Identifying solutions for car vehicle deliveries in urban areas: a case study in Belo Horizonte (Brazil)

Leise Kelli de Oliveira*, Gustavo Fonseca de Oliveira, Rodrigo de Abreu Vieira

*Universidade Federal de Minas Gerais, Belo Horizonte, Brazil

Abstract

This study presents the results of an exploratory study to identify solutions for unloading car vehicles in retail stores in urban areas. The focus group technique was used to identify the goals and solutions by the government and logistics operators. The revealed preference research was applied to the retailers, presenting hypothetical scenarios based on the solutions indicated by the first group. The off-peak delivery, the internalization of the unloading operation and the implementation of a freight distribution center were evaluated. From the results analysis, off-peak delivery and the use of a distribution center were the most pointed options by retailers. The results indicate that it is possible to identify sustainable solutions, from the city point of view, to urban freight distribution, when all stakeholders are included in the discussion. Furthermore, the off-peak operation is an important alternative for delivery vehicles to retailers, associated with the use of a distribution center for stock maintenance.

© 2015 The Authors. Published by Elsevier B.V.

Keywords: focus group, stakeholders, city logistics measure.

1. Introduction

With the significant increase in the vehicle fleet in the last decade in major urban centers, the efficiency of urban freight distribution has been compromised. The lack of urban planning coupled with the uncontrolled growth of these centers significantly contributes to this inefficiency. Moreover, another problem arising from the uncontrolled growth
of the fleet is the lack or incorrect use of spaces for loading and unloading of goods, contributing to the inefficiency of the already mentioned goods distribution.

This paper has the object of study the car dealerships. In this sector the following problems are observed: lack of internal area for unload, lack of specific signaling loading/unloading, poor conditions for parking, inadequate geometry for this type of operation, high unload time, absence of structure for overnight delivery, lack of security, among others. Actually, the delivery of car occurs on streets and generates impacts on urban traffic, contributing to increased congestion, especially at peak times.

Currently, most policies which aim at the freight transport impact reduction in urban areas are punitive for the freight operation (Bhuiyan, 2011), for instance, regulations regarding size and weight of the vehicle, the period of access restrictions, road closures for vehicular traffic, overnight delivery, among others. However, most of these policies proposed as solutions to urban freight transport have emerged as a reaction to problems, without any further studies in detail of its possible effects on the system as a whole, leading, in most cases, to policies which are not consistent with the city reality. Furthermore, the different stakeholder’s goals in process undermine the performance of the distribution system. Holguin Veras et al. (2013) points out that without the involvement of all agents in the policy formulation and conditions of movement restrictions, the result will not be satisfactory.

The absence of dialogue from the public administrators negatively affects other agents of urban distribution, they need to adapt, often in a short time, the conditions that are not considered in the initial planning. In the case of overnight delivery, one of the most visible negative externalities is the sudden increase in the price of the products soon after these policies are imposed. Still, the environmental aspects and movement, there is a substitution of cargo vehicles for large urban freight vehicles. This exchange does not cause the desired reduction in vehicle congestion, neither the reduction of greenhouse gas emissions.

This paper presents the results of an exploratory study to identify solutions for unloading car vehicles in retail stores in urban areas. The focus group technique was used to identify the goals and solutions by the government and logistics operators. The revealed preference research was applied to the retailers, presenting hypothetical scenarios based on the solutions indicated by the first group. The off-peak delivery, the internalization of the unloading operation and the implementation of a freight distribution center were evaluated.

2. Urban goods delivery and trucks restriction

The road traffic in many urban areas has grown at a faster rate than the capacity of the roads. With this, congestion, delays and unreliability of transport has increasingly gotten worse, thus affecting the efficiency of urban freight distribution process. Hence appear the concepts of City Logistics referring sustainable solutions that provide efficiency of freight transport in cities. The city logistics solutions aim to balance between sustainability, mobility and quality of urban life through communication, information and intelligent transportation system, urban planning, land use planning, urban freight transport planning and subsidies the government.

