MF
METROFREIGHT
Volvo Center of Excellence

# Parking for freight vehicles in dense urban centers - The issue of delivery areas in Paris

**Project Number: 14-3.2d**
**Year: 2014/2015**

**FINAL REPORT**
**July 2015**


## Principal Investigator
**Laetitia Dablanc**

## Researcher
**Adrien Beziat**

**MetroFreight Center of Excellence**
**IFSTTAR 14 Bd Newton 77455 Marne la Vallee France**

# Parking for freight vehicles in dense urban centers - The issue of delivery areas in Paris[1]


## Abstract

Parking during operations of deliveries and pick-ups of goods is highly problematic, especially in dense urban centers. Lack of space and competition from other users of the road network result in a scarcity of available parking places, and therefore, loss of time for delivery drivers, who then tend to park illegally. To cope with the situation, one possibility for policymakers is to set aside areas specifically designated as parking spaces for delivery vehicles, such as the Paris Municipality's delivery areas policy in France. The aim of this paper is, first, to measure the supply of parking areas for delivery vehicles in Paris. Second, we will estimate demand in terms of operations of deliveries and pick-ups of goods in the city of Paris, based on a generation model of freight flows, using data from the new Paris Urban Freight Survey, carried out from 2010 to 2012 by the Laboratory of Transport Economics in the region of Paris (Ile-de-France). Finally, we will compare supply and demand, taking into account spatial and temporal distribution and we will analyze the supply-demand balance, according to the characteristics of delivery vehicle parking, based on the results of the Paris Urban Freight Survey (UFS).



**Key-Words:** Urban freight; Delivery Areas; Public Policies; Paris Municipality.


[1] This research paper was presented at poster session 730 – *Urban freight parking: to curb or not to curb*, at the 94th Transportation Research Board Annual Meeting, Washington D.C., USA, 2015.

## Introduction: Parking for delivery vehicles in dense urban centers

Delivery-drivers carry out nearly all delivery and pick-up operations in urban environments. They are subject to pressure from several factors: their customers, city infrastructure, the goods they carry, and their own vehicles. Faced with several constraints, they generally put the needs of their clients first. Transport operators are held to performance standards, especially speed of delivery. This is shown in part by the results of the Paris Region Urban Freight Survey, conducted by the Laboratory of Transport Economics, and financed by Ile-de-France (the Paris Region), the DRIEA (Ile de France Regional Department for Equipment and Planning), and ADEME (French Agency for the Environment) (*1*). More than 50% of the operations of surveyed establishments were made with a double-parked vehicle, and more than 60% with a vehicle parked illegally (on a bus or bicycle lane, or on the sidewalk). Illegal parking has a cost: congestion of the road network, extra pollution, and problems of road safety (for the delivery driver as well as for the other users). Yet a majority of drivers would rather park illegally than lose time on a delivery. The logistics of Paris-based economic establishments depend on the quickness and flexibility of deliveries and takeoffs. Transport operators are well aware of this need for more parking spaces: according to the UFS, more than 70% of the surveyed transport companies see parking as one of the major problems they face.

The issue crystallized a lot of the tensions between delivery drivers and other users of the road network. The tension has been a catalyst for important changes in the way freight is viewed by Paris's local policy-makers (*2*): in 2001, the planning of several bus lanes was done without any dialogue with the transport operators, making it nearly impossible for delivery drivers to have access to the sidewalk in certain streets. Transport professionals protested vigorously. Their objections brought about new awareness of the needs of freight transport operators on the part of public decision-makers, reflected in the Paris Delivery Charter experience, between local authorities and transport businesses (*3*). In France, municipalities have police power over the roadway network. This is their main policy lever for regulating urban freight (*4*). The city of Paris can regulate and enforce traffic regulations, and can also alter the roadway and the sidewalk, particularly parking.

The aim of this paper is to analyze the balance between supply and demand for delivery parking. The location for the study is the city of Paris, the hyper-dense center of the Paris agglomeration. The goals are to measure the supply of delivery areas (1st Section), to evaluate the demand, through a classical freight generation model (2nd Section), and compare supply with demand (3rd Section). How and where freight is generated in the city of Paris? How does the freight demand compares with the supply of parking spaces for delivery vehicles? These are the questions this paper seeks to answer. The comparison between supply and demand could also allow us to establish a link between the supply-demand balance and the characteristics of delivery-vehicle parking surveyed in Paris through the UFS.

## 1. Supply of parking spaces in the city of Paris

Parking for delivery-drivers has been an issue for operational research for a long time, and the general observation is that most dense urban centers suffer from a lack of areas reserved for this type of operation. Cities either need to set aside more delivery parking areas (*5*), or focus on innovative solutions to improve the performance of existing ones (*6*) (*7*). Researchers have generally assumed that the supply was insufficient compared with the demand of the delivery vehicles. But this assumption may not be accurate, for two reasons.

First, many transport businesses complain that parking spaces reserved for delivery vehicles are often occupied illegally by personal vehicles. In that case, the issue is not one of supply of parking spaces—the parking spaces exist. The issue is one of enforcement of traffic rules in Paris. Second, empirical observation shows that in some cases, even when a delivery area is available, some delivery drivers will prefer to double-park. That way, they don't waste time performing parking maneuvers (this is especially true for the biggest and least maneuverable vehicles).

