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The Aspects of the Urban Distribution in a Megacity: A Comparison Between São Paulo's and Boston's Urban Deliveries

Nathalia de Castro Zambuzi[1], Cláudio Barbieri da Cunha[2], Edgar Blanco[3], Hugo T. Y. Yoshizaki[4], Carla D. Rosa Carvalho[5]

[1] Department of Transportation Engineering, Polytechnic School of Engineering, University of São Paulo, .
Av. Prof. Almeida Prado, Travessa 2, n° 83, Cidade Universitária - São Paulo – SP, Brasil.
nathalia.zambuzi@usp.br
[2] Department of Transportation Engineering, Polytechnic School of Engineering, University of São Paulo. cbcunha@usp.br
[3] Megacities Logistics Lab, Center for Transportation and Logistics, Massachusetts Institute of Technology,. eblanco@mit.edu
[4] Department of Production Engineering, Polytechnic School of Engineering, University of São Paulo.
hugo@usp.br
[5] Graduate Program in Logistics Systems, Polytechnic School of Engineering, University of São Paulo.
carla.carvalho@usp.br

ABSTRACT

The paper aims to describe some of the aspects that characterize the logistic uniqueness of a megacity located in a developing country, through the comparison between the urban distribution operations that take place in São Paulo, a perfect example of a megacity in an emerging economy like Brazil, and a city like Boston, dense by U.S. standards. More specifically, we detail the results of two research workshops conducted in Boston-Cambridge and in São Paulo in 2012, addressing some of the main observations and reflections related to the "last mile" distribution in terms of critical points and operational differences between these two cities. These results are based on an extensive information and data collection process, from the observation of several delivery operations at different areas of the two cities and the shadowing of some delivery routes from companies of different sectors. Some aspects are discussed, like traffic regulations and enforcement, drivers' behavior, loading/unloading zones and relationship practices between companies, drivers and customers.

Key-words: Urban distribution, megacities, field observations, delivery practices.

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RESUMO

Este artigo tem como objetivo apresentar alguns dos principais aspectos que caracterizam a unicidade logística de uma megacidade localizada em um país em desenvolvimento, através da comparação entre as operações da distribuição urbana de produtos na cidade de São Paulo, um perfeito exemplo de uma megacidade em um país emergente, como o Brasil, e na cidade de Boston-Cambridge, regida pelos padrões norte americanos. Mais precisamente, detalhamos os resultados de dois workshops realizados em Boston-Cambridge e em São Paulo, em 2012, abordando algumas das principais observações e reflexões relacionadas às operações da última-milha (last-mile) na distribuição de produtos, em termos de pontos críticos e as diferenças operacionais entre essas duas cidades. Os resultados apresentados baseiam-se em uma extensa coleta de dados e informações, a partir da observação de divrsas operações de entrega em diferentes áreas das duas cidades e do acompanhamento de rotas de entrega de empresas de diferentes setores. São discutidos alguns aspectos como as regulamentações do tráfego e a fiscalização aplicada, o comportamento dos motoristas dos veículos de entrega, as áreas de carga e descarga, assim como as práticas de relacionamento entre empresas, motoristas e clientes.

Palavras-chave: distribuição urbana, megacidades, observações em campo, práticas de entrega.

1. INTRODUCTION

Urban freight distribution, i.e., the transportation and delivery of goods within the city limits, is an operation of great relevance, essential to the realization of most economic and social activities that take place in urban areas. However, at the same time it plays a fundamental role in the functioning of the city, urban distribution is also the reason for some disturbances in urban life. According to Dablanc (2007), the large number of different types of freight flows constantly cross an urban environment, including consumer goods, building materials, waste products, postal mail and other, occupy about one fourth of the street traffic of a typical city. Freight vehicles compete for road capacity with passenger cars and buses, contributing to traffic congestion and degradation of air quality, as well as to visual and noise pollution. Further, Dablanc (2007) says that freight materials require loading/unloading, storage, conditioning and packaging, which demand even greater use of urban space. It is not uncommon to observe delivery vehicles disturbing and even blocking the traffic of other vehicles and pedestrians when, for example, parked in prohibited places, such as traffic lanes and even sidewalks, to accomplish their loading and unloading operations.

It is then easy to think that, as urban areas, populations of cities grow, so do the problems associated with some urban distribution activities. Cherret et al. (2012) affirms that increases in population and economic growth in urban areas have resulted in a growing demand for goods and services by commercial and domestic users. This greater demand, in turn, to a larger number of delivery trips and vehicles circulating on the streets. In this sense, in megacities, defined by the United Nations as urban agglomerations with more than 10 million inhabitants,the problems caused by urban distribution operations and their vehicles tend to acquire a unique complexity, as do the search and implementation of solutions, especially for those located in developing countries, where population growth and urban sprawl are is happening at a very fast pace[1] (Blanco and Fransoo, 2013) and usually not followed on the same scale by the development of road infrastructure.

Rather than the mere size of the city, from a logistics perspective it is in particular the high population density in combination with its size that makes the megacities in emerging markets very different from the large cities in the United States or Europe. The consequences for transportation in these cities are serious. Many of these cities are more or less permanently congested. Due to the rapid organic growth of the cities, with little planning, the infrastructure is insufficient to deal with the increase in traffic. Some areas of the city are, because of the width or steepness of the streets, not accessible by trucks or sometimes even by cars. Moreover, these cities are characterized by unprecedented income disparities, which are often associated with security problems and other problems of crime. Furthermore, income disparities also lead to huge geographic differences in the cities. Some cities are very dense, poor neighborhoods, while others may be very affluent. This diversity is much beyond the characteristics that can be observed in cities in developed economies, where differences are much smaller, and precludes their freight solutions to be simply reproduced.

