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MIXED APPLIED SURVEY METHODOLOGY FOR PLANNING/ENFORCEMENT OF URBAN LOGISTICS DELIVERY BAYS– AN APPLICATION TO THE MOROCCAN CONTEXT

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Abstract:

Roads and parking areas represent a place of conflict between freight vehicles and other urban activities, especially on mixed residential and commercial streets. This conflict results in traffic congestion, illegal parking, pollution and road safety problems. The challenge is to allocate public space between the right operating activities, parking activities, public transport and so on. To address that, urban logistics delivery bays, also known as loading/unloading (L/U) zones, have become a real solution to facilitate the delivery and pick-up operations of urban freight vehicles, ensure accessibility for delivery drivers, reduce congestion and improve road safety. Therefore, this paper reports on planning and enforcement of urban delivery bays needs. It is part of the urban freight transport (UFT) surveys. This involves consolidating with new contribution the development, implementation and statistical analysis of a survey in order to quantify the need of delivery areas. Compared to the existing literature, this paper presents a mixed applied methodology which is divided into two parts : "Exploratory survey" and "Establishment-vehicle observation" survey. These two surveys techniques were conducted to offer an overview of the freight vehicle delivery and pick-up frequency according to the daytime and weekdays and the operations related to the loading/unloading activities. This makes it possible to estimate the delivery bays requirement in the study area. The findings from a methodological and practical angle are illustrated through a real case study in a commercial street in Morocco. The findings suggest that 60% of deliveries are made between 8:00 A.M and 12 A.M, and the movements generated by each establishment are 257 movements. For this, the study zone requires the development of three loading/unloading (L/U) bays. The main contribution is to propose an approach that urban authorities can use to estimate urban delivery areas efficiently and thus allow simple replication of the proposed framework in other cities.

Keywords: *urban freight transport, survey techniques, delivery bays, loading/unloading area*

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1. Introduction

Urban freight transport (UFT) is occupying a more important place in the urban mobility planning agenda as it is generating higher costs due to increasing congestion, risk of traffic accidents, air pollution and noise (Moufad et al. 2018 ; Gonzalez-Feliu et al., 2020). It can be defined as the activities that cover deliveries, pick-ups and transfers of goods and services in urban areas (Toilier et al., 2016 ; Comi et al., 2018). In addition, parking deficit freight vehicles that park illegally (i.e. double-parking) or in situations prone to cause traffic disturbances thus reduce the quality of life in the city (El Mokaddem et al., 2019 ; Pinto et al., 2018). To address that, urban delivery bays have become a real solution to facilitate the delivery and pick-up of the urban freight vehicles, ensure accessibility to delivery drivers, reduce congestion, and improve road safety (Gonzalez-Feliu et al., 2020; Moufad et al. 2019a).

In Morocco, the reports on urban freight transport (UFT) surveys are rare, even less the methodological work explored in this field. There are often technical reports and national guides rather than scientific publications (Moufad et al., 2018).

As such, there is often a lack of important detail in these reports, such as data recovery methods and procedures as well as sample selection methods. As a result, the particularity and the contribution of the UFT investigations is to take into account the exhaustiveness of the UFT; the linkage of the survey method to the objectives and the orientation of the policies as well as a weighting which makes it possible to calibrate the method for another case study (Toilier et al., 2016; Alho at al., 2014).

These elements will help us to know and explain the determinants of the movement of goods in the city, and thus to (Allen et al., 2012; Dablanc et al., 2013 ; Golini et al., 2018):

- Making a diagnosis on goods movements to know who? (type of activity by establishment); When? (Time of deliveries); What? (type of vehicle); How? (Frequency of deliveries).
- Study the impacts of the UFT vehicles on the urban traffic.
- Highlight extrapolation relationships for transferring its results to other cases without repeating these investigations demanding more resources.
- It is against this background that this paper proposes a survey method in order to understand the activities and operations of road-based urban freight transport in the situation of a commercial street in Morocco. The purpose is to determine the need for delivery bays and assess the consequences.

Therefore, the paper is structured as follows: as a first step, a review of survey techniques employed to collect data about the movements of the UFT vehicles is provided in order to set the context and positions our contribution within existing research. The proposed survey methodology development, implementation and statistical analysis are then reported. The results and discussion section summarizes the finding of this study. Finally, conclusions and suggestions for further work are included.

2. Background

In light of the current increasing freight demand in urban areas, the use of public space for parking needs to be carefully planned. According to Allen et al. (2012), there is a relationship between road freight transport activity and urban forms. In the same line, Cherrett et al. (2012) identifies the main factors influencing dwelling times, including parking location and the distance between the parking place and the served premises. In this context, as underlined by Alho et al. (2016) loading/unloading (L/U) area represents a real solution to facilitate the delivery and pick-up of the urban freight vehicles and improve mobility. It can be defined as a roadside space for commercial parking that may contain one or more parking stalls (Pinto et al., 2018). In the same way, an establishment-based freight survey was developed in Lisbon city revealing retail establishments 'characteristics, goods ordering and delivery processes (Alho et al., 2015). We also refer to Pokorny et al. (2018) who proposed a retrospective survey to study truck and bicycle conflicts in urban areas. In addition, Toilier et al. (2016) developed a guideline explaining how urban goods movements can be surveyed in a megacity. Even more, Allen et al. (2012a) have reviewed and evaluated the different survey techniques used in studies to understand the road freight transport activities in urban areas. Other relevant contributions have developed a survey methodology in this context. We also refer to Holguín-Veras et al. (2014) who proposed a freight demand data collection framework for large urban areas and identified the roles of different data collection methods. In addition, Sánchez-Díaz (2017) who explored urban commercial establishments' freight

needs and their impacts on traffic using data collected from establishments in the city of Gothenburg (Sweden).

