EVALUATING THE FEASIBILITY OF SHARED PASSENGER-GOODS URBAN TRANSPORT SOLUTIONS

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ABSTRACT

Nowadays, in a sustainable urban development point of view, cities are looking for instruments and policies to ensure an efficient and effective urban mobility for both passengers and goods. Indeed, optimizing passengers and goods flow in the urban area while reducing the externalities linked to direct mobility's improvements, become more and more stressing. Although it is commonly argued that the transport of passengers and freight interact with each other strongly in the urban environment, it is quite difficult to design and manage an infrastructural network other than the road, which allows a smooth sharing of passengers and goods. Furthermore, there is lack of theoretical and experimental studies evaluating the possibility of introducing shared passenger-goods urban transport solutions.
The aim of this paper is to explore this issue. Firstly, the existing shared solutions are identified, as a result of a survey of the experiences developed in cities.
Secondly, a qualitative evaluation of the feasibility to adopt those solutions in a medium size city is carried out, according to the following criteria: the adaptability to different distribution schemes and the compatibility to different goods. A devoted section describes the experimental approach used to deduce the qualitative evaluation.
Thirdly, with an inductive reasoning we move from a set of specific facts to establish a whole concept for city transport system, in order to ensure a smooth cohabitation of passengers and goods in urban transport.
Finally, based on the adoption of some shared solutions in two different urban transport systems: that of La Rochelle and of London, the translation of the concept in real life is proposed.

PROBLEM STATEMENT

Both people and goods move in the urban environment, the ones transported by their individual vehicles and collective transports, the others by freight carriers, shippers, craftsmen, people…
An efficient and effective transport for passengers and goods is an essential element for city life and development. Just as passengers need to resort to efficient transportation solutions which allow them to reach their destinations on time, goods must also be handled quickly to avoid creating excessive stocks and to minimize warehouses size and related operating costs. Figure 1

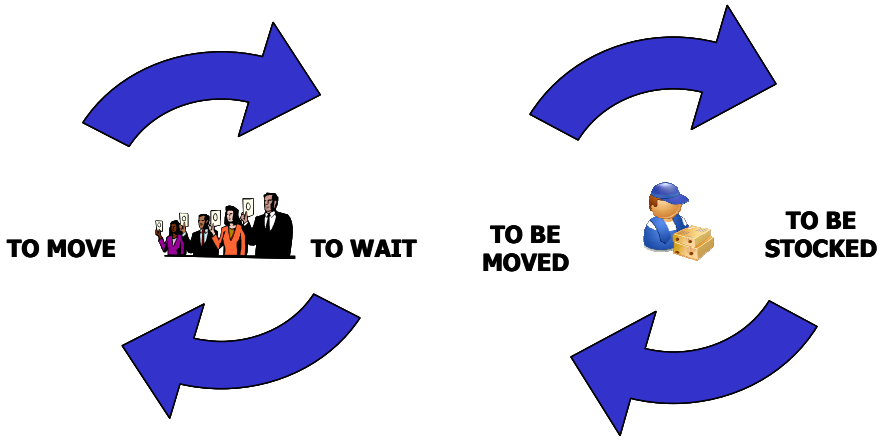


Figure 1 : passengers and goods flows needs

As urban space is a limited resource, it is commonly argued that the movement of passengers and goods interact strongly with each other. Consequently, the global level of urban accessibility for both decreases: according to this trend, congestion problems result and the travel time for all increases; (Macario, 2005), (Roque et Delaître, 2009).
One of the key factors to reverse this trend could consist of cities adopting a different way to manage the transport network, ensuring a smooth sharing of passengers and freights.
“Urban freight distribution could be better integrated within local policy-making and institutional settings. Public passenger transport is usually supervised by the competent administrative body while freight transport distribution is normally a task for the private sector. Local authorities need to consider all urban logistics related to passenger and freight transport together as a single logistics system”. (European Commission, 2007).
To be coherent with this European recommendation, cities could lean three axes of development:

1. Improve the sharing of road space - between private and public motorised road transport passengers flows and private motorised road transport goods flows;

2. Shift passengers and goods flows - from private motorised road transport to other urban transport modes – i.e. public transport like buses, tramways, subways, cars and bicycles sharing systems - . An increased use of public means could release

cities from congestion while increasing revenues to public transport, making it less subsidy dependent.

Introduce distribution facilities - like consolidation centres, urban delivery stations and storage equipments - in urban areas already devoted to passengers hanging on – i.e. car park areas, public transport stations, etc - .This could be useful to avoid empty runs or unnecessary driving and parking.
Actually, these axes of development are not really explored, because of several reasons (cultural, historical, and economical). Sustainable urban mobility plans still adopt approaches which take passengers and goods flows separately into account, although they encourage measures for both. This situation sometimes leads to antagonist solutions and introduces perverse effects which limit the efficiency of global mobility in the city (Delaître, 2008)

OVERVIEW OF THE EXISTING SHARED SOLUTIONS

For each of the three identified axes, several experiments have been implemented in cities leading to a large range of results. In many cases it is difficult to set up solutions or compromises which can be accepted by both stakeholders. The detected solutions are detailed in the next part, and summarized in Table 1.

Axe 1: To improve the sharing of road space

- *Multiuse lanes:* this solution aims to use lanes as priority bus lanes, during the peak hours and to convert on-street parking spaces into unloading spaces during the prescribed hours. Web-based information services give bus priority regulations, through variable message signs. Multi-use lanes have been implemented in Barcelona, as a measure of the CIVITAS I MIRACLES project (2002 – 2006) [1].
- *Night deliveries*: this solution aims to manage vehicle traffic in high density central business districts of urban areas, delivering to retailers and shops in the inner city area during night hours when the city is usually quiet and inactive. Typical times are between 10.00 p.m. and 7.00 a.m. In several cities such as Barcelona or Dublin, successful experiences with trials on night delivery are made replacing a higher number of vehicles operating during day time by a fewer number of vehicles operating during night time[2].
- *Shared Bus and lorry lanes*: this solution aims at recognising lorries, along with buses, as essential components of urban traffic, assuring a prioritised treatment where possible. At present, in Europe, there is only a limited experience from this type of prioritisation initiative. The introduction of shared bus and lorry lanes has taken place in London and Newcastle-uponTyne (Browne, 1997). Recently, the Smartfreight project[3] aims to specify, implement and evaluate Information and Communication Technology (ICT) solutions that integrate urban traffic management systems with the management of freight and logistics in urban areas.

[1] Source: www.civitas.eu
[2] Source: www.bestufs.net
[3] Source: www.smartfreight.info

Axe 2: To shift flows from private to others urban transport modes

- *Shared buses*: this solution aims to combine a door-to-door service for passengers and a transport service of goods (parcels and small packets) in order to develop a public transport service oriented to users' needs in time of little demand. This solution has been implemented in Germany, in the framework of MULI project (1996 – 1999). The project had the aim to propose buses able to carry not only passengers, but also small goods. The project took place in three German municipalities, Gangelt, Selfkant and Waldfeucht (district of Heinsberg) located at the border to the Netherlands, about 20 kilometres north to Aachen. The region is characterized by disperse settlements. Usually, the transport of small goods was carried out in an uncoordinated way by different service providers. Multibus aimed at bundling up these transportation trips. (Shaefer et Dalkmann, 2003)
- *Shared subway*: within urban areas there are only limited opportunities to enhance physical capacity of road infrastructure at surface level. This solution aims to reserve access to underground infrastructures, during specific periods, for goods vehicles. Some Japanese, American and Dutch cities have considered such option. (Van Binsbergen and Visser, 1999), (Chiron-Augereau, 2009).
- *Shared tramway network*: In Zurich, Cargo tram and E Tram assure free services to collect large and heavy rubbish and electrical items, such as hairdryers, keyboards, etc. This offer is reserved for pedestrians, cyclists and passengers using public transport, at stated times and stops on the line. In Dresden, supplies to the Volkswagen factory are delivered by tram. In Vienna, there are plans to introduce a freight tram service. Various Dutch cities are planning freight tram services. Of these, the plans of Amsterdam are most advanced. (Chiron-Augereau, 2009)
- *Car sharing*: this solution aims to enlarge the urban use of the sharing vehicles systems, to the good distribution, to answer a demand for goods transportation by craftsmen, shopkeepers and even citizens. In Osaka, a new co-operative system of electric vehicles started, in 1999. In Genoa, car-sharing service dedicated to goods transport (Van-Sharing service), has been introduced in the framework of the CIVITAS CARAVEL[4] project, (2005 – 2009), to rationalize the vehicles use, by the traders who transport goods to the shops with their own cars. In La Rochelle, a van sharing service has been introduced too, since 2008, in the framework of the CIVITAS SUCCESS[5] project (2005 – 2009).

