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How can urban goods movements be surveyed in a megacity? The case of the Paris region

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Abstract

This paper describes the survey method built to carry out the UGM survey in the Paris region. The size of the city, around 12 million inhabitants spread over a territory of 12,000 km², and the cost constraints led us to design a specific sampling methodology based on a typology of the 1,300 Parisian municipalities. Thus it was possible to capture all the movements and main logistical behavior of the city by surveying only 1,200 establishments.

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Keywords: Urban goods movements survey; Paris, sampling methodology; cost constraints; megacities; establishment-based freight survey; data collection method; typology of municipalities.

1. Introduction

In France, knowledge of goods movements occurring in urban areas owes much to the surveys performed in the 1990s in three cities with different sizes and spatial configurations: Bordeaux (836,000 inhabitants), Dijon (238,000 inhabitants) and Marseille (1,557,000 inhabitants). These surveys, performed according to a novel methodology developed by the Laboratoire d'Economie des Transports in Lyon (Bonnaïfous, 2000), were demanded and sponsored by the French Ministry of Transport, the ADEME and local authorities, to fill in the gaps that had become apparent in recent decades regarding knowledge of goods transport in cities (Garrido, 2001). Indeed, up to the 1990s,

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the concerns of public actors had for long focused on interurban goods transport, neglecting last mile trips and the last link in the supply chains irrigating the city. This was also the case in many other countries (Ambrosini and Routhier, 2004).

The French surveys were the first to our knowledge to include all the flows of goods exchanged between all the economic activities of a conurbation and its urban area[†]. This space includes the majority of the economic activities that supply the city with the goods it consumes (wholesaling, hypermarkets, the main peripheral warehouses). Thus the surveys included all the transport operators (own account, third party), all types of vehicle (from two-wheeled vehicles to semi-trailers), and all goods deliveries and pickups (from express courier service to full loads). These surveys made it possible to quantify the deliveries and pickups generated by businesses, characterize the logistics organizations deployed (vehicle, round or direct route, number of stops, the type of transport operator), take into account the conditions under which establishments were served (mode of parking, handling facilities used) and measure the quantities of goods transported according to their type, packaging and weight. The convergence of the results obtained from these three cities also led to the development of the Freturb model, which allows any city that wishes, to simulate the goods movements within its boundaries (Routhier and Toilier, 2007). The particularity of this model is that it allows evaluating the flows of goods generated by the economic activities of an urban area without it being necessary to carry out a specific survey, thus making it easily affordable for local authorities. This is why fifty French and European cities have adopted this model.

15 years after this initial wave of surveys, in an economic context marked by the stagnation of GNP that has led enterprises to reorganize to reduce their costs and by the generalized use of the Internet and new information technologies that have radically modified goods management, traceability and purchasing behaviors, the French Ministry of Transport wanted to update its knowledge of this segment of urban mobility (Ambrosini and Routhier, 2004). Since only partial funding was provided by the government, a call for offers was launched in French cities to select those that would be used to carry out these surveys. The fact that this initiative came from the government is a particularity of the French system. Indeed, such surveys are difficult to consider in most other countries, as they must be paid for solely by the local authorities concerned.

The administrative region of Île-de-France, which includes Paris, was the first to express its desire to participate. Its selection immediately raised several questions: that of the spatial scale chosen (the region rather than the city), that of its representativeness (with a population of 12 million, the Paris region holds foremost position in the French hierarchy of urban areas, with six times more inhabitants than Lyon, the second city on the list), and that of feasibility (how is it possible to survey such a vast and atypical territory without huge costs?).

As the Parisian urban area approximately corresponds to the administrative region, the first question can be discarded immediately. Regarding the second, the specific nature of the Paris region argued in favor of carrying out a survey in it to obtain a full panorama of goods movements in French cities, by enlarging the scope of investigation to a megacity. Thus the last question of “How” remained and the aim of this paper is to clarify this point by first presenting the survey methodology considered to make comparisons with previous surveys, then the work performed on the sampling to reconcile the methodology with the financial constraints. Lastly, the first results are discussed and briefly compared to those of the surveys of the first wave.

2. Methodology of Urban Goods Movement Surveys: UGMS

Here, we summarize the main lines of the survey method. For more details the reader can refer to Patier and Routhier (2009), Patier et al. (2015). The analysis of urban goods flows for a long time came up against the complexity of the urban environment in which a multitude of actors, activities and regulatory systems are present. This complexity affects organizations (round sizes and small vehicles), meaning that the indicator generally used to measure interurban exchanges (ton*km) cannot be applied within cities. The success of the first UGMS above all

[†]. In France, the urban area defines the area in which the inhabitants have access to all the usual services of a town or city, whether functional (jobs, daily mobility) or economic. It is composed of a number of municipalities, covering a single space without an enclave, with an urban center, and with rural municipalities or urban units (urban fringes) where at least 40% of the resident population having jobs works in the center or in the municipalities within its sphere of attraction (INSEE).

stemmed from the introduction of a novel unit of observation: the movement, and a method designed to take every aspect of this unit into account.

