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Last mile freight distribution and transport operators' needs: which targets and challenges?

Cristina Pronello [a]*, Cristian Camusso[a], Rappazzo Valentina[a]

[a] Interuniversity Department of Regional and Urban Studies and Planning, Politecnico di Torino, Viale Mattioli, 39, Torino 10125, Italy

Abstract

The paper aims at investigating the needs of three sets of stakeholders – retailers and HoReCa, transport operators and local authorities – aimed at designing a dynamic and participatory platform of services and applications for the optimisation of the last mile urban logistics.

The research has been carried out in the city of Torino where some integrated services will be introduced: a) management and booking of loading/unloading areas; b) experimental dropbox for collection and delivery; c) the introduction of dynamic access to the limited traffic zone (ZTL, Zona a Traffico Limitato); d) real-time dynamic optimisation of routes. To meet this goal a survey has been administered to a sample of transport operators, points of sale, public administration. The survey has been designed using a quali-quantitative method (web-questionnaire, interviews and focus groups).

The results have showed a large gap between the needs of the operators (transport operators and retailers) and the strategies that the administration would seek to implement. A lack of interaction between the stakeholders has led to misperceive the problems that the carriers have to face daily and to overestimate the importance of the technology in solving the last mile issues. Prior to designing complex and expensive platforms, it is fundamental to implement some basic measures, closely related to the efficiency of the unloading and delivery of goods within the urban centre.

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Keywords: Last mile, transport operators needs, sustainability, quali-quantitative survey.

* Corresponding author. Tel.: +39.011.0905613; fax: +39 011 090 7499
E-mail address: cristina.pronello@polito.it

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1. Introduction

Freight transport and logistics are strategic for the economic growth of cities and urban areas, being a key factor for manufacturing as well as for satisfying the customers' needs and, hence, making regions and countries more efficient. However, the distribution of goods in urban area has become an issue for most of the main developed cities (European Commission, 2013; MDS Transmodal, 2012). The urban freight transport by individuals and by third parties ranks first in road transport, in terms of tons transported (ISTAT, 2012; OECD, 2003). Furthermore, the E-commerce business-to-consumer (B2C) has increased the movement of goods to satisfy the increased demand of individuals, retailers, industries that want to receive the products on time and in the desired location.

Some studies show that most of the costs related to logistics are coming from the last mile distribution (Gevaers et al., 2011; Goodman, 2005) and that such costs have to be analysed at different geographical scales (Browne et al., 2012), with a particular attention to the urban level (European Commission, 2010).

Last mile delivery often being not sustainable, the consequences for the cities in terms of economic, social and environmental impacts, regulations and infrastructure development can be significant (Dablanc, 2010). Freight transport in cities interacts with other human activities, disturbing residents and businesses for different reasons and in various ways: traffic congestion (Crainic et al., 2004; Goodwin, 2004), welfare (Bilbao-Ubillos, 2008), noise (de Jong and Miedema, 1996), greenhouse gases and pollutant emissions are caused by the presence of the heavy vehicles in the urban traffic (Dablanc, 2008).

Energy consumption and heavy vehicles emissions are influenced by a wide range of factors: vehicle typology (model, displacement, fuel, age), load capacity, traffic, road typology, driving style and the number of times the vehicle stops and restarts. Some studies show that over a distance of 10 km, five stops increase fuel consumption by 140% (Schoemaker et al., 2006).

According to a study by the Italian Automobile Association (ACI, 2011), commercial vehicles travelling in Italy are unevenly distributed, ranging from Euro 0 to Euro 6. Statistics show that 47.04% of vehicles meet EURO 3 and 4 standards, while 22.16% of vehicles are EURO 0 – the category in which vehicles do not meet any emissions standard. The consequence is that emissions from freight are significant, even though commercial traffic represents only a fraction of total urban traffic. On average, in European cities, commercial traffic ranges from 8% to 15% of urban traffic flow, but it accounts for 20-30% of total traffic emissions. Furthermore, freight vehicles often travel at peak times and the unloading of goods takes place in spaces not designed for parking due to the lack of proper areas or because such areas are occupied by passengers vehicles (MDS Transmodal, 2012).

