INTEGRATING GOODS IN PUBLIC TRANSPORT: THE CASE OF PARIS

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ABSTRACT

Goods transportation has not been considered by transport operators since the beginning of public transport. However, it seems that the transport system of cities would be optimized if flows of goods and passengers are managed together with a unique responsible. Pooling resources (stations, tram or metro ...) is the keyword to optimize and to improve the flows of goods and people in urban areas.
Unfortunately, the logistic of goods are not yet integrated in a transport operator. It could be easily explained because it is not clear that the operator can effectively provide this service with existing resources. To integrate logistics services, it is question therefore to analyze and to modify the current transportation system where goods, parcels and pallets can be handled without any difficulty. An interesting approach is to combine logistics to the matter of accessibility to transport spaces for persons with reduced mobility (PRM) because it is fully integrated in the work of replenishment, rehabilitation or improvement of stations, bus stops, tramways, bus and metro.
Based on the approach to open transport spaces to PMR, we develop a methodology for integration of logistics in an urban transport operator. This article revolves around the description of infrastructures and skills, according to the dichotomy Logistics - Cargo / Transport - Passengers, the evaluation of supply and demand, in terms of logistics, for the identified areas and the selection of sites potentially suitable for urban logistics. Finally, we specify our research with a concrete case which is the RATP in Paris intramurals.

Keywords: city logistics, freight and passage flows, public transport

INTRODUCTION

Freight transport in big cities (such as Paris and its suburb) has become a major issue, for different reasons. Traffic congestion, mainly in the small streets of the town centre, which

causes in addition delay in the delivery of goods, greenhouse gas emissions (more than a quarter of CO_2 emissions due to urban traffic is attributed to freight transport, although it represents less than 10% of the total traffic), noise… all these nuisances are due to several factors. First, freight transport is made nearly exclusively by road. This mode is almost the most flexible way to transport large quantities of goods from one point to another, door to door (from a warehouse to a supermarket, for example). Furthermore, the recent development of e-commerce and more generally speaking the changes in consumer usages made freight flows more and more complex, and sorely compatible with the classical schemes of transport, and developing a growing demand on the reverse logistic.
A recurring idea to help solving all these matters, or at least to reduce the nuisances, would be to lower the number of trucks accessing the city center by using the urban railway network, which is very well developed in the Paris region, to transport a part of freight flows. The idea seems to be promising, but as we will see later on, raises also many issues.
We will draw a first picture of the existing solutions or experimentations in Europe and the we will present the successful solution implemented in Ile de France region by Samada, the logistic branch of Monoprix, by using a daily train from its distant warehouses to reach the city center were the goods are dispatch on some lighter and greener trucks (NGV) ensuring the last miles to the final destination. This will lead to describe the specific context of Paris Urban MassTransit Operator RATP, and to present the researches launched by the RATP in the field of Urban Freight, dealing with the possible opportunities for a transit operator to use its infrastructures or rolling stock in such a way... Then, we will finally focus on the first results of one of these on-going researches dealing with the feasibility of the integration of the RATP stations as local logistic platforms

URBAN FREIGHT TRANSPORT: EXPERIMENTS AND PROJECTS

Several experiments of urban freight transport were already carried out. Some of them were successful, other failed. We can notice that most of these experimentations or operational solutions are implemented on tramway networks. The tram of Dresden is used to transport pieces from a production centre to a VW factory. The tram of Zurich is used for the reverse logistics. Now, let us review in detail two show cases : the Monoprix / Samada solution in Paris and the City Cargo Tram in Amsterdam.

Monoprix/Samada

Context:

Monoprix is a major French supermarket chain, specialized in convenience stores, and strongly established in city centers, especially in Paris and its suburb. Involved in a sustainable development policy for 20 years, the group pays much attention to the environmental impact of its activities, especially its logistics.

