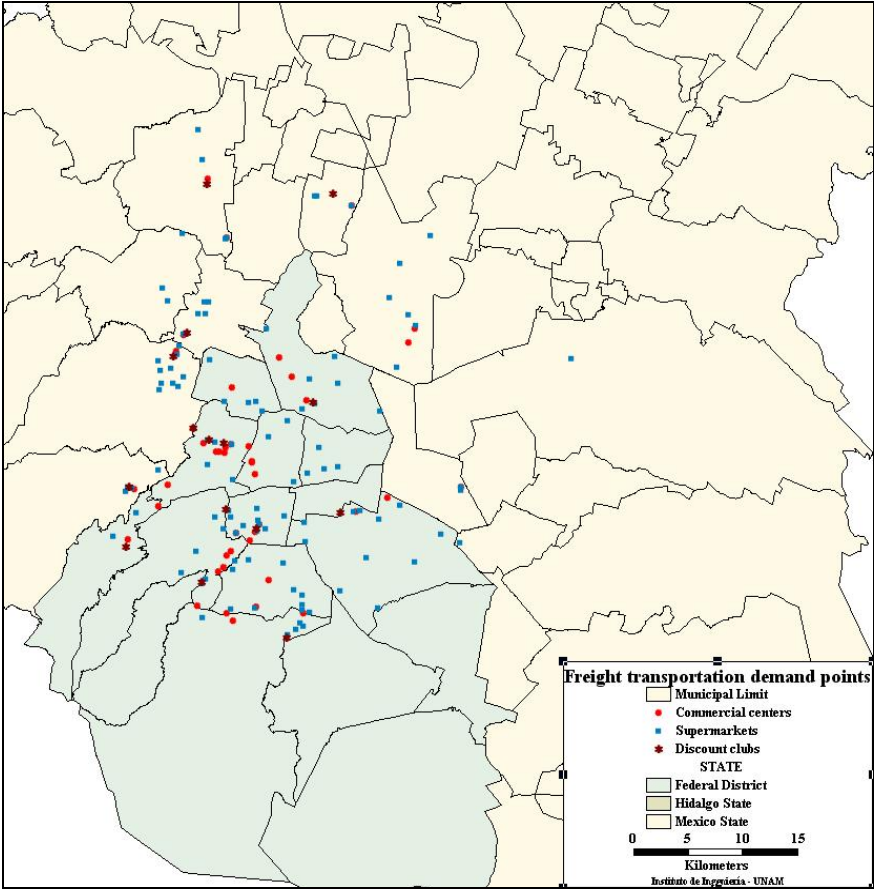
The most congested road segments are located around the MZMC, where the flow of large trucks makes up nearly 5 per cent of the total flow. On the 30 main road segments, large trucks make up nearly 19 per cent of traffic and even 30 per cent in some urban segments of the México-Querétaro highway and the Naucalpan-Toluca highway. On a scale of A to F, a fourth of the road network is either E or F, meaning it is severely congested (Martínez, 2009). The road segments with the highest number of trucks are located in the northwestern and eastern parts of the metropolis. The MZMC does not have a fully operational external ring road, but recently an arch on the northern part (Arco Norte) was built. Given that the ring is not completed in the eastern, western and southern parts, many thru vehicles still have to cross the MZMC.

As we will see in the following sections, the mobility of freight vehicles in the MZMC is inadequate, contributing to aggravated congestion, air pollution and noise and conflicts with local communities. Neighbourhood groups require ‘topes’ (speed reducers) and traffic lights on the streets where trucks travel, generating an increase in travel times and costs.

Urban Freight in Mexico City

The available information on freight transportation considers a subzone of the MZMC, which includes 50 municipalities (16 in the Federal District and 34 in Mexico State). This zone has a total of four million registered vehicles of all types, of which about 600,000 are commercial (see below).

Map 4: Location of upscale retail sites in the MZMC



Source: Lozano et al, 2006b.