Furthermore, many papers focus on identification of best practices in the location and improvement of L/U areas. Reference can be made to Delaître et al. (2010) who proposed the combination of two models (FRETURB & DALSIM) for dimensioning and the allocating of the delivery zones, taking into account the impacts on overall traffic flows and provided an example of implementation in the city of La Rochelle. Also, Gardrat and Serouge (2016) develop an approach based on the CERTU methodology and the FRETURB model to assess the number of vehicles and the pick-up and delivery movements in order to determine the number of loading/unloading spaces required for delivery operations. A further study by Muñuzuri et al (2017) has defined the optimal number of loading/unloading areas required for delivery operations and thus solved the location-allocation problem. Other studies have assessed the impact of changing the location and number of delivery bays on the level of illicit parking practices (McLeod et al., 2011; Comia et al., 2017; Pinto et al., 2018).

According to these works, they can be divided into two parts. On the one hand, there are the works that have proposed methods for the design and planning of delivery bays in several steps. On the other hand, some works have not focused entirely on operational practices, but rather on the studying the impact of implementing or changing the configuration of delivery areas on congestion, illegal parking practices and mobility. One limitation of these works is that they only consider the planning and location of delivery areas without understanding the urban freight transport activities based on a survey methodology.

To overcome these limitations, this paper proposes a mixed survey approach to estimate the loading/unloading area's needs. Reporting on UFT investigation is nothing new. This paper contributes to the available literature by providing a development, implementation and statistical analysis of the proposed survey.

The section bellow provides the different survey techniques that have been employed in the literature for collecting data on urban freight transport activities (Allen et al., 2012a; Holguín-Veras et al., 2014; Pokorny et al., 2018; Toilier et al., 2016) (Table 1).

In conclusion, from the methods of investigation described above, the establishment and vehicle observation survey provide insight into a wider range of issues related to urban freight deliveries and pickups to and from establishments in a specific urban area than the other survey techniques discussed. These two survey techniques provide an overview of the frequency of goods vehicles operations by the daytime and weekdays, the operations associated with the loading/unloading activities, and the freight needs of individual establishments.

3. Survey Methodology

This section is designed to provide basic guidelines for development and application of UFT survey that has been carried out to estimate the need for delivery bays in the case of a commercial street and evaluate the consequences on traffic. The survey methodology is divided into two parts: "Exploratory survey" and "Establishment-vehicle observation" survey.

To ensure the relevance of the UFT surveys, three elements need to be defined: what field of study can give the data requested? Which variable needs to be assessed? Which unit must be surveyed? (Gardrat & Serouge, 2016; Pinto et al., 2018).

3.1. Case study and zoning

The proposed survey was conducted in the city of Fez. It is Morocco's second largest city after Casablanca with a total population of 1.1 million in 2014 (World Population Review, 2020). The city accounts for nearly62% (Fes Meknes Invest, 2020.) of the industrial fabric of the Fez-Meknes region, takes a privileged place in the national industrial economy and contributes to the socio-economic development of the region and consequently of the country. The estimation of the L/U areas needs must be conducted on a homogeneous area representative of a high level of commercial activity. For this, the "Mohammed Zerktouni" avenue was selected as a study area. This zone represents a one-way residential and commercial street that runs for a length of 600 meters. Located in the city centrer, its entrance is located at the "Atlas" roundabout and terminates at the "Mohammed Esslaoui" avenue. This street was divided into four sections. Given the cost and time needed to complete the study, section 1 was selected to conduct the survey (Fig.1).

Table 1. Overview of urban freight transport survey

Establishment survey This type of survey is carried out in commercial and industrial establishments in the city (Sánchez-Díaz, 2017). It is employed for collecting information about freight vehicle trips to/from surveyed establishments. It also collects information on the delivery/collection process: vehicle types, loading/unloading times, stop location of vehicles and method of goods movement from the vehicle (Alho, 2015).
Vehicle observation survey Similar to establishment survey as regards the data collected, the vehicle observation investigation implies one or more surveyors being posted on the street to collect data on goods vehicle trips to/from establishments and loading/unloading activity by time of day (and can be used to study variation by day of week) (Allen et al., 2012; Pokorny et al., 2018).
Vehicle traffic count survey This survey is carried out to develop origin/destination matrixes of surveyed vehicles (Moufad et al., 2020). The sample of the survey is made up of a number of vehicles positioned along the roadside during the day. In this type of survey, the operator is asked about the departure and arrival places of his vehicle, the reason for his movement, as well as the various stops in the study zone (Allen et al., 2012a). Such surveys are supported by automatic traffic counts using pneumatic tubes or electromagnetic detectors or by manual traffic counts (Dablanc et al., 2013).
Freight operator survey Two types of surveys can be applied in relation to freight operators (Fu et al., 2018): – Heavy Good Vehicles (HGV) investigations: conducted by means of a logbook, given to delivery drivers, describing the vehicle's trips (goods transported, origin and destination, the handling tools used and the location). This investigation allows to determine the yearly traffic generated by the vehicles and to link it to the goods transported. – Light Good Vehicles (LGV) investigations: In this type of survey, each vehicle owner received a mail questionnaire and provided information on yearly vehicle use (operation mode, urban or interurban, type of goods, handling tools) (Holguín-Veras et al., 2014).

Fig. 1. Mohammed Zerktouni Road Map

The surveyed zone extended 205 meters from the access of "Mohammed Zerktouni" road to "Patrice LEMOMBA" road. This section is defined by the existence of two entrances and two exits. At 95 meters from the principal entrance, a two-way road through which the UFT vehicles transit is located. The studied section represents a narrow commercial road. It is about 8 meters wide. Indeed, 2 meters is reserved on each side for parking vehicles (Fig. 2).
As regards the investigation period, it should reflect as far as possible the regular commercial activity in the study area. Based on the UFT surveys, the duration is approximately 6 months (Moufad et al., 2019a; Sánchez-Díaz, 2017). The period chosen is November 2017 to April 2018.