That is why SAMADA (logistical subsidiary of Monoprix), worked in partnership with public institutions (regional direction of equipments, region Ile de France, city of Paris, RFF) to design and apply a new scheme of transport to supply the Monoprix stores situated in Paris and its close suburb.

Device:

This scheme of transport consists in gathering freight flows toward Parisian stores via the railway as far as a logistical plate form situated in Paris intramurals (halle de Bercy). Flows are then transported to Monoprix stores by NGV (natural gas for vehicles) trucks.
The products involved in this operation are the general goods (textile, hygiene, non-foodstuffs…), and the soft drinks (water, milk, juice, sodas…), which are prepared in 2 warehouses situated in Combs and Lieusaint (Seine et Marne), 40 km away from Paris, and linked to the railroads serving the south east suburb of Paris.

Setting up:

First of all, SAMADA had to build the branch line between its warehouses and the railway national network. Then, a partnership has been concluded with Fret SNCF, which delegated the rail transport (5 trains a week, 22 cars maximum) to one of its specialized subsidiaries: VFLI, and made available a 3700 sqm plate form in Bercy, near Gare de Lyon.
In addition, 26 NGV trucks were rented out to 2 trucking companies: Geodis BM and GT Location. Finally, SAMADA construct a natural gas compression plant built by GNVert on the site of Bercy in order to make the energy supply easier for the trucks.
After 3 years surveys, studies and calls for tenders, the activity could begin in November 2007.

Operation:

The plate form SAMADA-Bercy receives one train per day, from Sunday evening to Thursday evening, with 17 cars in average that is about 750 pallets, which are unloaded, scanned and stocked during the night, from 21h 30 to 4h 30, after that, they are loaded from 6 o clock, from Monday to Friday, in the NGV trucks, which come to Bercy after having delivered fresh foods from others refrigerated plate forms. The 26 trucks are then reused as many times as necessary to deliver goods to 90 stores situated in Paris and its close suburb.

Outcome:

In 2009, this new scheme of transport brought a reduction by 50% of greenhouse gas (carbon dioxide) and pollutants (NOX, COV…) emissions in comparison with the previous

situation, in particular by reducing the total distance covered by SAMADA trucks in Ile de France by 700 000 km per year.
This new conception of the supply chain is currently a source of additional costs due to the innovative parts of the scheme of transport (rail transport, breakdown, NGV motorization), but SAMADA looks for new solutions to optimize this new scheme and so far, to reduce their impact.

City Cargo. Cargo Tram in Amsterdam

Presentation of the project

The aim of the project was to demonstrate that delivering goods in Amsterdam via the tram network is viable, and to replace 2500 of the 5000 trucks which enter Amsterdam every day with the Cargo tram.
Two trams were converted to freight trams (50 were planned in the final project). Trucks supplied these cargo trams with goods at the end stop of a tramway line, which was used as a cross docking plate form (in the final project, there were 4 of these plate forms situated in the periphery of Amsterdam). Then the cargo trams ran on the network, using a specially selected route (several routes were possible), during off hours. 2 transfer points (out of 15 in the final project), so called “city hubs” (picture 1), were located in the inner city to unload the trams, using small electrical powered vehicles (e-cars) that operated the transport of freight downstream. A special container (10 cubic metres busload) was designed to package goods. Each e-car was able to carry one of these containers, and a cargo tram could transport 11 of them.
The society “City Cargo Amsterdam” (CCA) was created in April 2005. It obtained 200k€ subsidies from the municipality of Amsterdam to build a business model. In May 2006, the municipality accepted the principle of carrying out a pilot project preliminary to the granting of a concession. The pilot project was presented in November 2006. It was successfully carried out in March 2007: 2 empty cargo trams ran on the network during one month without impacting the traffic of passengers. In July 2007, a 10 years concession was granted to CCA to use the tram network for freight transport; but in January 2009, CCA got bankrupt default of financing (less than half of the 150M€ needed for the project were raised).