The assumption that the supply of parking spaces is insufficient given the demand in Paris is worth verifying. Many researchers already focused on the supply of delivery parking spaces, and what their characteristics should be (*8*) (*9*) (*10*). Some researchers have studied the

supply-demand balance in New York, for modeling purposes (*11*). We consider that there are lessons to learn from studying the supply-demand balance, both spatially and quantitatively, in Paris.

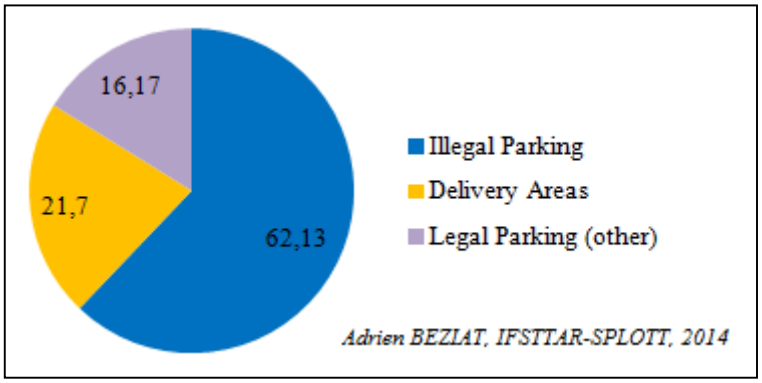


**FIGURE 1 Shares of the parking practices for freight vehicles in Paris (Source: ETMV 2011-2012 – RIF-DRIEA/DGITM-ADEME)**

There are several ways to meet the parking needs of delivery drivers. Delivery vehicles can use "standard" parking spaces (i.e. that can be used by anybody); they sometimes have access to parking on the premises of establishments; or, they can park on specially-designated delivery areas, set aside by the Municipality of Paris, for deliveries and pick-ups. Our assumption is that the first two options are not used much: it is very hard to park in Paris, because demand is already extremely high from the other users. Moreover, standard parking spaces are not necessarily well adapted to delivery vehicles, which are often much larger than personal vehicles. Also, Paris is a very dense city, and land prices are very high. Few establishments have parking space for deliveries at their disposal. The biggest establishments (very large office buildings or malls) may have space allocated for deliveries, but that's not the case for the majority of the Paris establishments. The results of the UFS show that only 9.5% of the deliveries and takeoffs of surveyed establishments were made on the premises of the establishment, and that only 6.5% were made on "standard" parking spaces (free or paying). So we will assume that 16% of deliveries and takeoffs in Paris can be made without resorting to parking specifically allocated to deliveries. It means that about 84% of operations need alternative parking supply. Only 21% of parking is done using delivery areas (Figure 1). The share of illegal parking is extremely high: more than 62%. In comparison, illegal loading only accounted for 28% of all loading activities in London in 2002 (*12*).

The best legal option for freight vehicles is to use a delivery area, regulated by the municipality of Paris. The full list of delivery areas is published in the Paris Official Municipal Bulletin (issue n°95 of November 30 2010). The list includes two types of spaces: permanent delivery areas, reserved for freight vehicles all day, every day; and temporary delivery areas, reserved for freight vehicles from 7am to 8pm, except on Sundays and National Holidays. Parking on all delivery areas is limited to 30mn.

The municipality of Paris also grants permission for delivery vehicles to stop in bus lanes to make deliveries during certain hours: 9.30 am to 4.30 pm and 7.30 pm to 7.30 am. However, for the purpose of this study, we did not take this additional "legal supply" of parking spaces for freight vehicles, for several reasons. It is not a well-known city regulation, and it is not applicable everywhere in the city, as some streets are exempted from it (which is often not specified by road signs). Interviews with practitioners from the municipality of Paris also revealed that a lot of transport operators don't even know about this regulation, and therefore cannot benefit from it. Also, although it has to be considered a supply of parking spaces for deliveries from a legal point of view, it does nothing to alleviate the negative externalities caused by parking on the roadway for freight vehicles (congestion or problems of road safety).

## 2. Demand for freight deliveries and pick-ups in the city of Paris

### *2.1 A generation model to estimate freight operations*

Generation models for freight in urban environments are a longstanding practice in operational research (*13*): today, several models can provide a good estimation of these types of flows (*14*). For the needs of this paper, we will simply estimate demand in terms of deliveries and pick-ups, so we will not need to measure flows (with an origin and a destination) as an output for the model. We have used a classical generation model to estimate movements from economic establishments (*15*), similar to the one used by the Laboratory of Transport Economics in France. Our generation model is fairly simple: it takes into account the type of activity and the size of the establishment (i.e. the number of employees). It covers all

establishments in Paris. The source for the list of establishments is the Alteres Database, which uses a data retrieval from the French register of establishments (called "SIRENE"). The Alteres Database contains the address, activity type and number of employees for every establishment in the Paris Region. The activity type is in the form of a NAF code (equivalent to the NACE code for the European Union, or NAICS code for the United States). The NAF code is a classification of activities into 732 subclasses, requiring a stratification of the establishments into smaller classes of activities.