✓ Measurement variable:
To determine the need of delivery bays, it is required to concentrate on the urban space management (Aiura et al., 2006). The main issue involves the road occupation by UFT vehicles that are in conflict with other uses (cars, pedestrians...). Therefore, it is important to consider the road occupancy according to these elements: vehicles in circulation and those parked to handle delivery/pick-up or service movements. This means that, considering the "road occupation" variable, congestion and accessibility conditions can be explained.

✓ Observation unit:
The purpose is mainly to observe and understand how urban freight vehicles contribute to road occupancy. It is therefore interesting to consider the vehicle movements generated by delivery/pick-up operations than in the goods themselves. These movements describe not only vehicle movements, but also parking conditions. These movements describe not only the vehicle trips, but also the parking conditions. Consequently, " the movement" described as a pick-up or delivery or other operation performed by UFT vehicles has been selected as the observation unit (Moufad et al., 2019a). Indeed, the observation of vehicle movements establishes the link between economic activities and the road occupation of the UFT vehicles (Toilier et al., 2016).

3.2. Guidelines of Survey implementation

3.2.1. Exploratory survey

Beforehand, a set of field visits was conducted to understand the urban freight transport activities of the study section. This step is a pilot phase of the exploratory investigation. In Table 2 was presented the characteristics of each visit, the tasks that have been carried out and the findings deduced.
During these exploratory visits, several photos were taken exposing the problems encountered that is congestion, illegal parking practices, and the occupation of the public space (Fig. 3).

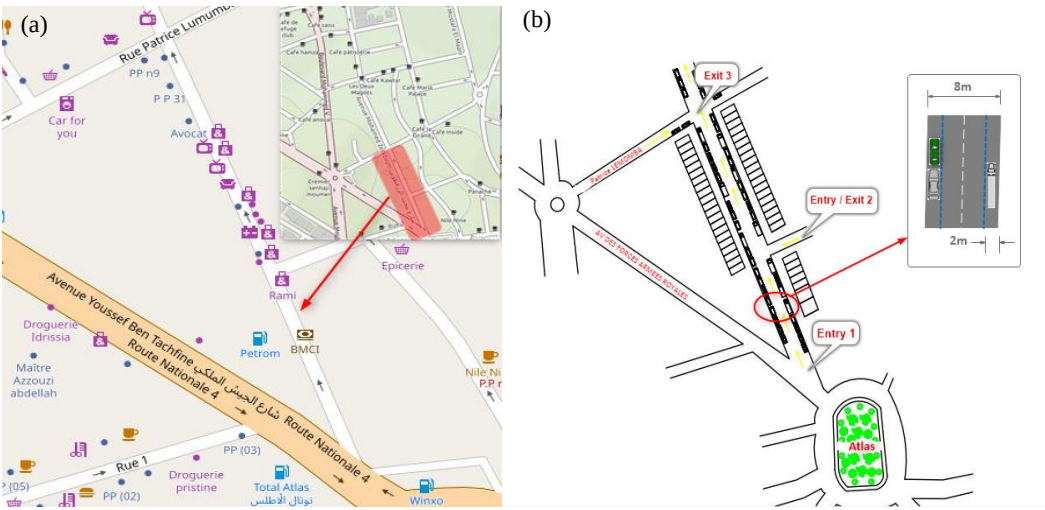


Fig. 2. (a) Surveyed zone (outlined in red) / (b) Geographical layout of the study section

Table 2. Summary of field visits

Visit	Date	Tasks performed	Observations
First visit	15/11/2017 (Wednesday)	– Taking photos of UFT vehicles and the handling tools used. – Observation of commercial activity	– The 1st section of study zone represents a high commercial density area – Three types of movements exist: Pick-up, delivery and service
Second visit	18/11/2017 (Saturday)	– Observation of the commercial activity of the study area – Note the types of activities, vehicles and handling tools – Note of type of problems	– Strong commercial activity compared to Wednesday (1st visit) – Diversity of UFT vehicles; – Diversity of handling tools; – Problem of occupation of the road network; – Lack of parking spaces; – Illegal parking
Third visit	20/11/2017 (Monday)	– Rectification of data concerning the commercial typology survey; – Observation of problems	– The same commercial density compared to Saturday (2nd visit); – Congestion problem due to double parking or the exit or entry of two vehicles at the same time.

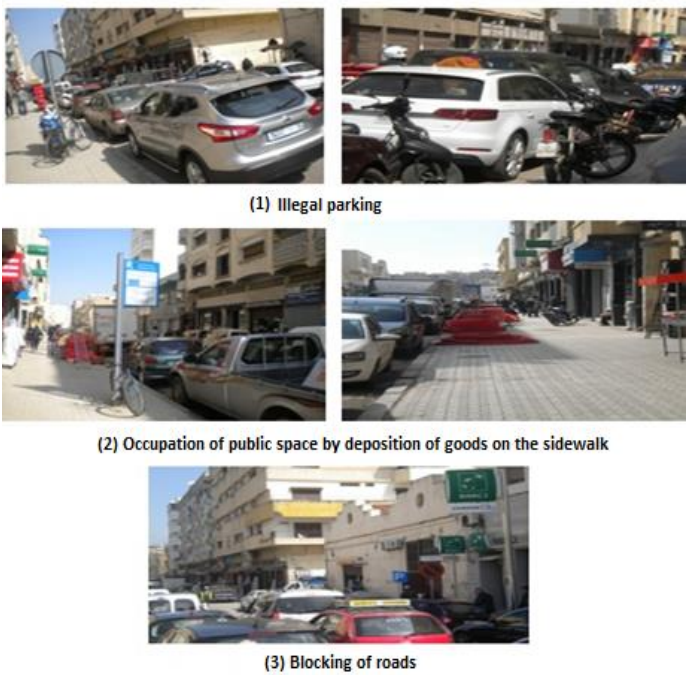


Fig. 3. Problems of urban freight transport study zone

Subsequently, a set of interviews with the establishment of the study section was conducted face-to-face. The objective is to understand their practices and needs. A sample of 23 establishments representing the different types of activities was We constructed. The survey was administered on one day and in two phases, a period of 10 to 15 minutes at each interview was carried out:

– A first phase from 9:30 A.M to 12:30 A.M with 12 respondents.
– A second phase between 3:00 P.M and 5:00 P.M with 11 respondents.