Figure 1 – City hubs (source APUR)

Conclusion

The experiment of Cargo Tram showed that it was possible to insert freight trams in the traffic of passengers during off hours. Thereby, there are two options to transport freight via a railway network. The first one is to use the network by night, when it is closed to passengers. It avoids all the problems of cohabitation between freight and passengers, but it can be a source of tensions with the maintenance employees, who already use the network by night. The other one is to follow the example of Amsterdam, and to transport freight during off hours.
This experiment would have offered a wealth of learning opportunities if it had been a success, but the fact to know that the cohabitation between freight trams and trams of passengers is possible is already something very important.

The context in Paris and its region

A significant existing railway network

Metro, tramway, suburb trains, regional express railway lines, main line trains, high speed trains… The railway network in the Paris region is as developed as various. Concerning the passengers, two different companies operate this railway network: SNCF (French Railways National Company) for the main conventional and high speed lines as well as main part of suburb trains, RATP (Paris Transit Operator) for the metro system, a small part of the suburb trains (Regional Express Railway) and, up to now, the main part of the tramway network.
We will focus on the part of the network operated by the RATP.
The Metro network in Paris is made up of 16 lines adding up 214 km of tracks. There are 300 underground stations, including nearly 250 in Paris intramurals, which means that the inner city is very well covered by this network, but the periphery much less, especially the more distant areas, from which the metro is totally absent.

On the contrary, the RER network is strongly developed in the periphery, but much less in Paris intramurals. There are indeed 257 stations, spitted up into 5 lines, but only 28 in the city of Paris. Moreover, among these 257 stations, only 68 are operated by the RATP.
These two networks have something in common: the stations in Paris intramurals and in the close suburb are in underground (except a few metro stations which are in viaduct). We will see that this is a major issue for the implantation of logistic platforms, for obvious accessibility reasons.
The third network (tramway) is very different: it is not entirely developed yet: 11 tramway lines are planned but only four lines are in operation nowadays. It is nearly entirely in the periphery, even the new lines will not enter Paris intramurals, due to the level of coverage of the city center by the metro, the tramway stays tangential to the historical center, it is not really a “network”, as far as the different lines which exist today are not interconnected, yet.

Urban Freight Mission

RATP, in the framework of the research activities of the General Delegation for Innovation and Sustainable Development, has launched in 2009, an Urban Freight Mission in charge of investigating the possible use of urban public transport infrastructure (and rolling stock) for Urban Freight and Goods Delivery.

Major axes to be investigated by the Urban Freight Mission are the followings:

- Possible use of RER (Paris Express Regional Metro) for small express freight between CDG airport and Paris downtown
- Integration of the Urban Freight component in the new urban transport projects, such as the automatic metro ring road around Paris, or any other urban railway project
- Experimentation of implementation of automatic lockers in the Paris metro stations, for small parcels delivery (e-business)
- Reverse logistic: how to use the potential of a metro line to evacuate “clean” garbage from stations and facilities of this line

In addition the two following axes are also to be scrutinized:

- Airport Links : feasibility of implementing a downtown check-in counter in Paris
- Creation of an international “club” of mass transit systems operators, regarding the topic of urban freight.

To now, the Urban Freight Mission has successfully been awarded two funding from the PREDIT 4 (national program of research and innovation for land transport) for the following projects:

- Feasibility of the Logistic Integration of Urban Transport System Stations and Facilities
- Operational Composite Flows: State of the Art and Possible Developments

Another one is under negotiation, regarding the second major axe, evaluation of the additional cost of the integration of an urban freight component into the conception of urban mass transit system.

All these topics are closely related with sustainable development and are aiming to help reaching the French environmental issues known as “Grenelle I & II”, essentially by increasing the modal share of the railway mode, especially in central urban district.