2.1. Unit of observation and survey organization

The movement is defined as the service provided to a given economic establishment by a given vehicle, to make a delivery or a pickup (or both at the same time). It is computed in an establishment each time a vehicle delivers or picks up goods. The movements are computed at the establishment where they are observed independently of the number of packages loaded on or unloaded from the vehicle.

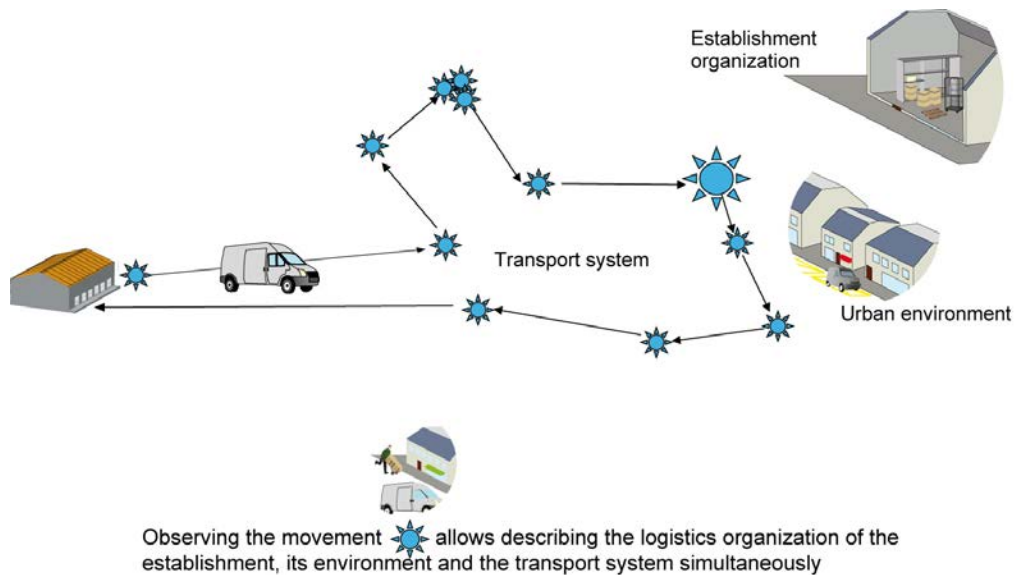


Fig. 1. The movement as an observation unit

To characterize all the logistics operations linked to movements the UGMS is organized in three nested sections for the following target populations:

- The establishments;
- The drivers serving these establishments;
- The transporters operating in the study area.

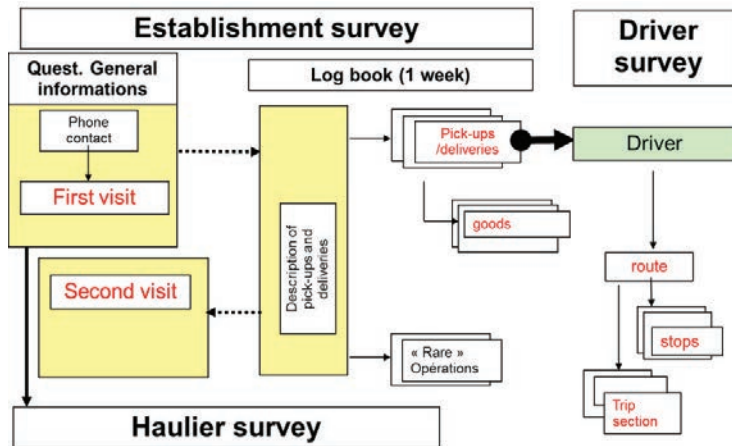


Fig. 2. Summary of the surveying method

The establishment survey is carried out on economic establishments installed in the city. It is used to characterize the establishments by variables that allow explaining the formation of flows (type of activity performed by the establishment; type of premises – workshop, shop, office, etc.; number of jobs; availability of a fleet of vehicles, parking possibilities, etc.). As all the establishments are liable to generate goods movements, this survey involves every type of activity performed in the survey territory (shop, craftwork, offices, warehouse, etc.), and establishments of all sizes (from 0 to several hundred employees). A questionnaire is administered by an investigator who goes to the establishment to collect data and furnish driver questionnaires for one week.

The driver-deliverer survey provides information on the mode of operation used by the people managing goods transport (type of vehicle, number of stops on the circuit, the activities served, itinerary, etc.). It is given to all the drivers who deliver or pickup goods in the establishment surveyed (whether employed by the establishment surveyed, by an external supplier or by a transporter). This survey is self-administered by the driver and permits identifying the transport companies most frequently involved in the urban deliveries of the territory surveyed, thus feeding the sample of the haulier survey.

The haulier survey addresses the main transport companies active in the city in order to obtain information on the urban and interurban logistic organizations of the largest transport operators in the city. This section is vital to understand the link between the intra-urban flows and those that enter and leave the city. It is administered in face-to-face interviews by an investigator.

The objective of these UGMS is therefore very ambitious as it entails taking into account all the activities present in a territory and all the logistics organizations deployed in it. The success of the surveys in fulfilling this objective therefore depends on the sampling method best adapted to satisfying the criteria chosen.