The results highlighted that the study section represents an area with a high commercial density due to the diversity of activities and products characterizing it. They also confirmed that the commercial activity has periods of decline and increase depending on weather conditions and holiday periods of commercials and industrials establishments.

By analyzing the weekly activity, the respondents reported that the average of delivery movements is the same between Monday and Saturday, and it varies on other days of the week. On the other hand, the respondents posed a set of problems that constrain the urban freight transport and the loading/unloading operations. These problems are manifested in the lack of parking spaces. Consequently, they opt for illegal parking thus accentuating the congestion on the road. Regarding the solutions proposed by the establishment, several respondents raised the importance of regulating delivery schedules (booking a period for delivery operations).

Finally, this exploratory survey enabled us to understand the situation of freight transport in the study street and to gather the information required to establish the questionnaire of the establishment-vehicle survey.

3.2.2. Establishment-Vehicle observation survey

This section reports the main lines of the proposed survey methodology which represents a mixed approach involving two survey techniques: Establishment and vehicle observation survey. Indeed, the surveys were developed and administered concurrently over a period from 1 December 2017 to 14 April 2018. This period includes the preparation phase, the test phase and implementation survey.

These two surveys were conducted to offer an overview of the freight vehicle delivery and pick-up frequency according to the daytime and weekdays, the operations related to the loading/unloading activities and the commercial establishments' freight needs.

Therefore, a questionnaire has been developed for the identification of the following data required for planning and location of the delivery areas bays (Moufad et al., 2019a ; Pinto et al., 2018 ; Alho et al., 2016 ; Dezi et al., 2010):

- Map and position of delivery points (businesses, shops, warehouse)
- Types of activities consulted by vehicles;
- Specific characteristics of load/unload operations (e.g., deliveries by period of day, season changes);
- Frequency of deliveries and duration of loading/unloading operations;
- Type of operation (delivery, pick-up or other);
- Walking distance from the parking stall to the delivery point;
- Arrival and departure time for each type of vehicle;
- Vehicle parking activity;
- Handling tool used;
- Traffic counts (Type of urban freight vehicles in study zone).

Preparation of field phase

(1) First stage: Supervision of the surveyors. The supervision through training was conducted for all surveyors selected for the achievement of the survey. It was carried out over two days given the availability of surveyors. Through a PowerPoint presentation, the survey purpose, the scope of the study and the questionnaire completion methodology have been explained.

(2) Second stage : Assignment of observation posts. To facilitate the organization of the survey, a study section distribution in posts of 30 meters length representing a whole number of establishments was carried out. This distance was not randomly chosen, it is the result of several observations to test the observers' visibility of vehicle movement in the field.This distance covers an observation field for 5 to 6 vehicles of 5 meters long. To each post, one or two observers have been appointed depending on their availability. The figure 4 illustrates the location of observation posts that were developed using the Edraw Max software.

Implementation of establishments-Vehicle observation survey

The survey implementation was administered in two stages:

(1)Test phase: This step represents a demonstration phase for conducting the survey (Allen et al., 2012a; Muñuzuri et al., 2017). It represents a one-day survey designed for validating the questionnaire and data collection schedules and testing the ability of the surveyors to cope with the field conditions.

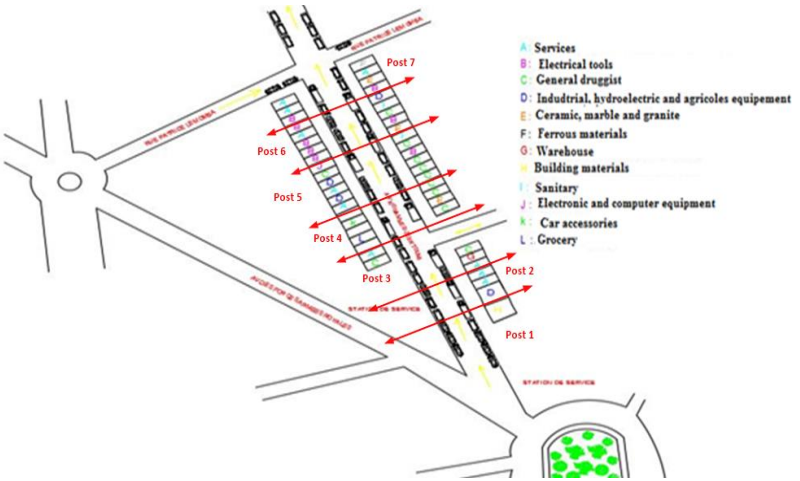


Fig. 4. Map of delivery points (lettered) and distribution observation posts (outilined in red)

Therefore, the test phase was conducted on Saturday, January 20, 2018 for three periods of the day. In fact, 20 surveyors were divided into groups (two observers per group). The other surveyors verify that the questionnaires have been filled in correctly, check compliance with the survey management guidelines (post order, positioning of observers in the survey area) and recuperate the questionnaires from the surveyors by the end of each step. Due to lack of human resources, most groups agreed to conduct the survey on two different times of the day. Below the schedule of the test phase (Table 3).