Currently, most policies designed to reduce the impact of freight transport in cities is punitive for the operation of freight distribution (Bhuiyan, 2011), for example, regulations regarding the weight and size of the vehicle, the period of access restrictions, vehicular traffic road closure, overnight delivery, among others. This is somewhat explained by the size and proportion of the impact caused by freight vehicles. Litman (2003) and Gorman (2008) reported that, although the freight vehicles represent only 10-20% of the total distance traveled, they tend to impose a significant impact on the traffic flow and reduction of freight vehicle can reduce significant the congestion.

However, many of these policy proposals as a solution to urban freight transport has emerged as a reaction to problems, without prior study of their possible effects on the system as a whole, leading, in most cases, to policies which are not consistent with the reality of the city. In addition, an important factor that affects performance of the distribution system is related with the stakeholders: logistics operator, retailers, population and administrators. Because they have different behaviors, interests and objectives, it is necessary that all being considered in models and studies in order to verify possible conflicts, since they are connected and the action reflected in an action of another.

Several specialists have approached the urban freight transport problems and their restrictions in recent years. The impacts related to this type of restriction were analyzed by Holguin-Veras et al. (2007, 2008) in New York City, in studies of policies restricting truck traffic at peak times, using stated preference techniques. Sarhaye et al. (2010)
analyzed the restriction of environmental standpoint in Los Angeles and Long Beach. Quak and Koster (2009) studied the restriction imposed by the Dutch government from the point of view of retailers, the financial and environmental aspects.

Holguin-Veras et al. (2013) discussed the lessons learned from the program of New York restricting the movement of heavy vehicles on time from 06:00 to 19:00. The authors describe how the interaction between the agents was crucial for the success of the implemented policy. The main conclusion points out that without the participation of all stakeholders involved in formulating and addressing the assumptions of movement restriction conditions, the result is not satisfactory.

In general, a city adopts a restrictive policy by the existence of some problem that needs to be understood, considering the city planning. From there it becomes possible to develop projects closer to reality. An efficient way to validate and set a project or model is by conducting a pilot project to test the solution in a sample of the universe analyzed.

The Brazilian experience in this field began in 1982 in the city of São Paulo, with restriction of movement of vehicles with a gross weight over 15 tons, from 06:00 to 09:00 and from 16:00 to 21:00. Today, São Paulo has three types of this constraint: (1) ZMRC, Maximum Area of Restriction of Movement, (2) SEE, Structural and Restricted Routes (3) ZERC, Special Area of Restriction of Movement. Other Brazilian cities also have some type of this restriction, as Belo Horizonte, Rio de Janeiro, Porto Alegre and Salvador. However, in most cities, the restriction on freight vehicles was implemented without considering its impact in the medium and long term. For the government, these policies reduce congestion, noise and air pollution. The carriers believe that the restriction to large vehicles increases the movement of vehicles with smaller load, worsening the level of service deliveries. In addition, there are the safety problems of deliveries at night (Bontempo et al., 2013).

Considering the traffic conditions during peak hours, the urban distribution of goods during this period becomes very expensive due to the time lost in congestion, and also increases levels of pollution. Among the potential benefits arising from the shift to off-peak delivery are reducing delivery costs and better environmental performance. One of the few studies that quantitatively analyze the aforementioned improvements was the experiment conducted by a supermarket in the UK which received the goods at off-peak for three months. The results indicated reductions of 60 minutes per trip, £ 16,000 per year and 68 tones of CO2 per year also were observed (Palmer and Piecyk, 2010). Fisher et al. (2010) estimated that a 1% increase in overnight delivery would save about 18 million pounds into externalities. However, Campbell (1995) concluded the opposite and claims not to be conclusive emissions reduction in overnight delivery.

This context highlights the importance of careful analysis and the use of evaluation processes to ensure that the positive effects of regulatory policies implementation for the movement of freight vehicles in urban areas to offset the negative effects (Bhuiyan, 2011).

3. Methodology

This methodology has two different steps: the first stage investigate solution with governments and logistical operator using focus group. The second stage explores the solution, suggested by logistics operators and government, is also interesting for car dealership using stated choice preference technique.