For the needs of this paper, the establishments have been grouped into eight classes, using the stratification developed by the Laboratory of Transport Economics for the Urban Freight Survey in the Paris Region (*14*). Part of the survey was carried out through a questionnaire, sent to a sample of establishments of the Region, to estimate the volume and characteristics of the deliveries and pick-ups that those businesses needed. The preliminary results of the survey have yielded weekly generation coefficients according to the type of activity of each establishment (Figure 2).

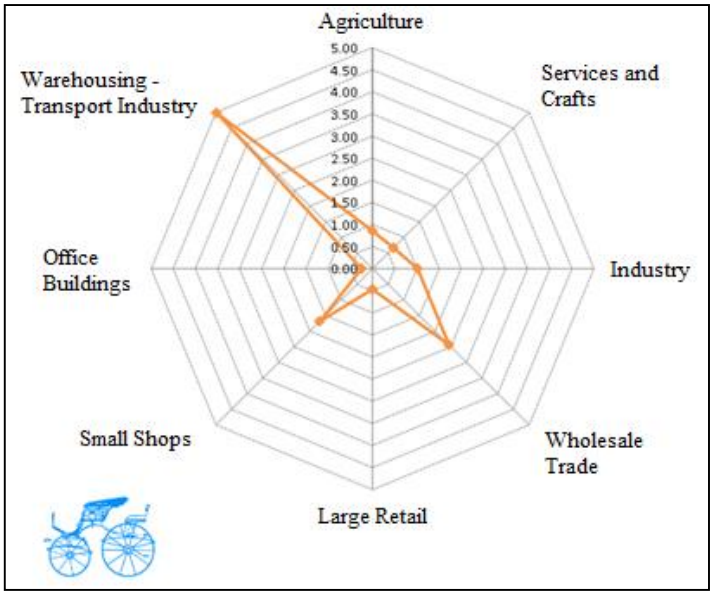


**FIGURE 2 The generation of weekly operations of deliveries/pick-ups according to the activity type (Source: Laboratory of Transport Economics, ETMV-IDF, 2014)**

We have used the database to analyze spatially the demand for deliveries and takeoffs. The addresses of the establishments have been geocoded, using GIS software. The file of

establishments was thoroughly revised. The original file includes all establishments in the legal sense, some of which are not establishments in the economic sense, (i.e. a unit that provides goods and/or services, and operates from a single physical location), do not generate freight flows, and were not even included in the Paris UFS, such as professionals, sales representatives or impartible estates (they are legally viewed as establishments by the SIRENE database). Note also that NAF codes give a distorted image of the activity of some establishments. In a city like Paris with a high concentration of decision centers, many businesses, identified in the database under Industry or Agriculture, are in fact office buildings. The database differentiates between company headquarters, and simple establishments. Under the "Industry", "Agriculture" and "Warehousing-Transport Industry" categories, all the headquarters were classified as Office Buildings, for the purpose of the generation model.

Once processed, the data can be used to estimate the number of operations per week and per job, according to the type of activity. The generation model is simply the product of the number of jobs in each establishment, and the assigned generation coefficient according to the type of activity. This gives us a number of weekly operations, which in turn, allows us to estimate a number of movements per day.

### *2.2 Generation of freight flows in Paris: results according to activity and geographical location*

The first results of the UFS show that establishments in the Paris Region generate approximately 0.7 weekly operations per job. 1.8 million people work in the city of Paris. There are just over 1,050,000 weekly operations, or about 0.6 weekly operations per job. The lower ratio (0.6, vs. 0.7 for the Paris metropolitan area) is not surprising, because the center of the agglomeration attracts a lot of activities that do not generate much freight. Only 4% of operations take place on Sundays: most businesses are closed on that day. Applying this ratio, we can estimate a volume for the rest of the week of about 167,000 operations a day in Paris, from Monday to Saturday. The ratio of 167,000 operations for 1.8 million jobs is consistent with estimations from other cities: for example in Manhattan, it is estimated that "102,597 commercial establishments, that employ about 2 million individuals, attract 182,247 […] deliveries" (*11*).

According to the UFS, the average duration of each operation is 14 minutes. Results from other cities (*11*) have shown a much higher stopping time for trucks (the median value is 1.8 hours in New York City!). This major gap could be explained by differences in logistics behavior for freight operators in Paris compared to other cities where studies on parking for freight vehicles were conducted (smaller vehicles, more illegal parking, smaller establishments delivered…). Actually, 14 minutes is consistent with the results of the surveys that took place in the 90's in other French cities, which was around 15 minutes per stops (*16*).