Table 3. Planning of the test phase

Post / Step	S1 : 8:00 A.M to 12:00 A.M	S2 : 12:00 A.M to 2:30 P.M	S3 : 2:30 P.M to 6:00 P.M
Post 1	G5	G5	G5
Post 2	G2	G4	G7
Post 3	G3	G6	G3
Post 4	G4	G9	G1
Post 5	G1	G8	G9
Post 6	G6	G1	G8
Post 7	G7	G10	G10

Note: G1 (Groupe 1); S1: Step 1

Based on this test survey, it has been confirmed that the steps S1 and S3 represent high commercial density periods. Thus, the evolution of commercial activity varies from one post to another. Indeed, posts 3, 4, 5 and 6 are the subject of a large number of movements (deliveries/pick-ups). These observations were used as the basic assumptions for the elaboration of the planning of the survey.

(2) Data collection process : Since the organization of freight movements is variable over a week according to the activity performed by the establishment and the periods, the survey the achievement was based on the following assumptions:

– H1: the trend of commercial activity was the same for Mondays and Saturdays;
– H2: the trend of commercial activity varies in the rest of the week (except Sunday);
– H3: Most of delivery movements were made at the beginning and the end of the week ;
– H4: the posts 3, 4, 5 and 6 represent a dense commercial area;
– H5: the steps S1 and S3 represent periods of high commercial activity.

Depending on the availability of human resources, an observer was assigned to each position for a specific period of time, as all observers were familiar with the process. The schedule (Appendix) describes the configuration of the seven-week data collection period.

4. Results and discussion

4.1. Estimation of the number of logistics delivery bays

Through the field visits and the information about the position of all business activities, the commercial map of the study area was established. On the basis of this map and the data collected during the survey

concerning the movements generated by each establishment per week, the theoretical number of loading/unloading zones was calculated (Figure 5).
According to the results of the survey, 60% of deliveries are made between 8:00 AM and 12:00 AM. Thus, a delivery area can have 4 deliveries per hour (Alho et al., 2016 ; Muñuzuri et al., 2017 ; Dezi et al., 2010). Considering that the commercial activity is carried out 6 times a week and a delivery area allows treating 6*16 deliveries. So the capacity of a delivery area is 96 deliveries per week.
The number of delivery areas is obtained by adding the weekly movements generated by the establishment performed in the study zone (257 movements) and dividing by the capacity of a delivery area (movements generated by the delivery bays in full potential).
Therefore, the study area required the planning of 3 delivery bays. However, according to the principles of location and sizing, it is important to know the conditions of generation of the movements in order to determine the delivery bays location.

4.2. Statistical analysis

4.2.1. Utilization rate of UFT vehicles

Concerning the typology of vehicles using the study area, four sub-categories were distinguished: 2-3 weels (motorcycle and tricycle), cars, light goods vehicles (LGV) and heavy goods vehicles (HGV). The rate for use of each sub-category during the survey is illustrated in Figure 6.
According to the results obtained, the study area accounts for 48 percent of the cars, 32 percent of LGVs, 18 percent of the motorcycles and tricycles, and 2 percent of HGVs. The use of these vehicles varies according to the type of business activity for weekdays. Indeed, as it was pointed out previously, the total deliveries daily variation follows a logic of up and down. The Figure 7 illustrates the average deliveries weekly variation per types of vehicles.
It can be seen that there is three pairs of daily deliveries variation ranked by priority (Monday, Saturday), (Tuesday, Thursday) and (Wednesday, Friday). Monday and Saturday are days of higher commercial activity. These results confirm the hypotheses generated before the survey.

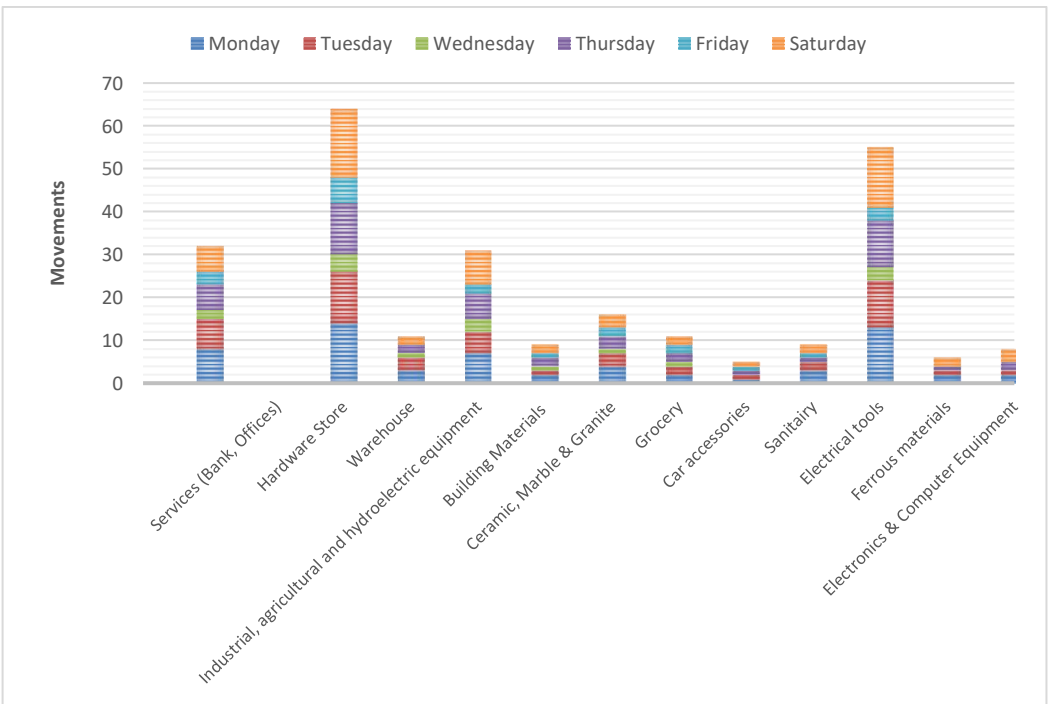


Fig. 5. The average of deliveries generated by each establishment in the study area