2.2. Sampling method

The establishments to be surveyed are selected on the basis of an exhaustive file produced by the INSEE (the French National Statistics Institute), the SIRENE file. This file is exhaustive because every creation or change of establishment occurring in France is obligatorily recorded by the INSEE, which issues an identification number that the administration uses to identify the establishment. It also contains a great deal of information: precise address, activity, bracket of number of employees, legal and business status, type of premises, date of founding, bracket of turnover, etc.

Many establishments in this survey base do not produce any flow at the address of their domiciliation as they are simply letterboxes (linked to the prestige of having a Paris address), or single person enterprises or associations without employees generally located in private residences whose flows of goods cannot be measured, since these are often included in private consumption. These establishments must be withdrawn from the survey base.

The surveys performed in the mid-1990s made it possible to formulate a typology of activities with respect to the number and characteristics of the movements generated by the establishments. This typology relies on the information contained in the SIRENE files and especially the activity, the size and the type of premises. It highlighted 45 groups of activity (ST45), subdivided by classes of size (the size of an establishment is measured by the number of its employees), resulting in a total of 115 types (ST115). This typology was chosen because it explains 31% of the variance observed in the number of weekly movements of the establishments surveyed during the first wave of the Bordeaux UGMS (Ambrosini et al., 1997). Furthermore, the typology is robust as it was used to build the Freturb model, whose results have compared well with counts many times and for different cities (for example, Lyon, Saint-Etienne, Bayonne, etc.). This is why the selection of establishments to be surveyed was done on the basis of this typology (Gerardin et al., 2000).

Table 1. Establishment stratification (ST45).

Group of activity	ST45 codes	Nomenclature of the activity stratum	No of establishments (IdF region)
Agriculture	1	Agriculture	10,293
Craftsmen	2-2	Craftsmen (repair)	4,421
Craftsmen	2-3	Craftsmen (manufacturing or installation)	55,623
Craftsmen	2-4	Craftsmen (light repair)	4,782
Craftsmen	26Ha	Other tertiary sector (tertiary services: high flows)	38,939
Craftsmen	26Mi	Other tertiary sector (tertiary services: mixed flows)	123,418
Craftsmen	26Mo	Other tertiary sector (tertiary services: average flows)	7,299
Industry	3	Chemical industry	543
Industry	34-2	Construction industry (repairs)	2,025
Industry	34-3	Construction industry (manufacturing or installation)	19,870
Industry	4-2	Industry (goods of production and intermediate – basic bulk)	3,992
Industry	4-6	Industry (goods of production and intermediate – small objects)	6,599
Industry	4-7	Industry (goods of production and intermediate –bulk)	15,746
Industry	5-2	Industry of consumer goods (fragile foodstuffs)	232
Industry	5-4	Industry of non-consumer goods (fragile foodstuffs)	9,976
Industry	5-5	Industry of non-fragile consumer goods, equipment of the house and individuals	3,833
Wholesale	7-2	Wholesale (fragile intermediate products)	6,090
Wholesale	7-3	Wholesale (other intermediate products)	17,798
Wholesale	8-2	Wholesale (non-food fragile consumer goods)	671
Wholesale	8-3	Wholesale (non-food non-fragile consumer goods)	3,030
Wholesale	9-2	Wholesale (fragile food consumer goods)	879
Wholesale	9-3	Wholesale (other food consumer goods)	3,440
Department stores	10	Hypermarkets and big department stores	145
Department stores	11	Supermarkets	675
Department stores	12	Specialized department stores	804
Small retail stores	13	Minimarkets	1,750
Small retail stores	14	Retail trades, clothing, shoes, leather	17,493
Small retail stores	15	Butcher's shops	2,766
Small retail stores	16	Grocer's shops	7,150
Small retail stores	17	Bakeries – Cake shops	5,954
Small retail stores	18	Cafés, hotels, restaurants	52,591
Small retail stores	19	Pharmacies	4,304
Small retail stores	20	Hardware stores	1,232
Small retail stores	21	Furnishing shops	2,071
Small retail stores	22	Book shops	4,493
Small retail stores	23	Other retail shops	40,701
Small retail stores	29	Street trading (outdoor trading centers)	17,532
Offices	25	Pure tertiary sector (offices)	283,505
Offices	26Fa	Other tertiary sector (low flows)	27,414
Offices	27-2	Not tertiary offices (agriculture, wholesales)	3,755
Offices	27-3	Not tertiary offices (retail trade, industry, transport, administration)	1,608
Offices	6	Transport (except storage)	24,868
Warehouses	28-2	Warehouses (bulk)	1,480
Warehouses	28-3	Warehouses (of which transport)	1,666
Warehouses	30	Quarries	248
Total			860,704

The sampling rate in the typology is not uniform but specific to each of the strata. For example, for a “common” activity like artisanal bakery of which there are many in a city, the sampling rate is low; on the contrary rarer activities are surveyed with a high sampling rate in order to take into account the variability of these specific establishments’ behaviors. Regarding issues of the survey’s statistical representativeness, a minimum of 30 establishment surveys correctly filled-in must be obtained per stratum ST45, and, when possible, at least 10 establishments per sub-stratum ST115. Therefore, and whatever the size of the city, at least 1,500 establishments must be surveyed to satisfactorily take into account the diversity of the activities carried out in the urban territory. The previous table presents the 45 strata that describe the variety of activities to be surveyed and the number of establishments to be surveyed in each stratum.