Axe 3: To introduce distribution facilities in urban areas

- *Shared delivery bays*: this solution aims to increase of parking areas in cities, allowing all vehicles parking in loading/unloading bays, during the night and the bank holiday. They should only be restricted to goods vehicles if absolutely necessary. A recent implementation of this solution has been done in Paris, often characterized by a lack of parking areas.(Maire de Paris, 2009),
- *Automatic goods lockers in car parks*: this solution aims to offer to the small shops and the costumer service professionals to receive during night- time on its dedicated urban

[4] Source: www.civitas.eu
[5] Ibid.

logistic automats their spare-parts delivered by the freight company of their choice. One of the advantages of the system is to reduce the traffic by avoiding workers from the small shops and technicians make daily return trips to their providers located in the suburbs. An implementation of this solution has been done in Paris, where the Consignity Company settled up the first Parisian network of eight logistic relays located in car parks of the city. (Atlassy, 2006)

- *Lockers in underground stations*: this solution aims to settle up lockers to be used to facilitate consumer deliveries, i.e. those times when it is more convenient to collect a parcel from a locker in a chosen location than wait somewhere for it to be delivered – This service is becoming increasingly popular in Europe. In Paris, Coliposte, the parcel division of La Poste, launched a postal lockers service, Cityssimo, during 2006. (Chiron-Augereau, 2009).
- *Urban delivery stations in car parks*: this solution aims to settle up services and infrastructures to urban distribution in urban areas, already devote to the passengers hanging up. Experimentation has been done by Chronopost International, in Paris. The company started a program to gain ISO 14001 certification at its sites. For this reason, an Urban Delivery Station has been placed, in the underground park of La Concorde, to deliver the Champs Elysées quarter. This experimentation, managed in cooperation with the city of Paris, has seen interesting results, achieving reductions in greenhouse gas emissions. (Chiron-Augereau, 2009)

1. *To improve the sharing of road space*		
SHARED SOLUTIONS	**WHAT IS SHARED**	**WHERE**
▪ Multiuse lanes	Public road space	Barcelona
▪ Night deliveries	Public road space	Dublin Barcelona
▪ Shared bus and lorry lanes	Public road space	London New Castle Upon Tyne
2. *To shift flows to others urban transport modes*		
SHARED SOLUTIONS	**WHAT IS SHARED**	**WHERE**
▪ Shared buses	Public transport service	Heinsberg
▪ Shared subway	Public transport service	Japanese, American and Dutch cities
▪ Shared tramway	Public transport service	Zurich Vienna Dresden Amsterdam
▪ Shared Car sharing service	Public transport service	Osaka Genoa La Rochelle
3. *To introduce distribution facilities in urban areas*		
SHARED SOLUTIONS	**WHAT IS SHARED**	**WHERE**
▪ Shared delivery bays	existing urban areas	Paris
▪ Automatic goods lockers in car parks	existing urban areas	Paris
▪ Automatic goods lockers in underground stations	existing urban areas	Paris
▪ Urban delivery stations in car parks	existing urban areas	Paris

Table 1 : Summary of existing shared passengers/goods urban mobility solutions

ADOPTING SHARED SOLUTIONS: FEASABILITY EVALUATION

In this section, we describe the experimental approach that allows us to establish a qualitative evaluation of the feasibility to adopt the previous shared solutions in medium size cities, and, specifically, in La Rochelle.

Why medium size cities?

Medium-Sized Cities[6] have an important role in the overall European urban system. They have many potentials arising from the environmental, social and institutional advantages of smaller size, and, with urban region dispersal and better transport and telecommunications networks, the disadvantages of size can be more readily overcome. However, there are many constraints on realising the opportunities available.
Most of these cities are built around an historical city centre. This city centre is quite often rich with several types of shops as well as craftsmen and small industries, with other commercial or tourist areas scattered around in the city. Commercial and industrial zones have grown up in the surrounding areas and are accessible within a short time.
Regarding transport, the main characteristics of such cities are their small surface area, the human size of relationships and their small investment capacity. Buses often provide the main form of public transport.
Medium sized cities generally have a low demographic density, with the population often spread over a large area, sometimes in surrounding small towns which are included in the "life zone". On the one hand this means short travel times, good accessibility and freedom for travelling, but on the other hand it makes collective transport very difficult to organise.
In such cities, relationships between citizens and between citizens and politicians are closer. The proportion of inhabitants involved in the city life is quite often higher than in larger ones: through different associations and clubs, inhabitants come to know each other more easily and have often direct access to politicians involved in these motors of the city life. So the city culture is more widespread and is shared by a many inhabitants. (Civitas Success, 2009), (Delaître, 2008).

Why La Rochelle as case study?

The decision to focalise our attention on La Rochelle is due to the following raisons:

1. The city is committed in urban mobility research, considering that the La Rochelle Urban Community participated on the Success[7] European project.

2. The city is the capital of the Charente-Maritime region. With its 76,711 residents, it is one of the most attractive and dynamic cities in France and it is a good representation of a medium-sized European city.

[6] Mid-size city: one with population between cities with populations of 100,000 to 500,000 inhabitants.
[7] Smaller Urban Communities in Civitas for Environmentally Sustainable Solutions.

Methodology

Starting from the statements that:

- "The procedures for the service and management of goods do not often depend on from the kind of goods but rather on the related supply chain and distribution channels" (City Ports, 2005).
- An economic activity can be involved into more supply chains as well (City Ports, 2005).
- A shared solution is linked to the context in which it should be implemented, namely to the city planning and economical characteristics of the area under intervention and to the supply chain that are working in that area.

We decided *to* administer a survey with the objective of understanding how the identified shared solutions fit to different retail activities. We estimated that the comprehension of this topic is possible only if we are aware on the phenomena connected to the freight transport.
So, we selected indicators to measure and estimate the constraints and criticalities of retail activities. Those indicators have been developed by City Ports methodology, (City Ports, 2005), Quak and de Koster (2006) and are listed in the table below.

<table>
<tr><th colspan="2">INDICATORS</th></tr>
<tr><th>LOGISTICS</th><th>TECHNOLOGICAL AND ORGANIZATIONAL</th></tr>
<tr><td>Product type (value, volume, etc.): this parameter describes the characteristics of the product (i.e.: if the product is perishable, complex or expensive, while if it is standardized, durable and inexpensive. Small, medium or high volume, etc.)</td><td>Typology of vehicles: dimensions and technical features (for example refrigeration, insulation, etc.) of the vehicles;</td></tr>
<tr><td>Delivery frequency: this parameter indicates how many times per day or per week goods are delivered to shops and size of deliveries.</td><td rowspan="2">Logistics management, which is the formal procedure of goods delivery, let us say who sends goods to whom and who decides how and when to do it (for example "free departure", "postage paid", etc.). Sometimes it is necessary to distinguish between those who manage the transport (how) from those who instead manage the flows (when);</td></tr>
<tr><td>Delivery size and Load unit: this parameter indicates the size of deliveries and the shape in which the goods are usually grouped and loaded on vehicles (pallet, roll, box, etc.);</td></tr>
<tr><td>Retailer Inventory storing capability: from this parameter depends the dependence from consignments</td><td>"Nodes" of the supply chain, are the departure points (producers, suppliers, warehouses of wholesalers, etc.) and arrival (retail shops, final consumers, etc.) of the goods;</td></tr>
<tr><td>Time windows flexibility: a time window means the moment in which goods are delivered to the retailer. Trough this parameter is used to describe if the retailer can shift the consignment operations in different moments of a day or not.</td><td rowspan="2">Contact requirement with the customer, which is the necessity to have a contact with the customer during the accomplishment of the transport service (typically at the delivery moment). This can happen for different reasons: attempted sale, payment retrieval, assistance and assembly of the delivered goods, etc. The necessity of the contact with the customer represents a possible tie to the accomplishment of solutions such as logistic platforms.</td></tr>
<tr><td>Self-implied time windows: a self-implied time window is the time window required by the retailer given staff availability or to separate the shopping public from the supplying activities. This time can be narrow, wide or medium.</td></tr>
</table>

Then; we interviewed certain retailers from: pharmacies, franchised fast-food, non franchised fast-food, restaurant, smaller food distribution associated to a large distributive chain, neighbourhood commerce, hotels.