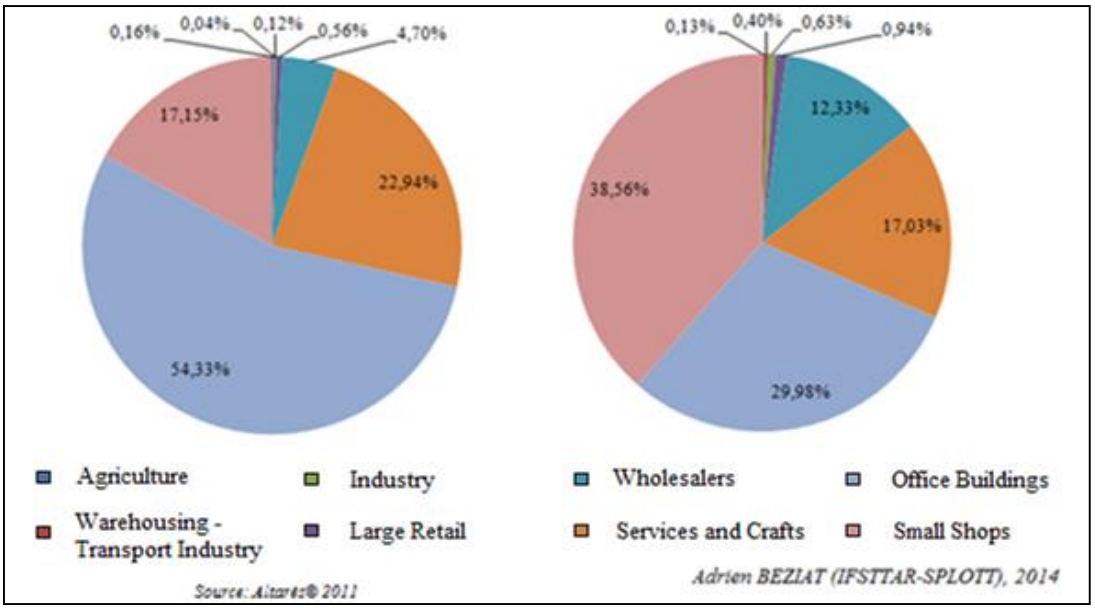


**FIGURE 3 The distribution of establishments in Paris according to the type of activity (left) and the of operations of deliveries and pick-ups of goods in Paris according to the type of activity (right)**

The pie-charts (Figure 3) show the distribution of activities in Paris, and the deliveries and pick-ups they generate. Economic activity in Paris can be broken down into three main categories: office buildings (54% of establishments), services and crafts (23%), and small shops (17%). Wholesalers come in a distant fourth. Industrial activities, large retail, warehousing/transport industries, and agricultural activities do exist, but they represent a negligible number of establishments. Paris is a "global-city" (*17*), a center of post-industrial production, dominated by services and trade.

The distribution of operations of deliveries and pick-ups is explained by Paris's economic structure, and by the generation coefficient of the activities. Although small shops represent a minority of the businesses, they are the ones that generate the most flows of goods (38.5%). Office buildings make up half of the city's establishments, but they generate relatively little freight transport (30%). Services and crafts also generate significant flows (17%), although relatively little compared to the number of establishments. The fourth category, the wholesalers, represents less than 5% of all Paris establishments, but accounts for 12% of delivery and takeoff operations.