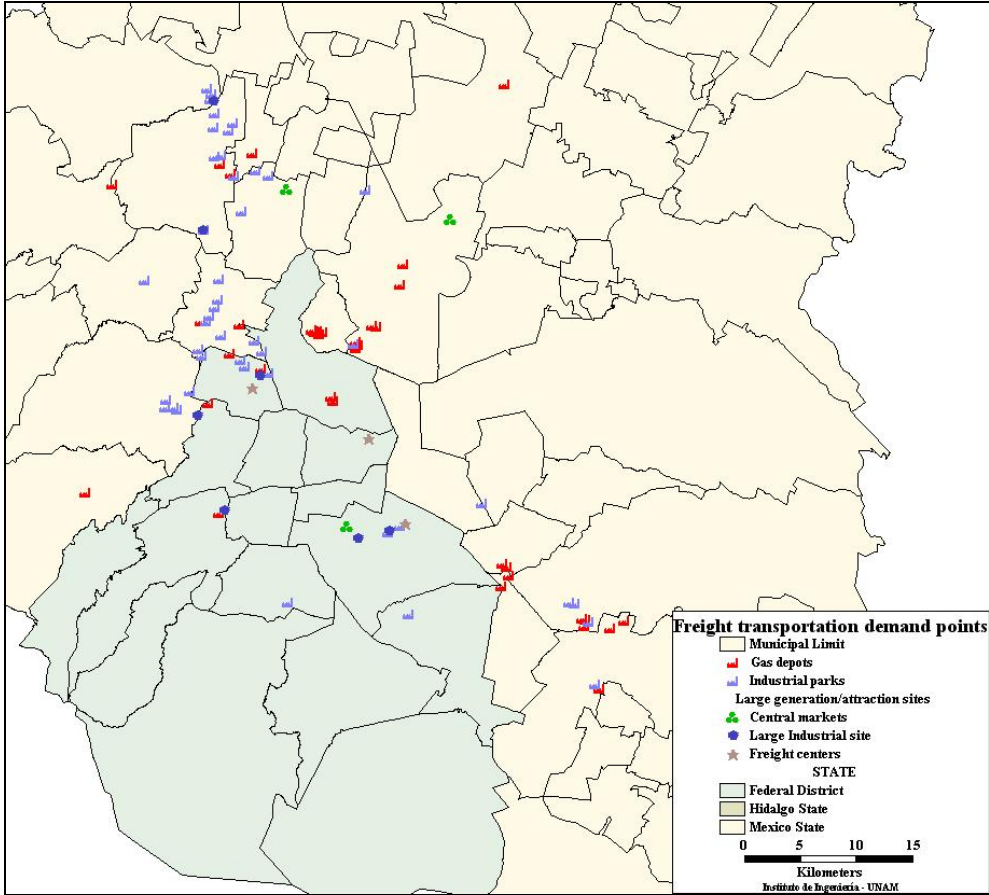
Freight transportation demand in Mexico City: huge, diversified and ubiquitous

The MZMC is a market of nearly 20 million inhabitants, demanding and producing a huge diversity of commodities and products, estimated at 400 million tonnes annually (Martínez, 2009).

There are thousands of large transport demand generators, presenting specific locational patterns in the metropolitan area. The majority of the large retail centres, medical facilities and schools are located in the west and the Federal District (Map 4), while markets¹ and everyday retail are more dispersed but predominantly located in Mexico State, which has a lower socio-economical level. The former tend to generate consolidated full truck deliveries while small retail tend to generate more frequent smaller volume deliveries. Open-air markets (*tianguis*)² are more evenly distributed between the two states.

Map 5 presents major manufacturing, freight centres (including two intermodal facilities) and wholesale sites that are truck attraction/production points. The majority of these sites are located in Mexico State, in the northern and eastern parts of the city. Industrial parks favour the proximity to the Mexico-Querétaro highway.

Map 5: Sites generating freight transportation demand (production/attraction points)



Source: Lozano et al, 2006b.

1. A market (*mercado*) is formed of many small shops, is located in a fixed public facility and is managed by the municipality.

Additionally, there are around 44,000 registered smaller industrial activities and an unknown number of registered and unregistered small supermarkets and shops, all generating individually low numbers but collectively enormous amounts of deliveries. The main commercial area in the MZMC is the historical centre. It is divided into two contrasting parts. The western part (of approximately 9 km²) belongs to the UNESCO World Heritage List and groups many shops, hotels, restaurants and offices, many in pedestrian streets. In the eastern part behind the Government Palace, lies the main garment and textile centre (mostly wholesale) in the country. That area is chaotic, with non-registered vendors taking over the streets. Motor vehicles have difficulties manoeuvring, and 'diablitos' (rolling cars moved by hand) have to be used for the physical distribution of goods (Figure 1).