The transport and delivery of goods become then a crucial matter in the management of a megacity located in developing countries, like São Paulo, where an better understanding of urban freight activity, and the characteristics that affect logistics services, would help planners better

[1] In 2025, the top 600 cities of the world will cover 22% of the world population, and more than half of the world's GDP, according to a projection by the McKins ey Global Institute (Dobbs et al., 2011). Most of these large cities will be in what is currently considered the developing (or emerging) economies. According to the same McKinsey projection, of the top 25 megacities in the world, only 4 will be in what is currently considered as the developed world. Within these markets, the cities are the largest share of the economy, both the leading megacities and the second tier of cities.

cater for freight vehicles through improved design and use of facilities and infrastructure, and investigate the potential feasibility and benefits that could arise from various freight initiatives (Cherret et al. , 2012). Among these initiatives are the freight related policies, imposed by local governement, which are strongly associated with the size, population, urban structure, level of development, among others characteristics of a city. By regulating delivery vehicle's size, delivery time windows, parking and unloading rules, among others, these policies affect the way in which goods will be delivered and, therefore, the efficiency of urban distribution operations.

While Dablanc argue, based on an extensive field work in France, that urban goods movements are independent of local urban characteristics, in the sense that, from a logistics point of view, a drugstore (or a bakery, a bank, a warehouse, etc.) operates the same way whether located in the centre of a very large metropolis or at the outskirts of a medium size city, our comparative field study show that this reality can be rather different in terms of last-mile distribution, as detailed in the subsequent sections of this article . In other words, the so-called "neutralisation" of the urban territory, i.e., the idea that, whatever the city, deliveries will be made in more or less similar way, does not apply when different countries are involved, nor when it is related to a megacity.

The paper is organized as follow: Section 2 briefly characterizes the cities of Boston-Cambridge and São Paulo, in terms of their general aspects and freight regulations. Section 3 describes the adopted methodology for delivery observations and data colletion, as well as the areas were these activities took place in both cities. Section 4 reports and discusses the observed delivery practices, cosidering the critical points and the operational differences between the two cities. Finally, section 5 summarises the main findings of the study concludes the paper.

2. CITIES' GENERAL CHARACTERISTICS AND TRAFFIC REGULATIONS

2.1. Boston-Cambridge

Boston, the capital and the largest city of the state of Massachusetts, in the United States, has an estimated population of about 617,500 inhabitants and a surface area of approximately 77.70 km^2 (United States Census Bureau, 2010). The city is considered an international center of higher education, due to its traditional colleges and universities. Two of them, the 'Massachusetts Institute of Technology' and the 'Harvard University', which are among the most important universities of the world (QS World University Rankings, 2012), are located in Cambridge, a small city in the metropolitan region of Boston, with a population of about 105,000 inhabitants in an area of approximately 18 km^2 (Demographic Profile Data, 2010).

According to the traffic analytics firm (INRIX Inc.), Boston area has the 10th-worst traffic congestion in the United States. In fact, the latest official data published by the Boston Transportation Department, in 2002, indicate that the city of Boston faced a significant increase in auto registrations between 1991 and 2001; while Boston's population grew about 3%, auto registrations increased over 36% in this decade, reaching a total of 356,000 new vehicles in 2001. In an attempt to improve traffic flow within the city limits, a set of policies have been implemented. Some of then, the ones focused on freight transportation are listed below:

(i) Loading zone: during the hours when stopping or standing is not prohibited, commercial vehicle is allowed to stop for no more than one hour, unless otherwise posted, for loading and unloading goods. Passenger vehicles are allowed to stop while receiving or discharging a passenger.

(ii) All-Night Commercial Vehicle Parking: from 9 p.m. to 8 a.m. or at any time on Sundays, any commercial vehicle or semi-trailer having a capacity of 1 ton or over its not allowed to park or stand for more than one 1 hour, unless during loading and unloading activities.

(iii) Overnight Parking of Heavy Vehicles in Residential Areas: from 9 p.m. to 8 a.m. or at any time on Sunday, any vehicles having a gross vehicle weight in excess of 12.000 pounds are prohibited to park in residential areas.

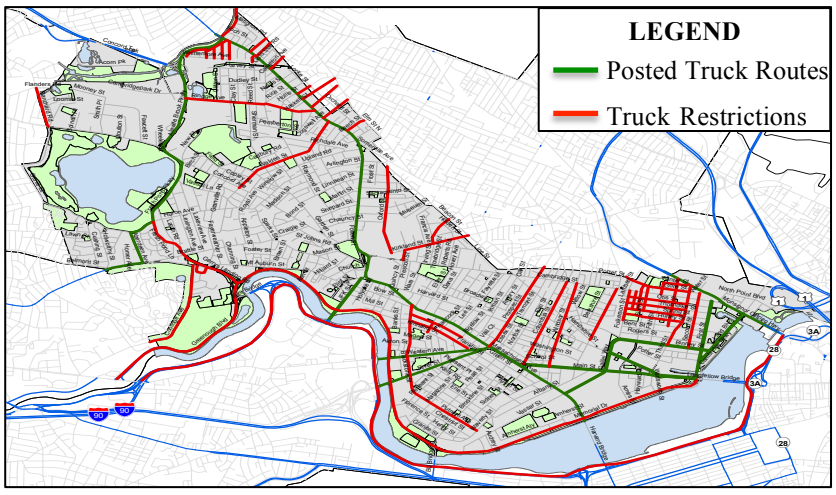
(iv) Exclusion of Vehicles: commercial vehicles are not allowed to circulate on several streets or parts thereof in the city. This rule applies in different ways depending on the type of vehicle or area of the city. There is, for example, a set of restricted streets only for heavy trucks (>2.5 tons), while others are restricted for any commercial vehicle. Still, any commercial vehicles are excluded from all parkways, which are typically four-lane roads characterized by long, uninterrupted stretches running parallel to Boston's open space systems, such as the Charles river, and which, in most cases, have historic elements, including continuous rows of trees and curbing that are shared with adjacent parkland.