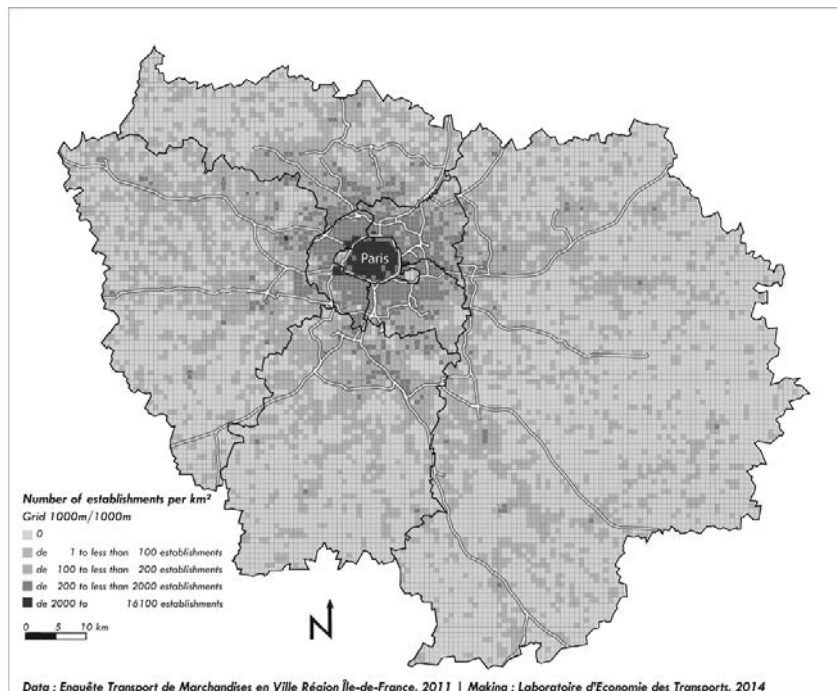


Fig. 3. Map of the density of establishments in the Île-de-France Region, Source: LET 2012.

2.3. Constraints linked to the size of the Paris region

The SIRENE file indicates that the Paris region has more than a million establishments spread over a territory of 12,000 km² composed of 1,300 municipalities. After cleaning, the file included 860,000 active establishments. Much of this territory is urbanized in a shape resembling the fingers of a glove, with a very dense city center beyond which most of the activities are grouped around eight main highway corridors.

2.4. Cost constraints

In a city of average size, it is necessary to count at least 30 establishments in each stratum ST45. It is also important to overestimate large establishments judged to be strong generators of goods flows. This led us to recommend a sample of 1,500 establishments. We recommended that the sample should be increased to 2,500 establishments to take into account the larger variety of activities and sizes as well as the territorial diversity of the megacity of Paris.

However, the budget allocated for performing the survey was about €1,000,000 including tax. This cost was above all linked to the administration method (face-to-face), its duration (a log-book for a week's activity was given to the establishment) and the nested structure of the three surveys. The cost of administering a single establishment survey was about €400, so it was possible to survey only 1,200 establishments. Then came the question of how to survey such a vast space while keeping within the financial budget?

One option could have been to revise the survey methodology to shorten the questionnaires or to carry out a survey exclusively by telephone or by Internet. These approaches were tested but considerable biases were observed in the counting of movements and the precision of the responses provided. Apart from a few adaptations (the Computer Assisted Telephone Interviewing - CATI method was chosen for activities generating fewer flows such as the liberal professions), any radical change of the methodology was rejected since a major transformation of the survey would have introduced a statistical bias difficult to control when producing the results. It would also have prevented any reliable comparison with the previous surveys.

The need to limit costs made it necessary to consider the sampling method. In the cities surveyed during the first phase, which were smaller (the largest, Marseille, had only 75,000 establishments), the sample was built precisely to represent the dispersion of establishments over the territory, for a given activity and size (ST115). In a territory as vast as that of the Paris region, this method would have led to generating long distances between each of the places surveyed and thus excessive travel time in going from one establishment to another. Besides the transport costs linked to these distances, since the field survey was programmed to last 8 months, offsetting the time lost in travel would have required the recruitment of a larger team of investigators and additional survey costs, thus leading to its cancellation. An adapted sampling method was therefore developed to select the establishments to be surveyed.

3. Sampling the Paris Region

A procedure to select the most "representative" areas of the Paris region was implemented to limit the need of the investigators to travel and privilege the acceptability of the surveys by promotion actions targeting the areas and actors to be surveyed. It was based on a three step approach. Documentary work aimed at building different "representations" of the Île-de-France region such as "concentric city" and "radial city" was carried out. It was seen that the information available remained partial or imprecise, bearing on territories smaller than the Paris region or on specific sectors of activity. We therefore began a series of interviews with around thirty local actors whose knowledge of the territory was susceptible to bring to light one or more "representative" areas. Once again, each organization presented its own vision oriented more towards the future fate of Parisian areas than towards their characterization. A third direction based on the typological analysis of the municipalities of the Île-de-France region (and of the arrondissements (districts) of the city of Paris), was therefore implemented.