The area of study is extended on *the inner centre and the "Minimes" district* (Figure 2)

- the inner centre represents the most attractive area, with 10,827 inhabitants and almost 2,000 economic activities.
- the "Minimes" district is the Europe's biggest marina on the Atlantic coast, with 3500 berths, with mooring for thousands of yachts, about 2 km south of the old harbour.

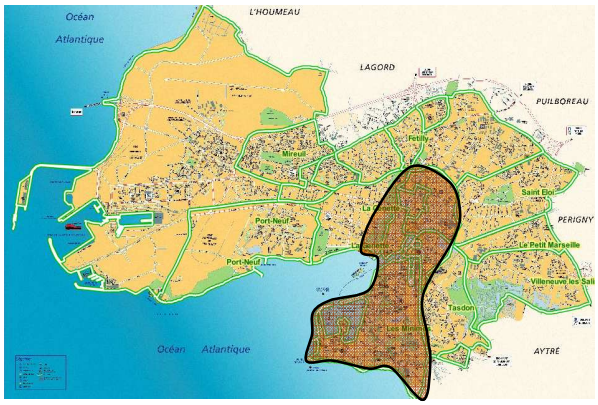


Figure 2 : the La Rochelle centre, the "Minimes" district

The qualitative estimation of how well a shared solution can fit different retail activities has been done according to the following criteria:

- the adaptability of each shared solution to different distribution schemes: it means the capability of each solution to fit to the way in which transport activities are managed.
- the compatibility of each shared solution to different goods: it means the capability of each solution to perform in harmonious combination with the larger type of deliveries.

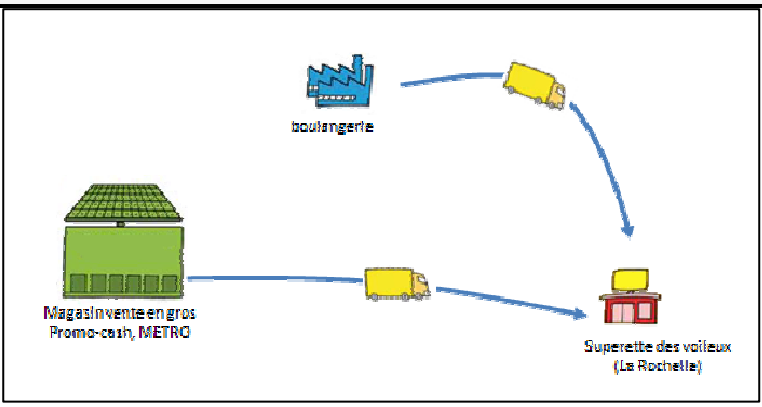
The main campaign findings are detailed in the following paragraph.

RETAIL ACTIVITIES HIGHLIGHTS

NON FRANCHISED FAST FOOD SUPPLY CHANNELS

Non franchised fast food supply channels are characterised by :
- small quantities of product;
- service incorporating little technical

The fast food manager carries out most of deliveries for his own account, as detailed below.



non franchised fast food supply channels schemes

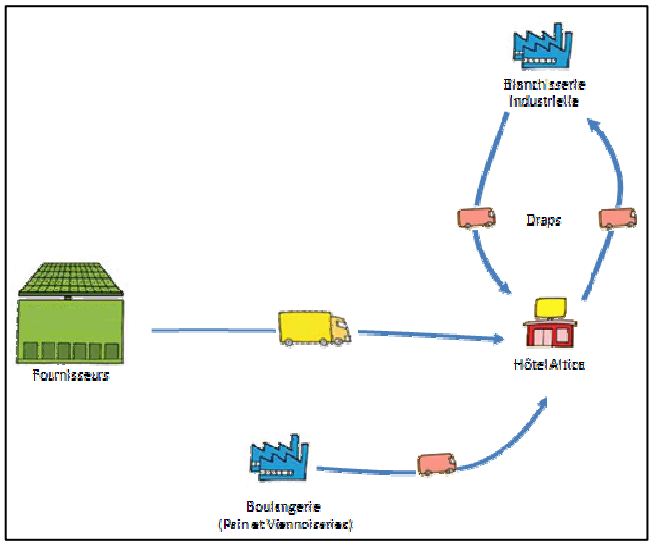
DETAIL ON LOGISTICS, TECHNOLOGICAL AND ORGANISATIONAL INDICATORS:

Product type	**Typology of vehicles:**
Frozen products:, like meat, French frites Breads, sandwiches Dried products: like coffee, sugar, chocolate Vegetables Drinks, sauces, chips	Frozen products: deliver by a refrigerated truck of 7,5t Breads, sandwiches: deliver by a refrigerated truck of 15t Dried products: deliver by a truck Vegetables: small commercial vehicle Drinks, sauces, chips: small commercial vehicle other: The fresh products needs a frozen or a refrigerated room and refrigerated transports
Delivery frequency	**Logistics management:**
Frozen products: *twice a week* Breads, sandwiches: *once a week* Dried products: *once a week* Vegetables: *three times a week* Drinks, sauces, chips: *three times a week*	Frozen products: delivered from a wholesale Breads, sandwiches: delivered from a supplier Dried products: deliver from a supplier Vegetables, drinks, sauces, chips: the manager is provisioning himself the commerce, by buying in a wholesale
Delivery size and Load unit	**Nodes" of the supply chain**
Breads, sandwiches: conditioned in bulks Vegetables: conditioned in bulks, pallets and boxes Drinks : conditioned in bulks or boxes	Frozen products: the wholesale deliver the commerce Breads, sandwiches: the supplier deliver the commerce Dried products: the supplier deliver the commerce Vegetables, drinks, sauces, chips: the manager is provisioning himself the commerce, by buying in a wholesale
Retailer Inventory storing capability:	**Contact requirement:** Yes
Frozen products: frozen room (12m²) Breads, sandwiches: frozen room (12m²) Dried products: reserve (9m²) Vegetables: refrigerated room (4m²) Drinks, sauces, chips: reserve (9m²)	
Time windows flexibility: yes	
Self-implied time windows: narrow	

LEVELS OF COMPATIBILITY AND ADAPTABILITY BETWEEN SHARED SOLUTIONS AND PHARMACIES	
High C & A	*Shared buses, Night deliveries, Shared Car sharing, Shared delivery bays, Multiuse lanes*
Neutral C & A	*Urban delivery stations in car parks, Automatic goods lockers in car parks, Shared bus and lorry lanes*

HOTEL SUPPLY CHANNELS

Our study focuses on the economy hotel chain of small-scale.
Deliveries of food are collected several times a week by the delivery system of the provider (METRO).
Regarding the sheets, they are recovered every morning around 11:30 by a specialized company, which takes the opportunity to deliver the clean sheets.
The interviewed hotels do not dispose of restaurants but only the breakfast service. Detailed information is furnished below.