3.1. Focus Group

Morgan (1997) defines focus groups as a qualitative research technique, derived from group interviews, collecting information through group interactions. Its main purpose is to gather detailed information on a specific topic from a group of selected participants. It seeks to collect information that may provide to understand of perceptions, beliefs and attitudes about a topic, product or service.

Gaskell and Bauer (2002) believe that focus groups provide an open and accessible debate on a topic of common interest to participants. Focus groups are preferably adopted in explorative or evaluative research - may be the main source of data - or as a complementary technique in quantitative research (Merton et al. 1990) or qualitative techniques associated with in-depth interviews and observation participant (Morgan, 1997). However, more specific purposes are identified in the use of focus groups in research, such as: focus research and formulate more precise research questions;
support the development of instruments for experimental and quantitative research; to guide the search for a field of research and local language; to evaluate a service or program and to develop research hypotheses for further studies (Morgan, 1997; Gaskell and Bauer, 2002).

In this research, the focus group objective is to identify city logistics solutions for the unload car operation in the car dealership. In that moment, government and operator logistics were invited to discuss the problem. The context is to find solutions that can be implemented by the government without impacting on shipping cost.

The following questions were discussed:

- What are the three main problems of the sector related to urban freight distribution?
- What is the financial impact of these problems?
- What are the three main solutions related to urban goods distribution?
- What are the three main barriers to the implementation of the suggested urban freight distribution solutions?

Each question was discussed during 30 minutes. After that time, the main contributions were emphasized. The discussion was held at the University, considering a place where participants feel comfortable to express their opinions. The main solutions identified in this stage was used in specify research with car dealership using stated choice preference technique.

3.2. Stated Choice Preference Technique

The manifestation of individuals’ preferences for a particular product or service reflects its performance concerning a set of options available. Some events allow identify the components of the user’s action for a given product or service. For some types of analysis, such as changes in the service provided, implementation of a service and identification of unknown scenarios, these techniques become ineffective because it is not clearly detected the relative importance of variables, making it impossible to obtain results to guide future predictions or new situations. In this case, the stated choice preference technique becomes appropriate, because it is more flexible (Kroes and Sheldon, 1988), since it permits the analysis does not necessarily exist and to identify the relevant characteristics for users of the service studied. It can be used in marketing studies, for example, to analyze the impact of introducing a new product in the system.

With the stated choice preference technique, it is possible to identify the relative importance of each characteristic in relation to others. This allows further configuration of the service closer to the desires of users. As a disadvantage, these techniques present the fact that users do not necessarily do what they said. The stated choice preference technique involves the preferences of individuals and their behavior is estimated using the choice models, and it is possible to analyze nonexistent situations real, and identify characteristics of the system under study which are relevant for the user.

The stated choice preference technique is based on interviews and presents to the respondent a set of options, which are scenarios or hypothetical alternatives, constructed by the researcher. The respondent, through a range of options, choose your preference. One of the main objectives of stated choice preference experiments is to build a set of hypothetical options but realistic, known alternatives (Ortúzar and Willumsem, 1990).

In this research, the information below was obtained with car dealerships:

- Frequency of delivery;
- Average unload time;
- Time that deliveries are carried;
- If the dealership has internal parking for the stork truck;
- If there in the street, loading/unloading space regulated;
- Origin of new vehicles: the factory or distribution center;
- Observed facts during the unloading;
- Number of carriers.
After that information was obtained, it was showed to the interviewee (manager or responsible for car dealership) the hypothesis “stork truck ban in the urban center” during the commercial time and asked “how the car dealership would adapt to attend the policy of restrictions, if it were implemented”. The comments of the respondent were determined by the research revealed preference that aims to model the actual behavior by exposing the needs, problems or information in a given situation. The solutions investigated were:

- Does the car dealership have a structure for monitoring nocturnal of unloading car?
- Some car dealerships have distribution centers in Belo Horizonte vehicles. If this company does not have a distribution center, or want to build one, is it possible to operate sharing urban distribution with other brands?
- Is car dealership interested in expanding or creating an internal space for unloading vehicles?
- Given the scenario of the truck stork ban, which alternatives could be adopted by this car dealership?