All the above aspects require specific policies at local level, aimed at regulating the use of urban spaces and at identifying a compromise between land use and economic interests. Hence the priority is to develop new forms of access to urban areas and city centres, even more in historic and tourist contexts, in order to optimise freight transport in coordination with passenger transport and to promote the use of vehicles with high standards of eco-sustainability. The description above explains why, in recent years, the development of new technologies has been addressed to reach an integrated urban and transport planning and to optimise the use of existing transport resources. Although the new technologies have helped to reduce pollutant emissions due to freight transport, it is hard to lessen the pollution level, since traffic volumes have progressively increased. Literature shows that the problem cuts across different actors and sectors (Taniguchi and Thompson, 2015; Lindholm, 2013) and that solutions are a combination of technical innovation and policy (Gonzalez-Feliu et al., 2014; Browne et al., 2012; Dablanc , 2011).

Literature mainly shows examples related to technical and operational solutions: new loading units (Dell'Amico and Hadjidimitriou, 2012) or special reception/delivery boxes, located in strategic places of the urban area, are supposed to reduce trucks/vans trips (Punakivi et al., 2001), be it for the transport of general goods or for food requiring boxes at controlled temperature. In some cases such boxes are installed in the consumer's garage (Punakivi et al., 2001), or in specific points in the underground or at petrol stations (Punakivi and Tanskanen, 2002). Sometimes the solution was not economically sustainable, needing high investments, while in other cases "shared vehicles" are proposed (Wygonik and Goodchild, 2012) showing a possible reduction of costs and pollutant emissions. Other solutions are related to e-commerce where citizens are the final recipients of goods; to this end, diverse internet and mobile applications have been developed to optimise the delivery activities (Petrovic et al., 2013), reducing the number of vehicles passing through the urban areas and leading to a better use of those vehicles

(Nemoto, 2003).

On the policy side, one of the most common actions adopted in urban areas is the introduction of access restrictions and/or of specific time windows to accede to certain areas (notably the city centre) but the effects are not well known; moreover, in some cases, access restrictions involves an increase of costs and pollution (Quak and Koster, 2006).

Notwithstanding the various solutions described above, it is important to notice that the logistic operators already use optimisation algorithms for routing and for loading, seeking at optimising their delivery to boost profits from their work. Thus, the aforementioned solutions are today taken for granted and the answer to the issues related to the reduction of impacts of last mile transport has to be found elsewhere. For this reason, a holistic and multi-disciplinary approach is required; the design of solutions combining technical and operational aspects with policy issues to regulate the access of the heavy vehicles to urban areas, requires integrated and shared initiatives that go over the simple "optimisation of the delivery".

The URBeLOG[†] project, an Italian initiative to reduce the impact of the last mile freight distribution in the three urban areas of Torino, Milano and Genova, tries to respond the above challenge. It aims at finding a possible solution based on an innovative, open, dynamic and participated computerised platform of services and applications for last mile urban logistics that can aggregate the ecosystem of stakeholders and manage in real time the distribution processes, from production to delivery. The idea behind the project is the implementation of a virtuous freight system that will streamline distribution processes, making them efficient and eco-sustainable, reducing the direct and indirect costs of last mile services. A logistics system providing high added value services – interfaces for the transactions to use logistics resources and safe, dynamic tariff-based payments – can facilitate the use of the most advanced forms of trading and might enable the use of certification and accreditation systems for the urban transport of goods. Of course the development of such solution passes through the development of "smart vehicles" and "smart platforms" but also through the definition of roles as well as of specific rules regulating the collaboration with local institutions. However, a local partnership alone could not solve all the freight transport issues (Lindholm and Browne, 2013) because the solutions are often designed only to take into account technicalities without considering the real needs of transport operators. In any case, the development of new applications (mobile applications, web portals, specific on board units) or services implies the definition of the data and information to be shared among different actors.

This paper aims at analysing the needs of the stakeholders (retailers, transport operators and decision makers) in the urban area of Torino collecting their opinions, needs and suggestions about the solutions provided by the URBeLOG project.

Section 2 describes the methodology for individuating the users' needs through the survey. The results are presented in section 3 and allow match the efficacy of the services proposed by the project with the users' needs. Finally, section 4 discusses those results and compares them with the relevant literature.

2. Methodology

The paper wants to analyse the solutions to urban freight issues proposed by the URBeLOG project that aims at reducing freight traffic in the urban area through:

- the introduction of reservation loading/unloading bays;
- the installation of "dropboxes" in strategic locations inside and around the limited traffic zone (ZTL: Zona a Traffico Limitato) where couriers could store packages and customers could pick them up through an electronic access. The drop boxes should be used like a transfer point between couriers and final users and it is supposed that such boxes could be shared by different transport operators and could store any type of product, unlike what reported in literature;

[†] http://www.urbelog.it/urbelog/ (accessed on September 2015)

- the introduction of dynamic access on ZTL according to the typology of vehicle and the loading factor to guarantee the access to the most efficient and less polluting transport operators;
- the development of specific applications/services like a route planner (mobile/web based) to support and optimise the delivery activities. It is more and more frequent, nowadays, to look for solutions oriented to mobile applications and to the use of real time data.