Figure 1 - Street in the eastern part of the historical centre of Mexico City



Source: Lozano et al, 2006b.

Freight transport supply in Mexico City: an increasing truck traffic

Informal means of transportation in the metropolitan area of Mexico City such as by foot or in carriages are difficult to record but probably represent a significant share of freight movements (Dablanc, 2009). The part of transport which is documented represents about 400 million tonnes annually. It is mostly based on road transportation, although about 12 million tonnes (3 per cent of the global tonnage) are moved annually in the rail freight stations in the MZMC, for the most part from the Pantaco station in the north (Martínez, 2009).

Three distinct categories of companies

Road freight vehicles can be registered under one of the following regimes: private service, local public service and federal public service. Usually, the private vehicle regime is used for fleets of companies (for their own account or for-hire services). Their operations are predominantly based on delivery tours (with multiple stops). A local public service is a sort of truck taxi, predominantly operating direct deliveries (one stop). Both local and private services use mostly light trucks (at least 70 per cent of their fleets). The federal public service is dedicated to long-haul transportation and usually employs large vehicles belonging to small

2. A 'tianguis' is an open air market formed of tiny stands opened one or a few days a week in local neighbourhoods. Some *tianguis* can be very large, selling everything including cows, cars.

transportation companies and owner-drivers. In recent years, there has been quite a high development of for-hire transport and 3PL (third party logistics) services.

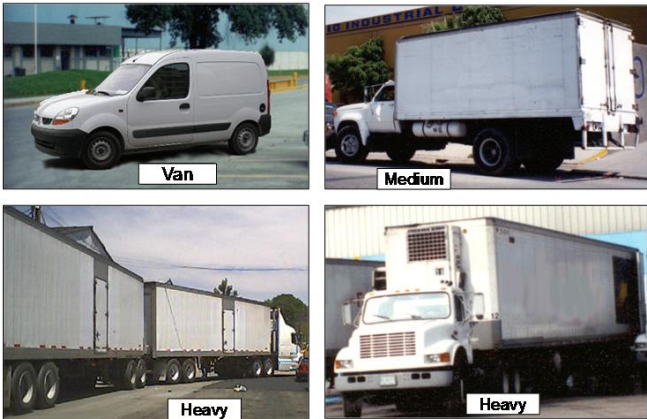
Many trucks are illegally operating as local public service, particularly in Mexico State. In total, as of today (2011), there may be over 600,000 freight vehicles operating in Mexico City, including 73 per cent for private service, 20 per cent for federal public service and 7 per cent for local public service.

A high average age of vehicles and diverse types of energy used

Truck companies operating in Mexico City tend to be really small: as an example, two-thirds of trucks belonging to private fleets under 100 vehicles belong to companies with three trucks or less. One important consequence is the average age of the vehicles, as vehicles tend to be older in small companies. The average age of private service trucks belonging to large (above 500), medium (between 100 and 500) and small fleets is six, seven and fifteen years, respectively. The average age of trucks for public federal service and public local service is very high, being 15 and 21 years respectively.

Vehicles operating in the MZMC are classified into three size categories: light vehicles have two axles and are lower than 3.5 tonnes; medium size vehicles are non-articulated trucks or articulated trucks lighter than 20 tonnes, and heavy trucks are articulated truck-trailers over 20 tonnes and doubly-articulated truck trailers (see Figure 2).

Figure 2 - Examples of vans and trucks in Mexico City



Source: Lozano et al, 2006b.

As in other countries, large trucks in Mexico City mostly run on diesel and smaller vehicles generally use gasoline,³ but one characteristic of Mexican commercial vehicles is the important use of liquefied petroleum gas (LPG). For example, approximately 40 per cent of the trucks for private service belonging to medium and large fleets use liquefied petroleum gas. A few vehicles today are electric (Lozano et al, 2006c).