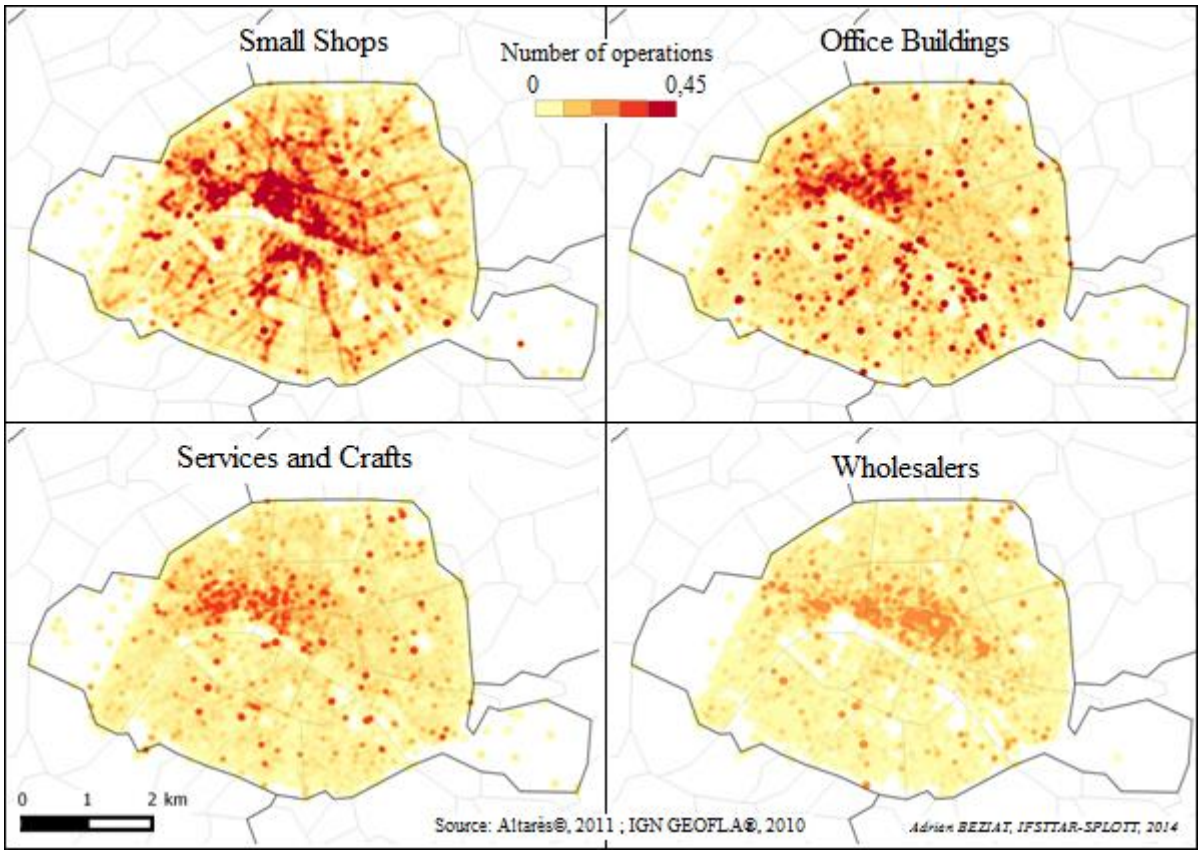


**FIGURE 4 Daily operations of deliveries and pick-ups of goods in Paris**

The spatial distribution of deliveries and pick-ups is consistent with the geography of the city of Paris. Figure 4 shows the spatial distribution of operations according to different types of activities: small shops, office buildings, services/crafts and wholesalers (from top left to bottom right).

- Operations generated by small shops are scattered along the commercial streets everywhere in Paris. There is naturally a high concentration in the trade center of the city (Les Halles, Rivoli, Madeleine…), and in some adjacent neighborhoods (the Champs-Elysées, Saint-Lazare, Saint-Michel…).
- Flows generated by office buildings are much more polarized. Though the highest concentration is in the Central Business District, around the Opéra in the 8th district, there are also many smaller areas of concentration in other parts of the city.
- Flows generated by services and crafts follow the same logic as flows generated by office buildings (in this case, the main areas are the trade centers around the Champs-Elysées and the Opéra, with smaller areas of concentration in other areas of the city); deliveries and takeoffs generated by wholesalers are located at the fringe of the trade centers of Paris.

# 3. Comparison between the supply of and demand for delivery parking spaces

## *3.1 Temporal distribution of the supply-demand balance*

There are a total of 7,984 delivery areas in Paris (1,637 are permanent, 6,347 are temporary). There are 167,000 deliveries made every day: according to the UFS, about 93% or 155,000 take place between 7am and 8pm (in this time slot, all delivery areas, including temporary ones, are restricted to freight vehicles). We have assumed that only 84%, or 130,000, need special parking areas. According to the results of the UFS, the average duration of an operation is 14 minutes. Each delivery area can therefore accommodate an average of 56 deliveries between 7am and 8pm. From a theoretical standpoint, existing delivery areas should be able to receive almost 450,000 deliveries. Of course, the reality is very different, as deliveries are not distributed uniformly, either in time or space.

In the UFS, establishments reported that more than two thirds of their deliveries took place between 8am and 12.30pm. Applying this ratio to our model, about 88,000 operations are generated during this time-slot. Between 8am and 12.30pm, each delivery area could theoretically accommodate about 23 operations of an average duration of 14 minutes, or a

total of nearly 185,000 operations. If we take into account the peak hours of goods deliveries (i.e. between 10 and 11am) which account for 21% of all operations, or some 27,000 deliveries, each delivery area can accommodate 4 average operations, or a total of about 32,000 deliveries in all. During an average day for goods deliveries, the demand is almost equal to the supply during the peak hour. That said, deliveries are not distributed in a uniform way in space.