3.1. Formulation of a typology of Parisian municipalities

This typology of municipalities was formulated using multidimensional data analysis methods, chaining the following processes.

- A Principal Component Analysis (PCA) of 1,300 municipalities for the 15 variables below:
- Density (Population+Employment)/Surface area;
- Distance to nearest highway infrastructures;
- Distance to Paris city center (in km and average access time);
- Contribution (in % of flow per activity) of 8 main sectors of activity to goods flows.
- Land Use mode (relative share of properties in the municipality according to their use in % - file describing the land use of the Ile de France as a function of the type of building installed).

Employment and population account for the weight of each municipality in terms of inhabitants and activity. The ratio of the sum of the latter to the surface area of the municipality was calculated to produce a composite density of activity that takes into account the effects of the conurbation, the population and the activity. Times of access and distances to the city center and to the infrastructures are a measure of the center's accessibility and of isolation. The mode of land use specifies the density of development in the municipality. The contributions of 8 main sectors of activity to goods flows takes into account the functional specialization of the activity of each municipality.

The PCA led to building non correlated factorial axes (statistically independent, which was not the case of the initial variables) which could then be subjected to a typological analysis.

- An ascending hierarchical classification (AHC) on the first nine axes led to building nine classes of the most homogenous municipality possible in relation to all the initial variables.
- The interpretation of each of the classes of municipality is obtained by a projection of the initial variables, called contributions of variables, to the classes formulated.

These methods were implemented in the “R” software package (Venables et al., 2011).

Different national statistical sources (INSEE: population, employment; IGN: surface areas, distance to infrastructures and to the center) also fueled this work which, moreover, relied on flow simulations using the Freturb software developed by the LET on the basis of previous surveys (weekly movements). At the end of this step, we obtained a typology of Parisian areas with 9 different types of area (Table 2).

Table 2. The 9 types of area in the Île-de-France Region, Source: LET 2012.

Type	Name	Characteristics	No of municipalities	Surface area (km ²)
1	High density	Dense, shops	75	341
2	Commuter belt	Non differentiated fabric	315	2,500
3	Commercial towns	Small retail	191	1,899
4	Industrial municipalities	Industry	93	976
5	Peripheral towns craft	Rural, craft	127	1,288
6	Predominance of wholesaling on outskirts	Wholesaling, industry	210	2,045
7	Predominance of large warehouses	Logistics activities	141	1,560
8	Green desert	Agriculture	122	1,221
9	Presence of hypermarkets	Hypermarkets	26	237
Total			1,300	12,072

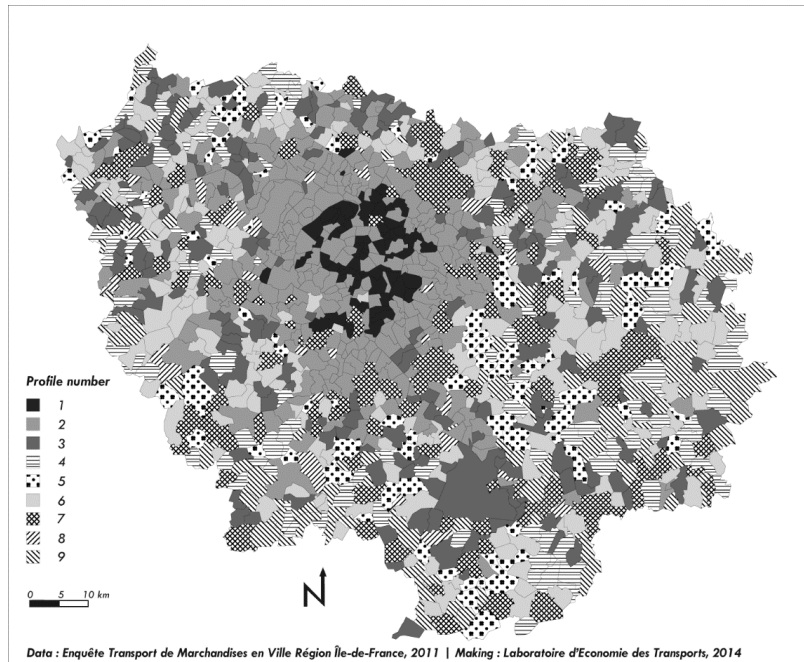


Fig. 4. Map of the typology of areas of the Île-de-France Region | Source: LET 2012.

Table 3 summarizes for each profile of the Paris urban areas typology, their characteristics in terms of urban goods movements, modelled through the Freturb model. For each profile we can see the average proportion of movements by type of activity. In order to highlight specific profiles, we confronted these values to the average goods movements' structure of the Île-de-France region. We therefore marked in *italic* the values that are under half the average structure and in **Bold** the values that are above 1.5 times the average.

Table 3. Table of the goods transport characteristics of the urban typology.