As we focus on the existing networks, the tramway is not our immediate target. Though, its logistics integration seems easier than for the RER or the metro, as it is a less congested network (one tramway every 5 minutes in rush hours, every 15 minutes in off hours, versus less than 2 minutes and up to 9 minutes for the underground) whose stations and tracks are on the ground. That is why the tramway is the subject of many surveys for its logistics integration. As far as we are concerned, for simplification reasons, we will mainly consider the metro network.

New model of Supply Chain. Necessity and difficulties

Using the urban railway system to transport goods in the inner city implies to strongly modify the structure of the supply chain, more precisely the part between the local warehouse or platform, which is often situated in the remote periphery, and the customer, for example a shopkeeper in the town centre. In the current situation, except in a few cases, goods are delivered to urban shops and supermarkets by trucks or vans which come directly from the remote warehouse, and, as we have already stated, participate to the congestion of urban traffic. Our aim is to propose an alternate solution to these trucks and vans by train (the metro in our case). Nevertheless, neither the warehouse, nor the urban shops are connected to the underground network, so that a transport by road, but also rail or waterways is still necessary upstream and downstream. Finally, by using the underground to transport freight, two more transfers are added in the supply chain, one on the point of insertion in the network (a maintenance area in the periphery, for example), one on the urban platform (that is to say the metro station from which goods will be distributed to shops).
An additional break in the supply chain is problematic, because it implies more handling charges. Two additional breaks are then a major financial issue. The only way to remove one of them is to link the warehouses to the network. It is possible (but expensive) to do that if the warehouse is close to the network. We already saw in detail the SAMADA experiment with its warehouse in Combs-la-Ville, which is linked to the national railway network. However, as we have said, the metro network, contrary to the RER network, is not developed at all in the remote suburb, where most of the warehouses are located. What is feasible (for an important cost) with the national railway network is not as easy to be done with the underground network. Thereby, making these two breaks as smooth as possible will be very important from a financial point of view, and in this filed there is ground for a lot of researches on the possible automations of the transfer of charges.

Who would be the customers?

There are many types of commercial areas in the inner city of Paris, from the little shop to the supermarket, department stores and the commercial shopping mall, from the mini market to all the types of specialized shops (high tech…). These commercial areas need different types

and different quantities of goods. Thereby, considering the commercial environment is very important to locate logistics plate forms and to size the freight network. Which quantity of goods will the network be able to transport each day? Which type of goods (knowing that some types of goods such as fresh foods or dangerous products need special facilities and equipment systems)? The potential customers will depend on the answer at these two questions, and also the best locations: for example, a station located just in front of a big commercial area specialized in high tech will be a good place to establish a logistics area only if it is able to deal with high tech products.
Answering these questions implies to make a strategic choice, which also depends on huge amounts of data, such as the location of all the types of commercial areas in Paris. Specific surveys may be conducted for a few stations, to see whether it is worth it to do specific investments to be able to deal with some types of goods, which would allow attracting additional customers.

USING METRO STATIONS TO TRANSPORT FREIGHT IN PARIS: BRILLIANT IDEA OR SIMPLY SOURCE OF TROUBLES?

Metro stations were not designed to be used as logistics plate forms. They have been thought and optimized for more than 100 years to transport people. People and goods are very different however, especially for the conditions of transport. People are indeed able to move by themselves, what goods cannot do. Facilities needed to transport freight and to transport people are then not exactly the same. Transporting goods via the underground network generates many issues, especially regarding accessibility, available surfaces, and interaction with passengers but also interaction with the operation, the maintenance, the fire risk and with all the legal issues related.