In the city of Cambridge, commercial vehicles are allowed to use any street whithin city limits, as long as they have a destination on that street or a nearby street. Otherwise, they are subject to the following rules:

(i) Posted Truck Routes: trucks are encouraged to use the system of Posted Truck Routes (Figure 1) for the majority of every trip. The Posted Truck Routes include, among others: Main Street, Galileo Galilei Way, Binney Street, First Street and Land Boulevard.

(ii) Streets with Restricted Circulation: the City has received permission to ban trucks on a number of streets (Figure 1) to all commercially-plated trucks over 2.5 tons gross vehicle weight, 24-hours a day.

Figure 1: Cambridge's Truck Routes and Truck Restrictions (modified from Cambridge GIS, 2013)



Still, regarding the parking practeces, commercial vehicles must obain the following rule:

(iii) All-Night Commercial Parking Prohibited: any commercial vehicle or trailer having a capacity of 2.5 tons or over shall be parked on any part of any street, way, highway, road, or

parkway under the control of the City for a period of time longer than one hour between the hours of 11 p.m. and 6 a.m., on any day, and all day Sunday, except for vehicles actually being used, loaded, or unloaded during such time.

2.2. São Paulo

São Paulo, located in the southeastern of Brazil, is one of the largest cities in the world. With a surface area of almost 8,000 km^2 and a population of approximately 20 million inhabitants (Emplasa, 2012) its metropolitan region (an urban agglomeration composed of 39 municipalities) can be qualified as a megacity. Actually, the municipality of São Paulo itself is also a megacity: the biggest and richest city of the country has a population that surpasses 11 million inhabitants, with 99% of them living in the urban area of the city.

As every big city, São Paulo faces a set of problems. One of them, and probably the first that comes in mind, is the heavy and congested traffic issue. With more than 4.5 million cars, trucks and buses in activity nowadays (CET-SP, 2013), traffic jams are a routine for drivers of both passenger car and buses as freight vehicles. And as the number of vehicles increases (in the last five years about 1.3 million new vehicles were registered in the municipality of São Paulo, what represents an increase of 21% in fleet) other negative consequences than traffic issues are also intensified as noise, vibration, traffic accidents and air pollution.

In order to mitigate the negative effects caused by the intense traffic, especially CO_2 emissions, São Paulo's local government has been implementing (and modifying), since 1982, a set of public policies to regulate the circulation of freight vehicles in some areas of the city.

The current legislation operates in the areas and roads highlighted on the map of the Figure 2 and is composed of the following policies:

(i) Municipal vehicles rotation: inside the mini ring-road area, from Monday to Friday, from 7 a.m. to 10 a.m. and from 5 p.m. to 8 p.m., all types of motorized vehicles (except motorcycles) must obey rotation`s rules, which prohibit circulation according to a match between the final number of vehicle's plate and the day of the week. E.g.: vehicles with final plate number 1 or 2 cannot circulate on Mondays;

(ii) ZMRC - Zone of Maximum Restricted Circulation: truck circulation restricted from Monday to Friday, from 5 a.m. to 9 p.m., and on Saturdays, from 10 a.m. to 2 p.m. VUCs are allowed;

The VUC (Urban Freight Vehicle) was introduced in 1997, from the need of an smaller and alternative delivery vehicle, which had an operational performance compatible with high level traffic roads at the same time it was allowed to circulate in the restricted areas. Nowadays, to fit VUC’s category, a vehicle must have a maximum dimension of 2.2 x 6.3 meters.

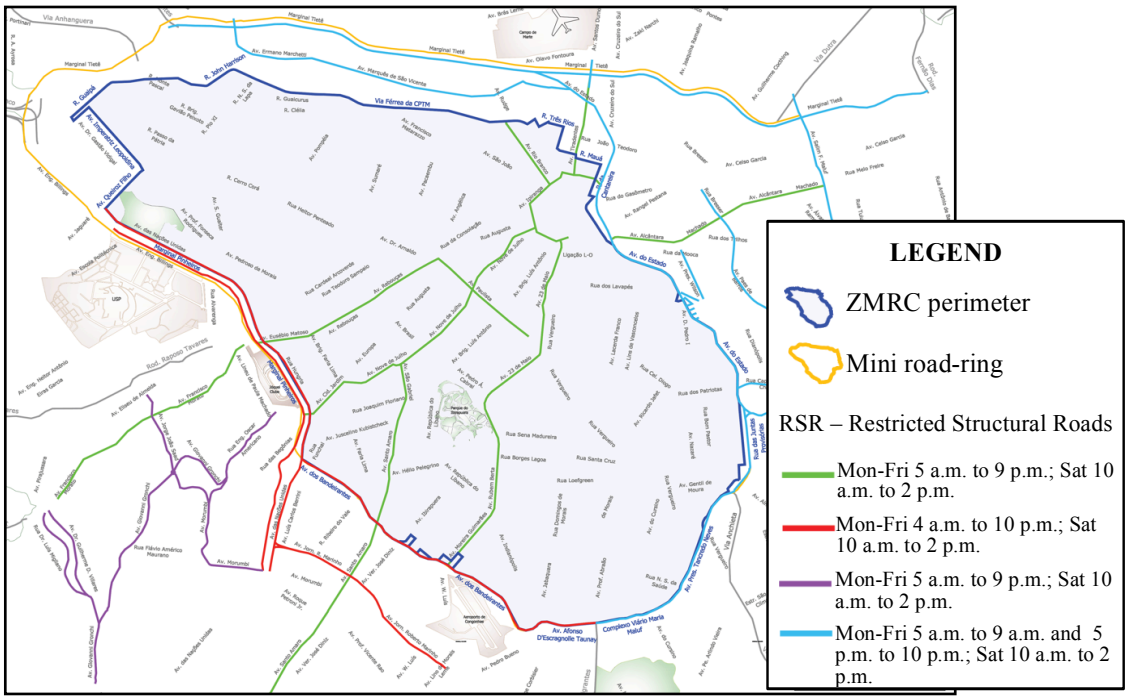
(iii) RSR - Restricted Structural Roads: specific roads and their access, which are subjected to local regulations defining the periods of restrictions to the circulation of trucks and VUCs;