Type of activities	Urban typology profiles and goods movements characteristics									Total average
	1	2	3	4	5	6	7	8	9	
Agriculture movements	<i>0%</i>	<i>1%</i>	7%	7%	12%	9%	<i>3%</i>	25%	<i>1%</i>	7.0%
Crafts- services movements	27%	28%	35%	27%	49%	29%	16%	30%	22%	29.8%
Industry movements	12%	15%	8%	37%	11%	11%	11%	11%	9%	13.4%
Wholesale movements	21%	18%	<i>6%</i>	8%	<i>2%</i>	30%	17%	<i>2%</i>	15%	14.5%
Hypermarkets movements	2%	2%	<i>0%</i>	<i>0%</i>	<i>0%</i>	<i>0%</i>	1%	<i>0%</i>	16%	1.1%
Small retail movements	23%	24%	30%	13%	14%	11%	11%	10%	30%	18.2%
Offices	9%	9%	13%	8%	11%	10%	<i>5%</i>	22%	5%	10.4%
Warehouses movements	6%	4%	<i>0%</i>	<i>0%</i>	<i>0%</i>	<i>0%</i>	37%	<i>0%</i>	2%	5.6%

Table 4 synthesizes the main characteristics of the urban areas profiles through spatial, demographical and accessibility variables. In this approach, the values are not translated into absolute values, but rather into relative values: for each of the variable, the absolute value is divided by the maximum in order to normalize the characteristics. Moreover, the density is converted into a logarithmic scale in order to reduce the effects of the surface of the areas. In this table the same process is used to highlight specific profiles in **Bold** and *Italic* fonts.

Table 4. Table of the general characteristics of the urban typology.

Characteristics	Urban typology profiles, geographical and accessibility characteristics									Total average
	1	2	3	4	5	6	7	8	9	
Distance to conurbation center	10%	28%	50%	52%	59%	51%	46%	66%	40%	44.3%
Distance to nearest motorway	5%	11%	24%	25%	33%	24%	17%	39%	16%	21.2%
Access time to nearest motorway	2%	4%	8%	8%	10%	8%	5%	15%	6%	7.2%
Density logarithm (population and employment)	84%	68%	46%	42%	37%	40%	50%	32%	57%	50.8%
Employment density logarithm	75%	56%	29%	27%	19%	23%	36%	15%	46%	35.9%
Population density logarithm	85%	70%	47%	42%	38%	41%	50%	33%	57%	51.6%

3.2. Selection of areas to survey

On the basis of the map representing the types of municipalities, the survey areas were selected in order to choose aggregates (or clusters) of municipalities concentrating the largest possible number of different types. The best adapted choice of areas to survey was built to take into account the 9 profiles while minimizing the distances travelled by the investigators (see map below).

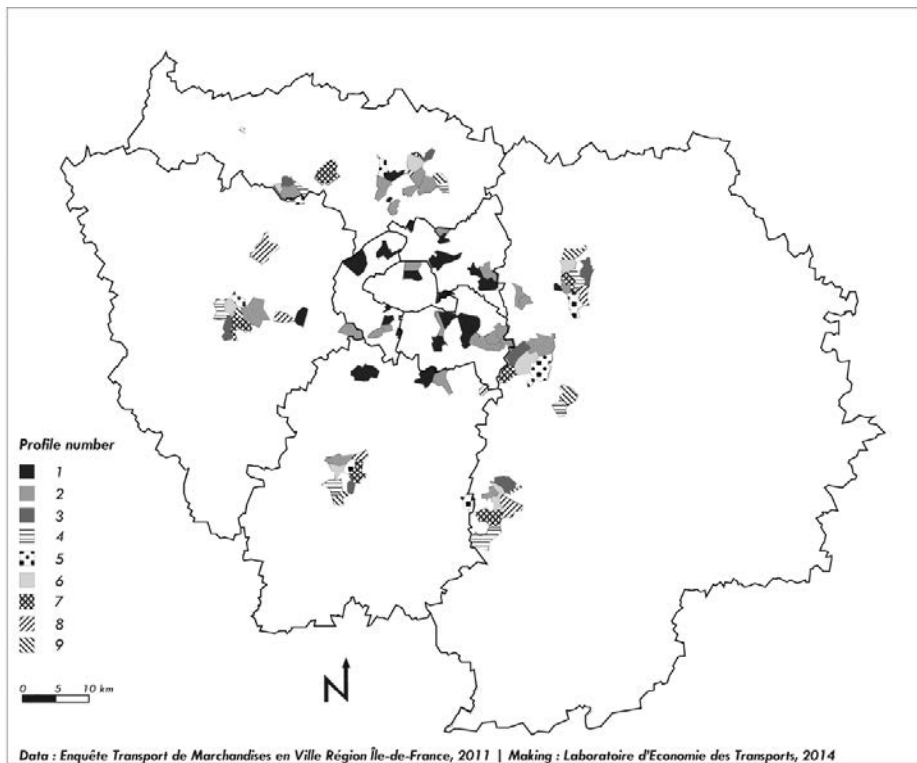


Fig. 5. Map of the areas chosen to administer the surveys, Source: LET 2012.