Accessibility issues

First, there are nearly no specific tools, such as freight elevators, to transport big amounts of goods (pallets…) in a multi-level area. As metro stations are never on the ground level (they are most of the time underground, or in a few cases in viaduct), it is a major issue. Escalators and elevators can't be used to transport goods for technical reasons. Escalators are designed to transport two people on each step, no more. It is then out of the question to transport a 500kg pallet via the escalators. The elevators which already exist in the metro stations are designed to transport between 630 and 1275 kg, enough for a pallet. Nevertheless, an excessive use of these elevators (to transport freight, for example), can cause multiple breakdowns, which is a big impact on the passengers who use the elevators; and yet the very first condition to the project of freight transport in Paris via the underground is that freight flows mustn't harm passengers. Anyway, transport of goods via the escalators or elevators is forbidden by the rules of the RATP. The only possible way to bring freight from the reception area (typically the platform) to the delivery area (often the station's entrance) is then to use normal stairs, which requires very specific means of handling, as a classical pallet truck cannot be used in the stairs. A six-wheeled trolley is able to bring light freight (less than 60 kg) downstairs or upstairs. It is the mean of handling used today to supply the

shops situated in the stations and the vending machines on the platforms. Nevertheless, it is unthinkable to use only such trolleys as soon as the quantity of goods to transport is too big. Another solution is to use special structures equipped with tracks (figure 2).

Figure 2 – (source: www.alitrak.com)

This type of vehicle is able to bring charges as heavy as 400 kg in any type of stairs, but it is very expensive, and its speed is very low, particularly to go upstairs. Finally, unless freight elevators are set up in the stations (some freight elevators are already set up in some stations, but not enough to cope with important flows of freight), which is very expensive and not always technically feasible, it seems impossible to find a good solution in the long run to the issue of accessibility of underground areas.

Nevertheless, what mustn't be forgotten is that there is not only the "Métro" in the Paris underground, but also many other facilities and networks, including large car parks, which are not always fully used. A survey must be carried out to determine whether it is possible to connect a metro station with one of these car parks or not. This connection is feasible if the car park is just next to the metro station, and brings a big added value if this park is on the same level as the metro tracks and platforms. Goods could be easily carried from the platform to the car park, and then accessibility is not a problem anymore, because the car park is designed to be accessible to vehicles, which could operate the transport of freight downstream. Moreover, using car parks as logistics plate forms was already made in Paris, by the company Chronopost for example, which uses a former car park in Place de la Concorde to dispatch its parcels in the centre of Paris. Linking RATP stations with car parks could be a way to make the break downstream much less expensive. This solution must be considered carefully, and technical and financial surveys must be carried out.

Another solution to this issue of accessibility is to use very small packages: no pallets, but parcels, for example, which can be transported in stairs by employees. However, in order to give credibility to the project, it must be possible to make big amounts of goods transit in the transport area, which is possible only by using big packages such as pallets.

As far as the point of insertion in the underground network is concerned, the issue of accessibility is much less important. It exists indeed in the periphery several areas on the ground level, which are linked to the network, and which can be used as injection points without the issues of accessibility of an underground area.

Available surfaces issues

Surfaces are a strong point as well as a weak point for the underground network. A strong point because metro stations represent thousands of square meters in Paris intramurals, which is a unique situation (no other company owns such surfaces in the city), a weak point because all these thousands of square meters are not available for logistics. The priority of the RATP stations is not the transport of freight, but the transport of passengers. That is why most surfaces are reserved for people, and so unavailable for goods. Each square meter devoted to logistics will have to be conquered, and the surfaces needed are often higher than 100 square meters!

Nevertheless, contrary to shops, logistics activities don't need necessarily a great devoted surface, that is to say a surface which would be used only for logistics. It is of course necessary to stock pallet trucks and the others handling means, which requires a devoted surface all the more big so the size of the logistics plate form is significant; but surfaces used to stock goods temporary can also be used for the passengers in rush hours.

Once again, the surfaces won't be an issue anymore if it is possible to connect the metro station with an under-used car park or other similar facility.

Interaction with passenger flows issues

Pooling the flows in a same network causes issues of interaction, especially if the connection points that lead outside are common for both passengers and freight. One flow can harm the other by causing delay, for example.