### *3.2 Temporal and spatial distribution of the demand-supply balance*

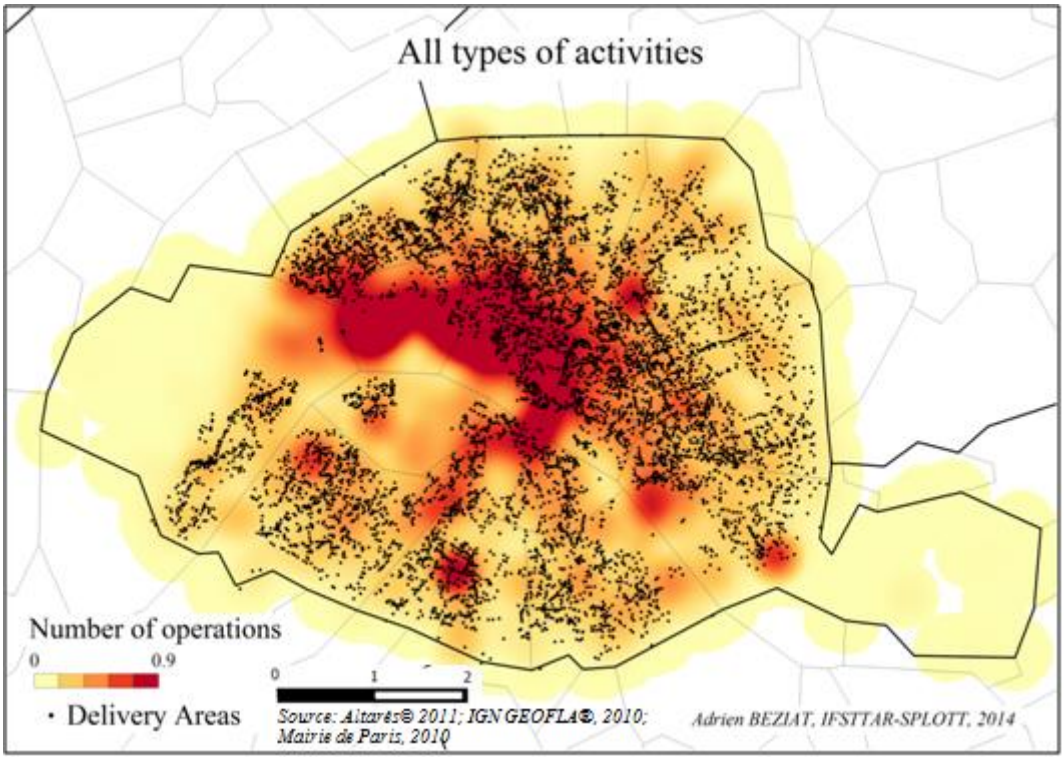


**FIGURE 5 Spatial distribution of the daily operations of deliveries and pick-ups in the city of Paris, compared with the distribution of delivery areas**

The map (Figure 5) shows the generation of deliveries by Paris establishments (for all types of activities) and the precise localization of all the delivery areas. First it appears that the supply of delivery areas in some parts of Paris is sharply inadequate given the number of operations generated. The 8$^{th}$ district, the west of the 1$^{st}$, the east of the 7$^{th}$, and the north of the 16$^{th}$, for example, are almost completely devoid of any delivery areas, although these locations are "hotspots" of economic activity in Paris. Strikingly, some of the most commercially active streets in Paris have no delivery areas at all: the Champs-Elysées, for example, or the rue de

Rivoli. In contrast, some areas, that are not very active economically, such as the outlying northern districts, are very well equipped with delivery areas. This map illustrates the spatial inadequacy between the demand for and supply of parking areas for delivery vehicles.

In the maps (Figure 6), we estimate the number of operations that require a delivery area, by district, compared to the number of delivery areas in the district. If we take into account all the deliveries taking place between 7 am and 8pm (93% of operations), we can see that the 8th district has too few delivery areas. If we look at the time slot between 8am and 12.30pm (67% of operations), when two thirds of daily deliveries are made, the 1st and 7th district also show a deficit. Lastly, during the peak hour between 10am and 11am (21% of operations), almost half of the districts of Paris show a deficit.

