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Special issue – City Logistics

Introduction

During the last decades freight transport movements have increased enormously. The EU White paper “European transport policy for 2010: time to decide” forecasts a 38% increase in the demand for goods transport by 2010, and predicts that heavy goods traffic alone will increase by nearly 50% over its 1998 levels (OECD, 2003). Currently, the number of vehicles used for freight deliveries in European urban areas represent the 10% of all the vehicles circulating in the cities.

The increasing trend of urban freight traffic has substantially affected the quality of life of the urban residents, who presently represent more than 75% of the European population (www.ue-portal.net), and who are projected to rise up to 83% by 2020 (OECD, 2001). Noise, pollution, congestion, accidents, use of non-renewable fossil fuel¹, loss of greenfield sites and open spaces as a result of transport infrastructure development, production of waste products, such as tyres, oil and other materials increase as traffic rises. Historical city centres are damaged by pollution, tourist industries are threatened, while the distribution of goods and services in the urban areas is getting more and more inefficient. The external costs caused by freight transport in Italian urban areas are estimated to be equal to 7 billions of Euros, that is 23% of the total amount of externalities generated by urban traffic (TRT - Federtrasporto, 2002).

National and city governments have been actively trying to analyse this growing problem by financing research programmes aimed at exploring possible solutions. Some of these programmes studied, for example, which are the most efficient delivery methods that should be implemented in different urban areas. Examples of this kind of research programs are: LEAN whose aim was the development and demonstration of new concepts for goods distribution within cities; BESTUFS which identifies and describes the criteria to be used in order to improve the movement of goods; IDIOMA which shows the potential of optimisation of goods distribution in five urban areas within Europe; COST 321 which studies innovative measures to improve environmental impacts of freight transport in urban areas; and SOFTICE which identifies the cost of freight transport within Europe with regard to harmonisation in Europe and internalisation of external cost.

Other research programmes tried to develop optimal exploitation of the road network. For instance, DIRECT analyses transport-data sharing structures for traffic management within cities.

A third group of research programmes studied the possibility of creating efficient transshipment areas: FV-2000 analyses and evaluates several freight villages in Europe; FREYA aims at facilitating the access of SME’s to intermodal transport; IDIOMA studies city delivery centres in five urban areas in Europe; INFREDAT investigates the

¹ The French National Research estimated that goods transport contributes to around 40% of total urban transport energy consumption.

whole transport chain of intermodal transport, especially the requirements of data flows; and REFORM analyses and evaluates the effects of freight platforms regarding the urban traffic.

Most of these research programmes have demonstrated that the organization of the urban freight transport activities and the coordination of the numerous stakeholders involved are among the most critical aspects characterizing the inefficiencies of the urban freight mobility systems. The decision making process related to the transport process as a whole is highly fragmented. The supplier produces the good, the local transport firm moves the good from the supplier to the forwarding agent, the forwarding agent organizes the freight transport up to the receiver site, the long distance transport firm covers the long distance transport operations, the receiving local transport firm moves the good from the long distance transport firm site to the receiver, the receiver buys the good. Most inefficiencies characterizing the freight mobility system in the urban areas are caused by the fact that each segment of the transport chain is individually organized by each stakeholder independently of the goals and, even more importantly, of the logistic problems faced by the others.

Local authorities tried to enhance the coordination and the re-organization processes adopting various policies. These policies differ both in terms of their interference with the normal interaction process between the demand and the supply side of the market and in terms of their acceptability by the actors directly or indirectly affected by them. The “softest” policies, in term of interference with the market forces, used are those aimed at creating a widespread knowledge of the regulations and of the characteristics of the freight mobility system of each urban area by: surveying traffic conditions in term of travel time on the road network and providing real-time travel data on estimated time for different routes; supplying booking systems for curb loading/unloading spaces; providing the inner city areas with variable message signs informing on time window limits and fees to be paid for the access of the restricted traffic area, or on the urban lane sharing system, etc..

A second category of policies aim at enhancing the information diffusion among the transport chain actors. This goal have been obtained both via telematic solutions or the organization of meeting (or consultation programmes). Examples of the former are: Geographical Information Systems; Global Positioning System; Logistical Matching Systems which use the internet to perform e-commerce and match the shipper demand and the supply of carriers who offer vacant space in their trucks to transport additional goods; Intelligent Fleet Management System controlling the vehicle operations and allowing track and trace of packages, cases and containers. Meeting take place among representatives of freight industry, local authorities and local business community, in order to devise individually tailored solutions appropriate to the peculiar characteristics of each urban area such as driver information measures, delivery/loading facilities, enforcement measures, etc.

A third category of policies are concerned with the creation of an (public) agency aimed at centrally coordinating the activities carried out by each actor of the freight transport chain in the urban area.

A fourth category of policies comprise both regulation and fiscal policies with the aim of indirectly influencing the reorganization of the freight transport chain. Examples of regulation are the traffic and access restrictions within some areas of the downtown, generally called Restricted Traffic Areas, or RTA, time windows limiting the access to the RTA, varying accordingly to weight, length, width, environmental impact of the

vehicle and to the cargo type, freight dedicated lines, curb spaces for the loading/unloading operations, etc. Fiscal measures consist in licensing fees for the access to the RTA, road pricing, parking and loading/unloading facilities fees, etc.

A fifth category of policies aims at creating urban distribution centres where the freight consolidation process can take place before the goods are delivered in the downtown. It should be noted that this kind of solution is among the most invasive and controversial one, raising unanswered questions like: which of the involved actors should manage the centre? Should it be a private or a public facility? Should the access be allowed to any kind of vehicle and transport firm, or should it be restricted to some special categories (for example those transport firms using to low impact vehicles or demonstrating some competitive advantage if compared to their competitors)? Should the centre be financed by the local authorities, or by the fees paid by the users?

The aim of this special issue is to show how each country, and each city have chosen to implement a mix of policies that better suited their mobility problems, deeply influenced by their geo-morphological characteristics, by their architectural, urban and territorial organization, their cultural peculiarities such as a different inclination to cooperative behaviour, and their priorities in terms of goals to be achieved. Those differences justify the diversity of the solutions adopted by the local authorities at the European level.

Zunder and Ibanez - in their paper entitled "Urban freight logistics in the European Union" - summarize and critically discuss some of the research programs financed by the UE in order to improve the freight mobility in the European urban areas. they underline the international characteristic of the problems associated with urban freight transport and the importance of involving both private (shippers, receivers, transport service providers), and public (city administration and policy enforcing agencies, community interest groups, urban, transport and services planners) actors in order to assure a higher acceptability of the policy mix to be implemented in each of the involved cities. They focus on the successful (Berlin and Stockholm) and unsuccessful (only fifteen out of eighty projects implemented in Germany in 1985 have been able to survive till 2002) examples of distribution centres implemented over Europe. They underline the main drawbacks of this kind of measure - the fact that if the centre is managed by a public agency allowing equal access to all transport supplier, that it removes the competitive advantage distinguishing the actors involved in the distribution chain, and that it causes an increase of the delivery costs, both in monetary and time terms, due to the added transshipment operations.

Some papers included in this special issue on city logistics describe the results of other research experiences carried out in some European or American urban areas. The paper by Frosini, Huntingford and Ambrosino entitled "Urban mobility and freight distribution service: best practices and lessons learnt in the Merope interreg IIIB project" is focused on the Merope project involving 14 cities of the Western Mediterranean area. The paper describes how the telematic instruments can help freight mobility and logistics management in urban and metropolitan areas through the description of best practices and the problems encountered, and lessons learnt from the pilot projects and the feasibility studies carried out. It underlines that, in order to successfully implement any kind of innovation concerning the freight mobility system, the project: should be based on strong political support to be gained with frequent meeting and seminars involving administrative authorities, local community and the private sector); should encounter real territorial needs; and should be economically

sustainable with financial support by the public sector possibly limited to the initial phases of its implementation, and with the creation of public/private partnership in the medium-long run.

The paper by Frosini, Huntingford and Ambrosino entitled “Multi-service agency for the integrated management of mobility and of accessibility to transport service” describes the Agata project aimed at developing a multi-service agency coordinating the transport and mobility services in urban and rural areas via information and communication technologies. The paper presents: the evaluation techniques used comprising the development of realization indicators, results indicators and impact indicators; the expected results and the potentialities of the initiatives carried out within the project, that started in July 2004 and will end by June 2006. Among the most critical issues emerged by the experiences already carried out it appears that an in-depth analysis of the local needs and of the geographical, economic, social, political and infrastructural characteristics of the involved areas are the conditions *sine qua non* to ensure the success of any project based on the creation of a coordinating agency.

The paper by Bonacchi, Benini and Mattesini entitled “The Florence transit point: a feasibility study” presents the potentialities and the economic and environmental sustainability of the implementation of an urban distribution centre for the city of Florence. One of the most interesting issues emerging from the paper is the analysis of the problems related to the management and to regulation of this structure. The solution proposed by the authors is to separate the planning and controlling activities from the management activities of the centre. A public agency owning the infrastructure should be created in order to carry on the first group of activities, while a public call should be published in order to choose a private firm in charge for the second group of activities. The second important suggestion resulting from the paper is the need to accurately analyse the economic sustainability of the infrastructures under different scenarios both in terms of urban freight mobility regulation and in terms of fee levels to be paid by the users of the centre.

Finally, the paper by Morris entitled “The impact of inadequate off-loading facilities in commercial office buildings upon freight efficiency and security in urban areas” analyses some specific issues characterizing the New York City’s central business district: that is the security and safety problems caused by the insufficient off-loading areas of the commercial office buildings localized in that area. The paper suggests some recommendations in order to solve these problems underlining, in particular, the importance of appropriately planning the loading/unloading facilities in highly congested city centres, and of developing retrofitting strategies at existing loading docks.

The last two papers included in this special issue describe the analytical instruments that can be used to study the weaknesses and the peculiarities of each urban context before planning any kind of measure aimed at regulating their freight mobility system.

A review of measures, models, and tools developed at urban level to simulate the freight demand is presented in the paper by Russo and Comi entitled “A modelling system to link end-consumers and distribution logistics”. The freight measures reviewed by the authors are classified into four categories: unit of transport, infrastructure, telematics, and management. The urban freight models described in the paper include truck trip estimation models, multi-step models, attraction/generation models, combined equilibrium models of both passengers and freight movements, and they can be classified as commodity-based versus truck-based models, behavioural models (divided

into aggregate, disaggregate, international, intercity and urban models), macro-economic versus modal split versus route choice models. The simulation tools of the freight system reviewed by Russo and Comi are those actually used in France, the Netherlands, and Germany. The authors underline the necessity to develop a general model based on the measures and on the tools reviewed and able to jointly deal with the passengers and freight mobility, as they use the same congestible road network. The authors propose a two-level model responding to these needs.