This set of municipalities (denoted by Z) has a combined population of 1,660,000 with 819,000 jobs, i.e. almost 14% of the population and jobs in the Île-de-France Region in 2012. They cover a large share of the municipalities mentioned by local actors during the interview phase. They include 124,000 establishments (N_Z).

3.3. The methodology put to the test: selection of establishments in the Paris region

The first selection of establishments was made for the clusters chosen z ($z \in Z$) as follows:

$$N_z = \sum N_{sz} \quad \text{for } N_{sz}: \text{ no. of establishments in stratum } s \text{ within the survey area.}$$

The proportion p_{sz} of establishments of type s in each cluster of municipalities, is calculated:

$$p_{sz} = N_{sz} / N_s \quad \text{for } N_{sz}: \text{ no. of establishments in stratum } s \text{ within } z$$

The number of establishments to survey is n (with $n = 1200$):

$$n = \sum n_s \quad \text{for } n_s: \text{ no of establishments to survey in stratum } s.$$

$$n_{sz} = p_{sz} * n_s \quad \text{for } n_{sz}: \text{ no. of establishments to survey in stratum } s \text{ and cluster } z$$

In a pilot survey, we observed that in order to survey an establishment, it was necessary to contact several and even up to 10 establishments due to difficulties in getting through to them or because they refused to participate in the survey. For each of the n establishment surveys to be performed, a corresponding group of up to 10 “equivalent” establishments was built, that is to say establishments of the same stratum ST115, (the same class of activity ST45 and number of employees in class) and located in the same neighbourhood.

$$x_{sz} = \min (n_{sz} * 10 ; N_{sz}) \quad \text{for } x_{sz}: \text{ no of “equivalent” establishments in stratum } s \text{ and cluster } z$$

The sampling method is carried out as follows:

- Establishments were classed by order of increasing workforce for a given stratum
- N^{th} draw in z of establishment A of stratum s of the establishments with the lowest workforces of stratum s . This establishment is named i_{sA} .
- Selection of the nearest neighbours of establishment A ordered by activity, size, and distance to A (x_{sz}).

In each cluster z , the first establishment contacted is i_{sA} . If it accepted to participate in the survey, the other equivalents in its group (x_{sz}) were abandoned. If it did not the 1st nearest neighbour in x_{sz} was contacted. This process was repeated until a volunteer establishment was obtained for the survey. If a group of equivalents x_{sz} was exhausted, the equivalents of the same stratum were then explored and completed the selection of stratum s .

4. First results

The survey started in 2011 and the data were collected from January to September 2012. During the establishment survey, 1,188 valid establishment questionnaires were collected, describing 4,693 goods deliveries and pickups. 914 driver-deliverer surveys were collected. Once examined and weighted to ensure they were representative of all the Parisian establishments, the following results were obtained

4 260 000 goods movements occur in the Paris region every week, (deliveries and pickups). The sector of activity generating the largest flow is small retailers with nearly 1/4 of the movements, just above wholesalers, service activities and industry (about 19% each). This is followed by craft activities linked to services (15%). Warehouses, hypermarkets and agriculture (which is not limited to agricultural production but also covers landscaping activities) contribute more marginally to flows (less than 5%). These respective weights of the different activities in the goods movements generated by the establishments to a large extent express the structure of employment in the Paris region. To eliminate this phenomenon and allow comparison with the previous surveys, we calculated the number of weekly movements per job and per activity. This indicator permits highlighting the large proportions attributable to warehousing, far ahead of wholesalers, the retail trade and industry. Craft activities, which produce 0.7 movements per week and per job reaches the average of what is observed in the Paris region, ahead of hypermarkets and, finally, offices (0.25 movements per week and per job). Globally, these values are considerably lower than what was observed in the three conurbations surveyed in the mid-1990s. This is true for all the activities except for industry and small retailers, which present stable results, and for office activities for which the conurbation of Paris is characterized by a higher number of movements per job (0.25 vs 0.17).

Table 5. Key figures of the survey.

Activity	No of establishments surveyed	No of jobs*	No of establishments*	No of weekly movements*	Movements / job	Movements/ job (previous surveys)
Agriculture	12	25,287	10,293	21,742	0.86	0.8
Crafts-services	194	907,432	234,487	626,640	0.69	1.2
Industry	228	715,613	62,817	757,975	1.06	1
Wholesalers	123	291,854	48,909	815,233	2.79	4.2
Hypermarkets	54	140,183	1,624	73,002	0.52	0.8
Small retail	333	594,791	158,043	1,013,068	1.70	1.8
Offices	199	3,037,261	341,167	747,112	0.25	0.17
Warehouses-transport	45	40,859	3,394	203,989	4.99	6.5
TOTAL	1,188	5,753,281	860,734	4,258,762	0.74	1

* in the conurbation

These variances can be explained on first analysis by the combined effect of the evolution of activities over 20 years and the specificity of the Île-de-France in comparison to the cities surveyed previously. For the first effect, see Bonnafous et al. 2015, regarding the impact of the specificity of the Île-de-France see the forthcoming presentation at the URBE symposium).