Hotel supply channels scheme

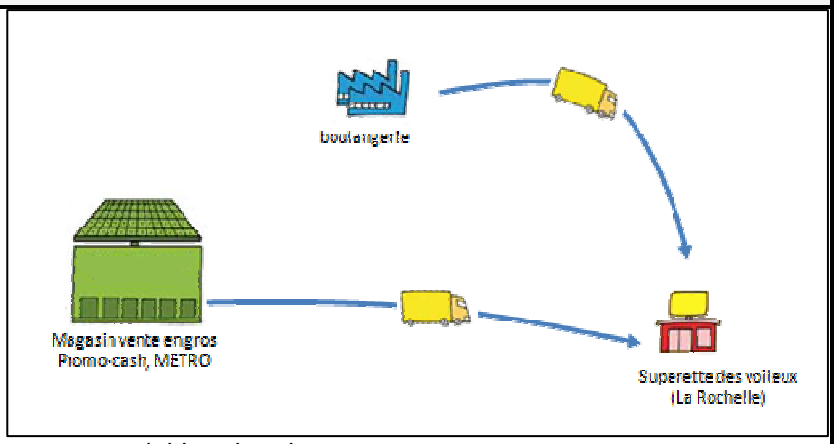
DETAIL ON LOGISTICS, TECHNOLOGICAL AND ORGANISATIONAL INDICATORS:

Product type	**Typology of vehicles:**
Dried products Fresh products Drinks Bread and others Bed sheet	Dried products, fresh products, drinks: delivered in a 18t truck other: the fresh products need a refrigerated transport
Delivery frequency	**Logistics management:**
Dried products: three times a week Fresh products: three times a week Drinks: *three times a week* Bread and others: *every morning* Bed sheet: *every day*	Dried products, fresh products, drinks: delivered by a wholesaler Bread and others : delivered by an industrial bakery Bed sheet: delivered by a special enterprise
Delivery size and Load unit	**Nodes" of the supply chain**
Dried products: the parcel are delivered on pallets Fresh products: the parcel are delivered on pallets Drinks: the parcel are delivered on pallets	Dried products, fresh products, drinks: the wholesaler is directly delivering to the hotel Bread and others : the industrial bakery is directly delivering the hotel Bed sheet: the special enterprise is directly working with the hotel
Retailer Inventory storing capability	**Contact requirement:** Yes
Dried products, fresh products, drinks: the storage capacity is about 8m²	
Time windows flexibility: no	
Self-implied time windows: narrow	

LEVELS OF COMPATIBILITY AND ADAPTABILITY BETWEEN SHARED SOLUTIONS AND PHARMACIES	
High C & A	Shared Car sharing , Shared bus and lorry lanes , Shared delivery bays, Multiuse lanes
Neutral C & A	Urban delivery stations in car parks, Automatic goods lockers in car parks, Shared buses, Night deliveries

NEIGHBOURHOOD COMMERCE SUPPLY CHANNELS

Neighbourhood commerces are intended for sale areas of food products generally of small dimensions. Neighbourhood commerces supply channels are characterised by a greater incidence of deliveries from wholesalers or of self provision, as detailed below



neighbourhood commerce supply channels scheme

DETAIL ON LOGISTICS, TECHNOLOGICAL AND ORGANISATIONAL INDICATORS:

Product type	**Typology of vehicles:**
Bread Fresh products Non perishable products Drinks (alcoholic or not) Frozen products Cleaning products	Bread: delivered by a small commercial vehicle or personal vehicle Fresh products, non perishable products, drinks (alcoholic or not), frozen products, cleaning products: delivered by a small commercial vehicle *other:* other transport features, for example necessity to respect hygienic rules (HACCP), necessity of staff training, etc;
Delivery frequency	**Logistics management:**
Bread: every days Fresh and frozen products: during the season, the supplying is every day, out of the season the supplying is only twice a week	For all the products the manager is buying it in wholesales or at the supplier, and carrying it himself.
Retailer Inventory storing capability	**Contact requirement:** Yes
The storage capacity is about 3m², so most of the goods are directly going on the shelves.	
Time windows flexibility: yes	
Self-implied time windows: wide	

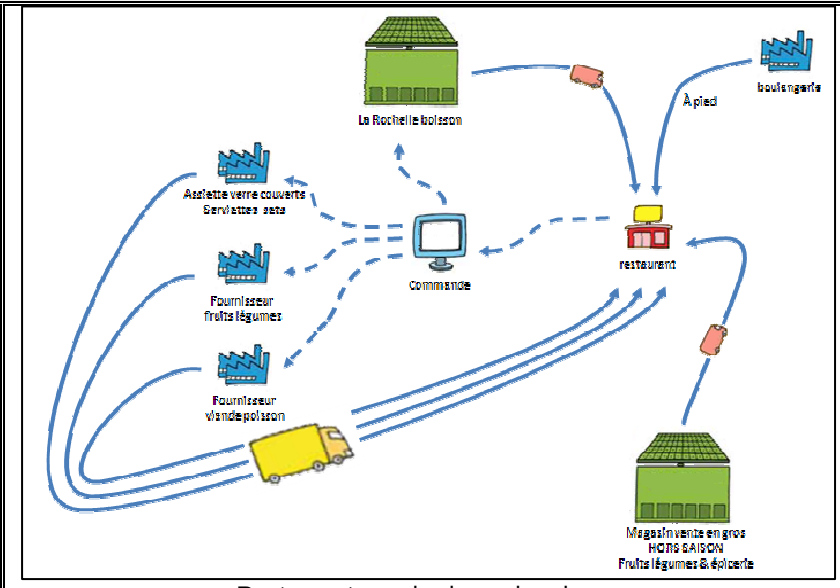
LEVELS OF COMPATIBILITY AND ADAPTABILITY BETWEEN SHARED SOLUTIONS AND PHARMACIES	
High C & A	Shared Car, Shared buses, Shared delivery bays, Multiuse lanes
Neutral C & A	Urban delivery stations in car parks, Automatic goods lockers in car parks, Shared bus and lorry lanes
Low C & A	Night deliveries

RESTAURANT SUPPLY CHANNELS

Restaurant supply channels are characterised by :

- small quantities of product;
- service incorporating little technical

Restaurateur chooses his products, to see and touch them. He uses his own vehicles to go to the specialised platforms (wholesale market, food industry platforms, etc.). Beverages are supplied by wholesalers, as detailed below.



Restaurant supply channels scheme

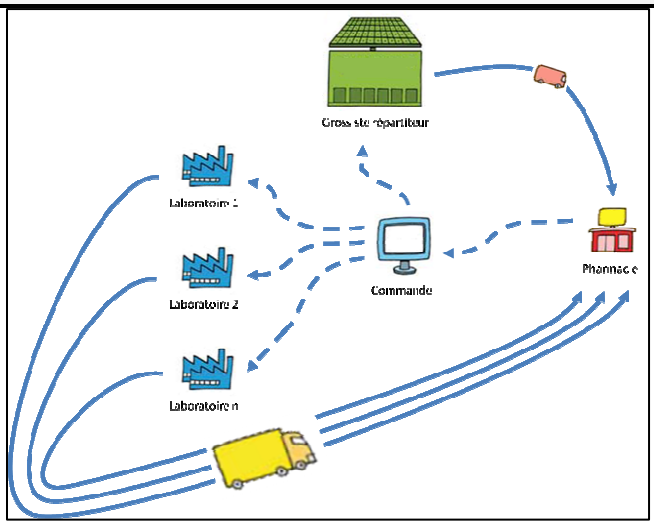
DETAIL ON LOGISTICS, TECHNOLOGICAL AND ORGANISATIONAL INDICATORS:

Product type	**Typology of vehicles:**
Meat and fish Drinks (alcoholic or not) Bread Napkins, glasses... Vegetables Dried products	*Meat and fish*: small and refrigerated truck *Drinks (*alcoholic or not): important truck *Bread*: employees are going to the bakery by foot *Napkins, glasses*: small commercial vehicle *Vegetables*: the delivering is done by a small commercial vehicle during the season, and by the personal vehicle out of season *Dried products*: either by a small commercial vehicle, or by personal vehicle, depending on the situation *Other:* for the fresh products, goods carriage has to be done with refrigerated trucks. For the drinks, the supplier is taking back the empty bottles.
Delivery frequency	**Logistics management:**
Meat and fish: every day Drinks (alcoholic or not): once a week Bread: every day Napkins, glasses: no frequency, deliver when stock is empty Dried products: in season, the deliver is every day, but out of season, the deliver is only every three days.	Meat and fish: delivered by the supplier Drinks (alcoholic or not); deliver by the supplier of self-supplying Bread: delivered by the supplier Napkins, glasses: delivered by the supplier Vegetables: during the season, the delivery is done by the supplier, and out of season by self- supplying Dried products: delivered by the supplier
Delivery size and Load unit	**Nodes" of the supply chain**
Fresh products: pallets disposed on bulks Dried products: pallets disposed on bulks Frozen products: pallets disposed on bulks, only the bread is conditioned in plastic paper.	The suppliers delivering directly to the commerce, or the manager directly provisioning in a wholesale.
Retailer Inventory storing capability: about 4m².	**Contact requirement:** Yes
Time windows flexibility: yes	
Self-implied time windows: narrow	

LEVELS OF COMPATIBILITY AND ADAPTABILITY BETWEEN SHARED SOLUTIONS AND PHARMACIES	
High C & A	Shared Car sharing, Shared delivery bays, Multiuse lanes
Neutral C&A	Urban delivery stations in car parks, Automatic goods lockers in car parks, Shared buses, Shared bus and lorry lanes
Low C & A	Night deliveries

PHARMACY SUPPLY CHANNELS

Pharmacies supply channels are mainly coordinated by logistics providers and wholesalers. The distance between the pharmacies and the distribution centers are generally short, as each pharmacy is supplied by the nearest regional centre carrying the required product.
This distribution system is very effective because all the actors involved share the same electronic database with real-time listings of the quantity of products required by each pharmacy, and the availability of products stored by the wholesalers localized in their proximities; Most of the information transmitted through this supply chain is sent on line via EDI (electronic data interchange) and Internet.

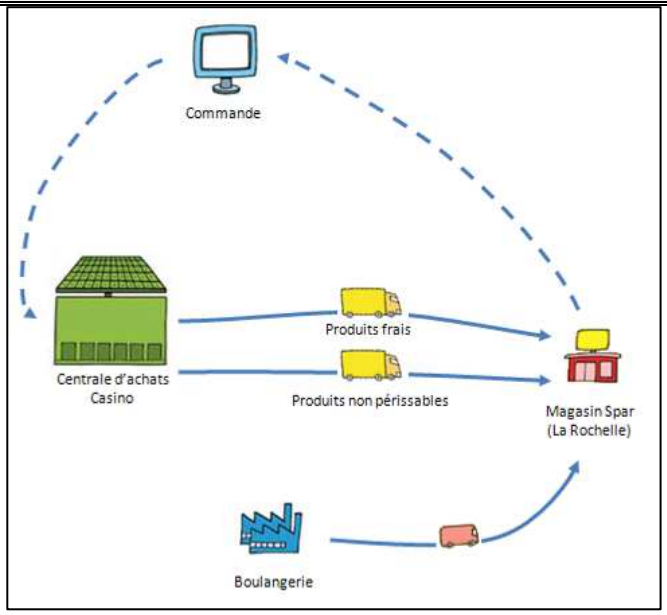


pharmacy supply channels scheme

DETAIL ON LOGISTICS, TECHNOLOGICAL AND ORGANISATIONAL INDICATORS:

Product type	**Typology of vehicles:**
▪ Medicines ▪ Beauty products, sunscreens, oils from pharmaceutical laboratories	Medicines: small commercial vehicle Products from pharmaceutical laboratories: truck
Delivery frequency	**Logistics management:**
▪ Medicines: twice a day ▪ Products from pharmaceutical laboratories: once to twice a month	Medicines send from wholesaler Products send from pharmaceutical laboratories
Delivery size and Load unit	**Nodes" of the supply chain**
▪ Medicines: boxes closed, or just normal boxes ▪ Products from pharmaceutical laboratories: parcel or pallets	Medicines: the wholesaler is delivering to the pharmacy Products from pharmaceutical laboratories: pharmaceutical laboratories are delivering the pharmacy.
Retailer Inventory storing capability	**Contact requirement:** Yes
▪ Medicines: 25m², which is equivalent to 5 days storage ▪ Products from pharmaceutical laboratories: stored in shelves	
Time windows flexibility: no	
Self-implied time windows: wide	

LEVELS OF COMPATIBILITY AND ADAPTABILITY BETWEEN SHARED SOLUTIONS AND PHARMACIES	
High	Multiuse lanes, Shared delivery bays Shared Car sharing, Automatic goods lockers in car parks , Urban delivery stations in car parks
Neutral	Shared bus and lorry lanes
Low	Shared buses, Night deliveries

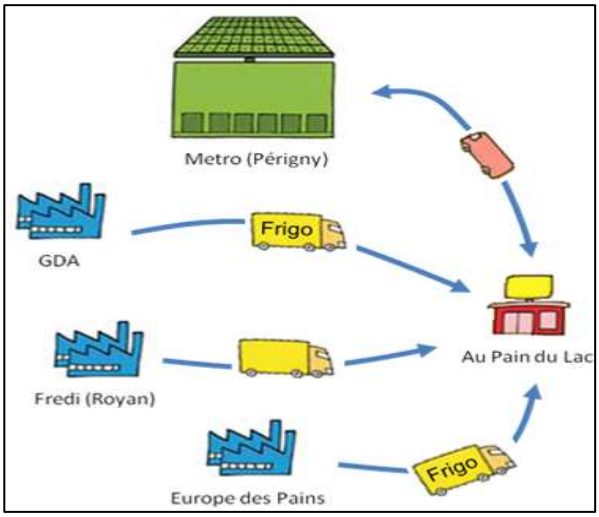
SUPPLY CHANNELS FOR SMALLER FOOD DISTRIBUTION SHOPS	
Supply channels for smaller food distribution are characterised by rhythmic deliveries, regularly scheduled through the central purchasing agency that caters for its various stores. The supplies are managed at national level, Stores usually have no inventory, supply chain is applied just in time, implying frequent deliveries. This is especially true for fresh produce. Detailed information is furnished below.	 smaller food distribution supply channels scheme

DETAIL ON LOGISTICS, TECHNOLOGICAL AND ORGANISATIONAL INDICATORS:	
Product type	**Typology of vehicles:**
Fresh products Bread Non perishable products	Fresh products: delivered in 3,5t truck Non perishable products: delivered in 3,5t truck *other:* the fresh products need refrigerated transport.
Delivery frequency	**Logistics management:**
Fresh products: four times a week Bread: every day Non perishable products: four times a week	Fresh products: the supplier is a wholesale central Bread: the supplier is a bakery Non perishable products: the supplier is a wholesale central
Delivery size and Load unit	**Nodes" of the supply chain**
Fresh products and non perishable products: delivered in rolls and bulks	Fresh products: the wholesale central is delivering the commerce Bread: the supplier is delivering the commerce Non perishable products: the wholesale central is delivering the commerce
Retailer Inventory storing capability	**Contact requirement:** Yes
The storage capacity is really narrow so most of the goods are directly on the shelves.	
Time windows flexibility: no	
Self-implied time windows: wide	

LEVELS OF COMPATIBILITY AND ADAPTABILITY BETWEEN SHARED SOLUTIONS AND PHARMACIES	
High C & A	*Night deliveries , Shared bus and lorry lanes, Shared delivery bays, Multiuse lanes*
Neutral C & A	*Urban delivery stations in car parks, Automatic goods lockers in car parks*
Low C & A	*Shared buses, Shared Car sharing*

FRANCHISED FASTFOOD SUPPLY CHANNELS

We took in consideration Mac Donald, as a typical example of franchised fast food. The supply channels of this brand follow this scheme: all products are purchased from a McDonald's central purchasing - there are three in France -.
The central purchasing supplies and manages subcontracts deliveries to a regional haulier.