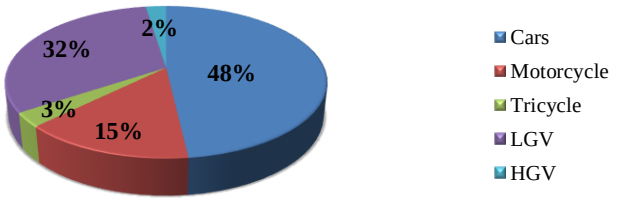


Fig. 6 Use of UFT vehicles in the study area

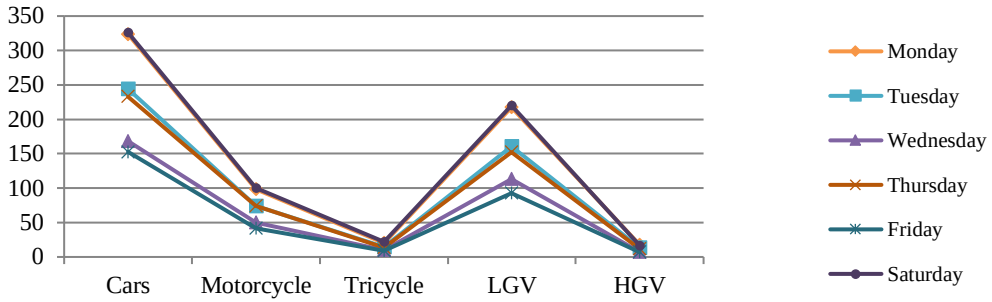


Fig. 7 Average deliveries weekly variation per types of vehicles.

On the other hand, the presence of heavy goods vehicles is a determining factor for the sizing of delivery areas (Moufad et al., 2019a; Alho et al., 2016). The utilization rate of UFT vehicles per establishment category is illustrated in Figure 8.

Heavy vehicles are mainly used in building materials establishments (29%), equipment and sanitary facilities (6% to 7%). The LGVs represent 25% to 52% of movements. The part of cars is important in all activities since it concerns delivery and pick-up movements.

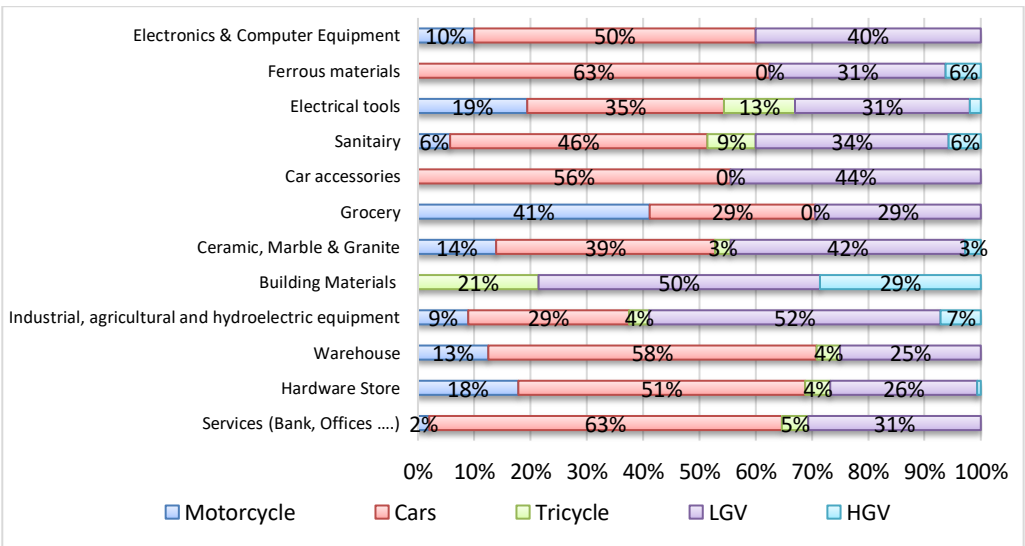


Fig. 8. Type of vehicles used in each establishment category

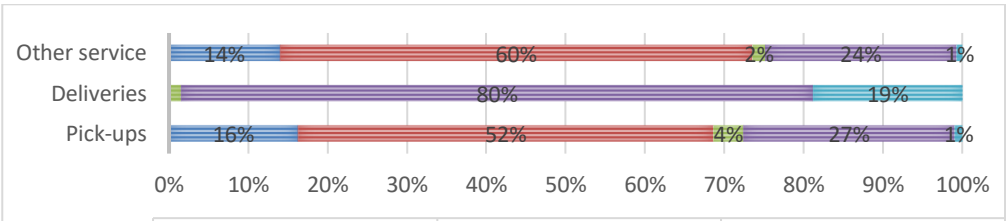
Indeed, from the number of movements generated and the distribution of the vehicles for each activity, it is possible to specify the location of the delivery areas adapted to them. The survey results reports that eighty percent of deliveries are made by LGVs and nineteen percent by HGV (Figure 9).

4.2.2. Duration of movements

The duration of the movements represents an important factor for the quantification of the delivery areas. It determines the possible turnover rate per each area. The Figure 10 summarizes the distribution of the average durations observed for each type of operation performed during the survey
Delivery movements were also reported to require 15 minutes for 18% of the cases, 15-30 minutes for 51% of the cases and from 30 to 60 min in 26%. More than 70% of pick-ups and movements have a duration that does not exceed half an hour.
Regarding other services, 76% of these does not exceed 30 minutes. Indeed, durations exceeding 60 minutes generally correspond to operations related to heavy goods vehicles. For other categories, most vehicles do not exceed 30 minutes.

4.2.3. Handling Tools

The determination of the parts of movements requiring a handling tool is an important factor for the sizing of delivery areas. According to the investigation results, sixty percent of LGV movements are done by hand and forty percent of these movements need the following handling tools: devil, trolley, wheelbarrow and pallet truck (Figure 11).