Type of commodities and origins and destinations of freight flows

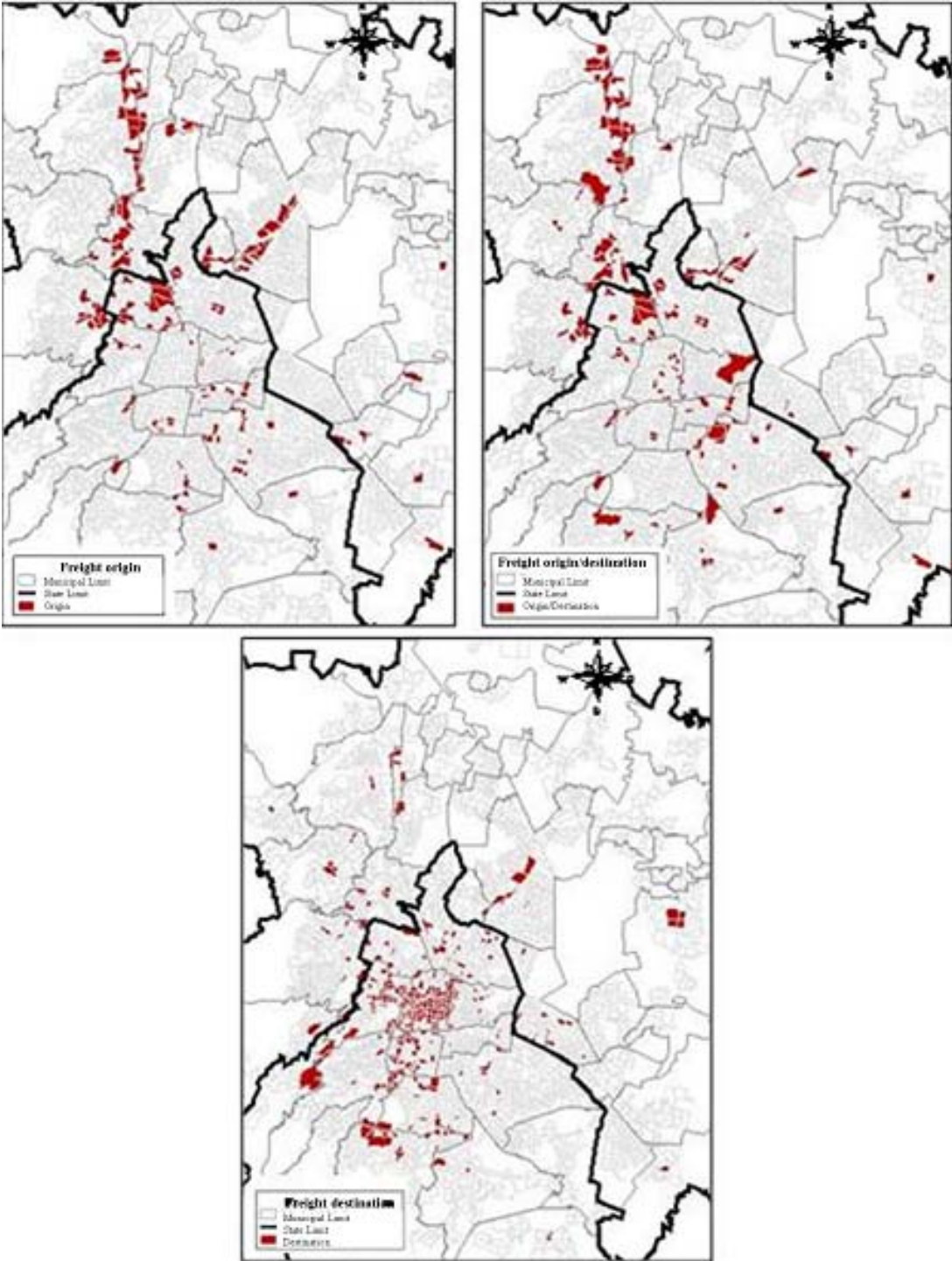
Each category of transportation service is rather specialized in terms of commodities carried. Processed food is the main product moved by private service trucks belonging to medium and

3. Nearly 80 per cent of the trucks for federal public service use diesel, the rest using gasoline (16 per cent) and to a lesser extent LPG (4 per cent). Gasoline is used by over 80 per cent of the vehicles for local public service and for private service with small fleets.

large fleets. Trucks belonging to small fleets carry mainly vegetables, furniture and processed food. Furniture is the main product transported by the local public service. Mineral and construction materials, vegetables, processed food and furniture are the main transported goods by trucks for federal public service (Lozano et al, 2006c).