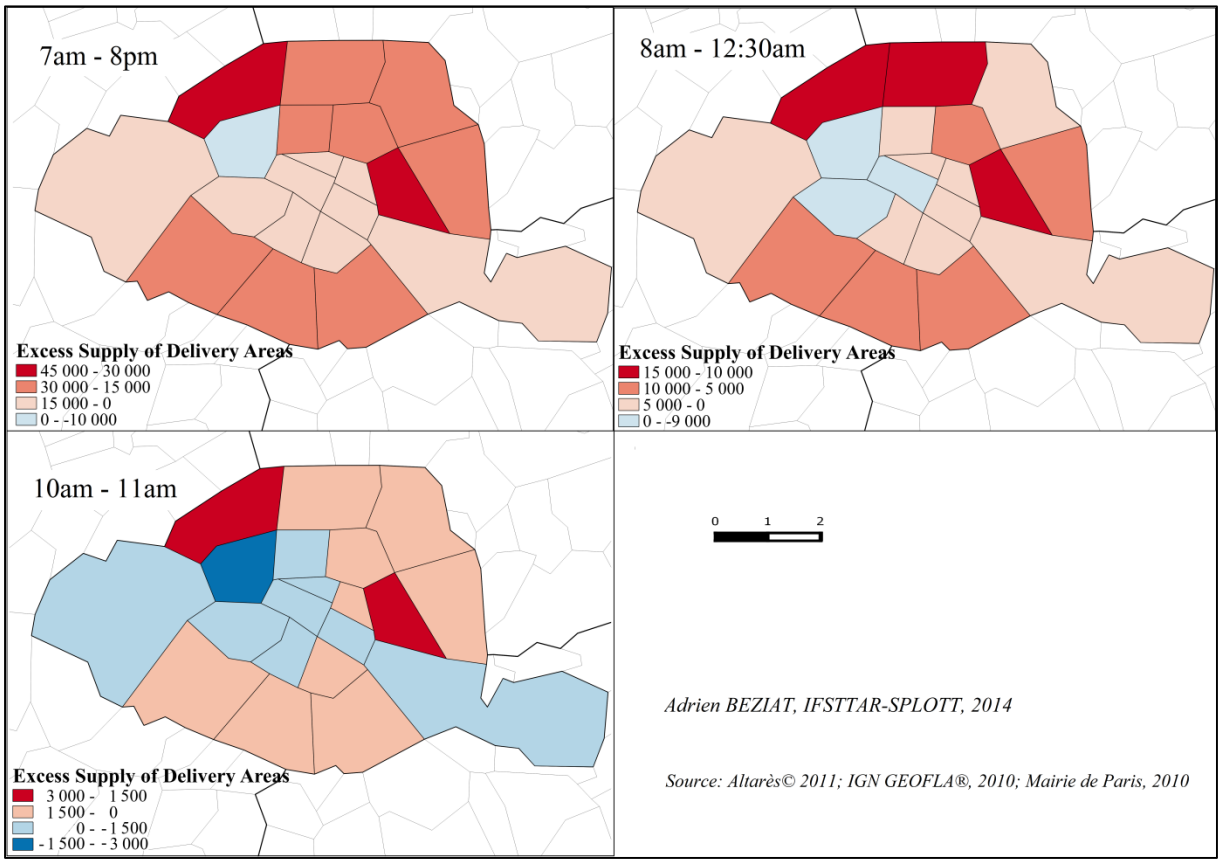


**FIGURE 6 Excess supply of delivery areas at different times of the day**

*3.3 Is it possible to clearly identify the link between the supply-demand balance, and illegal parking practices?*

Nevertheless, the discrepancy between supply and demand does not necessarily explain illegal parking practices entirely. The graphic (Figure 7) shows the absence of a statistical relationship between the excess of operations generated in a district (compared to the supply of delivery areas) and the percentage of deliveries involving illegal parking, as measured in the UFS. Some districts with very high demand also have a low percentage of deliveries involving illegal parking. In contrast, some districts that have a very good supply of delivery areas have a very high percentage of illegal parking.

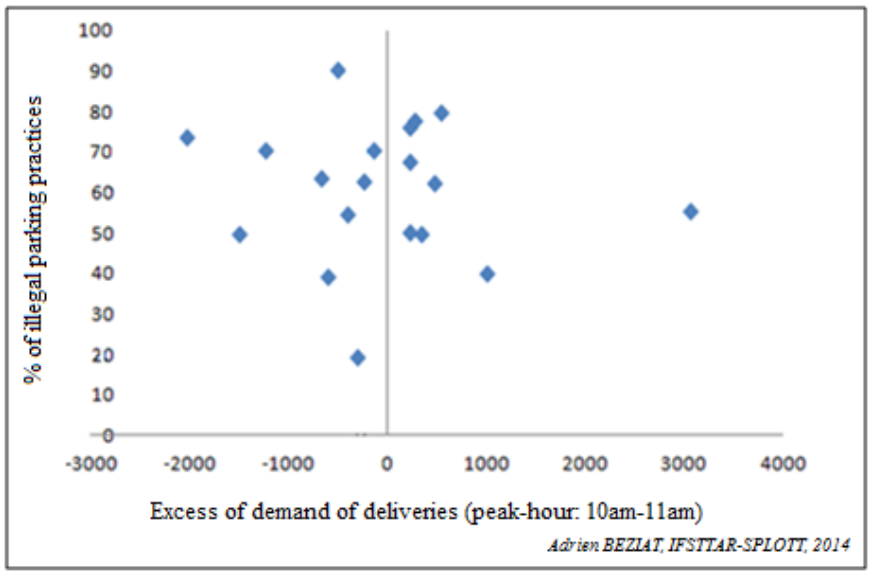


**FIGURE 7 Graph showing the absence of relationship between the excess of demand and the percentage of illegal parking practices (Source: ETMV 2011-2012 – RIF-DRIEA/DGITM-ADEME)**

In some cases, where there is a low supply of delivery areas, a lot of demand, and not much illegal parking, there may be ample alternative legal parking available (private parking on the premises of an establishment, standard parking, and delivery areas that are less likely to be occupied illegally by personal vehicles…). It is also possible that, in districts where there is an ample supply of delivery areas but a high percentage of illegal parking, delivery areas are not distributed correctly (i.e., according to the exact localization of economic establishments). In any case, our research on this specific point is not conclusive. Understanding the link between the supply-demand balance and illegal parking practices will require extensive field work, on-site observations and interviews with transport businesses, delivery-drivers and economic establishments, to better understand the logic behind these practices.

## Conclusion

Parking for delivery vehicles in dense urban environments is a highly problematic issue, for transport operators who have to meet logistic performance standards, and in terms of the social costs generated. In Paris, the reality is that many delivery-drivers park illegally to make deliveries to and from economic establishments. Since the signing of the Paris Delivery Charter, setting aside space for delivery vehicles has become a major priority for the Paris municipal authorities. But competition for use of the curbside is fierce. The city of Paris's objective is to facilitate deliveries, but elected officials have other concerns too: they have to keep a steady supply of traditional parking spaces for personal vehicles; they want to develop bus lanes and bikeways; and they want to increase the number of self-service bicycles and self-service electric cars stations (in Paris, "Velib" and "Autolib"). Last but not least, they have to keep sidewalks large, and in some cases, extend them, so that Paris remains a pedestrian-friendly city. Therefore, curbside space is very limited, and the voice of delivery-drivers and goods transporters is not always heard in the political debate.