The last paper of the issue is by Vleugel entitled “Modelling goods city distribution in the Netherlands”. In the paper a method for data collection, analysis and modelling of the urban freight system is described, underling the importance of specifically considering the relationships between transport demand, traffic, economic, social and environmental variables. The author describes the factors that have prevented the data collection and the implementation of a quantitative model in his home country, and illustrates the explicative power (in terms of indicative assessment, factor analysis and sensitivity analysis) of the qualitative model that can be used in turn. Vleugel strongly recommends to perform at least a qualitative analysis (via the qualitative model developed in the Netherland, or any other qualitative model better suiting the interested area) of all the possible effect generated by any intervention in the urban freight mobility system during the planning phase of the mobility policies. Finally he emphasises the importance of ameliorating the data collection and the database quality by fulfilling the databases gaps, making the datasets more dynamic, using information about logistic trends, improving the data about the small receivers in order to perform plausible quantitative analysis.

Lucia Rotaris and Elena Maggi

References

- OECD (2003) *Delivering the good, 21st century challenges to urban good transport*, Paris.
- OECD (2001) *OECD environmental outlook*, Paris.
- TRT - Federtrasporto (2002) *ASTRA model*.



A modelling system to link end-consumers and distribution logistics

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Abstract

In the last years the interest in urban freight mobility has increased. However, the management and control of urban freight transport requires models which simulate the transport system. In literature some models have been analysed and implemented with tools which allow the verification of the measures adopted in several cities around the world.

In paper a review of measures implemented in some cities to reduce the negative effects of urban freight transport, an updated review of models developed to analyse urban freight mobility and the tools used to verify and check the proposed measures are presented. Finally the modelling system to link end-consumer and distribution logistics is described.

Keywords: Freight; Models; Urban goods movements; Best practices.

Introduction

Freight transport has a major role to play in the transport system, and in the economics system in general, being a key element in the process of economic development.

In Europe, it has emerged from various surveys that the main components of freight urban transport are represented by distribution and purchases, amounting to about 81% of total trips, while construction and building-related trips are about 5% (COST 321). If purchase mobility is not considered in the set, distribution accounts for 68%, while other significant components are construction and building-related trips (8%) and removals (8%).

In recent years, in the industrialized countries, studies of urban freight movements have increased since freight transport is a major source of traffic congestion and nuisance, including air and noise pollution.

The swift increase of freight vehicles in urban and metropolitan areas contributes to congestion, air pollution, noise, and to increases in logistic costs and hence, the price of

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products. In addition, a combination of different types of vehicles on the road increases the risk of accidents. An efficient freight distribution system is required as it plays a significant role in the competitiveness of an urban area and is in itself an important element in the urban economy, both in terms of the income it generates and the employment levels it supports. Many initiatives have been developed in urban areas but few are supported by mathematical models. This emerged, as conclusions, also from a European Project that analysed the implemented measures in many cities around the world (BESTUFS, 2000-2004; Egger and Ruesch, 2003). It is necessary to have models for the design, evaluation and control of urban freight transport systems, thus simulating with the use of models what the state of the system will be once the new scheme/practice is adopted.

In this paper we will focus on the research into urban goods movements and we propose an advanced model system that seeks to link end-consumers and distribution logistics.

In the following section the freight measures at urban scale will be investigated and a classification will be proposed; state-of-the-art urban freight models will be discussed and finally, the tools and software used to simulate urban freight mobility will be described. Section three describes the modelling system developed to analyse freight and passengers together. This is followed by several conclusions.

State of the art

Freight measures at urban scale

An initial list of measures related to urban freight transport was given by COST 321 Action (1998). The identified measures are about 60 and are classified in 8 different classes. COST 321 provided quantitative results on the impact of measures and estimated effects in projects and case studies.

In 2000, the European Commission established a thematic network on Best Urban Freight Solutions (BESTUFS) with a 4-year duration. BESTUFS aims to identify and disseminate best practices with respect to urban freight transport. The BESTUFS project can be seen as a follow-up and continuation of the COST 321 project (Ruesch and Glucker, 2000; Wild, 2003).

Recently two European Projects on urban freight distribution were concluded: City Freight and City Ports.

City Freight was concluded in 2004. It carried out an analysis of selected freight transport systems already functioning in Europe and evaluated their socio-economic and environmental impacts in an urban context, with a common assessment methodology. City Freight focused on innovative and promising logistic schemes in the seven countries represented in the project consortium. The objectives of the City Freight project are the following: to identify and analyze the working of innovative and promising logistic schemes in the seven countries represented in the project consortium as well as the urban policies which could accompany their implementation in order to promote more sustainable development; set up a list of criteria and a common assessment method for evaluating such logistic schemes and the related accompanying policies (legal framework, land use planning, road traffic regulation, pricing); to analyze

their internal technical and economical efficiency; to design, for a city or an urban region in each country, one or more implementation scenarios of these schemes and related policies; to assess and optimize the scenarios according to the criteria of a sustainable development of the city; to present guidelines for implementing integrated strategies that could be recommended as “Best Practices”; to disseminate and exploit the Best Practice Guidelines through collaboration with local authorities for the design of concrete implementation plans of integrated strategies in each of the case study cities (City Freight, 2005).

The investigation of tools and policies for urban goods distribution in some European cities was done with an European project called City Ports and concluded in 2005. This project has been devoted to outline a general method to address city logistics problems within a comprehensive framework where policies are defined after local analysis, ranking of critical issues, design and evaluation of specific solutions, and through the involvement of the various stakeholders. The project joined a network of various cities, which followed a coordinated and parallel implementation of pilot actions, in the framework of the common methodology and exchanging experiences and results (City Ports, 2005).

To analyse the effects of policy measures and company initiatives for sustainable urban distribution, in England a project entitled “Modelling policy measures and company initiatives for sustainable urban distribution” was developed (Allen et alii, 2003). The main aim of the project has been to investigate the extent to which policy measures and company initiatives are likely to result in changes in patterns of goods flows and goods vehicle activity in different types of urban distribution operations.

The previous studies that analysed the measures implemented in urban area gave a list and did not consider the possibility to classify them in function of some characteristics, e.g. who takes the decisions (public agencies, etc.) or who has to undergo to them (community, retailers, carriers, etc.). So trying to find a classification that allows to consider it and from the study of world urban contexts, the main measures adopted in the urban areas can be classified into four classes:

- unit of transport, load and handling;
- infrastructure;
- telematics;
- management.

The measures on units of transport are on weights, space and emissions. This has implied the use of zero emission vehicles (tram, electric vehicles, etc.).

The infrastructural measures can be classified into three classes:

- nodal, like a Freight Platform (areas with different transport related companies and where at least two transport modes are connected); according to REFORM (1999) freight platforms can be defined as areas in which different transport related companies such as forwarders, logistic service providers etc. are established. There are different types of Freight Platform:
 - Freight Village (focus on multimodal transport), place where the transshipment is done and service providers are established on site, as well as a large number of forwarders and transport companies,

- Urban Distribution Centre; according to COST 321 it is a place of transshipment from long distance traffic to short distance (urban) traffic where the consignments can be sorted and bundled. In some cases the Urban Distribution Centre located close to city borders can be within the Freight Village and interfaces long distance transport and city distribution services;
- linear, as heavy vehicle network;
- surface, as areas for loading and unloading operations (Egger et alii, 2001; Egger and Ruesch, 2003).

The main measures on telematics can be aggregated in: traffic information, freight capacity exchange system, route optimisation services, vehicle maintenance management system, other information services through internet access, centralised route planning.

Finally there are the measures on management. We can have measures on: access time, heavy vehicles network, road-pricing, maximum parking time, maximum occupied surface and specific permission.

In Table 1, as an example, we summarise some measures adopted in four European metropolitan cities.

Table 1: Example of some freight measures in four European cities.

| | | <i>Barcelona</i> | <i>Paris</i> | <i>London</i> | <i>Rome</i> |
|-------------------|--|------------------|--------------|---------------|-------------|
| Unit of transport | <i>Emissions</i> | X | | | X |
| | <i>Weight</i> | X | | | X |
| | <i>Space</i> | X | | | |
| Infrastructure | <i>Urban Freight Platform</i> | X | | | X |
| | <i>Loading and unloading surface</i> | X | X | | |
| | <i>Network for commercial vehicles</i> | X | | | |
| Telematics | <i>Access system</i> | X | | | |
| | <i>Centralised Route Planning</i> | X | X | X | X |
| Management | <i>Access time</i> | | | | X |
| | <i>Road-pricing</i> | | | X | |
| | <i>Maximum occupied surface</i> | | X | | |
| | <i>Specific permission</i> | | | X | X |

Urban freight models

The first models on urban freight movements were proposed by Hutchinson in 1974. These models refer to the estimation of truck trips for some types of goods. Some daily truck-movement profiles were also reported.

In-depth analysis and a detailed description of urban goods movements were performed by Ogden (1992), who was the first to classify urban freight models, reviewing models which have actually been developed for each freight category. He also reports the first results of case studies in several cities worldwide, especially in the USA and Australia.

The models developed first by Hutchinson and later by Ogden are multi-step models, similar to those used for urban passenger mobility. Ogden proposed some models, both for goods quantity estimation and for direct truck estimation. Some of these models were specified and calibrated for many urban freight categories. The models aiming to

analyze the generation of freight or truck trips are descriptive of the index type per category. For distribution he reports some gravitational models. As he focuses mainly on attraction/generation and distribution models, he does not study models for commodity modal split, vehicle loading or for assignment in depth. He only proposes, for example in the case of assignment, some procedures to adapt the traditional models to freight movements.

More recently, similar analyses have been proposed by List and Turnquist (1994), Taylor (1997), Fridstrom (1998), He and Crainic (1998) and Gorys and Hausmanis (1999), while a combined equilibrium model of urban passenger travel and goods movement was proposed by Oppenheim (1994), in which commodity flows are generated by the need to support a given generic urban activity undertaken by individual travellers, which involves consumption of a given commodity. Travellers are assumed to maximize their utilities, through their joint choice of an activity site and travel route to it. Activity suppliers also maximize their utilities through their joint choice of commodity suppliers and freight shipping routes. An input-output model was adapted and applied to the Portsmouth area to predict purchases and sales for different freight categories within and outside the city limits by Harris and Liu (1998). An in-depth analysis of the relationship between trip length distributions (TLDs), in particular between vehicle TLD and tonnage TLD was performed by Holguin-Veras and Thorson (2000). The analysis revealed that: the shape of the TLDs depends upon the type of movements being considered; TLDs defined in terms of tonnage differ significantly from those defined in terms of vehicle-trips; TLDs for different types of vehicles, transporting similar commodities, reflect the range of use of each type of vehicle; albeit different, the relationship between tonnage TLDs and vehicle TLDs seems to follow a systematic pattern that, if successfully identified, would enable transportation planners to estimate a type of TLD, given the other. Major freight generators are likely to impact the shape of the TLDs such that complementary models may be needed to provide meaningful depictions of freight movements. An overall discussion of freight demand modelling is also conducted.

According to the outputs given by the models developed for freight analysis at urban scale a classification, accepted by several authors (Hutchinson, 1974; Ogden, 1992; Holguín-Veras and Thorson, 2000; Taniguchi et alii, 2001), categorizes the existing urban models in:

- *commodity-based*, models based upon the notion that the freight system is essentially concerned with the movement of goods, not of vehicles, and the movements of goods are modelled directly;
- *truck-based models*, that focus on movements of trucks and estimate them directly.