Origins of freight transportation are mainly located on the northern part of the city, destinations are around the central part, and transfer points (both origins and destinations) on the northwestern part and around the centre of the city (see Maps 6, 7 and 8).

Maps 6, 7 and 8 - Main origins and destinations of freight transportation in the MZMC



Source: Lozano et al, 2006d.

Trips for medium and heavy trucks are concentrated in the industrial areas (north of the Federal District) and in the largest general market zone (southeast).

Large trucks are not everywhere. They are preferably around the industrial facilities and general markets zones, and on the urban corridors connecting these zones with the national highways. The problem is that many of the streets forming these corridors are too small to readily accommodate large and medium trucks. Additionally, these streets are increasingly restricted to trucks, complicating truck routing.

A striking element is that a large majority of the trucks in the MZMC stay *within* the metropolitan area, with few originating from or going to other destinations or transiting. For the federal service (which has the longest average hauls), 15 per cent of the trucks are in transit and an equal number have an origin or a destination outside of the MZMC: this leaves more than 70 per cent of the trucks with both origin and destination in the metropolitan area (Lozano et al, 2006c).

Logistics terminals and logistic services in Mexico City

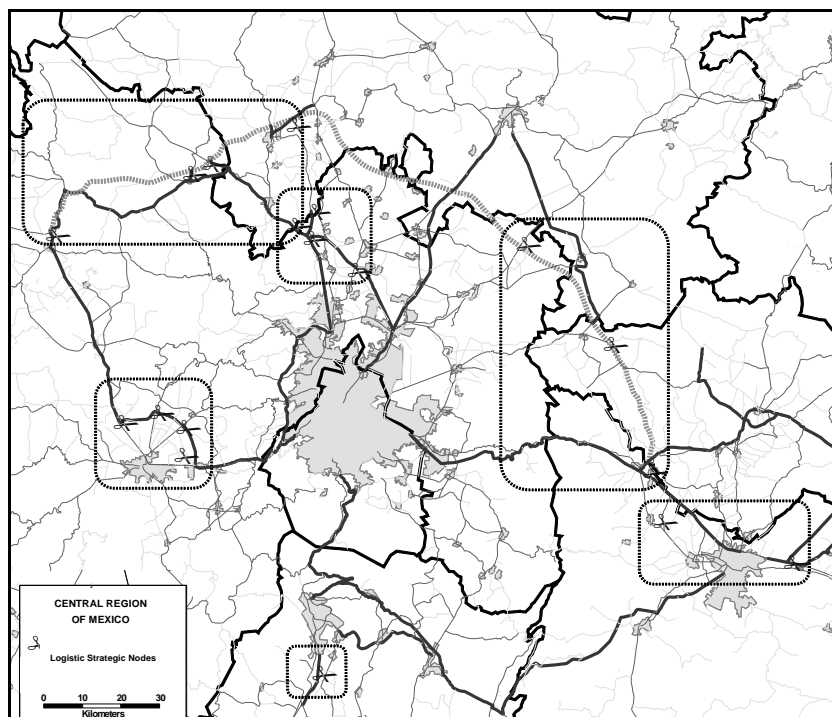
Despite recent private investments,⁴ Mexico City does not provide yet enough modern logistics services up to the standard that the city's companies as well as its role in the national and global economies would require. Future developments, and the role of local governments in their implementation, are under discussion today in academic and business circles.

Lozano et al (2008) identified that a key problem in the location of logistics facilities in the MZMC is the change of land uses from industrial to residential and services. As a consequence, many companies moved their logistics facilities to the northwestern part of the city, where available land remained near the main highway. Several extensive clusters of facilities have grown there accommodating distribution centres and private logistics facilities. However, some areas nearby are already occupied by legal and illegal residential development projects, due to the absence of zoning protection of existing logistics areas and the lack of land-use planning.