(iv) ZERC - Zone of Special Restricted Circulation: areas or roads located in exclusive residential areas, totally restricted to the circulation of trucks and VUCs;

(v) Roads restricted to the circulation of trucks: roads with no specific classification, but that are restricted to the circulation of trucks from Monday to Friday, from 5 a.m. to 9 a.m. and from 5p.m.

to 10 p.m., and on Saturdays, from 10 a.m. to 2 p.m.

Figure 2: Zones and roads of restricted circulation of vehicles in the city of São Paulo (modified from CET, 2013)



Some delivery and service trucks, however, are exceptions to the restrictions and are authorized to circulate in the ZMRC due to the nature of products transported and services offered. Postal service vehicles, for example, are allowed full time, while waste disposal trucks can circulate only from 9 p.m. to 6 a.m. Vehicles which at least half of the cargo is of perishable food, in possession of special permissions, are authorized to circulate from 5 a.m. to 12 p.m.

Other examples of exceptions vehicles are: news gathering vehicles, concrete mixer and concrete pump trucks, moving trucks, armored vehicles and vehicles dedicated to essentials and infrastructure urban services or to emergency works and services. There are also exceptions for the others restricted areas and roads, to each of which different rules are applied.

3. OBSERVATION AND DATA COLLECTION METHODOLOGY

In order to observe and experience different realities in terms of urban delivery, this study has conducted two research workshops, one at Boston-Cambridge, in September 2012, and one at São Paulo, in October 2012. The workshops' activities "City Exploration" and "Route Shadowing", detailed below, allowed research team to identify the main different and common practices on delivery strategies and operations in a city like Boston versus a megacity like São Paulo.

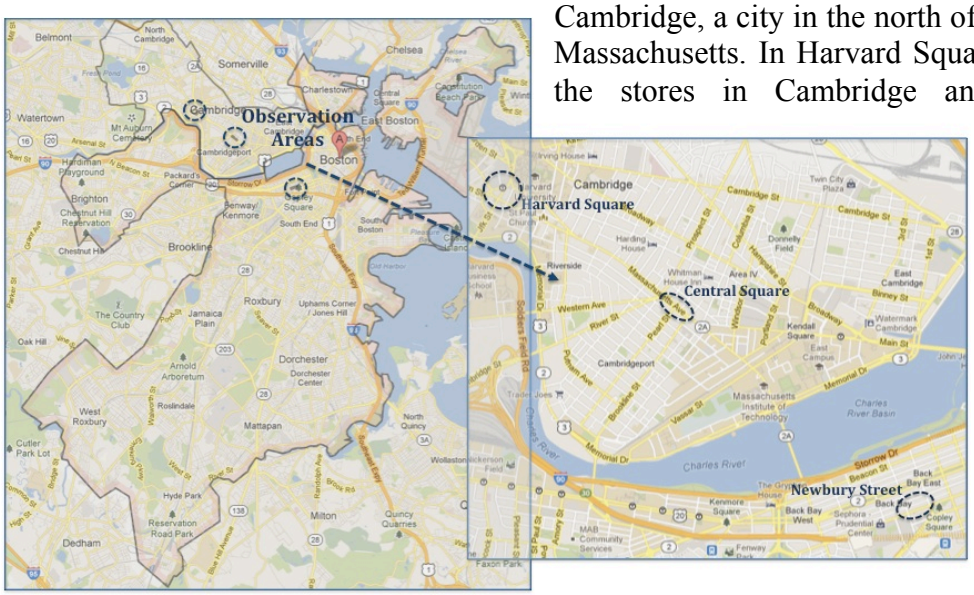
3.1. "City Exploration" and "Route Shadowing" Activities

From the observation of deliveries´ taking place at three different urban areas of the two cities (Figure 3 and Figure 4), "City Exploration" activity had the objective to identify some general delivery practices, as to characterize these areas from a city logistics perspective. For that, the observations and data collections procedures have considered:

(i) The general aspects of the observed area:
- Street configuration (lanes, flows, traffic lights, stop signs, etc.);
- Number and type of commercial establishments;
- Parking (load/unloading zones, residential, general parking, etc.);
- Enforcement (if any observed).