In the case of the RATP, the very first condition to the project of urban freight transport is that freight flows must not have any impact on the level of service, which means that:

1) The schedule of passengers' trains must be changed neither in time, nor in frequency
2) The passengers themselves must not be impeded by the presence of freight in the stations. For obvious safety and security reasons, pallets mustn't block a whole corridor, for example

The best way to solve these issues is of course to avoid interactions. A solution would be to transport freight during the night, when the network is closed to passengers. There are no issues of schedule anymore, nor issues of interaction in the RATP areas, because flows are temporally separated. Nevertheless, transporting freight by night is also quite difficult, because the network is unavailable. The maintenance uses it and parks trains on the work sites during the whole night, every single one of them being an obstacle for the freight trains. In addition, for safety reasons, the electrical supply is cut in each sector where employees work on the tracks, which prevents also freight trains from running.

A part of the interactions could also be avoided if spaces used for logistics weren't public spaces. It exists for example park areas for trains, specific sites for the maintenance… which are not accessible to passengers. Even in the public stations, some areas are not public, for example the technical areas. In this case however, it is rarely possible to find such an area greater than a few square metres, which is not sufficient for logistics. Anyway, if all the handling is made in private areas, the only remaining issue is the respect of the schedule of passengers' trains. The experiment of Amsterdam showed that this condition was bearable, except for one point: loading and unloading of freight trains. In Amsterdam, this was made on

private tracks, and 10 minutes were necessary to fully unload a tram. In the case of the underground, it is impossible (or too costly) to build new tracks devoted to freight transport, because it implies at least to widen tunnels. Service tracks exist, to go from one metro line to another, for example, where passengers' trains never go, but the issue is that these service tracks are not linked to the surface, as platforms are linked through a RATP station. Thereby, it is impossible to unload freight trains in such areas. In addition, if freight trains are unloaded on the platforms, there is first an issue of schedule because the interval between two successive passengers' trains is never greater than 8 minutes (not enough to unload a train), secondly we find again the issue of interaction in the stations, because platforms are of course public areas.

Here is an additional difficulty to use an underground network to transport freight. It is the limited number of connection points to the outside. It is feasible to add 100 metres of tracks and a stop between two stations for a ground network, but it is impossible for an underground network, which means that passengers and freight are more likely to cohabit in the limited number of connection points available.

CONCLUSION

Using the railway to transport freight, by pooling flows of passengers and flows of goods, seems to be a good idea, but through the example of the RATP in Paris, we have seen that many issues must be tackled. Only the major ones have been presented here, other factors such as safety (with specific safety standards for the transport of goods in tunnels), security, but also institutional and legal (do we have the right to transport goods via the RATP network? Who is responsible? …) must be taken into account. The solutions depend on many factors (which railway network do we use to transport freight? Do we use it by day or by night? ...), so it is impossible to give a standard project which would fit to any railway network in Europe and in the world. However, we have defined a few standard criteria, in order to determine whether a logistics plate form can be integrated in a given facility (in our case, a RATP station) or not:

- Available surfaces (is there enough place in the facility to implant a logistics plate form?)
- External accessibility (is it easy to reach the station by train and for the transport downstream by truck or by van?)
- Internal accessibility (is it easy to transport goods from the platform to the exit of the station?)
- Commercial surroundings (are there many potential customers next to the station?)
- Risks linked to the interaction with metro users (accidents…)
- Risks linked to the goods themselves (fires…)
- Environmental indicators (is the logistics plate form able to avoid big amounts of GES emissions?)
- Economical indicators (is the logistics plate form easily sustainable? What is the business model? Will it be profitable?)

For each of these criteria, several questions must be asked to different protagonists (station managers, operators, logistics experts…) in order to decide whether the criterion is positive or not for the considered RATP station.
Nevertheless, deciding which RATP facilities could be used for logistics is only the first step of a large program, during which many protagonists (institutions, professional logisticians…) will have to be convinced, and many reforms will have to be carried out.

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