Commodity-based models receive socio-economic data as input and give as output commodity quantity flows that can be converted into truck flows by vehicle loading models. The input of truck-based models is the same as the first but it gives truck freight flows directly as output. Within the first and the second classes different types of models have been developed.

Commodity-based models can be further divided into multi-step models, similar to those used for passenger travel mobility (Ogden, 1992), input-output models by Harris and Liu (1998) and spatial equilibrium of the prices models by Oppenheim (1994).

Truck-based models are mainly multi-step models and use models developed for passenger assignment to obtain network flows. In Seville a process based on entropy maximization to estimate origin-destination matrices in trips for freight transport has been developed by Munuzuri et alii (2003).

In recent years other types of models have been developed to determine the optimal size and location, to analyse the effects and impacts of Urban Distribution Centers (Taniguchi et alii, 1999; Crainic et alii, 2004). This concept of logistics terminals (multi-company distribution centres) has been proposed in Japan to help alleviate traffic congestion, environment, energy and labour costs. These facilities allow more efficient logistic systems to be established and they facilitate the implementation of advanced information systems and cooperative freight systems. A national project on City Logistics developed in Italy aims to promote the development of Intelligent Transportation Systems, new technology vehicles with cleaner fuels and innovative policy measures (Graggani et alii, 2004). In Taniguchi et alii (1999), Castro et alii (1999) and Segalou et alii (2004), there are models to limit the impacts of commercial vehicle traffic. In Thompson and Taniguchi (1999), the traditional routing and scheduling methods are fitted to urban scale with constraints of time slots. This model, connected to a dynamic flow simulation model, was applied to evaluate the following three measures (Taniguchi and Van Der Euden, 2000): implementation of an advanced system of route programming, co-operative organisation of transport operators and optimal control of vehicle loading. Other papers focus on the effect of e-commerce and its effects on urban freight distribution (Visser et alii, 2001; Thompson et alii, 2001; Taniguchi and Kakimoto, 2003; Taniguchi and Hata, 2004; Stumm and Bollo, 2004).

In 2000 a review and summary of research in the fields of freight demand and shipper behaviour modelling were presented by Regan and Garrido (2000). The authors divide the models according to the nature of data required and geographical scope into aggregate, disaggregate, international, intercity (interregional) and urban.

In Italy some models for different aspects have been developed: *macro-economic models*, which simulate the level (quantity) and spatial distribution of goods traded between various zones and ultimately produce Origin-Destination matrixes; models that simulate *modal split* and *route choice* on representative transport service networks (Cascetta, 2001; see for a set of specific models reference note in Russo, 2005).

In particular two different segments of the chain from producers to end-consumers are investigated: end-consumer – wholesaler (Russo and Comi, 2005) and wholesaler – producer (Russo and Carteni, 2005). For a general review see Russo and Comi (2003b); some specifications are reported in the next section.

An international comparison of methods developed and results obtained in urban goods movements is made by Ambrosini and Routhier (2001). In the countries analyzed, it may be noted that the recent approaches are very diverse and sometimes experimental regarding the data and methods used. It emerges that issues and methods vary according to the countries concerned.

Urban freight tools

To manage and control urban freight transport, it is of great importance to have tools (DSS) to simulate the system. The main tools developed to support urban freight

planning are: Freturb© in France, GoodTrip© in the Netherlands and Wiver© in Germany.

The main element distinguishing the French approach is the aim to take into account all city management aspects and not only environmental problems. Since 1994, heavy goods vehicles traffic has been measured with driver surveys in towns and a national shippers survey has been conducted to describe the organisation of logistic chains but without reaching the final urban link. Three surveys (in the cities of Bordeaux, Dijon and Marseilles) enabled quantitative and qualitative information to be collected, which provided the basis for developing the systemic and analogical Freturb© model (Gerardin et alii, 2000, Patier and Routhier, 2003).

The French tool (Freturb©) allows us to obtain the number of vehicles used in each urban traffic zone for restocking shops and warehouses. The tool uses some statistic-descriptive models, it uses as inputs the socio-economic data on the urban area (number of establishments in the traffic zone and number of relative employees, disaggregated in 45 different freight types belonging to 8 main classes). The surveys to specify and calibrate the Freturb© models were carried out in many cities of France and for each type the number of movements effected per establishment and per week was estimated.

The tool is articulated in four steps and each permits specific indicators to be obtained (Routhier and Aubert, 1998): movement generations, estimation of parking time for loading and unloading, estimation of freight flows on the road, estimation of freight vehicle density and flows among traffic zones.

In the early 1990s in the Netherlands, the Ministry of Transport and Civil Engineering launched a national programme to fight pollution and traffic congestion in the urban centres and particularly supported research regarding the urban distribution centres. The main idea of the Dutch project is to reduce, at the same time, the number of commercial vehicles running and the number of kilometres travelled, while rationalising and optimising the rounds. In this context, the Goodtrip© DSS was conceived (Boerkamps and Van Binsbergen, 1999). It is a tool to evaluate different steps of urban freight distribution using geographical, economic and logistical data. It estimates goods flows, urban traffic and its impacts. Goodtrip© calculates the volume per goods type in m³ in every zone. It consists of four physical components of urban freight transportation: spatial organisation (it describes where people live and work, where facilities are located and where goods are produced and consumed), goods flows, traffic flows and (multi-modal) infrastructure. It starts by generating freight flows for different commodities from end-consumer demand and these freight flows are probabilistically linked to different distribution channels. It was applied in the city of Groningen to evaluate the impacts on the city of different freight distribution alternatives (Boerkamps and Van Binsbergen, 1999). It is not clear which models are used in the DSS.

Finally, the DSS Wiver© was developed in Germany. In the city of Berlin, Munich and Hamburg, with regard to urban freight transport, a large quantity of statistical data was collected and analysed to develop an oriented DSS for commercial traffic on roads for the purposes of city planning. It provides the basis for different scenarios and measures. The outputs can be differentiated by business sector, vehicle type and time of day (Sonntag and Tullius, 1998).

Wiver© is a simulation model that acknowledges the complexity of trip chains for commercial freight traffic. Wiver© differentiates between 10 business sectors and four vehicle types: passenger cars/station wagons, trucks up to 2.8 tons, trucks between 2.8 and 7.5 tons, trucks weighing more than 7.5 tons.

The input data result from land use data (zone-based data concerning jobs, work places and population) as well as surveyed data. The calculations permit zone-precise information to be obtained about origin and destination. The freight traffic matrices refer to the number of vehicles or the weight of freight. Results can be differentiated by business sector, vehicle type and time of day. To construct the Wiver© models many companies were surveyed. They represent different branches and for each investigation zone, the number of companies and employees per branch was identified.

As GoodTrip©, in the knowledge of authors, it is not evident which models are used. Indeed, only the steps to calculate commercial traffic and the method to combine the elementary trip into tours are described. This tool has been applied for many city traffic planning processes both in Germany and other European countries such as Italy (Rome and the Region of Lazio in 1997), and Spain (Meimbresse and Sonntag, 2000).

In 2003 the Wiver© approach was transferred by Lohse (Lohse, 2001; Boyce et alii, 2002) to a general framework backed up by a system theory and included in the software program Viseva© at the Technical University of Dresden (Friedrich et alii, 2003).

Other simulation tools, within the COST 321 project, have been developed and applied in a series of countries (COST 321). In Denmark the software GAMS (General Algebraic Modelling System) was developed. It calculates total energy consumption, emissions, transport costs and traffic accidents as a function of truck and van traffic at various road categories of the town. To simulate the effects of individual measures, the space-and-time-related desegregate traffic model VENUS was adopted. The latter determines the traffic volumes in a given area on the basis of structures present in each zone. In Italy the work was based on the use of HAPPYTRAILS, which is a suite of programmes dealing with traffic management. It also includes the search for minimum length paths and minimum cost paths. In Switzerland a model to simulate potential for a vehicle fleet transformation was selected, which deals with statistical data and specific surveys. It is called a simple effectiveness analysis model (EWN) and is divided into two parts: firstly the intrinsic characteristics of the city truck are researched; secondly, various determinant factors relating to the feasibility of the proposal are incorporated in the model.

Proposed modelling system

It emerges that the developed urban freight models are not integrated with other components of urban mobility and, in particular, they have no connection with measures implemented at urban scale and are not integrated with urban passenger models, which have been considerably developed (Cascetta, 2001). Indeed, urban freight models are useful to develop tools that allow the potential measures for implementation in urban areas to be assessed. Urban freight demand models appear to have been developed to simulate the restocking process (from warehouse to shop-retailer) and so they do not start from the end-consumer. Hence it is difficult to consider the connection between these urban models (developed for logistics movements) and end-consumer models (that are those developed for traditional passenger mobility) and to analyse the complexity of urban transport systems with all components that make up urban mobility.

A study was developed to link passenger mobility for purchases to retailer demand in urban areas. The study allows to estimate the freight sold in each urban shop (or in general urban business) starting from consumption demand (Russo and Comi, 2003a). Subsequently, the connection for restocking urban businesses was analysed and a specific model was proposed for connection between wholesalers and retailers (Russo and Comi, 2003b).

The urban transport system is a complex system in which freight is moved in the same transport system in which passengers travel.

Two main classes of freight movements can be identified schematically, called here in:

- *end-consumer*: end-consumer movements are those in which the freight is moved by the customer (private or business end-consumer) who purchases and consumes the freight (for example in this class of movement there is the freight movement effected by a generic purchaser who buys the freight in a shop and then transports it to a place where he will consume the goods);
- *logistics*: logistics movements are those movements in which the freight reaches the facilities where it is delivered to markets for producing other products (goods) or services (for example there is the movement of freight from the warehouse to the retail outlet). These movements allow shops and warehouses to be restocked.

Much has been written both on one side and the other, but there are no studies that consider the possibility of linking the two segments of freight mobility. In the same way for each of these two classes of movements a quantity can be defined. To analyse freight mobility in a general planning process that allows the two mobility segments to be connected could be useful as passenger and freight flows take place on a common, congestible network, which is also used for general travel. It is therefore important to remember that several decision-makers are involved in freight: as there are different actors, at each level there are different decision-makers that choose how the freight must be moved.

To overcome these limitations and to create a point of interaction between end-consumer quantities (ring or chain) and logistics quantities (supply-chain or tour-based), a modelling system is developed. Different functional relations can be identified in the chain that takes the freight from producers to end-consumers (Figure 1):

- the freight is moved from the zone of production or from the zone where the international commerce facilities are located (regional port, freight village, etc.) to the zone where it will be consumed by the end-consumer; in Figure 1 this movement is identified by the link from the white square to the black square;
- one contact point between producer and end-consumer exists in which the freight is transferred from the producer or international/national seller (white square) to the end-consumer (black square); this point is shown as a black circle in Figure 1; this last seller is usually called the retailer;
- there are one or more points in which to consolidate/deconsolidate loading between the firm or the international commerce facilities location and end-consumer; this point is shown as a white circle in Figure 1;
- under several trading patterns the black circle can coincide with

- the black square (this happens in the case of sale by correspondence, over the Internet, etc.);
- the white circle (this happens in the case of sale in a cash and carry, metro, etc.);
- the white square (this happens in the case of purchase in a factory, at a general market, etc.).