The implementation of the interventions proposed by the URBeLOG project implies investments for specific technological infrastructure; to be financially feasible, the interventions need to be well accepted and, then, utilised by the potential users. To assess their acceptability, the key factor was surveying the needs of the different stakeholders involved in the freight delivery in urban area. To this end, a three-step methodology was applied in the urban area of Torino, providing:

- the definition of the sample of stakeholders involved in urban freight transport;
- the design of the survey to be administered to the stakeholders;
- the administration of the survey.

The sample of the survey included all the main actors involved in the delivery of goods within the urban area of Torino, stratified according specific criteria for each category: retailers and HoReCa (Hotellerie-Restaurant-Café), transport operators and decision makers.

Eighteen retailers and HoReCa were selected among all those located in the ZTL because this area is subjected to several restrictions already affecting transport operators. The stratification of the sample was made according to the size of the retailers and HoReCa, in order to include representatives of small shops or cafés as well as large stores, supermarkets and restaurants or catering services; all the categories of products were considered: food, clothes, telecommunication, etc.

Eleven transport operators were selected among all the companies delivering the goods within the ZTL and were stratified according to their typology: couriers and logistics operators.

Six decision makers were selected among those technicians and politicians working in the sectors of transport, environment and commerce in the municipality of Torino.

The survey has been designed using a quali-quantitative method to investigate the needs of the three groups of stakeholders as well as to gather their opinion regarding the interventions proposed by URBeLOG project. This mixed approach included web-questionnaire, focus groups and interviews to collect in a comprehensive and detailed way all the information needed to design the potential business model. Furthermore, such an approach allowed to go in depth in each specific situation to understand the way in which each operator worked as well as its needs.

Three different questionnaires were designed, to be administered in two formats: web-based and paper-based. This last one was used when the respondents preferred to be interviewed; in this case an interviewer directly went to the respondent to collect the information to be filled in a paper questionnaire.

The questionnaires were organised in different sections to investigate the characteristics of the three typologies of respondents, their constraints, needs, expectations as well as their opinion about the interventions proposed by the project:

- description of the retailer and transport operator: size of the shop/company, number of employees, typologies and number of used vehicles, etc.;
- description of the delivery: typologies of service and goods delivered and urban area covered;
- information on supply of goods to the retailers and HoReCa: period of the day, frequency, etc.;
- information on the management of the delivery: routing, packing, etc.;
- opinions or suggestions about the perceived problems related to the supplying activities;
- specific policies already implemented (addressed only to decision makers).

Most of the questionnaire provides “closed answer” while the opinions were asked using a Likert scale with five points to measure the degree of agreement/disagreement (Likert, 1932).

In addition to the questionnaire three focus groups were designed to discuss in depth the aspects contained in the questionnaires and to understand the stakeholders’ point of view about the solutions proposed by the project.

Unfortunately, only the focus group involving the transport operators was carried out due to the reluctance of the retailers to meet. On the contrary, decision makers preferred to have interviews due to problem of finding common

dates for meeting all together.

The layout of the focus group was geared to investigate:

- the opinion about the problems related to the goods delivery in the ZTL;
- the possibility to book the loading/unloading bays by on-line booking procedure;
- the proposed rules to access to the ZTL according to a dynamic authorisation.

In the next section the results are reported crossing the outputs coming from the questionnaires and the focus group.

3. Results

The analysis of the results of the survey was firstly carried out separately for each of the three typologies of respondents to characterise in detail their activities.

The *eighteen retailers and HoReCa* involved in the survey represent different commercial sectors: 4 clothing stores, 6 restaurants, 3 supermarkets and 5 general shops (greengrocers, bookshops, etc.). They have different size in terms of: a) number of employees: from a minimum of 2 people in small shops to a maximum of 39 people in the restaurants; b) surface area : from 15 m^2 of the small shops to 1,800 m^s of the bigger clothing centres.

Some shops are in franchising, some are privately owned and others are chain of shops.Opening hours are different but in general all shops open around the 9.00 a.m. and close around 7:30-8:00 p.m.; only the restaurants open late in the morning and close late at night; this issue is significant because it affects the supplying activities.