franchised fast-food supply channels scheme

DETAIL ON LOGISTICS, TECHNOLOGICAL AND ORGANISATIONAL INDICATORS:

Product type	**Typology of vehicles:**
Fresh products: like salads, tomatoes Dry products: like drinks, bulks, napkins... frozen products: like bread, meat, French frites	Fresh products, dry products and frozen products: articulated lorry *other:* the frozen products needs a refrigerated room and truck for the carriage
Delivery frequency	**Logistics management:**
Fresh products: *every two days* Dry products: *twice a week* Frozen products: *twice a week*	All the products are coming from a central (the franchised wholesale).
Delivery size and Load unit	**Nodes" of the supply chain**
Fresh products: pallets disposed on bulks Dried products: pallets disposed on bulks Frozen products: pallets disposed on bulks, only the bread is conditioned in plastic paper.	The departure is the warehouse of the central (the franchised wholesale), giving the deliver to another company, delivering the foods to the franchised fast food.
Retailer Inventory storing capability: medium	**Contact requirement:** Yes
Time windows flexibility: no	
Self-implied time windows: narrow	

LEVELS OF COMPATIBILITY AND ADAPTABILITY BETWEEN SHARED SOLUTIONS AND PHARMACIES	
High C & A	Multiuse lanes, Shared delivery bays, Shared bus and lorry lanes, Night deliveries
Low C & A	Urban delivery stations in car parks, Automatic goods lockers in car parks, Shared buses, Shared Car sharing

MAIN CAMPAIN FINDINGS

The main objective of our work was to collect some field information to give a qualitative estimation of how well *a* shared solution can fit different retail activities.
The criteria chosen through the evaluation we have made are:

- *the adaptability of each shared solution* to different distribution schemes: it means the capability of each solution to fit the way in which transport activities are managed.
- *the compatibility of each shared solution* to different goods: it means the capability of each solution to perform in harmonious combination with the larger type of deliveries.

It is quite interesting to observe that, (Figure 3) shared solutions fit better to distribution schemes of retail activities that carry out their deliveries or collections for their account. Own account transport is used on specific segments, for the last kilometres, or even the last metres, which are more difficult and expensive to organise.
In reality, there is a lack of expert evaluation of the cost-effectiveness of the own account transport but at the same time, it seems to be more convenient than third party transport for specific segments of retail activities even though the latter is already well advanced in its organisation (Patier, 2004).
This aspect indicates that the largest part of retail activities that still adopt own account as solution to supply their business, could be change their behaviour, if merely available opportunities existed, for retailers that do not dispose of enough means to convert their way of supply , addressing to professional transport services.;
Thus, shared solutions can be used as a leverage, from local authorities in charge of transport , to replace the part of own account transport, finding a better way to distribute products necessary to urban life.
Taking steps toward the adoption of shared transport solutions could be a real opportunity for cities to reduce own account transport that seems not to be maintained in urban logistics in a sustainable urban development point of view (Patier, 2004).
Furthermore, *Multiuse lanes* and *shared delivery bays* seem to fit all the retail activities that we took in consideration.
Shared car sharing follows the previous solutions. It has been considered to fit neutral for smaller food distribution schemes.
Our evaluation reveals that *night deliveries* are more pertinent for urban retail activities like Fast food, franchised or not, and smaller food distribution supply channels.
They are not advisable for pharmacies, restaurants and neighbour commerce. They are neutral for hotels.
Shared buses are pertinent solutions for Non Franchised Fast Food and neighbour commerce, but not for pharmacies, smaller food distribution and franchised fast food.
This solution seems to be neutral for hotels.
Shared bus and lorry lanes are pertinent solutions for hotels, smaller food distribution and franchised fast food. They seem to be neutral for Neighbour commerce, restaurant and pharmacies.

Automatic goods lockers in car parks and *Urban delivery stations* in car parks fit well to pharmacies. Otherwise, their introduction in urban environment seems to be neutral for the others retail activities.

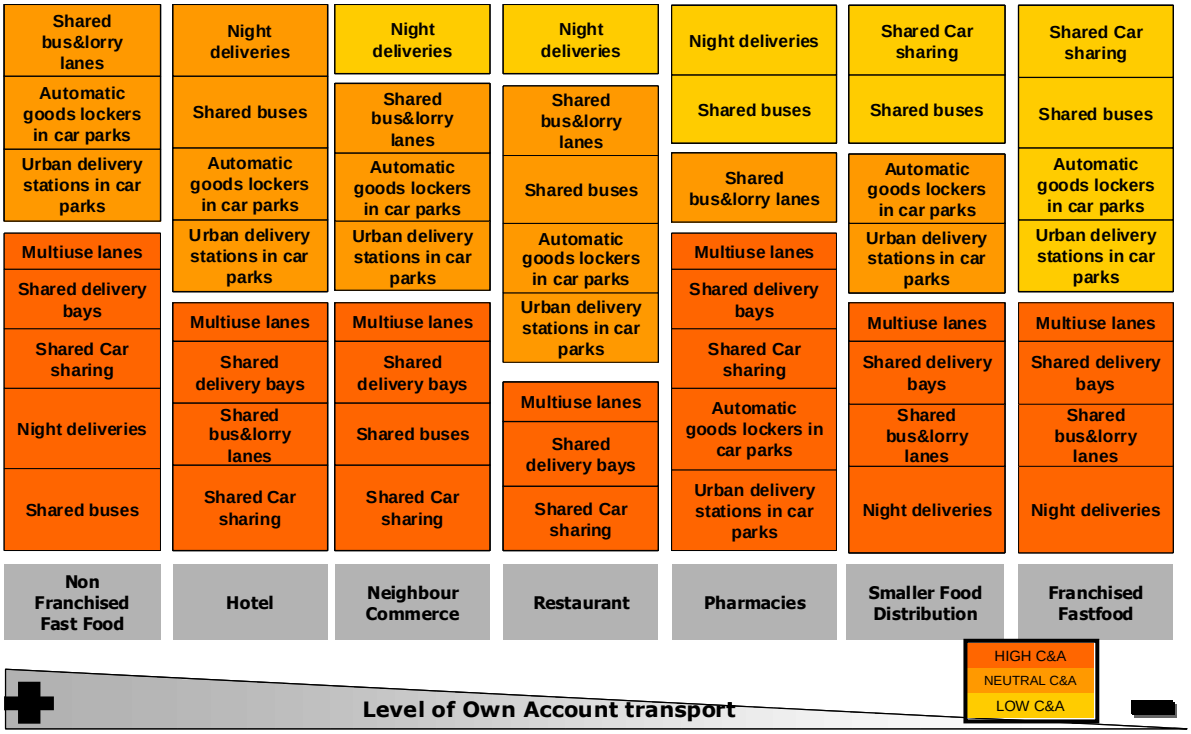


Figure 3 : qualitative estimation of how well *a shared solution* can fit to different retail activities

TOWARD A SHARED URBAN TRANSPORT SYSTEM

After a field observation of several real cases of implemented solutions, an inductive reasoning enables us to move from a set of specific facts to establish a whole concept for city transport system, in order to ensure a smooth cohabitation of passengers and goods in urban transport.

Two principles define the concept:

- The first principle prefigures that urban transports are shared between passengers and goods, through the access for both to the largest modes available in the network (i.e.: bus, tramway, subway, car sharing, bike sharing)
- The second principle prefigures that cities are equipped of shared gates ensuring a smooth trans-shipment for passengers and goods, arriving from various sources, and having various destinations.

Through the coupling of those principles, we propose an archetype for a radical new urban transportation system.