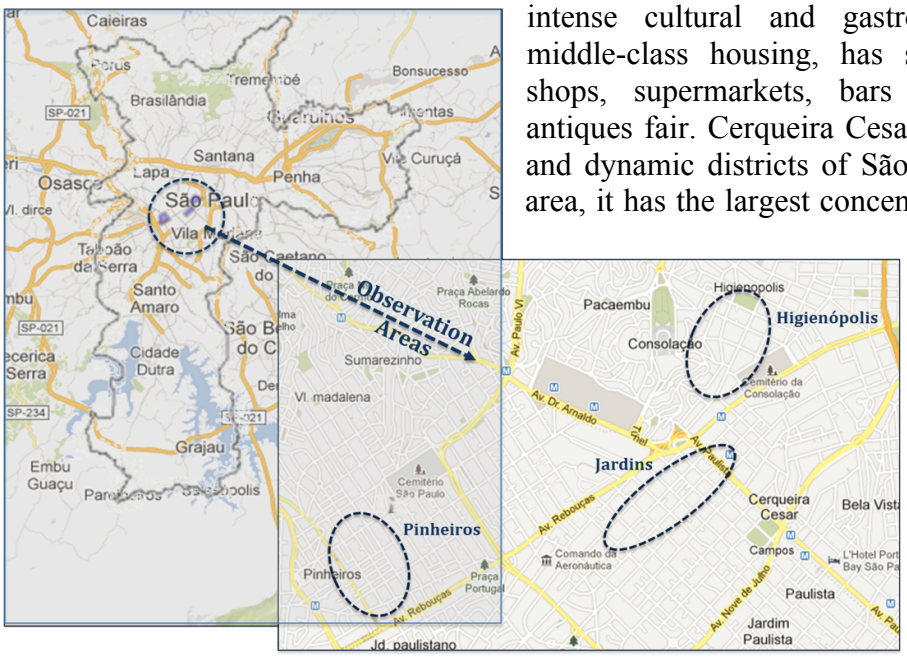
(ii) The observation of delivery operations:
- Time of arrival;
- Type and size of delivery vehicle;
- Company and product type;
- Parking/stop process (in commercial area, in regular spot, traffic blocking, time taken during parking, etc.);
- Eventual difficulties for drivers to park (traffic impacts, multiple laps around the block searching for a parking area, etc.);
- Delivery process details;
- Unitization (pallets, boxes, containers, etc.);
- Number of establishments attended;
- Type of unloading equipment (if any);
- Distance walked by driver (if any);
- Attended or unattended delivery;
- Vehicle locked/unlocked during delivery;
- Engine running or stopped during delivery;
- Time of departure.

Figura 3: Boston's Observation Areas



Harvard Square is a neighborhood center of Cambridge, a city in the north of Boston, in the state of Massachusetts. In Harvard Square are located most of the stores in Cambridge and also the Harvard University Campus. Central Square, also has gained visibility in 1985, when began the construction of the University Park at MIT. Moreover, this area is well known for its great selection of ethnic restaurants. Newbury Street, located in Boston's historic Back Bay area, is renowned for its fashionable and unique salons, boutiques, shops and restaurants. The street was built in 1861 and still features restored 19th century brownstone homes. It was once the most famous and elegant neighborhood in Boston.

Figure 4: São Paulo's Observations Areas



Pinheiros, located in the west side of São Paulo, has intense cultural and gastronomic. Features, mostly middle-class housing, has several restaurants, banks, shops, supermarkets, bars and nightclubs, art and antiques fair. Cerqueira Cesar is one of the most valued and dynamic districts of São Paulo. Located in a noble area, it has the largest concentration of hotels and luxury shops and restaurants. Moreover, it offers different shopping and leisure options, including nightclubs, theaters and cinemas. Higienópolis has one of the most expensive square meters of São Paulo and is characterized by a population of upper middle income. Furthermore, it is also known for the presence of relevant cultural institutions as well as universities, schools, hospitals, museums, theaters, shops, banks, restaurants and various shops.

3.2. "Route Shadowing"

The "Route Shadowing" activity, in turn, has restricted the comparison focus of this study, by limiting observations and data collections to the delivery operations of a single company. Both in São Paulo and Boston the same company was choose (an important company in the sales business of office supplies, the second largest internet retailer), which allowed the research team to follow their delivery vehicles in their delivery routes, from distribution center to a set of customers located in the urban area of the city.

Boston´s delivery area covered the city's Financial District, located in the downtown area, near Government Center and Chinatown, which includes the headquarters of important mutual fund companies, banks, accounting firms and law firms. São Paulo´s delivery area covered the Paulista Avenue area, not only one of the main city´s financial center, but also an important entertainment and cultural region, where, in addition to the headquarters of major corporations, banks, consulates and hotels, many restaurants, museums, shopping malls and nightclubs are located.

4. OBSERVED DELIVERY PRACTICES AND DISCUSSIONS

4.1. General Delivery Practices

This Section presents the general delivery practices observed in the cities of Boston-Cambridge and São Paulo at the three areas presented and described.

4.1.1. Typical Delivery Vehicles

In Boston-Cambridge, as there is no restriction regarding the size of freight vehicles, a wide variety can be observed, as shown on Figure 5(A). In addition to vans, pick-ups and regular trucks, it is common to find very large trucks circulating on streets.

In São Paulo, however, it is not usual to find large delivery vehicles once they are prohibited to circulate for an extended period of the day (from 5 a.m. to 9 p.m.), according to the current traffic regulation, presented before on Section 3.2. Pick-ups, kombis, vans and small trucks (the VUCs), showed on Figure 5(B), are the most common types of delivery vehicles that can be found.