4. Belo Horizonte

Belo Horizonte (Brazil), the capital of Minas Gerais, which has approximately 2.4 million inhabitants, distributed over 331,401 km², and is Brazil’s sixth largest city in terms of population. The Belo Horizonte Metropolitan Area (BHMA) has 5.8 million inhabitants distributed in 34 municipalities. It is the third largest urban agglomeration in Brazil and comprises the political, financial, commercial, educational and cultural center of Minas Gerais, representing around 40% of the economy and 25% of the state population. The BHMA is the 62nd largest urban agglomeration in the world, the seventh largest in Latin America, and the biggest in Brazil outside the Rio-São Paulo area. Belo Horizonte has the 5th largest GDP of Brazil’s cities, a fleet of 1,596,084 vehicles, 69% cars and 14% freight vehicles (IBGE, 2014).

In 2009, restrictions to freight vehicles were implemented in the Central Region of Belo Horizonte by BHTRANS, a mixed capital organization responsible for transport throughout Belo Horizonte. This resulted in an alteration in the fleet of freight vehicles to comply with legislation and a consequent increase in the number of freight vehicles (Oliveira, 2014). The central region has an area of 8.66 km².

5. Results

The methodology was applied in Belo Horizonte to understand the vehicle delivery process and find solution to related problem in this operation. Cargo Carriers’ Union in the State of Minas Gerais (SETCEMG), the leading logistics operator in the automotive area in Brazil, representatives of the car carrier drivers’ Union, representatives of a major Brazilian automaker and the representatives of the government attended to focus group. According to the participants, on average, there are 50-70 stork trucks circulate in the Belo Horizonte’s metropolitan area. Currently, only 20% of trips have return cargo. The maximum fleet age is 10 years for the car carrier and five, for the truck tractor. The insurance is different, because it incorporates various types of risk. The retailer wants to receive cars every day for not keep high inventory in the area. However, the participants indicated that it is the factory or CD which must have the stock. The focus group participants informed there had been unsuccessful attempts to use railway systems in Belo Horizonte.

The focus group participants indicated the main problems of the sector: i) mobility: traffic and delivery time increasing the logistics costs, ii) ability to receive the goods with agility so the truck remains the shortest possible time at the store; iii ) the absence of a routine for receiving the cars; iv) schedule to delivery in the stores. The "lack of appropriated infrastructure in the city and, also, in the retailer to receive the vehicles" was reinforced by all participants. The participants indicated the solution and main challenges to its implementation, as shown in Table 1.

These results provided information for analysis of the best alternative by the car dealership. In Brazil, there are 4,914 stores responsible for the sale of 1.7 million new vehicles. Specialized stores were interviewed in two important avenues in Belo Horizonte, which comprise the majority of brands. The survey results identified that 40 new vehicles are delivered to the stores daily, via four car carrier, and the operations are conducted during business hours. The average time of these operations, which includes the conference and unloading of vehicles, is two hours, which may vary according to the unload area location and the type of product marketed by the store (imported cars have a higher unload time).
Table 1. Solutions for cars delivery and its challenges to implementation.

<table>
<thead>
<tr>
<th>Solution</th>
<th>Challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution center with car brands’ integration</td>
<td>Paradigm shift (long-term vision)</td>
</tr>
<tr>
<td>“In new stores, should be a place to receive the car carrier”</td>
<td>The internalization may demand a larger area, which can be considerate a non-productive one. It is necessary 170m², beyond the car carrier maneuver area</td>
</tr>
<tr>
<td>Off peak deliveries</td>
<td>Public security</td>
</tr>
</tbody>
</table>

The survey was conducted in thirteen car dealerships that sell ten major brands of car manufacturers in Brazil. The survey period was April and May 2013, in the city of Belo Horizonte, Brazil. At the request of some respondents, the car dealerships here will be referred to as C01 to C13.