The sketch of this archetype is drafted in the scheme below (Figure 4)

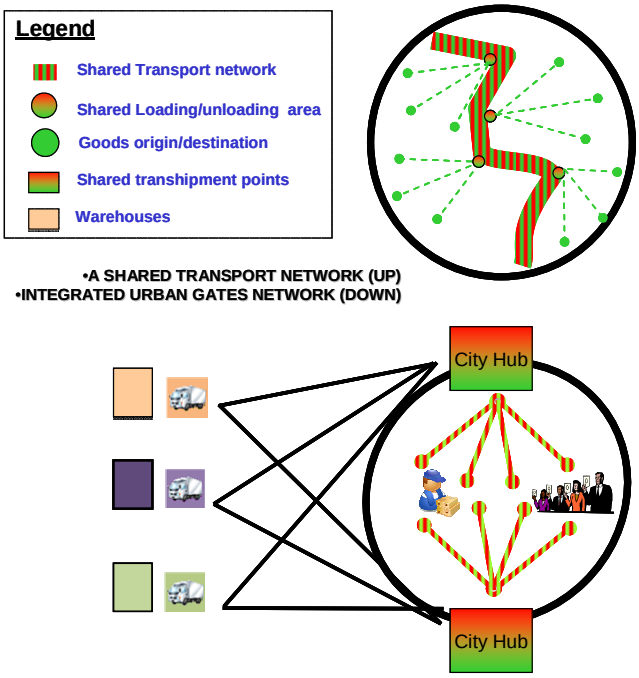


Figure 4 : the sketch of the archetype for a radical new urban transportation system

FROM ARCHETYPE TO REAL LIFE

The on-route proposal for London[8]

A multi-disciplin design specialist has come up with a radical urban transport proposal, called On-Route, which he believes tackles the two biggest problems caused by city-centre transport today; congestion and pollution. Frost's proposal was submitted to Transport for London (TfL)'s 'A New Bus for London' competition which the Mayor of London, Boris Johnson, launched from July to September 2008.[9]

A real 'step change' in city transportation logistics, On Route proposal marks the integration of passenger and freight transportation, providing increased passenger and freight capacity, improved convenience and service, whilst reducing congestion, pollution and real costs. It covers with (Figure 5):

- A new iconic design of double-decker bus, Freight*BUS™, that combines a passenger-carrying bus with that of freight haulage with the minimum of disruption to either service. It can be reconfigured in seconds by the conductor or driver to carry freight and passengers. Furthermore, passenger space & freight space can be easily adjusted to match demand. The new city bus is a full car length shorter than the "bendy bus". In maximum seated mode it will seat a whopping 43 more passengers than the bendy bus. At night time when it is not carrying passengers it can deliver up to 34 pallets when fully loaded.

[8] Text extract form the website http://www.onroutebus.co.uk/
[9] http://www.tfl.gov.uk/tfl/corporate/projectsandschemes/technologyandequipment/anewbusforlondon

- Consolidation centres and cross-docks for freight movement and hubs for passenger and freight delivery and collection.
- Hubs located at major bus stops, and concentrations of retail, commercial & light industrial units.

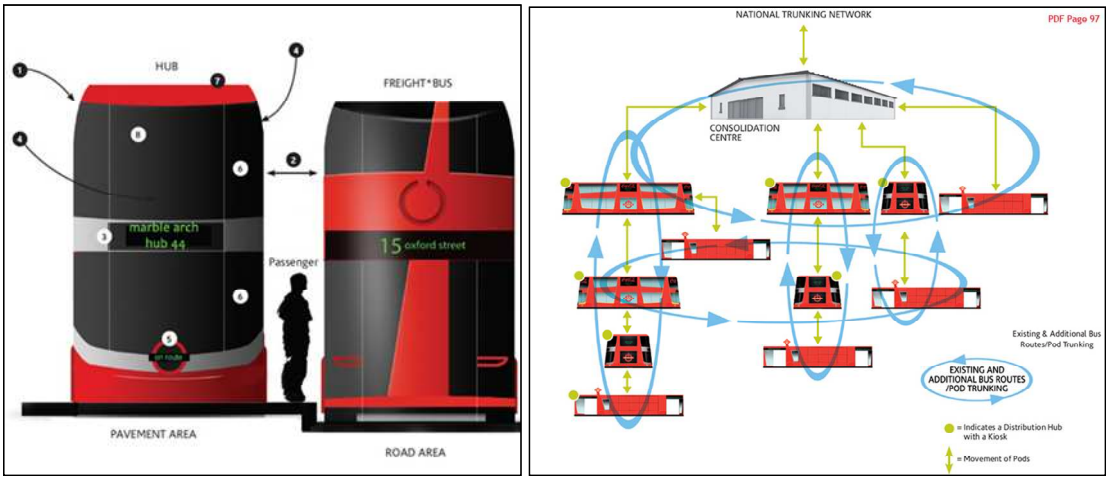


Figure 5 : the On Route proposal, source: www.onroutebus.co.uk

It is evident that this avant-garde concept requires a whole new way of thinking about urban transportation systems and it will have a profound impact on city infrastructure. But then, it is possible to observe that many of these elements already exist and can be linked into existing infrastructure such as bus/rail stations & depots; haulage/sorting depots etc.

To bear out this thesis, Frost points to studies which have already been carried out in London showing that the implementation of alternative freight systems, including the use of 'Consolidation Centres' in city areas can give exceptional results. One such study found a 68% reduction in construction vehicles entering the City of London for the project, an average journey time reduction of 2 hours, a circa 75% reduction of CO2 emissions, and a 10% reduction in local distribution journey times. The On-Route Bus supports the existing aims of the London Freight Plan as set out in the existing Transport Strategy of the Mayor of London.

When looking at the idea of consolidation in relation to bus routes and passenger transport, Frost quickly realized that not only were there opportunities to improve bus routing & linking with other transport services and types using consolidation principals, but that there is an even bigger opportunity to use the buses for freight as well as passenger movement that would reduce the number of goods vehicles on city roads (especially light goods vans which are responsible for 15% of all UK carbon emissions from all forms of transportation) by as much as 50%.

He remarks: "We looked at passenger & freight systems end to end and concluded that there is sufficient overlap to be able to build on and integrate existing infrastructure of both passenger & freight systems".

Taking London as an example, Frost leans on low bus occupancy statistics, and says that "the most optimistic proposals put the average occupancy of its buses at 25%. However, our calculations show that for around four hours a day, their utilisation drops to as low as 20%. Despite this, city authorities are tasked with increasing the numbers of vehicles, routes and service frequency to supposedly reduce congestion and improve services. My idea is to put

our cities' buses to good use by using them to provide an alternative city freight system at times of low passenger capacity utilisation. This could reduce the numbers of freight vehicles on city roads by as much as 30%. By using the buses to carry freight in the evening and overnight, the utilisation of these vehicles would be maximised, offering maximum return on investment (ROI) and substantially increased revenue from the vehicles. However, in order to fulfil this dual role, the entire concept of buses, as we know them today, needs to be re-visualised."

The design of Freight*BUS will readily accommodate battery or fuel cell technology. The 200mm deep space in the main floor of the bus will house batteries or fuel cells and the accompanying hydrogen storage tanks (if required). Indeed, it is envisaged that when fuel cell technology is affordable, the fleet could be easily switched to this propulsion system, while keeping the drive motors and control systems in place. Similarly, its re-configurable interior design could even be broadly applied to existing vehicles built with combustion engines. However, it is the designer's view that the latest and emerging advances in battery technology will make the re-fit and the use of hydrogen and fuel cells unnecessary. Freight*BUS would also feature the very latest in other emission-saving technology , such as distributed wheel motors which can be as much as 50% more efficient than central motors.

La Rochelle: a new on demand shared transport service

The old management system of passenger and goods transport services

The car sharing system

Since 1999, a self service car sharing system has been running in La Rochelle. 50 electric cars (Peugeot 106 or Citroen Saxo) are dispatched on 7 seven stations localised in the south west of the city and the city centre.

This was an experimental car sharing system which brought two innovations at the time:

- the car sharing in a medium size city as a complement to public transport;
- the use of electric cars;

LISELEC organisation was entirely managed by the La Rochelle Urban Community which financed the difference between subscriptions and revenues, and the exploitation costs (this comes from the experimental aspect of the whole organisation).