Delivery to clothing stores occurs during the opening hours along the day, partly in the morning (10:00-12:00 a.m.) and partly in the evening (after 4:00 p.m.); furthermore, the transported stocks are not the same during the year, peaks being recorded during the seasonal changes. Small retailers (greengrocers, etc.) show similar supply hours, the frequency being once a week. The supermarkets, instead, receive the goods from 6:00 to 8:00 a.m. within short time windows, even though they can receive goods also at other times during the day.

Most of the interviewed shops are regularly supplied by transport operators; the supermarkets also use third parties but in some cases they receive the products directly from the farm without passing through transport operators.

It is interesting to notice that 9 shops are involved in the “reverse logistic” that is an important aspects for the three supermarkets with returns of loading units, as “pallets” or “rolls” (specific trolleys to move packs).

The *eleven transport and logistics operators* involved in the survey are in the sector of: logistics (1), logistics and shipping (1), production and distribution of own products (2), couriers (1), shipping (2), wholesale food (2), food distribution (1), distribution centre and warehouse (1). The sample spans different sizes, from small operators with only 7 employees to big logistics operators with more than 500 employees for each branch. Types of vehicles used for delivery are also different and related to the operator size, varying from 5 vans for the small couriers, to 80 trucks for the big logistics operators.

Food carriers report from 2-5% to 20-30% of their customers in the ZTL (just one sends the 80% in ZTL and the 20% in the rest of the city), amounting to 10 to 110 deliveries per day and to 2 to 17 deliveries/vehicle/day. Instead, the other transport operators send to ZTL only 5% to 10% of their goods (while from 10 to 70% end in the rest of the city and in province) with 5 to 204 deliveries per day and 5 to 58 deliveries/vehicle/day.

On average, transport operators use three vehicles (to a maximum of 15) for the shipments in ZTL, with a loading factor of the vehicles ranging from 50% to 75%, referred in some cases to weight while in other cases to volume, the difference being due to the loading typologies (e.g. loads on pallets versus refrigerated cells).

Seven transport operators out of nine pick-up the loading units: in six cases the pick-up is made during the normal delivery activities while in one case the pick-up needs a dedicated trip.

Most of the transport operators (8) use software for orders and warehouse management; only one uses a specific software for routing while three big operators use software to optimise loading and fleet management. Six operators use software for satellite control of the fleet: three out of six use GPS for vehicle localisation while the other three use GSM mobile application. In few cases the tools are installed on the vehicle in specific on board units (OBU); in other cases a GSM-based technology is used and the tool is inside the personal digital assistant (PDA) given to the drivers. The vehicle tracking depends on the operator typology; if the logistics operators use third parties (private

single transport operator/courier) for the last mile delivery, the contractual agreement usually does not allow to track the vehicles.

Furthermore, four transport operators out of eleven declare not to plan the trip, leaving the route choice to the driver; in two cases they assign to the driver a specific zone in the ZTL (based on multiple of statistic cells) and he plans the route according to his knowledge and the deliveries schedule. As a result the driver becomes highly skilled about a quite narrow area and the route choice inside it. Instead, for those planning the trips in advance, the route is strictly connected to delivery priority and loading; in other cases the sequence of the deliveries is adjusted by and in collaboration with, the drivers. Nobody uses information about the location of the loading/unloading bays.

The *six decision makers* come from different local authorities: one from the central district of the city covering the ZTL, two from the Torino City Council, one from Torino Province and two from the Piemonte Region. All the individuals are working in sectors related to transport, urban planning and freight.

The results of the questionnaire show that freight issues are partially considered in some local programmes but there is not an integrated mobility management plan even though this is requested by the Strategic Regional Transport Plan. Furthermore, the Regional Logistics Plan defines some macro-rules and provides a strategic vision without going in depth into the governance of the freight in the urban area, just suggesting two general strategies: 1) access restricted to specific hours of the day and limited according to the vehicles' size and emissions; 2) optimisation of the freight delivery.

While for all six actors the freight regulation is important to reduce congestion, noise emissions and pollution, their visions on how to reach such targets are different. Half of them consider important to discourage non sustainable freight in the city centre but they have different opinions on the usefulness of policies providing a "premium" access or specific forms of accreditation for freight requiring access to the city centre. Moreover, while almost all the six stakeholders think it is useful to give real time information on mobility in the urban area, sharing specific information on freight traffic is perceived as less important.