Figure 5: Typical Delivery Vehicles Observed in Boston Cambridge (A) and in São Paulo (B)

(A) ***(B)***

The types of vehicles adopted to make deliveries in a city are mandatory in determining a set of other aspects related to the delivery operations in that area. A large truck, for example, can transport a greater amount of products and, then, attend more customers in a single route than a small vehicle. This greater number of customers that could be attended by a bigger truck is not, of course, unlimited. It depends on the available period of time to realize deliveries (so called "delivery time window"), whether it is imposed by traffic regulations, by drivers' labour hours or by stores' opening hours.

Figure 6: Half-empty trucks in Boston-Cambridge

Bigger trucks, however, needs more space to park, requiring dedicated loading/unloading zones, as the alleys presented in sub-section 5.1.3, which can be not so close to the customer as a regular parking space where one can park a small vehicle. Moreover, also due to delivery time windows and/or delivery schedules, the use of bigger trucks for urban deliveries increases the chances of half-empty vehicles in circulation, once their capacity may not be fully achieved in every delivery route. It is not a coincidence, therefore, that it was not uncommon to observe half-empty trucks circulating in Boston-Cambridge areas, even in the early hours of the morning, (Figure 6). In São Paulo, however, this situation was not related.

4.1.2. Support Equipment

The use of support equipment, like manual hand trucks, cages, pallets and containers, was observed for the deliveries in both cities [Figure 7(A) and 7(B)], as it was the use of trucks with powered lift gates at their rear (Figure 8(a) and 8(b)). Some more up-to-date equipment, such as

powered pallet lifters and hand trucks [Figure 7(A-a) and 7(A-d)] and the use of unloading ramps at the rear of the trucks [(Figure 8(c)] could be observed only in Boston-Cambridge.

Figure 7: Support equipment observed in Boston-Cambridge (A) and in São Paulo (B)

(A) ***(B)***

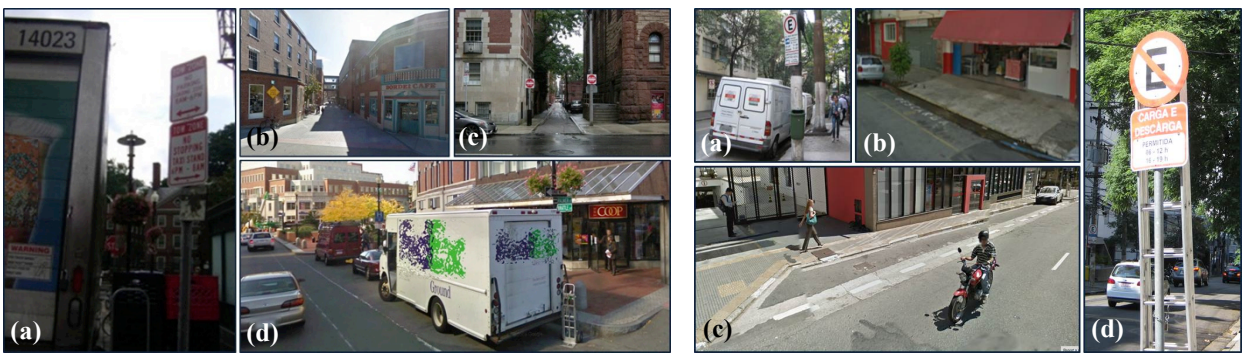
Figure 8: Support equipment – liftgates (a, b) and unloading ramp (c)

4.1.3. Loading/Unloading Zones

Loading/unloading zones and parking spaces can be observed both in Boston-Cambridge and São [Paulo. The presence of regulated loading/unloading zones, identified by official signs (Figures 9(A, a) and 9(B-a, d)] and/or sidewalks retreats [Figure 9(A-d) and 9(B-c)] are common to both cities. The former, which is more easily found, can identify a exclusive loading/unloading space or a shared space, where, in some periods of the day, loading and unloading operations are allowed, whether for a limited time period (usually 15 minutes) or not. Regarding the loading/unloading zones, three main differences can be observed between Boston-Cambridge and São Paulo:

Figure 9: Loading/Unloading Zones observed in Boston-Cambridge (A) and in São Paulo (B)

(A) ***(B)***



The alleys, or alleways [Figure 9(A-b,c)], a thoroughfare through the middle of a block giving access to the rear of buildings, were observed only in Boston-Cambridge areas, since this kind od structure is not usual in São Paulo, or even in Brazil. Alleys allow delivery vehicles to realize their load and unloading operations in an isolated and dedicated area, without disturbing other vehicles and pedestrians. These alleys generally have direct access to stores and offices located inside the buildings surrounding them;

Only in São Paulo could de found commercial establishments which have an not regulated loading/unloading parking space just in front of them [Figure 9(B-b)]. This means that the store itself was responsible for signaling and reserving a parking space for the delivery vehicles attending it, but without the permission of the city's traffic department;

The availability of loading/unloading zones and parking spaces observed in Boston-Cambridge and São Paulo was totally distinct. While in Boston-Cambridge's observation areas it was not unusual to find free parking spaces (loading/unloading-dedicated or not), the lack of loading/unloading zones is an important issue for deliveries operations in São Paulo, where the difficulty in finding a place to park was pointed out by some drivers as the first major problem, followed by heavy traffic and security issues.

4.1.4. Deliveries on Foot

The lack of available parking spaces in São Paulo, mentioned in previous section, contributes to another delivery aspect observed in the city: the deliveries by foot to different customers, relatively close to each other, from the vehicle parked at some spot at delivery area, as shown on Figure 10. The map of Figure 11 shows a set of customers attended by a beverage's delivery vehicle, as it the locations where it was parked. Points of the same color represent customers attended on foot from the same vehicle's stop. One can note that, in this case, 16 different customers were visited from four vehicles stops.