The goods distribution system

One of the first examples of a city distribution centre using electric vehicles was implemented in La Rochelle, by the Urban Community of La Rochelle in February 2001, in the framework of the ELCIDIS program (Electric City Distribution System). In the beginning, it was dedicated only to parcels distribution, but this evolved and Elcidis now also manages pallets and has developed ancillary services. The platform is located in edge of the historical and commercial heart of the city of La Rochelle. The deliveries realised by ELCIDIS concern only the historic city centre. Conveyers, who cannot (Trucks of 3.5 tonnes and over are not allowed to enter the city centre after 07:30) or do not want to enter in the city centre, can discharge goods at the platform. Then, parcels and pallets are gathered by city's sector and are delivered to their recipients by electric vehicles. The first operator of this platform was a local conveyor, "Genty

Transport". Although this trial provided a wealth of insights, results did not meet the initial expectations in terms of quantity of distributed goods and number of carriers involved in the process. The main reason was linked to the management of the whole system which was operated by the carrier: it was difficult for this company first to convince competitors to share the platform, then to carry on specific activities with the shopkeepers and various customers. Marketing activities were mainly realised by the Urban Community and the operator did not put enough effort in those in order to increase the distribution market.

The new management system of passengers and goods transport services

This first phase was coming to the end and it was decided to benefit from the CIVITAS Success project opportunity for changing/improving management system of passenger and goods transport services in La Rochelle. The Urban Community found a contractor who will operate and develop the system according to the previous specifications and in cooperation with the urban community; this also means controlling and if necessary improving the operation modes; this task was a very important issue in the process of re invigoration of ELCIDIS activities. Since one of the main reasons of the poor performance of the system was linked to the operator, it was necessary to find a company which will be really involved in the rebirth of the platform. The first point was to find the best appropriate way to establish perpetual relationship between the operator and the Urban Community. An innovative partnership was set up, for the first time in France in this domain: the "Délégation de Service Public"; this type of contract allows the delegation of the operation of a public service to a private company. It was carried out at the same time for three new mobility services: ELCIDIS management, Car sharing operator and Electric and Hybrid buses operator in La Rochelle. So the same company would have the responsibility over these three areas. Apart from the obvious commonality of electric motorisation, other convergent points such as goods transportation, the use of buses at non peak hours for transporting goods, the sharing of vans between ELCIDIS and car sharing subscribers have been examined,. As a result of this interaction, three Citroën Berlingo, electric utility vans, have been introduced in the Liselec fleet, to answer a demand for goods transportation by craftsmen, shopkeepers and even citizens (Civitas Success**,** 2009), (Trentini et al, 2009).
In the scheme below, we synthesize the main changes in the car sharing management system (Figure 6).

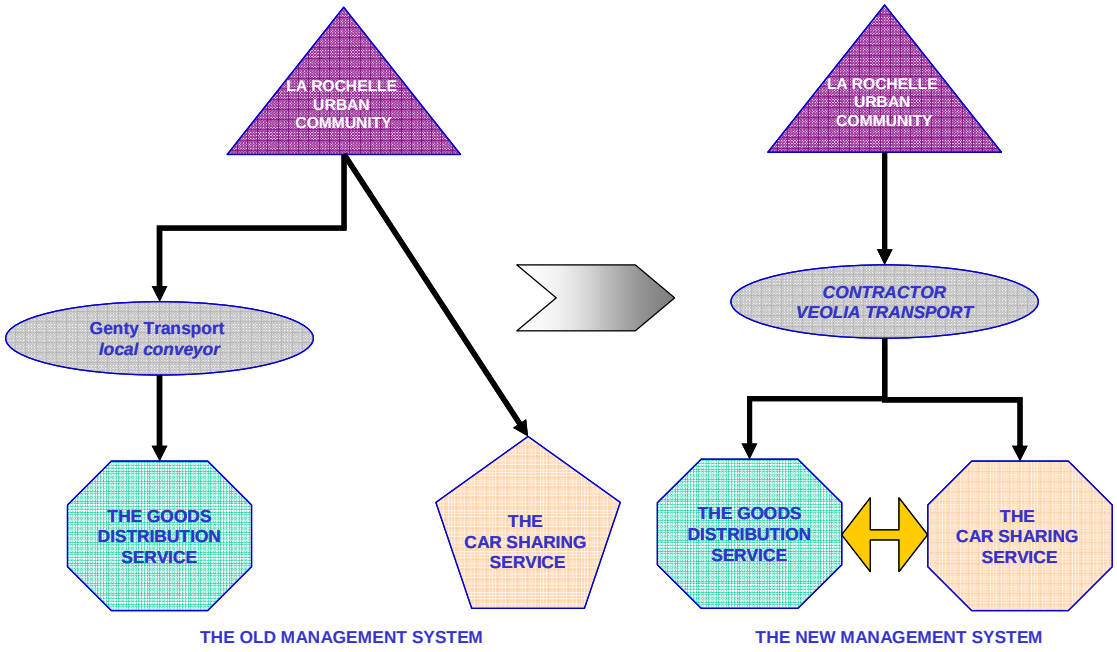


Figure 6 : The management system before and after the Civitas Success Project

CONCLUSION

The aim of this paper is to provide relevant thinking, ideas and examples in order to improve urban mobility. Our finality is not to focus on a cost-benefit analysis of the impacts of the proposed archetype on the different urban mobility stakeholders. Nevertheless, we are aware that it is necessary to accomplish this task, increasing political momentum around issues such as resource scarcity, climate change, security and new regulations. Until now, the most important parameters for supply chain designs have been related to cost efficiency and on-shelf availability. As a result of the growing importance of these emerging issues, new factors are becoming increasingly critical, such as traffic congestion in urban areas, energy consumption, CO_2 emissions and the permanent rise in transportation costs.

Moreover, the research shows that a management model is needed. This management model should serve as a basic framework for the planning and control of both passengers and goods flow. The starting point of the model building process should be the adoption of a systemic approach toward urban mobility.

To manage the whole urban mobility system, the model should distinguish three decisional levels associated to different temporal horizons: the strategic level, the tactical level and the operational level. Each level should ensure the integration of both flows. The definition of a clear and well structured regulatory and organisational framework, assuring an effective interaction between the different parts of the system, will be a determinant factor for a coherent structure of the model (Macario, 2005)

Further research directions

Starting from these conclusions, this research work will be further developed, with the aim to find useful results leading local transport authorities' managers to improve the integration of freight and passengers transport.
The research objective is to pursue the following axes:

- To assess a priori the effects of the adoption of the identified shared passenger and goods urban transport solutions, in Poitiers, as an alternative to the conventional transport solutions.
- To built a management model adapted to local authorities managers to guide them in the process of optimizing the whole passengers &goods transport activities ;

Nowadays, Poitiers's urban centre is deeply changing. Indeed, through the "Coeur d'Agglo" project, the city planners intend to reorganise the city entrances, to reduce traffic, to develop public space, to design for easy use of pedestrians and cycles, and to improve public transports. In this framework, the ANR[10] project C-Goods, has been launched, with the aim to rationalize passengers and goods urban flows, through innovative mobility solutions. The project, involving four partners[11], started in February 2009 and will end on 2012.
Through the project, some scenarios based on the adoption of shared passengers/goods urban transport solutions the urban transport system should be implemented. To define the solutions that better adapt to the characteristics of the context in which the intervention will take place it will be necessary to combine different elements:

- technical solutions;
- politics and administrative measures;
- Involvement of stakeholders.

The choice of the shared solution will be made by considering three types of factors:

- *logistics factors:* the different operating solutions work in an optimal manner in connection to specific flow volumes only (on departure and on arrival), that must be therefore carefully estimated;
- *Organizational factors*: the choice of the operative solution cannot ignore different stability features in relation to the interested parties;
- *Economical factors*: it is necessary to carry out a first evaluation to understand if the solution creates higher or lower economical costs for the different interested parties.

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[10] French National Research Agency
[11] The multi-disciplinary French engineer school EIGSI (Ecole d'Ingénieurs en Génie des Systèmes Industriels), the French university ENMP (Ecole Nationale Supérieure des Mines de Paris), the Poitiers Urban Community (CAP), and the consulting service Interface Transport, specialized in transport economy

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