In general all the respondents agree on the basic information local authority (municipality and public administration) should collect to grant access to ZTL and the use of loading/unloading bays, highlighting the need to collect more data on these issues. Furthermore, they consider important the use of environmental and mobility data to design good policies but they think that real time data are not deemed necessary. At the moment there is a system to collect traffic data using magnetic waves at the crossroads, cameras and Floating Car Data (FCD). FCD are data collected by dedicated cars, specially equipped, giving information on traffic flow characteristics: speed, running time, waiting time at traffic lights, etc. The information is used to feed transport models to forecast the traffic flow; the results are also showed to citizens in aggregated way through specific web portals; however, not any specific analysis on freight is undertaken.

After a clear insight of the current situation, the stakeholders' needs have been cross-checked to show possible common points of interest and/or barriers as regards the implementation of the interventions proposed by the project, as described in section 3.1. Finally, the proposals of the respondents are described showing strengths and weaknesses of the suggested strategy (section 3.2).

3.1. *The evaluation of URBeLOG interventions*

As explained in the methodology, the URBeLOG project put forward some instruments/policies to reduce the impacts caused by freight traffic in urban area: a) the introduction of a booking mechanism for the loading/unloading bays; b) the installation of "drop boxes"; c) a special policy for dynamic access to ZTL; d) the realisation of a freight route planner app to optimise deliveries.

Table 1 displays a comprehensive framework, reporting the main strengths and weaknesses of the proposed interventions according to the point of view of the three groups of stakeholders involved in the survey.

Table 1 Evaluation of the interventions proposed by URBeLOG for the last mile distribution

Intervention	Stakeholder	Strengths	Weaknesses
Booking loading/unloading	Retailers	Retailers gave their opinion even though they do not directly use the bays, used only by transport operators. Thus, they do not feel affected in terms of costs and their opinions are related to how they	

bays		think the transport operators could react to such intervention.	
		• As the bays are often occupied by other vans or non-authorised vehicles (cars, etc.), the booking procedure could reduce the illegal occupation of the bays. • The bays should be booked from two days to 30 minutes before their use.	• The uncertainty of the time delivery could induce to book the bay for a long time window. • The couriers or logistics operators may be responsible of the cost and the booking procedure, reducing their willingness to adopt such procedure. • In cases of high booking costs the transport operators would forgo the use of bays. • The booking procedure could force the shops to change their delivery time.
	Transport operators	• It could be useful to know if the bays are free or occupied through an app showing in real time the bays' availability.	• In general, bays are not perceived as useful. • In case of occupied bays operators would not wait and would park close to the shops.
	Decision makers	• The intervention could regulate the access to the ZTL and t freight distribution. • The intervention is in line with local policy for last mile distribution.	• Some transport operators could perceive the intervention as complicating the deliveries.
Drop boxes	Retailers	They are not interested in the service.	
	Transport operators	• The customers could decide when going to pick up the parcels in the drop box, avoiding waiting times or the need to communicate to the transport operators specific "delivery time windows". • The possibility to pay by credit card directly in the drop box reduces the couriers' responsibilities. • They are useful for consumers.	• The fresh products need boxes at controlled temperatures, but not all the products need the same temperature, so each drop box should be customised and used for a specific product. • The drop box should be cleaned and sanitized if used for storing food, reducing the time window in which it is available. • The drop box should be customised to each operator because different products from different operators cannot be stored in the same place. In case of theft is important to understand who is responsible. • Some supermarkets or greengrocers want to receive the products directly at the shop, they are unwilling to travel to pick up the products in a drop box. • The retailers do not perceive drop boxes as useful.
	Decision makers	• They could regulate the access to ZTL and the freight distribution. • They are in line with local policy.	–
Dynamic access to ZTL and freight route planner	Retailers	• It is important to obtain information in real time about the events (traffic disruptions, accidents, etc.). • It would be useful having tools to know bays availability in real time.	• The route planner is perceived as not very useful.
	Transport operators	• A certification by third parties could be a solution to evaluate the optimisation of the access to ZTL. • Even though a navigator is not so useful, an application giving information about the availability of loading/unloading bays could be useful.	• It is too complex to regulate access according to the loading factor. Furthermore, transport operators always load the vans/trucks at the maximum of their capacity; otherwise it would not be cost-effective. • Using the loading factors or tracking the trips could not be enough to regulate the access to ZTL and to optimise the freight transport. Most of the trips are rerouted during the delivery time because the customers' availability change during the day, in particular for the B2C delivery. • The driver accurately knows the area and the streets so that a navigator is not perceived as useful.
	Decision makers	• The intervention could regulate the access to ZTL and the freight distribution. • The intervention is in line with local policy.	• Some transport operators could perceive the intervention as complicating the deliveries.