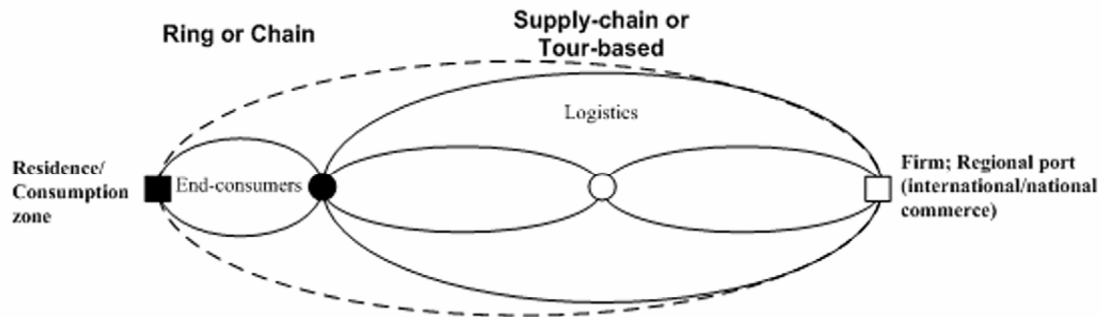


Figure 1: Functional relation between the end-consumer and logistics movements

Starting from this analysis a specific study was developed to define the main structure of a modelling system to analyze urban freight transport and logistics (Russo and Comi, 2003a, b).

In general, urban scale models may be developed, breaking them down into two levels:

- models that concern calculation of the demand by freight type, by $o-d$ consumption pair and $d-w/z$ restocking pair starting from socio-economic data;
- models that concern determination of the mode, service, time and vehicle used as well as the route chosen for restocking sales outlets. The freight transport multi-step model used concerns a medium-size city and considers a disaggregated approach for each decisional level.

First level

Attraction model. This model refers to end-consumer quantities and has as input general socio-economic data (residents, number of employees, etc.) and gives as output the freight quantity required by them (demand in freight quantity for each od pair).

The attraction macro-model consists of a set of elementary models that allows to calculate, as final output, the freight quantities (disaggregated by freight type) that are consumed in zone o , purchased and thus required in d . In this approach, defined as trip-based, the models allow the $o-d$ matrices in trips to be calculated, whether ring trip and chaining (Russo and Comi, 2003a).

Acquisition model (or large-scale distribution). This model concerns logistics trips. In the literature several types of models have been developed and different decision-makers can be considered for each choice level. This model receives as input the freight quantity needed in each traffic zone d by the retailer and analyses the restocking process

(demand in freight quantity for each $d-w$). The freight can arrive in zone d in several ways: from a warehouse inside the urban area (zone w , which may generally also coincide with d), from a warehouse outside the urban area, from the zone where the producer is located (zone z , which may generally be inside or outside the urban area).

In general, the acquisition model informs us from where the freight for restocking arrives. Using the previous models the quantities of freight required in each traffic zone, disaggregated in different types, are estimated.

The acquisition macro-model is thus composed by two different models:

- channel choice model, in which the probability of choosing a distribution channel to take freight of each type for each restocking zone is estimated. From the previous model (attraction model) the quantity is obtained. So with this model the freight quantity of each type that arrives in a zone using a defined channel of distribution can be estimated.
- stock model, in which the probability that a retailer takes the freight sold in his/her shop using a certain distribution channel and arriving from a zone inside or outside the study area can be calculated.

Second level

Models for the choice of service, quantity and/or vehicle type, time and path. These models are specific to the restocking process. The type of service performed (one-to-one, one-to-many, many-to-many, many-to-one) can be obtained by means of a logistics model (Daganzo, 1991) The models receive as input the demand in quantity for origin/destination (demand in freight quantity for each $d-w$) and give as output the vehicles and path used, and can be both static and dynamic (demand in vehicles, service and time in each w). The choice of vehicle can be analysed using models that treat the choice of vehicle jointly with shipment size or otherwise (McFadden et alii, 1986; Abdelwahab, 1998; Holguin-Veras, 2002). A model that allows simulation of freight distribution when the journeys connect several businesses in different locations using a tour-based approach is given by Russo and Carteni (2004). Several models can be used to evaluate the probability of choosing each path, considering within them the existence of a supply chain.

Some of the model outputs recalled are the flows of passengers travelling for purchases and the flows of suppliers who restock shops inside the urban area. These flows are divided by freight and vehicle type and allow us to estimate with the above models the environmental impacts on each link of the urban network.

Conclusions

To manage and control urban freight transport it is very important to have models and tools to simulate the system. Indeed, urban freight models are useful to develop tools that allow us to assess the potential measures to be implemented in an urban area.

To analyse freight mobility in a planning process a general model that allows joint treatment of passenger and freight mobility is desirable as passenger and freight flows take place on a common, congestible network, which is also used for general travel.

In this paper the different models, measures and tools developed at urban scale to simulate urban freight demand are reviewed. The paper proposes a modelling system that allows us to link freight and passenger mobility and some of the outputs can be useful to estimate the impacts of urban goods movements.

References

- Abdelwahab, W. M. (1998) "Elasticities of Mode Choice Probabilities and Market Elasticities of Demand: Evidence from a Simultaneous Mode Choice/Shipment Size Freight Transport Models", *Transportation Research Part E: Logistics & Transportation Review* Vol. 34 (4).
- Allen, G., Tanner, G., Browne, M., Anderson, S., Christodoulou, G. and Jones, P. (2003) *Modelling policy measures and company initiatives for sustainable urban distribution*, Transport Studies Group, University of Westminster, <http://www.wmin.ac.uk/transport/>
- Ambrosini, C. and Routhier, J. (2001) Objectives, methods and results of surveys carried out in the field of urban freight transport: an international comparison. In: *Proceedings of 9th World Conference on Transport Research*, Seoul.
- BESTUFS (2000-2004) *Best Urban Freight Solutions*, www.bestufs.org.
- Boerkamps, J. and Van Binsbergen, A. (1999) "GoodTrip – A new approach for modelling and evaluation of urban goods distribution", In: *City Logistics* eds E. Taniguchi and R. G. Thompson, Institute of Systems Science Research, Japan.
- Boyce, D., Lohse, D., Nöth, F. (2002) "Comparison of two combined models of urban travel choices: Chicago and Dresden", In: *Proceedings of 42 Congress of the European Regional Science Association* at the University of Dortmund, Dortmund Germany.
- Cascetta, E. (2001) *Transportation Systems Engineering: Theory and Methods*, Kluwer Academic Press.
- Castro, J. T., Kuse, H. and Kubo (1999) "Study of Location planning of distribution facilities", In: *Proceedings of 1st International Conference on City Logistics*, Cairns, Australia.
- City Freight (2005) *City Freight Project Report*, www.cityfreight.org
- City Ports (2005) *City Ports Project Interim Report*, www.cityports.org.
- COST 321 (1998) *Urban Goods Transport*, Final report of the action, Brussels, 1998.
- Crainic, T. G., Ricciardi, N. and Storchi, G. (2004) "Advanced freight transportation systems for congested urban areas", *Transportation Research Part C 12*, Elsevier Science.
- Daganzo, C. (1991) *Logistics Systems Analysis*, Springer-Verlag.
- Egger, D. and Ruesch, M. (2003) *Best Practice Handbook Year 3*, Project funded by the European Community under the 'Competitive and Sustainable Growth' Programme, www.bestufs.net.
- Egger, D., Glücker, C. and Ruesch, M. (2001) *Best Practice Handbook 2*, Project funded by the European Community under the 'Competitive and Sustainable Growth' Programme, www.bestufs.net.
- Fridstrom, L. (1998) *A stated preference analysis of wholesalers' freight choice*, Institute of Transport Economics, Norwegian Centre for Transport Research, Working paper of June.
- Friedrich, M., Haupt, T. and Nökel K. (2003) Freight Modelling: Data Issues, Survey Methods, Demand and Network Models. In: *Proceedings of 10th International Conference on Travel Behaviour Research, Moving through nets: The physical and social dimensions of travel*, Lucerne.
- Gerardin, B., Patier, D., Routhier, J. L. and Segalou, E. (2000) *Diagnostic du Transport de Marchandises dans une agglomération*. Programme National Marchandises en Ville, www.transports-marchandises-en-ville.org.
- Gorys, J. and Hausmanis, I. (1999) "A strategic overview of goods movement in the Great Toronto Area", *Transportation Quarterly* 53 (2).
- Gragani, S., Valenti, G. and Valentini, M. P. (2004) "City logistics in Italy: a national project", In: *Logistics systems for sustainable cities* eds E. Taniguchi and R. G. Thompson, Elsevier.
- Harris, R. I. and Liu, A. (1998) Input-output modelling of the urban and regional economy: the importance of external trade. *Regional Studies*, 32 (9).
- He, S. and Crainic, T. G. (1998) "Freight transportation in congested urban areas: issues and methodologies", In: *Proceedings 8th World Conference on Transport Research*, Antwerp, Belgium.