Our research confirms what has been a basic axiom in many previous papers, namely that the supply of parking spaces for delivery vehicles is insufficient compared to the demand (based on the number of pick-ups and deliveries). Given the spatial and temporal distribution of the demand for delivery vehicle parking, certain areas in Paris are significantly under-equipped. That being said, the link between insufficient supply and illegal parking practices remains to be established fully. Admittedly, insufficient supply probably explains this type of behavior to a certain extent. But it is probably not the only variable to explain the fact that barely over 20% of deliveries are made on delivery areas, or that over 60% of deliveries are made while parking illegally. Other possible factors, such as a lack of strict enforcement of parking regulations on delivery areas, or the refusal of delivery-drivers to park in delivery areas, even when these are available, because the overriding concern is loss of time, should be further investigated.

# References


1. PATIER D. & ROUTHIER J.-L. How to improve the capture of urban goods movement data? Resource Paper, *8th International Conference on Survey Methods in Transport*, Annecy, France, 2008.

2. BROWNE M. & RIPERT C. « La démarche exemplaire de Paris pour le transport de marchandises en ville ». In *Les Cahiers Scientifiques du Transport 55*, 2009, pp 39-62.

3. DABLANC L., DIZIAIN D. & LEVIFVE H. "Urban Freight Consultations in the Paris Region". In *European Transport Research Review 3*, Issue 1, 2011, pp 47-57.

4. DABLANC L. "Goods Transport in Large European Cities: Difficult to Organize, Difficult to Modernize". In *Transportation Research Part A: Policy and Practice 41*, 2007, pp 280-285.

5. MUNUZURI J., LARRANETA J., ONIEVA L. & CORTES P. "Solutions Applicable by Local Administrations for Urban Logistics Improvement". In *Cities* 22, Issue 1, 2005, pp 15-28.

6. JONES E., CHATTERJEE A. & MARSILI R. "A Collaborative Plan for Curbside Freight Delivery in Washington, DC, USA", *ITE Journal*, 2009, pp. 22-25.

7. PATIER D., DAVID B., CHALON R., DESLANDRES V. "A New Concept for Urban Logistics Delivery Area Booking". In *Procedia – Social and Behavioral Sciences 125*, 2014, pp 99-110.

8. HABIB P. A. & CROWLEY P. W. "Economic Approach to Allocating Curb Space for Urban Goods Movement". In *Transportation Research Record: Journal of the Transportation Research Board n°591*, Transportation Research Board of the National Academies, Washington, D.C., 1976, pp. 18-24.

9. CHRISTIANSEN D. "Off-Street Truck-Loading Facilities in Downtown Areas: Requirements and Design". In *Transportation Research Record: Journal of the Transportation Research Board n°668*, Transportation Research Board of the National Academies, Washington, D.C., 1978, pp. 10-14.

10. CHATTERJEE A., VARMA A., FISCHER A., and SWENSON J. "Curbside Delivery of Freight by Trucks in Downtowns of Small- and Medium-Sized Urban Areas", *ITE Journal*, 2008, pp. 32-42.

11. JALLER M., HOLGUIN-VERAS J. & HODGE S. D. "Parking in the city: Challenges for Freight Traffic". In *Transportation Research Record: Journal of the Transportation Research Board n°2379*, Transportation Research Board of the National Academies, Washington D. C., 2013, pp 46-56.

12. BROWNE M., ALLEN J. & CHRISTODOULOU G. *Freight transport in London: a summary of current data and sources*. Report for TFL (Transport for London), University of Westminster, 2004, 30p.

13. OGDEN K. W. "Modeling Urban Freight Generation". In *Traffic Engineering and Control 18*, Transportation Research Board of the National Academies, Washington, D. C., 1977, pp 106-109.

14. AMBROSINI C. & ROUTHIER J. L. *Urban Freight Modeling: a Review*, 11th World Conference on Transport Research, Transportation Research Board of the National Academies, Washington, D. C., 2007, 29p.

15. AMBROSINI C., PATIER D. & ROUTHIER J. L. “Urban Freight Establishments and Tour Based Surveys for Policy Oriented Modeling”. In *Procedia – Social and Behavioral Sciences 2-3*, 2010, pp 6013-6026.
16. GERARDIN B., PATIER D., ROUTHIER J. L. & SEGALOU E. *Programme National Marchandises en ville – Diagnostic du transport de marchandises dans une agglomération*. Document technique n°1, MELT-DRAST, avril 2001, 96p.
17. SASSEN S. *The Global City: New-York, London, Tokyo*. Ed. Princeton Paperback, 472p, pp. 126-168, 1991.

## Acknowledgement

This research was funded and supported by the Volvo Research and Educational Foundations through the MetroFreight Center of Excellence, IFSTTAR. The author of this article would like to thank the IAU for the use of the database Altarès©. The author would also like to thank Laetitia Dablanc (PhD supervisor), Martin Koning and Jesus Gonzalez-Feliu for their help. All errors and omissions are the responsibility of the authors.