	Pick-ups	Deliveries	Other service
Motorcycle	16%	0%	14%
Cars	52%	0%	60%
Tricycle	4%	2%	2%
LGV	27%	80%	24%
HGV	1%	19%	1%

Fig. 9. Type of vehicles used in each movements

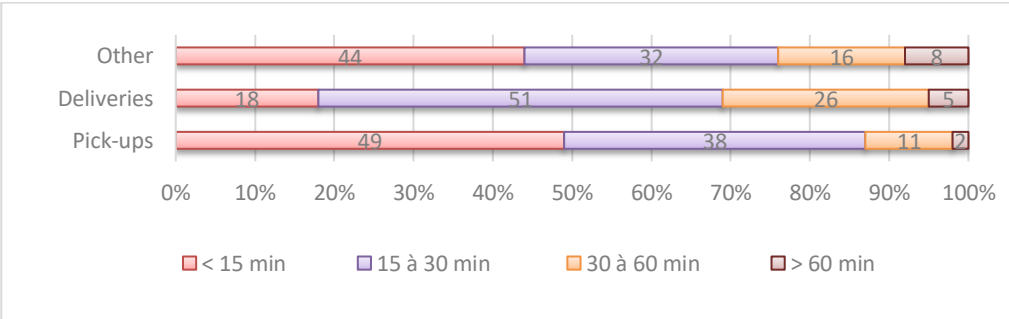


Fig. 10. Average daily variation of goods movements

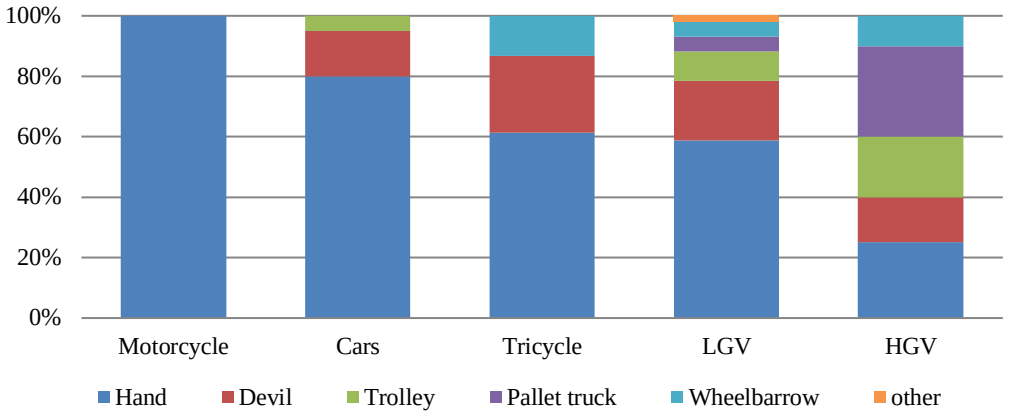


Fig. 11. Use of handling tools by type of vehicle

Regarding the HGV, twenty-five percent of movements are done by hand, fifteen percent by devil, twenty percent by trolley, thirty percent by pallet truck tool and ten percent wheelbarrow. Concerning other types of vehicles, most of the movements are done by hand.

On the other hand, The use of the handling tools is also related to the activity of each establishment. The Figure 12 provides information on the use of handling tools by activity. These data are essential for a good adaptation of the supply of delivery areas on demand.

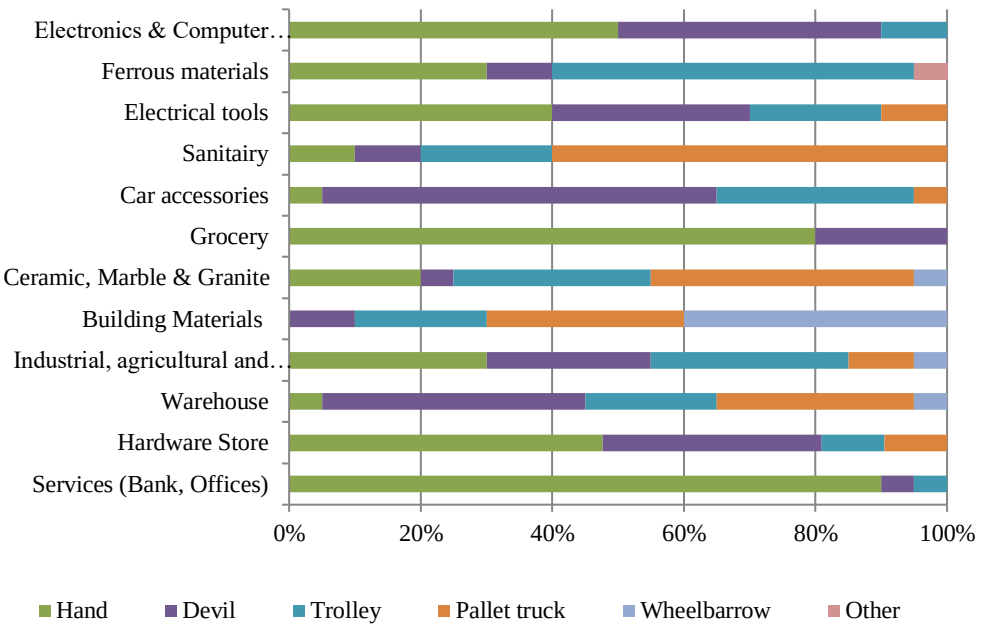


Fig. 12. Use of handling tools by type of vehicle

For example, Industrial, agricultural and hydroelectric establishment use devil, trolley and whelbarrow tools in the handling of their goods. Therefore, the location of the delivery area must be near to the establishment receiving the highest frequency of deliveries and/or near to those requiring handling tools. In our case, these are mainly: Construction materials, hardware store, electric tools, industrial, agricultural and hydroelectric establishment.

In the study section, according to the results of the survey, 64% of movements are made by vehicles parked within less than 30 metres from the point of sale.