Figure 10: Examples of deliveries by foot in São Paulo

Figure 11: Map of the deliveries of a beverage's company

In Boston-Cambridge, however, the observed situation was the opposite: the availability of parking spaces encourages deliveries to be made by truck, even those to customers near each other, which could be made by foot.

Current legislation also creates the need for adjustments in the forms of delivery, including deliveries by foo; due to rotation rules, one of the observed delivery vehicles could not circulate in the delivery area between 7 a.m. and 10 a.m. The driver then had to reach the area before this

period, park the vehicle and make all the deliveries by foot, walking up to seven kilometers, during the observation period (about two hours and a half).

4.1.5. Irregular Parking: Driver´s Behavior and Traffic Enforcement

Figure 12: Irregular parking in Boston-Cambridge and São Paulo

The observation of irregular parking practices both in Boston-Cambridge´s and São Paulo´s observation areas can lead to an interesting finding: regardless of the availability of loading/unloading zones or parking spaces drivers choose to park as close as possible of the delivery point, most of the time just in front of it, even if they violated traffic rules. In both cities it was not uncommon to find freight vehicles practicing double parking [Figure 12(a)], parked on a traffic lane and blocking the circulation of other vehicles [Figure 12(b, c)], over the sidewalk [Figure 12(e)] and also on parking spaces dedicated to other users, like elderly or disabled people [Figure 12(f)].

In the case of São Paulo, where the lack of available parking spaces was pointed out by drivers as a major problem, it could be deduced that irregular parking would be avoided if there were more loading/unloading zones, however, in some situations where there was an available parking zone in less than a 100 meters radius, drivers also choose to park in front of the delivery point. Then, the observed behavior of drivers, both from Boston-Cambridge and São Paulo, indicates that, except in the case of small and light deliveries, to stores very close to the loading/unloading zone, to increase the number of loading/unloading zones would probably not be able to compete with the convenience of parking right in front of the delivery point, once this practice saves time (allowing more deliveries per day) and preclude the need of using an additional support equipment to carry the load from vehicle to store.

It is possible to say that irregular parking is also motivated by the lack of enforcement penalties. In both cities, enforcement exists and is present (Figure 13), but, instead of ticketing delivery vehicles as soon as the irregularities are committed, once rules are very clear, at a first moment it only acts to warn drivers. This creates an "informality" that, somehow, invalidates the real function of regulations.

Figure 13: Presence of enforcement in Boston-Cambridge (a) and São Paulo (b)

4.1.6. Sidewalk Utilization

The use of sidewalk to place loads was frequently observed the two cities, as shows Figure 14. In some cases, almost half of the sidewalk width is been used to place the load and support equipment, blocking the circulation of pedestrians.

Figure 14: Sidewalk utilization in Boston-Cambridge (a) and São Paulo (b, c)

4.1.7. Number of Employees per Delivery

One very noticeable difference between the observed deliveries in the two cities is the number of dedicated employees. It is very rare to find in Boston-Cambridge more than one employee making a delivery, where, in most of the situations, one single person is responsible for all delivery operations (driving the vehicle, unloading and delivery the products to store), as show Figures 15(A). In São Paulo, however, it is common to find two or three employees dedicated to the same delivery, as shows Figure 15(B). In these cases, in general, there is one driver and one or two assistants, who are in charge to unload and deliver the products to stores, while the former is the one responsible for the vehicle and any other help to unload.

Figure 15: Single employee in Boston-Cambridge (A) and Group of Employees in São Paulo (B)

(A) *(B)*

4.1.8. Lack of Coordination

Figure 16: Trucks of the same company in the same delivery area

Finally, a lack of coordination is another relevant aspect that was observed and must be pointed out. In both cities it was possible to find two trucks of the same company delivering products in the same area, as shown in Figure 16. In the case of São Paulo, as only small trucks are allowed to circulate, even if there were two trucks delivering in the some area [Figure 16(b)], both of them were fully loaded, indicating that the imposed restriction to vehicle's size, increases the number of vehicle's in circulation. In the case of Boston-Cambridge, however, the two large trucks observed in the same area [Figure 16(a)] were half-empty, suggesting that transport coordination could bring a significant improvement to logistics operations by reducing the number of vehicles circulating on streets and, thus, logistics costs and environmental negative impacts.

4.2. Office Supplies' Company Delivery Practices

For the same office supplies company, this section presents a comparison between the deliveries operations practiced in the city of São Paulo and in the city of Boston.

4.2.1. Delivery Vehicle and Support Equipment

The type of vehicles adopted by the company to realize deliveries are different in the two cities, which specifications are presented in Table 1. Due to current regulation, as previous mentioned, small trucks and vans are the only option for São Paulo's deliveries, while in Boston-Cambridge, bigger vehicles can be adopted, like the medium truck shown in Figure 17(a). The hand trucks used as support equipment are similar in both cities, although the one used in São Paulo [Figure 17(d)] are relatively simpler and carry a smaller number of boxes than the one used in Boston-Cambridge.

Figure 17: Delivery vehicle and support equipment adopted in Boston-Cambridge (a, b) and in São Paulo (c, d)

Table 1: Delivery Vehicles' Specifications

	BOSTON-CAMBRIDGE	SÃO PAULO
Vehicle Specifications	**Truck *Isuzo* FTR 800**	**Van *Fiat Ducato***
Dimensions (length x width) [m]	8.52 x 2.40	4.75 x 2.0
Weight capacity [kg]	14,000	1,500
Volume capacity [m^3]	55.2	7.5

4.2.2. Deliveries' Control

Figure 18: Eletronic and Real Time Control of Deliveries

The use technology for the control of deliveries is another main difference observed. While in Boston-Cambridge code bar reading-based eletronic devices (Figure 18) are adopted to report to the distribution center, in real time, if a delivery was correctly realized or not (and the reasons why not), in São Paulo the realized (or not) deliveries are controled and reported later only through notes written on paper.