Recently, Antún et al (2010) studied the spatial distribution of the main logistics centres within the MZMC. The northwest of the MZMC has now obtained prominence for facilities developed by large companies. Also, the authors identified a set of high-priority logistics nodes in the central region of Mexico, and proposed a set of logistics zones related to the hinterland of connections to new freeways (see Map 9). Four of the identified logistics nodes are inside the MZMC and seven of them are on the Arco Norte toll highway, which are directly related with the MZMC's freight flows. Today, logistics real estate developments are appearing in some of these nodes, particularly on the northwest, close to the Mexico-Querétaro highway and the Arco Norte highway.

4. These developments involve large international companies. Examples from recent years include a Wal-Mart distribution centre for perishable goods (30 hectares), two logistics parks by O'Donnell (63 hectares), several development by Prologis (42 hectares) and several developments by Gisca (57 hectares). GE, Michelin, Nestlé, Kraft Foods, Cotsco, Kimberly Clark, McGraw-Hill, Synergex, MultiPack, El Palacio de Hierro, Mattel are among the companies that located in these parks.

Map 9 – High priority logistics nodes within the central region of Mexico



Source: Antún et al, 2010.

Environmental impacts of commercial transport in Mexico City

The MZMC has an altitude of 2250 meters, which makes combustion difficult and increases emissions. According to the country's Emissions Inventory of 2008, the transportation sector represents 51 per cent of total CO₂ emissions and 94 per cent of the total NO₂ emissions of the MZMC. For transport related emissions, the contribution of vans and trucks to PM₁₀, PM_{2.5}, NO_x and CO emissions – which are among the most damageable pollutants for people's health (Gehring et al, 2006) – is respectively 55 per cent, 62 per cent, 21 and 14 per cents (SMA-GDF, 2008). The MZMC commonly experiences 'environmental emergencies' due to high levels of NO_x and particulate matters.

The Metropolitan Environmental Council (Comisión Ambiental Metropolitana) is the responsible agency for the implementation of measures oriented to reduce air pollution. The environmental programme of Mexico City (Agenda Ambiental de la Ciudad de México 2007–2012) has proposed the following measures related to freight transportation (ProAire, 2008) but implementation so far is behind schedule:

- The inclusion of motorcycles, buses and truck trailers to the environmental programme.
- The implementation of a diesel self-regulation programme, which limits trucks' emissions.
- The calibration of emission factors for light and heavy vehicles, taking into account the altitude and atmospheric conditions in the MZMC.
- Stricter emission levels.
- The improvement and modernization of pollution assessment processes.
- The improvement of fuels.

Policies towards a more efficient freight transportation in Mexico City

Recent rules on truck access and deliveries

The Federal District and Mexico State had their own traffic regulations, but recently these were substituted by the Metropolitan Traffic Regulation (Reglamento de Tránsito Metropolitano, June 2007). This regulation forbids on-street parking and loading-unloading operations, when they represent an obstacle to vehicular flows. However, enforcement of the Metropolitan Traffic Regulation has remained problematic. An important positive side effect of the change has been a notable reduction in corruption levels from enforcement forces.

Freight vehicles in the MZMC must abide to access regulations. A recent legislation (June 2008) set the following rules: (1) Trucks over 3.5 tonnes are forbidden between 7:00 and 22:00 in the historical centre; and (2) Trucks over 3.5 tonnes or over 7.5 meter length are forbidden on Eje Central between Churubusco and Consulado, from 06:00 to 23:00. In both cases, there are exceptions for trucks delivering mail, construction material and perishable and frozen products.

In recent years, the Federal District government has been trying to convince large companies (which have large fleets) to buy less polluting vehicles and to operate at night. Many companies are experimenting with this voluntary measure. Night-time distribution could be difficult for some companies due to security concerns (high crime rates in certain zones of the MZMC).

Urban growth, new passenger public transport infrastructure (such as Bus Rapid Transit systems) and rapid changes in land uses at a metropolitan level have generated a surge in prohibitions on truck access on roads and corridors formally used by freight vehicles. These rules were implemented without offering good alternative routes for trucks. The consequences of these bans involve trucks entering inadequate streets, specifically in residential areas, an increase in the use of vans (which can increase congestion), the relocation of companies (and economic activities and jobs) outside of the MZMC and increased logistics costs

An insufficient dialogue with freight stakeholders

Local and state governments in the MZMC have not set up a permanent process for consulting with representatives from shippers and carriers organizations about freight transportation issues. The government of the Federal District discusses on freight issues occasionally with two associations, the National Association of Private Transport (ANTP, representing large companies with private service fleets) and the National Chamber of Freight Transport (CANACAR, representing companies of public federal service). Local municipalities have failed in setting up discussion arenas with carriers, which could have been places to easily remediate frequent MZMC problems such as poorly designed streets for trucks movements and the lack of adequate street signs.