- Holguín-Veras, J. (2002) "Revealed Preference Analysis of the Commercial Vehicle Choice Process", In: *Journal of Transportation Engineering*, Vol. 128 (4), American Society of Civil Engineers.
- Houlgium-Veras, J. and Thorson, E. (2000) "An investigation of the relationships between the trip length distributions in commodity-based and trip-based freight demand modelling", In: *Proceedings of 79th Transportation Research Record*, Washington, USA.
- Hutchinson, B. G. (1974) *Principles of urban transport systems planning*. McGraw-Hill.
- List, G. F. and Turnquist, M. A. (1994) "Estimating truck travel patterns in urban areas", In: *Transportation Research Record*, 1430.
- Lohse, D. (2001) "Verkehrsnachfragemodellierung mit n-linearen Gleichungssystemen", In: *Proceedings of 1st. AMUS Conference*, Schriftenreihe Stadt Region Land, Heft 71, Institut für Stadtbauwesen RWTH Aachen.
- McFadden, D., Winston, C. and Boersch-Supan, A. (1986) "Joint Estimation of Freight Transportation Decisions Under Non-random Sampling", In: *Analytical Studies in Transport Economics*, edited by A. Daugherty (Cambridge University Press).
- Meimbresse, B. and Sonntag, H. (2000) "Modelling urban commercial traffic with the model Wiver", In: *Proceedings of Jacques Cartier Conference*, Montreal.
- Munzuri, J., Larraneta, J., Onieva, L. and Cortes, P. (2004) "Estimation of an origin-destination matrix for urban freight transport. Application to the city of Seville", In: *Logistics systems for sustainable cities* eds. E. Taniguchi and R. G. Thompson, Elsevier.
- Ogden, K. W. (1992) *Urban Goods Movement*, Ashgate, Hants, England.
- Oppenheim, N. (1994) *Urban Travel Demand Modeling*, John Wiley & Son, New York.
- Ortuzar, J. de D. and Willumsen, L. G. (1994) *Modelling Transport*, J. Wiley & Sons.
- Patier, D. and Routhier, J. L. (2003) "Les apports des outils statistiques et de modélisation", In: *Proceedings of Colloque logistique urbaine: Les enjeux économiques juridiques et organisationnels*, Toulouse.
- REFORM (1999) *Research on freight platforms and freight organisation*, Office for Official Publication of the European Communities, Luxembourg, <http://eur-op.eu.int>.
- Regan, A. C. and Garrido, R. A. (2000) "Modeling Freight Demand and Shipper Behaviour: State of the Art, Future Directions", In: *Preprints of IATBR*, Sydney.
- Routhier, J. L. and Aubert, P. L. (1998) "Freturb: un modele de simulation des transports de marchandises en ville", In: *Proceedings 8th World Conference on Transport Research*, Antwerp, Belgium.
- Ruesh, M. and Glucker, C. (2000) *Best Practice Handbook 1*, Project funded by the European Community under the 'Competitive and Sustainable Growth' Programme, www.bestufs.net.
- Russo, F. and Carteni, A. (2004) "A tour-based model for the simulation of freight distribution" In: *Proceedings of European Transport Conference - PTRC 2004*, Strasbourg (France).
- Russo, F. (2005) *Sistemi di trasporto merci - approcci quantitativi per il supporto alle decisioni di pianificazione strategica tattica ed operativa a scala nazionale*. Franco Angeli, Milan.
- Russo, F. and Carteni, A. (2005) "Application of a tour-based model to simulate freight distribution in a large urbanized area", In: *Preprints of 4th City Logistics Conference*, Langkawi, Malaysia.
- Russo, F. and Comi, A. (2003a) "Urban freight movements: quantity attraction and distribution models", In: *Sustainable Planning & Development* eds E. Beriatos, C. A. Brebbia, H. Coccossis and A. Kungolos, WIT Press.
- Russo, F. and Comi, A. (2003b) "Urban freight transport and logistics: an acquisition model", In: *Proceedings of European Transport Conference - PTRC 2003*, Strasbourg (France).
- Russo, F. and Comi, A. (2005) "Demand models for city logistics: a state of the art and a proposed integrated system", In: *Preprints of 4th City Logistics Conference*, Langkawi, Malaysia.
- Segalou, E., Ambrosini, C. and Routhier, J. L. (2004) "The environmental assessment of urban goods movement", In: *Logistics systems for sustainable cities* eds. E. Taniguchi and R. G. Thompson, Elsevier, 2004.
- Sonntag, H. and Tullius K. (1998) "Reform: research on freight platforms and freight organisation", In: *Proceedings 8th World Conference on Transport Research*, Antwerp, Belgium.
- Stumm, M. and Bollo, D. (2004) "E-commerce and end delivery issues", In: *Logistics systems for sustainable cities* eds. E. Taniguchi and R. G. Thompson, Elsevier.
- Taniguchi, E. and Hata, K. (2004) "An evaluation methodology for urban freight policy measures with effects of e-commerce", In: *Proceedings 10th World Conference on Transport Research*, Istanbul, Turkey.
- Taniguchi, E. and Kakimoto, T. (2003) "Effects of e-commerce on urban distribution and the environment", *Journal of Eastern Asia Society for Transportation Studies*.

- Taniguchi, E. and Van Der Euden, R.E.C.M. (2000) "An evaluation methodology for city logistics", *Transportation Reviews*, 20 (1).
- Taniguchi, E., Noritake, M., Yamada, T. and Izumitani, T. (1999) "Optimal size and location planning of public logistics terminals", *Transportation Research Part E* 35, Pergamon.
- Taniguchi, E., Thompson, R. G., Yamada, T. and van Duin, R. (2001) *City Logistics*, Pergamon.
- Taylor, S. Y. (1997) "A Basis for Understanding Urban Freight and Commercial Vehicle Travel", *ARRB Transport Research Report*, ARR300.
- Thompson, R. and Taniguchi, E. (1999) "Routing of Commercial Vehicles Using Stochastic Programming", In: *Proceedings of 1st International Conference on City Logistics*, Cairns, Australia.
- Thompson, R. G., Chiang, C. and Jeevapatsa, M. (2001) "Modelling the effects of e-commerce", In *City logistics II* eds. E. Taniguchi and R. G. Thompson, Japan, Kyoto.
- Visser, J., Nemoto, T., and Boerkamps, J. (2001) "E-commerce and city logistics", In: *City logistics II* eds. E. Taniguchi and R. G. Thompson, Japan, Kyoto.
- Wild, D. (2003) The BESTUFS project. In *Proceedings of 4th BESTUFS Conference*, Praha, Czech Republic.



Modelling goods city distribution in the Netherlands

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Abstract

The interest in data collection and modeling of urban freight transport is rising. This paper describes a recently developed method for data collection, analysis and modeling that has been applied in several Dutch cities. By treating urban freight transport in an integral way, important relations between transport demand, traffic, economic-, social- and environmental variables are uncovered. The paper is interesting for local policy-makers and researchers in the field, by improving their understanding about urban freight transport and its specific research requirements.

Keywords: Urban freight transport; Data collection; Modelling; The Netherlands.

Introduction

Urban freight transport is “the delivery of consumer goods (not only by retail, but also by other sectors such as manufacturing) in city and suburban areas, including the reverse flow of used goods in terms of clean waste” (OECD, 2003). Optimization of urban freight transport is a key issue in city logistics. City logistics has been defined as (Taniguchi et al., 2004, p. 1) “the process of totally optimizing the logistics and transport activities by private companies in urban areas while considering the traffic environment, the traffic congestion and energy consumption within the framework of a market economy”.

For delivery and pick-up in urban areas either trucks, vans or passenger cars are used. In rare cases small vessels or trains are used. In most cities, there is hardly any local manufacturing or warehousing of goods, which means that freight has to be transported over considerable distances.

Urban freight transport contributes to the economic functioning of a city. It also creates externalities, like congestion, noise and hazardous situations. These problems

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and issues and the multitude of actors, users and non-users with their different opinions and interests make urban freight movement “enormously complex and heterogeneous” (Ogden, 1992). This leads to the following questions:

- What problems are caused or engrained by urban freight transport?
- Why do these problems continue?
- Who could or should solve or reduce these problems and under what conditions?
- Which options are likely to work?
- What are the costs and benefits of solving the problems?

These are very relevant questions, because in many cities there is a controversy about the impact of urban freight transport on the city between key actors like public policy makers, transport operators, receivers and citizens. This controversy has many causes. Apart from miscommunication between the parties involved, there are diverging interests and, a problem that is the theme of this paper, the lack of empirical information about urban freight transport. It may be assumed that the definition and solution of (perceived) problems can be carried out more efficiently with data of sufficient quality. By addressing the importance of data, the role of research into urban freight transport comes at the agenda. In general, three research approaches can be distinguished:

- policy-oriented/qualitative research;
- empirical research;
- modeling/simulation-oriented research.

This paper is about the second and last approach. It elaborates the results of a Dutch empirical study (TLN et al., 2003a), aiming at developing the method to collect, process and analyze data about goods delivery in selected Dutch cities. Part of this approach was to develop an analytical model, which could be used for quantitative analysis of the collected data.

The empirical study is one of the more recent initiatives in this area, initiated inter alia by OECD and EU. Both organizations stimulate practical applications in member countries. By considering best practices, member countries gain ideas about improving urban freight transport. The Bestuufs thematic network fits in this scheme. It has been set up to develop “European-wide approaches to common problems and issues surrounding urban freight transport within metropolitan cities in the European Community.” (Mortimer et al., 2004, p. 4). In the Netherlands, the Forum for Physical Distribution in Urban Areas (PSD) fulfills a similar role. The PSD initiated the background study, together with the Dutch organization of freight transport suppliers (TLN), and local governments of Amsterdam, Rotterdam and Utrecht. Connekt B.V., a so-called knowledge transfer organization and these local governments commissioned the background study.

The structure of the paper is as follows. In section 2 urban freight transport and its main problems are discussed. Section 3 deals with methodological issues encountered during the development of a methodology to support decision makers in urban goods transport. In section 4 an application of the methodology is presented. In section 5 main lessons about past research are presented. Finally section 6 ends the paper with conclusions and recommendations for future research.

Systems and problems

Introduction

Cities are concentrations of interacting human activities. In historic inner cities the road network is usually not compatible with the demands of modern (freight) transport, but also in other parts of a city problems may exist due to other reasons. During driving, parking and (un)loading, urban freight transport vehicles compete for space with private cars, pedestrians and bikers. Gridlocks occur, causing delays and increased air pollution. Government regulation with respect to vehicle dimensions and weight, and delivery time windows increase the logistic requirements, which are already considerable. Table 1 provides an overview of logistics requirements and their implications in cities.

Table 1: Logistics requirements and their implications.

| <i>Logistics requirements</i> | <i>Implications for the city and urban freight transport</i> |
|---|---|
| Chain reversal (order-driven instead of supply-oriented logistics) and efficient customer response (ECR), moving stocks upstream the distribution chain High order frequency, small drop sizes | Short lead times More deliveries for the same transport volume, higher distribution costs |
| Delivery before staff arrives Just-in-time delivery | Delivery is later than optimal for driver Minimal stocks, delivery certainty is more important than higher transport costs |
| Restrictions on vehicle size, axle weight Many receivers (shops) Delivery time windows | Cooperation between partners in the chain is crucial More, but smaller vehicles, more, multi-drop (round) trips, more traffic, lower loading factor More stress on drivers (higher chance of accidents) More stress on the environment (Ultimately) receivers leaving the (inner)city |

Source: De Jong et al., 2002, adapted.

Research into urban freight transport

Compared to the number of studies into passenger transport, there are not so many studies into freight transport. This holds even more for urban freight transport. In 1983 ECMT published its first major study about it. In the same period, the first academic studies arrived, most notably the one by Button et al. (1981), a concise overview of urban freight transport from an economic perspective. Ogden (1992) is a well-cited study from the early nineties, discussing many aspects of urban freight transport. Yet, he still concluded that research has a poor theoretical basis, primitive analytical framework and very little data to develop and calibrate models.

Although our intention is not to present a state-of-the-art of the field, nor to comment extensively on the work of other researchers, some statements can be made after reading the literature. In some cases, more general (non-urban or even non-spatial) theories and empirical evidence about freight transport is transferred to cities. In other cases, freight transport is modeled as a residue of passenger transport or even treated as if it were comparable to passenger transport. This is not correct, because passenger and freight transport are markedly different. A structural difference is that freight does not move itself, which explains the role of logistics and the complexity of the transport chain with

many actors and diverging interests. An example is the difference between trip planning in both cases. "Truck trips in urban areas are chained together in tours comprised of multiple delivery, pickup and mixed pick-up and delivery trips. The degree of trip chaining is so high compared to that encountered in urban passenger travel that it warrants special consideration in modeling." (Slavin, 1998, p. 2) A second major difference is the difference between trucks and passenger cars in terms of size and trip operating characteristics, while a third difference is that the number of trucks and truck trips differs considerably between location and industry (Slavin, *ibid*).