Table 1 highlights a lack of a common view about the proposed interventions, mainly due to the different needs of the stakeholders. Most of the shops have a loading/unloading public bays along the streets around the shops but they are not so much used; instead, private areas like parking in the inner courtyards are often used for loading/unloading activities. This habit is favoured by the closeness of the courtyard to the shop warehouse and it is also encouraged by internal rules prohibiting the transit of goods through the sale area. However, the main reason for not using the dedicated bays is their occupation by other couriers or private cars illegally parked. Speaking about fresh food, sometimes the bays are not close enough to the shop to guarantee the proper food preservation. Furthermore, the streets in historical central areas are paved with small blocks of stone, making difficult for trolleys to ferry goods from the van to the shop. For all the above reasons it is common to park the van outside the dedicated bays, in front of the shop, to facilitate and speed up the delivery: 12 respondents declare about 15 minutes while only 5 declare more than 25 minutes to deliver the goods.

Even though the use of the bays is considered difficult and often it is hampered by illegal occupation of other vehicles, the booking is perceived as interesting and if the municipality would like to implement this reservation service, it should tailor the booking process and its management to the specific needs of the transport operators. In fact, the retailers are unwilling to pay for booking the bays and 50% would stop to use them if a charge is levied; considering couriers and road hauliers should pay for it.

Concerning the booking needs, seven retailers declare that they would book the bays (if they were responsible for that) more than two days in advance, six respondents less than one day before and three only 30 minutes before. The reservation time period ranges from 15 minutes to 3 hours, due to the uncertainty of the arrival time. Only three retailers are willing to change the scheduling of deliveries if the bays are busy.

However, both retailers and transport operators share the same concerns about the scant usefulness of the booking service while they consider more interesting to receive the information about the position and the availability of the bays (free or occupied).

Decision makers are concerned by the small transport operators or the shops that stock up on their own; however, even though they do not know any concrete example of booking bays in the region, they think it could be useful to reduce the traffic in the ZTL.

The drop boxes are not considered an interesting service by the retailers, likewise most of the transport operators whose products are packed in big pallets difficult to stock in little boxes; furthermore the fresh food cannot be stored in such boxes not guaranteeing the preservation of the quality and food characteristics. Only the couriers as DHL and TNT, delivering small parcels rate such service as convenient.

The decision makers see the dropboxes as transfer points between producers and consumers that fits their current policies. They suggest the location of the boxes in the perimeter of the ZTL or inside strategic locations like supermarkets. They know other similar solutions like CityLog (Quak, 2012) where the boxes refer to a single operator while, within URBeLOG, they are favourable to solutions allowing different transport operators to share the boxes. This view is within a more complex framework of policies geared to regulate the access to the ZTL and the mobility in the city centre; the dynamic access to the ZTL through reward mechanisms, specific routes for freight or specific bays for accredited operators are under study. However, the criteria to accredit transport operators are not defined yet but the idea is to use the loading factors or vehicles emissions as parameters to select the operators that may enter the ZTL. The decision makers think that only the small logistics operators would reject these rules. The literature reports some cases of using loading factors to grant access to urban areas, or the definition of specific time windows for goods delivery, showing that they could have a negative environmental impact (Arvidsson, 2013), thus suggesting to investigate in depth the adoption of such criterion.

The access to ZTL of the least polluting transport operators is another suggested criterion that could be implemented. This would require monitoring and tracking the trips in real time through an OBU on the vehicle and specific telematics infrastructure in the city to allow communication between vehicle and infrastructure.

The interventions proposed by URBeLOG, that are coherent with the local policy, are not appreciated by the transport operators. They wonder which rules could be applied to allow the entry in the ZTL, and argue that only the use of ecological vehicles could be a fair approach for the admission. Actually, eight transport operators declare to be interested in replacing the vehicles used for the deliveries in the ZTL with less polluting ones: four respondents suggest vehicles with methane engine, three opt for hybrid diesel vehicles and one proposes electric vehicles.