The action of the Metropolitan Environmental Committee (MEC) is quite interesting, as it is one of the institutions most engaged in a dialogue with the industry. Created in 1996, its mission is to define, coordinate and monitor policies related to environmental protection in the Federal District and the urban municipalities around it. While general planning processes in Mexico do not usually consider more than six years (also a governmental term period), environmental planning is long-ranging, benefiting from the stability of the MEC. Almost all of the recent environmental regulations for improving air quality have been proposed and promoted by the MEC in coordination with freight stakeholders.

Land use and planning policies: a need for improvement

A policy for the development of modern logistics centres and for the protection of proposed sites for future logistics activities could contribute to a better land use organization and a more suitable management of freight transportation demand, reducing environmental and social impacts, but policies within the MZMC have been timid in this regard. Local governments do not take the importance of logistics for the MZMC into much consideration, and actions have been limited. Many leading companies have started to establish distribution centres and freight terminals in logistics nodes, forming large clusters. However, without sufficient land use protection in the surroundings of these facilities, fast growth of residential and other uses around logistics areas can be expected in the near future, obliging companies to move even further away. In the future, the provision of adequate and well-positioned land for logistics activities may be hampered by the lack of careful planning today.

Conclusion

Urban freight transport in Mexico City is facing several challenges, mostly related to truck traffic management in a context of limited availability of infrastructures, as well as to the insufficient provision of modern logistics services for the city's businesses and households.

Mexico City is an enormous megapolis whose activities (from informal artisanal workshops to modern conglomerates) and population generate a high and diversified demand for freight. Responding to this demand are very diverse modes of freight transportation. An important but undocumented part of transport relies on informal means (hand carriages, bikes and motorbikes). The dominant and growing mode of freight supply is trucking, whose flows and characteristics are well surveyed today. Vans and trucks are used by quite different kinds of transport companies whose characteristics are both a legacy of the country's former regulated trucking market and new entrepreneurial initiatives. Whatever their market segment, trucks (especially heavy trucks) in Mexico City face several difficulties on the streets, arising from poorly designed street space. The metropolitan truck network is not complete, forcing some in-transit vehicles to cross the MZMC.

A related issue is the very important responsibility of vans and trucks in air pollution in the MZMC, in part due to the high age of many commercial vehicles operating in Mexico City.

Other concerns discussed in the chapter are related to the high costs of logistics and freight transport in Mexico City, and the lack of a sufficient provision of modern logistics services. Part of the problem lays in the need for adequate logistics zones. Industrial land uses in the MZMC (where trucking activities have traditionally located) tend to disappear and are being replaced by residential and office activities. This has generated many conflicts between new residents and the remaining trucking activities. Additionally, the growing difficulties for trucks to access freight facilities have induced the relocation of some facilities, generally in the northern outskirts of the MZMC, increasing truck trip distances. This is referred to as 'logistics sprawl' (Dablanc and Rakotonarivo, 2010). Local governments show little concern for logistics issues and few are promoting policies for the development of logistics centres and the protection of specific areas as well as their surroundings. Local administrations tend to focus on developing new public passenger transportation systems and they are restricting truck access on major transportation corridors, without providing alternative routes for trucks. The consequences are increased conflicts involving commercial traffic, increased congestion and rising logistics costs.

Public policies should take a better account of the current trends in urban goods distribution and demand for modern logistics, and implement appropriate regulation and planning of

freight transportation, therefore decreasing negative impacts. Many potential areas of a freight policy have never been considered by Mexico City's decision-makers. Setting up a freight forum to better reach out to freight stakeholders could be a useful step. It could provide a basis for discussing important issues, such as the old age of the commercial vehicles circulating in the metropolitan area, the lack of logistics areas in the dense parts, the need for an optimized truck route network, or the opportunities to promote rail freight services.

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