4.2.3. Unattended Deliveries and Trust Relationship

Unnatended deliveries could be found in Boston-Cambridge, but not in São Paulo. This practice found in Boston-Cambridge is only possible in a trust environment, a situation that is not typical in a megacity like São Paulo. What was frequently observed was the situation when, before office's opening hours, the delivery man was allowed, by security staff, to enter the building and

leave the ordered box just in front of office's door [Figure 19(A)] or, in some cases, just on receiver's tables. In Boston-Cambridge, the company maintain a confident relationship with its customers, so that so they do not feel the need to check their orders as soon as they received it. A total opposite situation is observed in São Paulo, where customers do not feel safe about the conformity of their orders and check each received box and item received, as shown in Figure 19(B).

Figure 19: Unattended deliveries in Boston – Cambridge (A) and Checking of deliveries in São Paulo (B)

(A) **(B)**

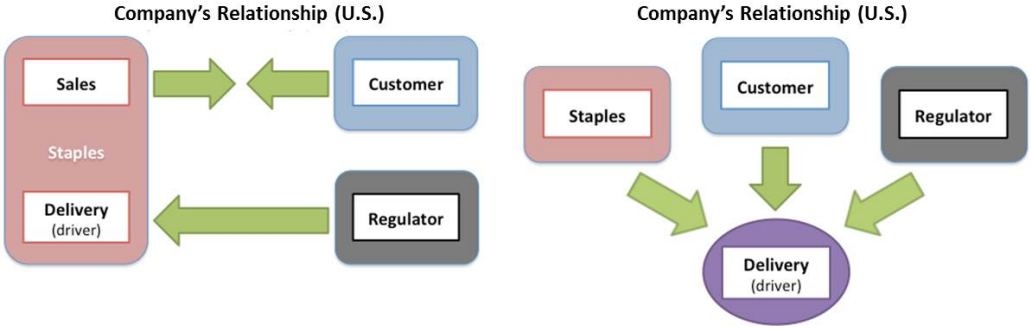
Ensuring that no unattended is stolen or damaged, it is also fundamental to allow this practice, which is guaranteed by a confident relationship between people in general, i.e., between the employees of the office itself and between them and other workers in the building.

4.2.4. Company-Employee Relationship

The labor-contracting model practiced by the observed offices supplies' company in Brazil, compared to the U.S. model shall be emphasized. While in U.S. the driver is a company's employee, paid per hour, in Brazil he has no legal relation with the company; he owns the vehicle, receives per delivery and is responsible for the payment of any extra expenses (assistant, tickets and regulation fees). This informal relation leads to an contradictory situation: to increase revenues, driver seeks for the maximum number of deliveries per day and the minimum number of expenses as possible, at the same time, because the company has no legal relation with its deliveries, customers are not supported in case of missing or damaged products and fell the need to check their orders in detail, as already mentioned, what requires an extra time for each delivery and impairs operation's efficiency.

In summary, as showed in the following schemes (Figure 20), while in U.S. the drivers are "the company itself", which maintain a strict relation with its customers and holds the responsibility for their deliveries, in Brazil drivers are an individual service provider who suffers pressure from all actors (company, customers and regulators).

Figure 20: Offices supplies' company relationship



5. CONCLUDING REMARKS

The observations of the deliveries of goods in two environments so different from each other as are the cities of Boston-Cambridge and São Paulo led to a set of interesting findings and considerations.

The similar behavior of delivery vehicles' drivers are worth mentioning. Weobserved, for both cities, that drivers tend to stop as close as possible of the delivery point, even if they violated traffic rules. From Boston observations it was possible to note that a lack of loading/unloading zones is not the reason for such practice, once available parking spaces were founded during the observations. For São Paulo, the lack of parking spaces were commonly observed and even mentioned by drivers as one of the main problems they face during deliveries operations. However for some situations where available spaces could be found, some drivers also preferred to park right in front of the stores.

It was clear that, as companies push their employees for more productive operations (even saving a budget for the payment of tickets) and enforcement is flexible about they violating traffic rules, the implementation of a parking policy must be linked to a constant enforcement, or drivers will keep looking for convenience and saving-times practices and the policy would be ineffective.

Some of the main differences between the observed deliveries in Boston-Cambridge and São Paulo may indicate how the environment of a megacity can influence companies' tactical and operational decisions. For example, the higher number of employees assigned to a single delivery may be related to: (i) security issues, once it is avoided that the delivery vehicle is left alone while a customer is being attended; or/and (ii) the imminent need to move the vehicle when it is parked in an non regular spot, as the impacts on a megacity traffic is bigger than in a small one.

Another example was the observation of unattended deliveries in Boston-Cambridge, whether to street-stores, but especially to office buildings, a practice that is possible only in a trust environment, what is not true for most of the situations in São Paulo. This trust relation between companies and customers allows the access of drivers to buildings and offices (before opening hours) out of peak hours, increasing the operation's efficiency.

Certainly, one can not say that the findings from this study are definitive in characterizing the urban distribution in megacities located in developing countries, as well as in defining a ultimate set of logistics aspects related to these particular environment. The challenges of logistics megacity, however, is an area with a lot of potential for academic research as well as entrepreneurial opportunities, and the results from this study contribute to emphasize the relevance of the topic and stimulate further research.

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