Concerning the trip monitoring, transport operators claim that a third party, expert in delivery activities, should analyse the data and decide whether or not the request to enter the ZTL should be accepted. The reason is the delivery process is constrained by numerous variables and a simple observation of the tracked trips (and possible rerouting) does not allow to understand whether the excessive kilometres driven, or t undue access to the ZTL, are caused by a bad management of the deliveries or by changes requested by customers during the day. About the installation of OBUs on vehicles fleets, two non-food and 5 food transport operators agree to install them but ask for sharing the cost with the municipality. Furthermore, they point out to difficulties related to using a third party for the last mile delivery because, in some cases, the contractual agreement does not allow to track the couriers.
The use of a freight route planner is considered useful only for new drivers working on the last mile in the city centre, even though they often work in the same area and become rapidly familiar with all the possible routes, as confirmed by another survey carried out in Gothenburg (Arvidsson et al., 2013). Moreover, real time changes during the trip could be not compatible with the plan made before the departure, making difficult to accept the route diversion. However, the transport operators were asked to express their opinions about possible information provided by a real time freight planner. In table 2 it can be observed that the transport operators are only interested on information about traffic disruption, bays availability and booking, video surveillance and proposal of routes allowing pollution reduction.

Table 2 Operators evaluation of the potential options of a real time freight application

Information in the app	Not Useful	Useful
Real time traffic information	x	
Events (streets interruption)		x
Accidents	x	
Loading/uploading bays availability		x
Information on bays size	x	
Possibility to book loading/unloading bays		x
Information on power connection on the bays	x	
Information on water connection on the bays	x	
Information on video surveillance	x	x
Information on policy contact	x	
General trip planner	x	
Specific oversize trip planner	x	
Delivery optimisation	x	
Routes allowing time reduction	x	
Routes allowing pollution reduction		x
Availability of drop box	x	

3.2. *Difficulties and possible solutions to urban freight proposed by the transport operators*

As already argued in the previous section, the interventions proposed by the URBeLOG project are an input for the public administration whose goal is the reduction of freight traffic in urban areas and, as a consequence, its environmental impacts. The proposed interventions only partly cover the user needs because never before the users' point of view was requested, as clearly emerged during the focus group. Logistics and transport operators have had limited opportunities, along the years, to share opinions with public administrations in regard to the delivery activities in the urban area, confirming the "unilateral" approach of the proposed interventions.

The survey allowed also highlighting difficulties and barriers that the transport operators face daily in delivering goods in the ZTL as well as suggestions and new proposals.

The main difficulties faced by transport operators are:

- retailers and HoReCa need regular and constant delivery periods as they are used to recruit more employees when receiving the goods; this is the reason why the transport operators cannot change their routing at will;
- the distance of the loading/unloading bays from the shops can be a technical problem. The delivery of fresh food must respect the "cold chain" (even more in summer) and, in order to maintain constant the temperature, the distance between the bay and the shop must not exceed 300 metres, even if dedicated boxes are used.

Furthermore, in some cases the products are not packed and they must be handled with care. The need to rapidly unload the goods is hampered, in the city centre, by factors as the narrow streets and the paving with blocks of stone that hinder the movement of trolleys;

- in some cases the transport operators have to manage also the payment of the delivery and the returns, increasing the delivery time as well as the drivers' responsibility;
- communication problems with the administration: *"politicians think we are like buses"*. The delivery work has to meet the time schedule that has also to be adapted to the customers' availability and needs;
- the transport operators who also collect the goods and deal with "reverse delivery" from shops or individuals (for example withdrawal of empty boxes, pallets, etc.) struggle to make this operation together with the delivery activities, in particular if they carry heavy goods. In this specific case it is really difficult to optimise the routing: Transport operators often complete the delivery and, later on, start the goods collection;
- at the beginning of the day not all the transport operators know all the deliveries: in general they know 60% of the deliveries while the information about additional deliveries comes during the day. The consequence is that it is not easy to optimise the delivery process;
- in some cases more than one vehicle is necessary to satisfy the customers of a same street, notably when the street is long and broad, and is home to many retailers and HoReCa, making impossible to serve, at the same time and with the same van, both sides of the road

Having to face so many difficulties and constraints, transport operators have developed many countermeasures and an ability to tackle the several and diverse barriers. Thus, they proposed several solutions to the above problems to facilitate their work into the ZTL:

- night delivery: in some cases the retailers have a warehouse or a dedicated place (for example a dedicated backroom inside the warehouse or the store) accessible by/to couriers who could store there the goods. The retailers have to trust the transport operators allowing them to operate also in their absence and giving them the access to the warehouse during the night;
- possibility to travel on lanes reserved to public transport according to specific rules granting the authorisation for circulation and reducing the interference with the public transport;
- possibility to use some public transport lines to deliver goods from the suburban warehouses/logistics centres to the city centre, for example using the public transport lines in the very early morning;
- Torino has two main railway stations at the border of the ZTL, in the city centre, allowing to organise temporary warehouses that could be a intermediate transfer point favouring also the intermodality of goods delivery;
- as the river Po goes through the eastern part of the city, part of the delivery trips could be made by boats;
- lighter vehicles for last mile delivery, like small electric vehicles or tricycles, could be used. Some couriers declare to use them in some cities, the only issue being the financial feasibility; a sufficient number of deliveries is required so as to cover the costs of staff (e.g. bike drivers);
- an economic incentive could support the transport operators who want to change their vehicles for less polluting ones. Methane vehicles could be an interesting option but, for the time being, the refuelling points in the city are not enough to guarantee a generalisation of these vehicles;
- to solve the problem of delivery in large and commercially dense streets a single vehicle, from a third transport operator, is proposed: this van can collect all the goods coming from different couriers having destination in the same street. The difficulty is how to deal with the underlying contractual responsibilities;
- for some cities the freight delivery is scheduled on a weekly basis instead of daily basis, rationalising the deliveries thanks to less and bigger orders from the retailers;
- the dynamic access to ZTL could be entrusted to a third party that certifies (as for quality certification ISO 9001) that the transport operators have reduced the pollutant emissions (thanks to the internal procedure, the optimisation of the routing, the use of less polluting vehicles, etc.) and, thence, accredits them for access to the ZTL;
- a better position of the loading/unloading bays could reduce delivery time and the illegal and double parking.

4. Discussion and conclusions

The problem of freight delivery in urban areas has been investigated with the aid of the stakeholders involved in the freight issue: decision makers, transport operators and retailers and HoReCa, requesting them to assess the interventions proposed in the URBeLOG project. The mixed approach adopted in the methodology allowed to understand in a precise manner the state of the art of freight distribution in the urban areas both through the questionnaire and the focus group, gathering around a table the transport operators.

The results, confirmed by state-of-the-art literature, showed the complexity of the interventions proposed and raised the need to adopt an holistic approach for better addressing future policies. What emerges in a clear way is that retailers, transport operators and decision makers have different needs and visions and they know little about each other. In fact, the interventions proposed by the decision makers are based on the opinion that transport operators travel with empty vans or with low loading factor and that they do not use an optimised approach to manage the sequence of deliveries. Is this opinion coherent with facts? It does not seem so. Furthermore, in the era of internet with a lot of information available on several channels, the risk of not being informed about traffic conditions is very low. In addition, the rules and constraints in the urban areas have prompted the logistics and transport operators to find solutions to optimise their deliveries. The focus group with the transport operators has clearly showed how the political approach is based on wrong (or old) assumptions, addressing technological solutions that are not useful or effective. Furthermore, the transport operators noticed that, despite the spreading of technological tools in the mobility sector, they have not seen revolutionary solutions yet.

The internal organisation of transport operators, the use of third parties for the last mile deliveries, the contractual rules between logistics operator and couriers – often calculating the payment as a function of the number of deliveries and the cost of petrol – are all constraints inducing the transport market to avoid waste.

The interventions proposed by URBeLOG project enjoy a limited acceptance by transport operators and retailers alike. In particular it is highlighted that the drop boxes could be a useful tool but only for final consumers and for specific operators like TNT or DHL while they are not applicable to the supply of shops or for specific goods like food. Concerning the freight route planner the most important result is the usefulness of an application (mobile or similar) providing the position and the availability of loading/unloading bays in real time. However, the mobile applications for freight in urban areas are not perceived as useful and the routing and trips are planned by drivers who know well the served area.

The dynamic access to ZTL is a controversial measure. The rules of access based on high loading factors, proposed by decision makers, are not perceived as useful to meet the stated goals, as confirmed by several researches in urban areas (OECD, 2003; Browne et al., 2007; De Magalhães, 2010). Instead, there is a clear consensus about the use of “green” vehicles to delivery in the ZTL, even though a support by public administration is requested to cover part of the economic investment requested to transport operators.

The loading/unloading bays are perceived like obstacles to efficient delivery activities and their booking is not appreciated; however, the need to better analyse their position within the ZTL and the increase of controls to reduce the illegal use of the bays have been argued.

Most of the constraints that transport operators face come from customers’ needs: different and specific time delivery windows, the modifications occurring during the day (especially for couriers like TNT or DHL). Thus, a change of behaviour of final consumers to receive their parcels could help the transport operators to optimise their work. Furthermore, the suggestion regarding the use of public transport to deliver the goods and the use of the two main railway stations as locations for intermediate transfer points demand a further consideration.

The lessons learnt from the survey investigating the users’ need are promising: They make up a starting point for future studies in the last mile freight delivery, more user-centered and less “top-down”.

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