In more recent years, many case studies and various modeling and simulation studies were carried out, a development that was also stimulated by the international Institute for City Logistics (founded in 1998). Despite these efforts, OECD (2003) mentions the need for more research, especially into evaluation methods and data collection, because only in a few member countries reliable data about urban freight transport are available.

The aim of the paper is to present a method for collecting, analyzing and presenting relationships between key variables about urban freight transport that has been applied in several Dutch cities.

Methodological aspects

The method

In 2002 Connekt B.V. commissioned a study with a two-fold aim. First, to optimize a previously developed (PSD et al., 2002) method of collecting data about urban freight transport. Next, the method was applied on data about shopping centers in the inner city of Amsterdam, Rotterdam and Utrecht (TLN et al., 2003b). This led to so-called delivery profiles for specific shopping areas¹ in these cities. A second aim was to develop a model for explaining relations between key variables in urban freight transport in these cities. The global steps to develop the latter model can be summarized as:

- define the aims of the model;
- select urban freight transport issues that should be dealt with in the model;
- translate these issues into model variables;
- define relations between variables;
- develop a quantitative model.

Initial plan for a model

The idea behind the model was as follows. By building a model, a relatively simple and general applicable tool would become available. The model should be capable of dealing with data about accessibility, local economic situation (potential), discomfort (air pollution etc.), safety and overall delivery quality in shopping centers in

¹ In the USA (Niles, 2003) a study was carried out for a wider region, describing inter- and intra urban goods transport.

(inner)cities. For each of these themes a set of variables was defined. A set of questionnaires was developed, which would be used to survey delivery vehicle drivers, goods receivers, people living in the selected shopping areas, and local government officials. These data would be put into a database. Using statistical analysis, causalities between the data in the database could then be determined. These causality parameters (coefficients in the causal model) would then represent a set of reference parameters. This assumes that the data are representative for the cases and sufficiently reliable. For new cases, the approach could then be restricted to collecting a few vital metadata, mostly related with classification (e.g., about the city size and its structure or different policy regimes). Next, these metadata should be put into a spreadsheet model (to be developed), which would determine the ‘performance’ of the shopping area (benchmarking). By varying the input parameters, sensitivity analyses can be carried out. By using standardized coefficients in the model, there is no need to carry out a new case study for every additional city. Hence, the method is also supposed to save research time and cost.

Major results from the data collection and analysis

Data were collected during the surveys, even in areas known to be difficult (Meyer et al., 2001), such as deliveries per branch of industry and commodity, vehicles, O-D pairs and route choice. A so-called delivery profile was developed (see Table 2). The profile could eventually be compared with profiles of other urban shopping areas of comparable size and (spatial, economic) structure.

The dataset also enables certain estimations. For instance, the number of delivery trips is the number of deliveries per week divided by the average number of stops per (round) trip. This gives an indication of weekly freight traffic in the area. Similar estimations can be made for days of the week or periods of the day.

However, the dataset turned out to have serious flaws. Three of them will be discussed, namely variance in outcomes per variable, (useable) sample size and data from local governments. The most common way to determine variance around a mean is by calculating variance or standard deviation. The latter turned out to be very large (much larger than the mean), which prevents making statistically valid statements about many variables or about the relations between them.

A second problem has to do with the response rates. They varied between 3 and 9 % for receivers ², nearly 100% for drivers (on street) and less than 0.1% for inhabitants. The low scores for 2 out of 3 user categories mean that the answers should be dealt with in a careful way. Another problem was that many questionnaires were not completely filled in or contained ‘surprising’ answers, hence could not be used to analyze all questions.

One likely cause of these statistical ‘problems’ was most likely outsourcing of data collection. Another is a routing error in the questionnaire, despite the fact that the questionnaires were tested. The last problem relates to data obtained from local governments. They may provide data about traffic/infrastructure, economic situation and environment. In practice the officials contacted had very little or no freight traffic data, because traffic counts make no distinction between cars and other motorized

² Range of averages for all branches of industry. There were substantial differences between branches of industry, e.g., in Amsterdam between > 80% for super markets to 1% for other business.

vehicles. This is an indication of a commonly found aggregation problem (Meyer et al., *ibid*) or collection of information on an ad hoc basis. ITS is not relevant as a source of information either.

Table 2: Delivery profile for Utrecht inner city (summary).

| <i>Policy issue</i> | <i>Details</i> |
|--------------------------------------|---|
| Economic vitality and attractiveness | <ul style="list-style-type: none"> The more than 3000 firms generate 21000 deliveries or 9000 m³ of freight per week Average dwell time is 23 years ¹⁾ 79% of the inhabitants rates the shopping climate as 'good' |
| Traffic safety | <ul style="list-style-type: none"> 48% of the inhabitants is satisfied with the level of traffic safety There were no deadly accidents between 1999-2001 ¹⁾ Freight vehicles were involved in 27% of all accidents, on the ring road this was 18%. In nearly all cases there was only material damage |
| Liveability | <ul style="list-style-type: none"> More then 50% of the inhabitants rates the living climate as good Most of the hindrance related with delivery is due to noise (36% of the inhabitants) and vibration (15%, idem) |
| Accessibility | <ul style="list-style-type: none"> Accessibility of the city centre is regarded as 'good' by about one third of all people, inhabitants experience less, and receivers and freight vehicle drivers mention much more problems It takes about 21 minutes to drive from the main road (city ring) to the inner city, average stay time is about 2.5 hours |
| Quality of delivery | <ul style="list-style-type: none"> In about 65 % of all cases small vehicles are used Delivery is evenly spread over the week About 75% takes place in the morning and 25% in the afternoon Accessibility of the area is regarded to be good and bad, the latter is due to the segmentation of the inner city (no direct connections ²⁾). The locations for delivery and pickup and the transport distance from there are regarded as 'good' |

Source: TLN et al., 2003b.

Notes:

1) Most recent data;

2) Nowadays, freight vehicles are allowed to pass, which improves accessibility.

There are nevertheless some exceptions. For instance Utrecht developed a dedicated policy note, partially based on our findings, while Amsterdam also has dedicated instruments for urban goods transport, partially based on experience and partially based on the (political) decision to ban or reduce motorized traffic in certain streets or areas. Agencies in the different city quarters can have their own policies, however.

Economic data has to come from other departments than the one dealing with traffic and transportation, which is not always easy. Environmental data is usually available, but also as aggregate data for all kinds of traffic.

These data issues led to the conclusion that building a quantitative model was not feasible with these data. Instead, attention was given to building a qualitative model. This model would be used to build a spreadsheet model.

Qualitative approach

The steps to build a qualitative model are comparable to the ones for a quantitative model (see section 3.1), except for the last step. The aim was to develop a conceptual model for urban goods delivery and pickup. It should be used to identify and explain

(causal) relations between variables. The model should enable explanatory analysis in a non-numerical, yet formal way. It should also support exploration of policy alternatives, e.g., in what-if form.

Choice of variables

The first step in developing the model was to determine which variables should be incorporated in the model. A brainstorm session with Dutch experts in the field was used to choose relevant policy themes, then topics within these themes and next aspects within the topics. Finally aspects were translated into (measurable) variables, called indicator variables, because they can be used to determine whether there is a problem and its seriousness (in relation to other variables).

Table 3 gives an example for accessibility. It becomes apparent that many different variables may be relevant in the analysis.

Table 3: Variables connected with accessibility.

| <i>Policy theme</i> | <i>Topic</i> | <i>Aspect</i> | <i>Indicator variable</i> | |
|---------------------|--------------|--------------------------|-------------------------------------|---------------------|
| Accessibility | Flow | Trajectory speed | Average speed | |
| | | Reliability | Visits per time period | |
| | | I/C | I/C in kms | |
| | | Stay time | Hours in the city | |
| | | Travel time | Minutes from the city's edge | |
| | | | Road structure in the shopping area | |
| | Valuation | Available infrastructure | | |
| | | By relevant actors | Individual perception | |
| | Policy | | | Measurement |
| | | Traffic | | Restrictions |
| | | Parking | | Ease |
| | | Vehicle | | Impact on logistics |

Source: TLN et al., 2003a.

A similar table can be made for discomfort, traffic safety etc. The paper discusses accessibility only.

Defining relations between variables

A way to define relations between variables would be to use a theory that relates these and other aspects of urban freight transport. Such a theory does not exist in practice, however. Instead there is transport-economic theory, logistic models, urban development theories etc. Merging them is complex especially because of the wide range of disciplines involved.

A more practical approach is needed to link these areas. There are examples of such approaches in the Netherlands. We will mention two more recent academic studies briefly, starting with the so-called Citymodel ('Stedenmodel'; Weiss, 2001), followed by the 'GoodTrip' model (Boerkamps, 1998).

The aim of the 'Stedenmodel' is to describe urban freight transport based on a set of determining factors (22 aspects of infrastructure, including accessibility and space for freight transport, economy, discomfort and perception of these). With the instrument, one may compare various local delivery situations and classify them. Because data (and

especially economic data) are in many cases not available, the model cannot be used for precise calculations. Instead rules of thumbs and best guesses are used. For instance, by dividing (estimated) demand for goods (in m³) by average truck capacity (in m³) times load factor (%), the frequency of truck movements (trips) per time period can be estimated. The author regards his work as a theory, but it is actually a partial model of urban freight transport. The author mentions the need for more research into the discomfort related with urban freight transport, and collection of data.

GoodTrip is a computer model, which was developed to generate data about logistic quality (load factor, number of trips etc.) and so-called external quality (pick-up and delivery trips, traffic intensity, emissions etc.) of urban freight transport. The model links economic, logistic, traffic and transport and environmental data with one another, using a so-called logistic chain of urban freight transport. Also in this case, available (disaggregate) data appears as a problem. The model was used to compare alternative urban freight transport concepts in environmental and amenity terms in a qualitative way. According to the author, pick-up and delivery of goods in urban areas can be so diverse and complex that a typology in terms of trips, load factors, delivery frequency cannot be given, especially not in dynamic and quantitative terms. Instead, a static approach was used. This means that space and time (windows) play no role, enabling straightforward modeling.

Comparing these two studies, it becomes apparent, that in both cases availability and quality of data is a restricting factor for model building, and more general, analysis and explanation of urban freight transport.

The approach followed in this paper is to some extent comparable to the one used for the GoodTrip model. Data are collected for a short period of time and spatial dynamics does not play a role. Relations between causal and effect variables are established using logic and data. Such logic is a step towards a more general model. The logic was tested during expert meetings. First, examples of the logic are given, followed by a graphical presentation of the relations between causal and effect variables, using a so-called relation diagram.

The case of accessibility

In the literature there are many definitions of accessibility. For practical purposes we will define accessibility as the ease with which a delivery vehicle can reach a location to pick-up or deliver goods.

Assessing accessibility is far from easy, because one has to relate available data and models with surveys of individuals, whose perception and personal objectives bias their view of the issue.

Our approach distinguishes three layers of accessibility: system, external influences and local situation (related with driving, pick-up and delivery). We will briefly discuss one of these layers, the system layer, presented in Figure 1. In the given diagram the relations between economics, space, infrastructure and goods movement are visualized. Such relations can be one- or bidirectional (arrow with two heads) and the relations between variables or groups of variables can be reciprocal (negative sign), neutral, positive or uncertain (-/+ sign). Uncertainty arises in many to many or one to many relations. They contain a mix of relations. Relations are defined based on likelihood, no

indication is or can be given about the strength of these relations. As far as we know, there is no literature in these areas, which could deliver this kind of information. Instead we relied on expert opinions.