5. Conclusion

In this paper, an urban freight transport survey methodology was developed in order to estimate the needs of loading/unloading area and to prepare their implementation. The survey was carried out in a commercial street in Morocco. It is the Avenue Mohammed Zerktouni of the city of Fez. According to the results of the survey, 60% of deliveries are made between 8:00 A.M and 12 A.M, and the movements generated by each establishment are 257 movements. For this, the study zone requires the development of three L/U bays.

Reporting on UFT investigation is nothing new. This paper contributes to the available literature by providing: a) an overview of the existing literature on UFT survey methods aimed at summarizing the available knowledge; b) a step-by-step description of the development, implementation and statistical analysis of the Establishment-Vehicle observation survey. The results and discussion section summarizes the most relevant findings of the analysis of the survey. The main contribution is to propose an approach that urban authorities can use to estimate urban delivery areas efficiently and thus allow simple replication of the proposed framework in other cities.

Most relevant constraints of the proposed approach are manifested in the extent to which the work required to carry out the survey. That's why we only drew the results from one sample from one city. Therefore, the model will be validated on other samples as the collection of data from several cities would not only increase the size of the research sample, but would also provide variations in the UFT conditions.

In future research, the limitation of the proposed survey methodology on a reduced sample in terms of geography and respondents, can be bypassed adopting other validation samples. The implementation of delivery areas seems to be a promising lever for improving the UFT performance. It will also be of great interest to quantify the need and study the feasibility of locating the delivery areas in other commercial streets, particularly in other Moroccan cities.

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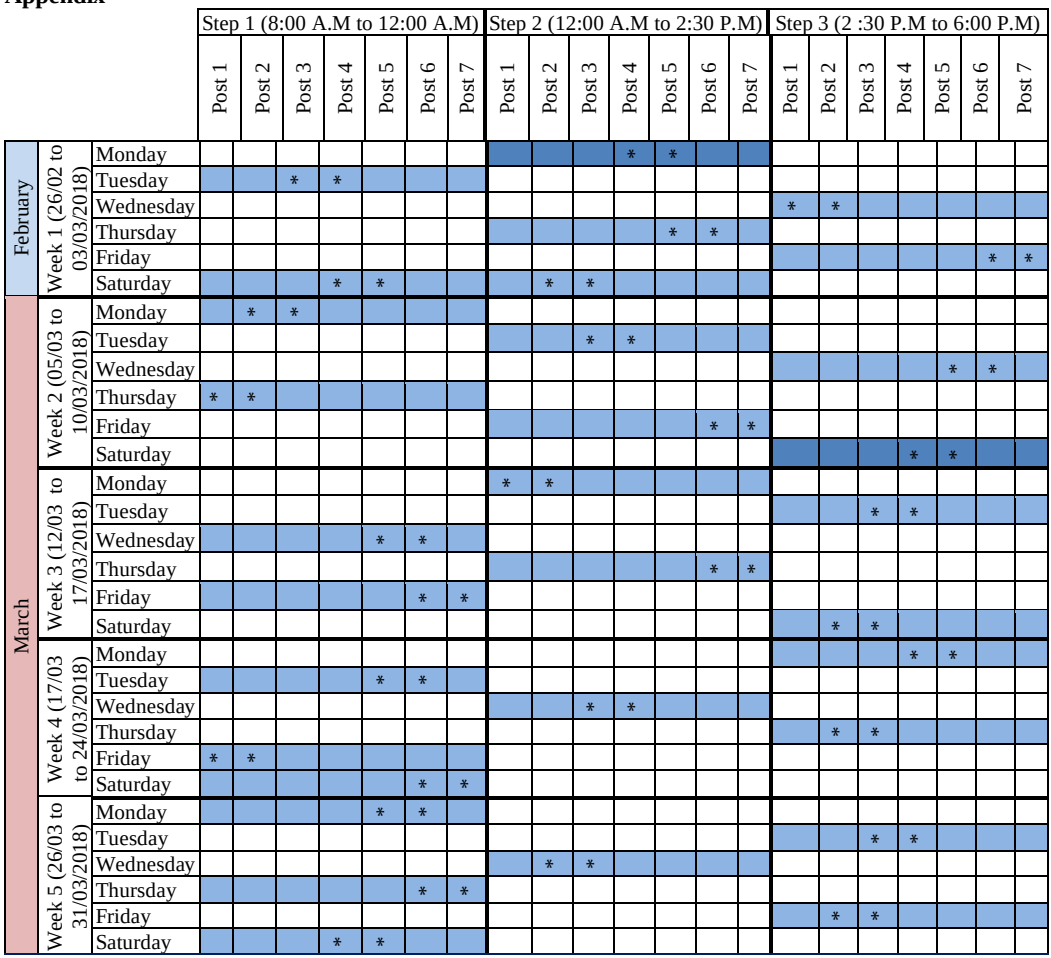
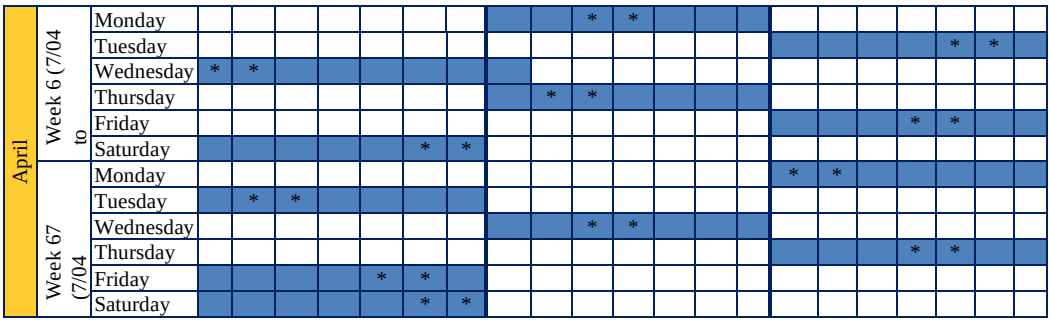
Appendix

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