As shown by the previous surveys, the city is a center of consumption. 56% of movements are receptions of goods and only 33% are shipments‡. The balance of about 11% was composed of combined movements, i.e. they gave rise to both a reception and a shipment. This can be, for example, deliveries of goods linked to the return of unsold goods, returns and packaging. However, the distribution between these three types of movement is closely linked to the activity.

Logically, production and bulking activities produce the largest number of shipments (warehouses, wholesalers, industry) whereas service activities (shops, services, offices) concentrate receptions. Agriculture and hypermarkets are the activities that benefit from the largest number of combined movements.

These results conform with those obtained from the first wave of the survey, although in the mid-1990s, the weight of deliveries was even greater (60% vs. only 29% shipments). The share of combined movements remained stable at 11%.

4.1. Management mode

For each delivery or pickup described, the survey questionnaires focused on the identity of the establishment carrying out the transport. It could be:

- The establishment itself;
- Another establishment belonging to the same company as the establishment surveyed;
- The supplier which transports its own goods or the client which comes to the establishment to pick up their order;
- A professional transporter.

The first three cases correspond to own account transport and the last to third party transport. Within the own account transporters a distinction can be made for own account shippers (OAS – when the establishment shipping the goods is also that which transports them) and own account recipients (OAR – the client comes to pick up the goods). The distinction between own account (OA) and third party account (TPA) also sheds light on the way in which the itinerary is organized for the vehicle and thus the efficiency of the logistic organization. Indeed, the third

‡ In this case only exchanges of goods between economic establishments are taken into account and exclude household deliveries, subject to specific processes, and travel by households to make purchases as it had already been measured by household mobility surveys.

party account, and to a lesser extent the own account shipper (OAS), mainly give rise to rounds serving several points, opening up the possibility of optimized vehicle filling, whereas own account transport (especially OAR) frequently takes the form of a single return trip (direct route) thus an empty journey.

Table 6. Identity of the establishment carrying out the transport

Activities	TPA	OAR	OAS	Total
Agriculture	9%	43%	48%	100%
Crafts- Services	46%	25%	28%	100%
Industry	58%	8%	34%	100%
Wholesale	56%	18%	27%	100%
Hypermarkets	74%	11%	15%	100%
Small retail	37%	19%	45%	100%
Offices	56%	7%	37%	100%
Warehouses	62%	11%	27%	100%
Île-de-France total	51%	15%	34%	100%
<i>Previous surveys</i>	<i>44%</i>	<i>19%</i>	<i>37%</i>	<i>100%</i>

The Paris survey shows that a slight majority of transport in the city is provided by third party account operators, showing a change in comparison to what was observed during previous surveys. The exploitation of the surveys performed in the conurbation of Bordeaux in parallel with those of Paris will allow determining whether this growth in the share of third party transport highlights a major trend of urban logistics, or whether it is linked to the specific nature of the conurbation of Paris.

LGVs (2-3 wheels, cars and vans less than 3.5 tons) carry out 61% of the deliveries and pick-ups in the city. Except for warehouses, wholesale and hypermarkets, heavy vehicles are less numerous than small ones. For the first time, cycles are significant essentially for delivering offices in express delivery contexts.

Table 7. Share of the types of vehicles for delivering

Activity	2-3 wheels	Cars	Vans (<3.5T)	Rigid truck	Articulated vehicle
Agriculture	0%	0%	98%	1%	0%
Crafts- services	4%	9%	59%	20%	8%
Industry	6%	6%	46%	37%	4%
Wholesale	2%	10%	33%	37%	17%
Hypermarkets	0%	1%	36%	34%	29%
Small retail	1%	15%	57%	25%	2%
Offices	12%	10%	55%	20%	3%
Warehouses	0%	0%	12%	56%	32%
Total	4%	10%	47%	30%	8%

5. Conclusion

As illustrated by the article, performing an Urban Goods Transport survey in the French capital represented both an opportunity and a challenge. It was an opportunity to update our knowledge of the supply practices of urban establishments and to enhance our panel of conurbations by taking account of a megacity, in this case an urban area with a population of 10 million. Regarding the financial and statistical constraints entailed by covering an area of 12,000 km², the challenge was first to determine the feasibility of such a survey. The implementation of an original methodology for characterising Parisian municipalities made it possible to reconcile the imperatives of

representativeness and limiting costs. We have started to produce results which already shed valuable light on the logistics practices deployed to serve the conurbation of Paris. They will enhance the comparison with the survey that has just been completed for Bordeaux, and will permit determining whether the status of megacity influences the supply chain characteristics of Paris or not.

Many other results are obtained from such surveys: time for delivery, double line parking, and miles driven for one delivery, according to the number of deliveries in a tour, as well as a large number of parameters for measuring road occupancy, and impacts on congestion and pollution. It is also possible to determine the weights and volumes delivered for each type of good according to the type of activity and vehicle linked to last mile logistics chains.

Lastly, these surveys will permit updating and enriching the urban goods movements simulation model, Freturb, developed by the LET and now used by nearly fifty cities in France and elsewhere in Europe.

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