Description of the prospective relations

Figure 1 may be regarded as a model of the city or area. A city may be defined in terms of space, economics and transport and traffic, which are internal factors to the model. External factors are regulation with respect to vehicles, infrastructure and economics R_t (Veh), R_t (Inf), R_t (econ) and externalities or impacts like discomfort, traffic safety etc.

In the upper left corner of Figure 1 a relation between the city (or area) typology and the economic typology is shown. The layout of a shopping area consists of branch distribution, shop type and number of shops³. Infrastructure is also part of the layout, but because of technical reasons it is treated separately.

In the middle part the number of shoppers determines sales per receiver and the layout of the shopping area. But, the layout of the area also determines the number of shoppers, because a shopping area with an unattractive layout will have a lower number of visitors than a more attractive area. Economic typology is also partially determined by government regulation R_t (econ). A local government may for instance influence branch composition by not allowing a concentration of certain shop types. Economic typology determines freight volume, e.g. in general more receivers mean a higher freight volume. The variable Branch is important here, because a concentration of a few supermarkets may generate much more transport than many small shops along a street. Some shopping streets also house many non-daily goods suppliers or services, which generate less or no demand for freight. Hence, the -/+ sign points out the uncertainty surrounding branch composition.

Freight volume Vol_{fr} and freight traffic intensity I_{fr} are related via a filter called logistic organization, appearing to be a complex issue. On the one hand, there are external demands, like those from receivers with respect to time and space for delivery or type of goods. Even within branches of industry logistic formulas may show (large) differences. There is also an important external force, government regulation R_t (Veh), which co-determines logistic processes.

Non-shopping traffic I_{other} , shopping-related traffic T_{rsh} and I_{fr} determine overall traffic intensity I_{tot} , which divided by infrastructure capacity Cap determines accessibility for freight Acc_{fr} and leads to externalities for people and environment.

The right part of figure 1 contains two feedback links. First, there is a link between accessibility and economic typology. The logic is that a more accessible area is more attractive for shoppers and because of that provides a more profitable and lasting environment for business. The other feedback link shows the relation between accessibility and logistic organization. The use of external links (gray boxes) helps to reduce complexity. In subsequent sheets these externalities and impacts were described and analyzed.

³ Other goods receivers, like service providers are excluded, because they are usually irrelevant in terms of freight volume. Their passenger traffic may however substantially contribute to inaccessibility and negative externalities.

In Figure 1 three main groups of variables can be distinguished: physical conditions, economic performance and (local) regulation. These categories will also be used in the spreadsheet model of the next section.

A spreadsheet model

Aims and applications

The aims of the model are the following:

1. Indicative assessment: what is the quality of delivery in a particular shopping area? In this case the user has only access to the input module;
2. Factor analysis: which factors influence the quality of delivery in a particular shopping area?
3. Sensivity analysis: What happens if the characteristics of the study area (e.g., regulation) or technical parameters change? The user can vary the characteristics of the study area and the technical parameters.

At present, only the first aim is partially achieved.

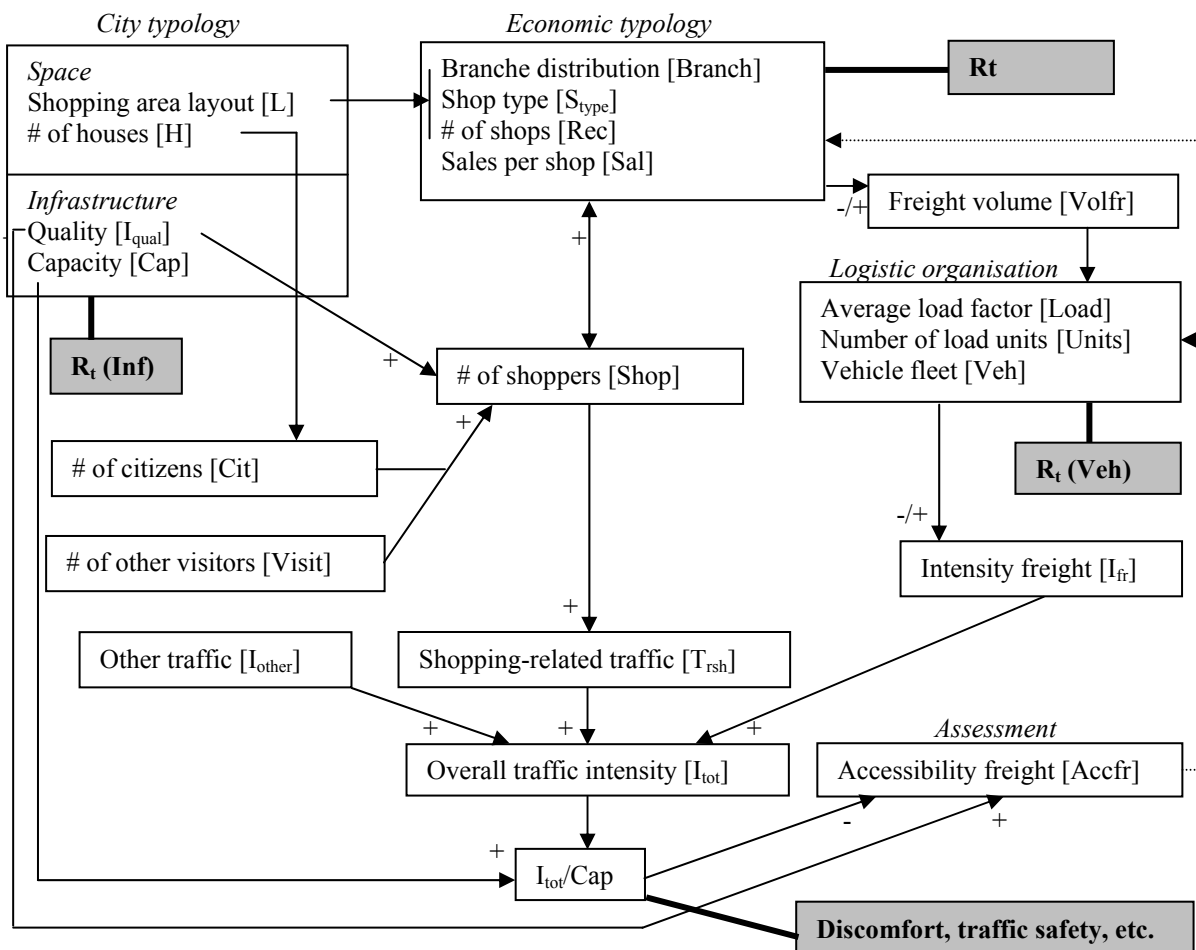


Figure 1: Relation diagram for accessibility. Source: TLN et al., 2003a, adapted.

Application of the model

The model was built using rules of thumb and logic partially derived from the experience with relation diagrams. It has three modules: input, parameters and output. We will describe the way the model can be used in practice. The input module is used to fill the model with values. It consists of three parts: economic data, city data and applicable regulation. Table 4 shows a simplified version of this module.

Table 4: Input module for accessibility for a city.

| <i>Characteristics</i> | <i>Variables</i> | <i>Value range</i> | <i>Average</i> | <i>Reference values</i> |
|-------------------------------|---|--------------------------------|--------------------------------|--------------------------------|
| Economic data | Size of shopping area in m ³ | 100.000-250.000 | 180.000 | 175.000 |
| | Main branches of industry | Retail, services | Retail | Retail |
| | Supplier type | Standard | Standard | Standard |
| | Deliveries per round trip | 5-15 | 10 | 12 |
| | Opening hours | 9.30-13.00 | 10.00 | 10:00 |
| | Storage space | 10-300 m ³ | 150 m ³ | 200 m ³ |
| | City data | Number of unloading areas | 5-10 | 8 |
| Width of road | | 6-8 meters | 7 meters | 8 meters |
| Interference with other users | | 4-8 'spots' | 6 'spots' | 2-4 'spots' |
| Distance from receiver | | 15-50 meters | 25 meters | 15 meters |
| Regulation data | Vehicle length | Limited to 12 meters | Limited to 12 meters | Limited to 12 meters |
| | Physical barriers | 4 | 6 | 5 |
| | Time windows | Delivery only in morning hours | Delivery only in morning hours | Delivery only in morning hours |

As can be seen, demand and supply variables are contained, as follows:

- demand in terms of transport volumes, modal choice, timing and frequency;
- supply in terms of accessibility, vehicle regulation, traffic policy and access policy.

The values in the third column of Table 4 are not from life, they are used for presentation only. The input module used to compare area data with reference data (averages from other locations) indicated that some values differ substantially from the reference values. This is logical, because no two shopping areas will be the same.

Table 5 shows part of the logic of the spreadsheet model.

Table 5: Relations in the input module of the model.

| | <i>Influence on</i> |
|--------------------|--|
| Economic variables | Transport volume Delivery frequency Vehicle choice Timing of delivery |
| Local policy | Vehicle requirements Traffic policy Access |

Finally, the model gives an indication of the consequences of using light or heavy vehicles (larger than 12 tons) for the delivery area. Heavy and long vehicles are frequently banned from inner cities. The question is whether this is always justified. If vehicle length and weight restrictions are in power, transport companies have to use smaller and lighter trucks or vans. In this situation, for a given transport volume more vehicles are needed, hence traffic intensity will increase. Accessibility may be reduced if traffic intensity increases, but smaller vehicles are easier to use in 'restricted areas', which may dampen the reduction of accessibility. The impact of different vehicle sizes on the environment cannot be determined easily, because too many variables are involved and there is still scientific uncertainty. The model generates a provisional ranking of vehicle types. Sensitivity analysis is among the options. The model shows how the balance between the two vehicle types may change after the introduction or change of policy measures.

Lessons learned

The aim of modeling was to provide decision makers with a conceptual tool, which would improve their knowledge and understanding of urban goods transport. By showing the links between economic, traffic/infrastructure and environmental/discomfort data, the decision maker can become aware that instruments employed in one area may have a profound and sometimes 'unwanted' impact on other areas of policy. This holds especially for vehicle regulation and traffic bans. To some extent these impacts are known, but the problem is that many policy makers tend to focus only on the small areas for which they are responsible. Problems are perceived instead of (fully) understood and instruments are introduced without detailed knowledge of the local situation or about the alternatives. The lack of knowledge or (political) disinterest to invest time and money to study the system of urban goods transport may explain why many cities do not develop dedicated instruments to improve urban goods transport, but instead rely on general instruments, which have originally been developed for passenger transport and/or 'simply' start banning (particular) delivery vehicles from congested areas. The outcome may be that urban goods distribution may become even more difficult, which has a negative impact on the local economy.

With the proposed model it would be possible to design more balanced policies for urban goods transport taking care of unwanted impacts of policy. The tool is not in a stage to support such policies, yet. Improvements are necessary in the survey methodology. For example, we learned that data collected for descriptive purposes is not necessarily the type or quality of data needed for analysis and model building, because such applications are much more demanding.