Fig. 1 shows an average frequency of stork trucks in car dealership for vehicle delivery and unload time in hours. The C01 dealership features superior to other media and this fact is justified because the brand commercialized by this dealership has a distribution center in Belo Horizonte and meets other dealers. The value corresponds to the total stork trucks conducting deliveries at the distribution center. On average each car dealership receives vehicle through four deliveries with stork trucks per week. About unload time, on average, a stork truck is unloaded in two hours. The fluctuations in the unloading time are due to loading/unloading space location and specifications of the product. For example, the car leadership sells exclusively luxury cars that demand a more detailed conference at delivery. Those car dealerships with a delivery time of 1 hour or less, basically sell popular cars or have distribution centers in operation.

![Fig. 1. Number of delivery by week and unload time for stork trucks in car dealership](image)

Of the car dealerships interviewed, 85% receive vehicles during business hours. The main origins of vehicles are factory (67%); distribution center (20%) and Port (vehicle imported – 13%). As the distance traveled for delivery is large because the continental dimensions of Brazil, it is difficult to predict the time of arrival of storks trucks in stores. Other problems identified in the research are the lack of security and low conditions for unloading. None of the car dealerships interviewed has an inside area for delivery and only one dealership has a near parking area regulated. One logistics operator is responsible for all deliveries to dealers interviewed. According to respondents, the main problems at the time of delivery are small damage (46%), heavy traffic (39%) and parking area (15%). The visit the dealerships
cars allowed to observe that the geometric design of the roads difficult the operations of vehicle and increase unload times.

Addition to this information, three car dealerships have their own distribution centers, whose cars are stored and delivered to stores in tow vehicles, that transport an average of 2-4 cars. For these dealerships cars, the deliver is faster and has fewer problems.

Considering the scenario of stork trucks banned during daytime and using revealed preference survey, four questions were exposed the interviewees to quantify the actions that the car dealership would adopt to suit vehicular restriction. Considering the overnight delivery, with 77% of dealerships reported that have no structure for receiving freight at night, with claims that the costs would be high and that security would be compromised. Concerning the distribution center shared with other brands to reduce costs, 46% stated that would share facilities with another brand, 31% would not share and 23% already have their own distribution centers. In relation to the internal expansion space for parking stork truck for delivery, 77% did not would expand its internal space by several factors, such as increased costs, lack of physical areas or absence of need for this practice for receiving the vehicles.

Finally, respondents were inquired about the practices they would adopt if the stork trucks were banned in the city during the day period. The results indicated that 46% would adopt the night delivery. 46% have operated distribution centers or could share with other brands and only 8% would expand their internal space for the parking of stork trucks.

6. Conclusion

This paper aims to investigate the efficiency of the conciliation of different purposes of the stakeholders of urban goods distribution, through an exploratory study of the distribution of car for dealerships in Belo Horizonte (Brazil). The methodology proposed in this paper proved to be suitable to identify solutions that are attractive to all stakeholders. Thus, it can be more success on focused for freight policies.

Regarding to the results obtained in the research, the focus group enabled us to identify attractive solutions from the carrier and government point of view. In the analyzed case, the adoption of overnight delivery, distribution centers and internalization of the stork trucks parking places were identified as the best solutions to reduce the impacts, especially congestion, form the delivery of vehicles in urban areas.

These solutions were presented for car dealerships as an alternative to the stork trucks prohibition during the day. It was noted that some dealerships have adopted distribution centers for delivery of vehicles, this being one of the practices investigated. Results indicated as better solutions to the proposed problem the use of urban distribution centers, including shared space with other brands and overnight delivery.

In conclusion, considering the restrictive policies that have been implemented in many Brazilian cities, the involvement of stakeholders in decision-making becomes more attractive and less costly solution to the system, since it is a win-win system and the most important is the economic and social benefits of the proposed solution, considering the concept of city logistics. Experiences as evaluated in this paper might become practice in cities to reduce the impositions to urban goods distribution.

Acknowledgements

The support of the National Council for Scientific and Technological Development (CNPq) is acknowledged and appreciated. The authors thank BHTRANS and SETCEMG by support city logistics research in Belo Horizonte.

References