To improve the quality of the dataset, data acquisition should first be improved and second, the group of potential data suppliers should be broadened. It is vital to find a way to extract logistic information from the system. It may help if suppliers of goods would be willing to participate in the study. The inclusion of (more) information from chambers of commerce would improve the economic part of the analysis. This would imply a broadening of the number of parties involved. The result would be that some of the existing gaps in the database could be closed.

A consistent and statistically valid dataset is a precondition for any kind of quantification and particularly for the definition of mathematical formulas and estimation of parameter values.

Conclusions and recommendations

There is a controversy about the impact of urban freight transport between public policy makers, transport operators, receivers and citizens in many cities. What contributes in particular to this controversy is a lack of a transparent description of local problems based on solid empirical information.

The paper discussed a Dutch method for standardized collection, processing and analysis of data about goods delivery in shopping areas. During the analysis an analytical model has been developed, which is an important leap towards a quantitative analysis of database. Because of many constraints, the development of a quantitative model was not feasible. An important constraint was the lack of an urban goods distribution theory.

Two crucial issues should be considered in new research in this area:

- a) develop a theory of urban goods distribution with these building blocks as a basis;
- b) improve the quality of data to be eventually used in this theory. This should particularly relate to
 - o formulating more dedicated research questions dealing with existing gaps in the dataset;
 - o making the dataset more dynamic. If time-series were available, then conclusions about the impact of specific policy instruments, about changes in logistic practices and their local impact etc. would be possible;
 - o using information about logistic trends to interpret and restructure the dataset and improve the relation diagrams and spreadsheet model;
 - o separating the transport requirements of different receiver categories and in particular improve the data about small receivers.

References

- Boerkamps, J. (1998) *Evaluatiemodel voor alternatieven voor stedelijke distributie, Eindrapport*, Subfaculteit der Civiele Techniek, Delft Technical University and DHV Milieu en Infrastructuur BV.
- Button, K.J. and Pearman, A.D. (1981) *The Economics of Urban Freight Transport*, MacMillan, London.
- ECMT (1983) *Goods Distribution Systems in Urban Areas, Report of the Sixty-first Round Table on Transport Economics*, 15th-16th December 1983, Paris.
- Jong, G. de, Mensen, A.A.H.M., and Pleijster, F. (2002) *Transportinfrastructuur en Groothandel, Een gelukkige Combinatie?*, EIM, Zoetermeer.
- Meyer, M. D., & Miller, E. J. (2001) *Urban Transportation Planning, A Decision-Oriented Approach*, 2nd ed., McGraw-Hill, Boston.
- Mortimer, Ph., Zunder, T. and Robinson, M. (2004) *Best Urban Freight Solutions (Bestufs), Deliverable D 4.8, Final clustering report*, EU, Luxembourg.
- Niles, J. (2003) "Truck, traffic, and timely transport: A regional freight logistics profile", *MTI Report 02-04*, Mineta Transportation Institute, College of Business, San José State University, CA.
- OECD (2003) *Delivering the Goods, 21st Century Challenges to Urban Goods Transport*, Paris.

- Ogden, K.W. (1992) *Urban Goods Movement: A Guide to Policy and Planning*, Ashgate, University Press, Cambridge.
- PSD, TLN, Trail, DHV Milieu en Infrastructuur B.V., Gemeenten Alphen a/d Rijn, Amsterdam, Apeldoorn and Rotterdam (2002) *Dataverzameling stedelijke distributie, Deel 1: Methodologie bevoorradingsprofiel*, report lv-se20020157, Connekt B.V., Delft.
- Slavin, H. (1998) "Enhanced framework for modeling urban truck trips", In: Proceedings of the 6th National Conference on Transportation Planning for Small and Medium-Sized Communities, 1998, TRB, Washington (internet).
- Taniguchi, E. and Thompson, R.G. (2004) "Visions for City Logistics", In: Taniguchi, E., and Thompson, R.G. (eds) *Logistics Systems for Sustainable Cities*, Elsevier Publishers, Amsterdam.
- TLN, Trail, DHV, Gemeenten Amsterdam, Utrecht and Rotterdam (2003a) *Verklaring Stedelijke Distributie: Deelstudie kwalitatieve en kwantitatieve analyse*, Connekt B.V., Delft.
- TLN, Trail, DHV, Gemeenten Amsterdam, Utrecht and Rotterdam (2003b) *Dataverzameling stedelijke distributie, Bevoorradingsprofielen*, Connekt B.V., Delft.
- Weiss, R.C. (2001) *De stad staat model, Een aanzet tot de beschrijving en vergelijking van de stedelijke distributie, Hoofdrapport en Bijlagen*, Twente Technical University and PSD, Enschede/The Hague.



Multi-services agency for the integrated management of mobility and of accessibility to transport services

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Abstract

AGATA (Multi-services agency based on telecommunication centres for the integrated management of mobility and of accessibility to transport services) is an INTERREG III B MEDOCC area project, which began in July 2004 and will last until June 2006.

The AGATA consortium of 8 partners from 3 European countries (Italy, Spain and Portugal) and one South Mediterranean country (Morocco), works towards the development of a multi-service agency which coordinates flexible transport and mobility services in urban and rural areas. This agency will be based on modern information and communication technologies, and composed of a network of services facilitating interactions between actors and agency. The project represents an example of transfer from the world of research to public administrations and transport companies, based on IST IV FP projects. AGATA's goals are: successful undertaking of feasibility studies and pilot projects, the results of which will be widely diffused, exchange of experiences and best practices, identification of a business model for an ICT based telecommunication centre.

AGATA was born in a context of growing mobility problems which this paper considers before going on to describe various different actions (studies, pilot actions, experiences exchange, results diffusion and promotion), which are currently being carried out both at a general project level and at a local level by the different partners. The results of these actions should in theory have an impact on the local environment and on the issues of transport and mobility on a wider scale. This paper shows the expected results and evaluation techniques and the possible future of such initiatives in political and financial terms.

Keywords: Agency; Car Sharing; Collective Taxi; Cooperation; Demand Responsive Transport; Flexible Mobility; Goods Distribution; Information and Communication Technology; Low Impact vehicles; Telecommunication.

Introduction

The AGATA Project - Multi-services agency based on telecommunication centres for the integrated management of mobility and of accessibility to transport services – was approved and financed on the European INTERREG IIIB Programme in the MEDOCC area. The project began on the 1st of July 2004 and will run until the end of June 2006.

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The AGATA project foresees the development of a multi-service agency which coordinates flexible transport and mobility services in urban and rural areas. Management and coordination within the agency will be based on information and communication technologies and on services which will allow integration and interaction between service, actors and the agency itself.

To understand AGATA, its aims and objectives, it is important to have an idea of the context in which the project was developed. Only once this has been established can we consider the various different actions which are currently being undertaken both at a general project level and at a local level by the different partners and which have developed directly from an understanding of the general and local context. This paper will analyse these issues before going on to identify the expected results of the project and the future of such initiatives.

Background and General Context

The AGATA project addresses current global impacts caused by changes in lifestyle and travel in rural, urban and metropolitan areas. In 1970 the average European citizen travelled 17 kilometres a day. Today that has risen to 35 km. This phenomenon cannot help but have negative impacts in terms of congestion, the environment and social inclusion. Every day, 7500 kilometres of road in the European Union are affected by traffic jams and it is universally recognised that transport is a fundamental element of the problem of climate change. In 1998 transport was responsible for 28 of greenhouse gas emissions, a share likely to rise dramatically before 2010.¹ The importance of environmental concerns was shown clearly by the European Union's decision to dedicate 2004 to the strengthening of international environmental treaties such as the Kyoto protocol and the United Nations Framework Convention on Climate Change. The EU 25 are all signed up to the Kyoto treaty and thus committed to domestic and European cuts in greenhouse-gas emissions of 8% in the commitment period 2008-2012.² In addition to negative environmental impacts, the rising dependence on motorised transport has led to a worrying level of isolation for those suffering from mobility handicaps. In rural areas those without a private means of transport are severely disadvantaged as public transport often does not offer a sufficient provision, a disadvantage that becomes all the more serious if the person is elderly or disabled.

It has gradually become clear that the problems highlighted above cannot be fully addressed with current provisions of conventional transport. Instead one positive, innovative solution is the use of new telecommunication and informative technology to create flexible mobility services, which respond to real transport needs using various methods and vehicles to suit the specific territorial and social context. In recent years, flexible services in the form of Demand Responsive Transport (DRT) applications, which do not intend to replace conventional transport provision but to compliment it in areas of dispersed mobility needs where an effective service cannot be provided, have been experimented and adopted in a number of European countries, including Belgium,

¹ European Commission, Energy and Transport Report 2000-2004, http://www.europa.eu.int/comm/transport/index_en.html

² United Nations Framework Convention on Climate Change, <http://unfccc.int/2860.php>

Finland, Italy, Sweden and the UK. Overall the results have proved advantageous within the relative projects, though in general DRT has yet to make a wide scale impact³.

DRT services and their inherent flexible characteristics require dynamic planning, programming, and management. One effective way to ensure this is to create a Multi-services Agency which can integrate and coordinate different mobility services, and which is based on some form of Information and Communication Technology (ICT). This technology may include advanced ICT applications and mobile communication platforms relative to communication, booking and reservation functions, and customer support.

AGATA consortium, objectives and activities

Within this context, and based on a process of transfer from the world of research to public administrations and transport companies, the AGATA project was developed. The analysis carried out before the presentation of AGATA concerned an in-depth consideration on the current state of DRT services in Europe. It became clear that a number of projects had been undertaken both by transport companies at a individual level and in other integrated projects. In particular, AGATA took the FAMS project into consideration. FAMS, a 20 months Trial Project initiated under the EU Research & Technological Development Programme Information Society Technologies (IST), aimed to address fundamental organisational and technical issues at the heart of DRT transport models.⁴ This project produced a wealth of information on the issues that AGATA hoped to address and ultimately the AGATA project was proposed as a means to take this detailed research carried out during FAMS and other related projects, to build on it and to produce concrete results. AGATA concentrates on the creation of an initial pilot of a multi service agency based on a telecommunication centre which manages the main aspects of flexible mobility and increases service accessibility and integration. The agency should be composed of a network of services able to facilitate interactions between all actors, the agency and the fundamental phases of the workflow involved in its operational functioning. See figure 1 for an illustration of the AGATA agency concept.

The overall objectives of the AGATA project can thus be summarised as:

- Identification and analysis of local AGATA sites' needs and of the requirements of flexible services;
- Definition of the agency concept based on a telecommunication centre and the planning of a functional reference and service framework;
- Development and completion of local projects (studies and pilot projects);
- Definition of best practices;
- Creation and promotion of guidelines for the definition and development of the concept of mobility agency.

³ For an interesting study on the feasibility of DRT services see: Dr Marcus Enoch, Dr Stephen Potter, Dr Graham Parkhurst, Dr Mark Smith, *Final Report INTERMODE: Innovations in Demand Responsive Transport*, Department for Transport and Greater Manchester Passenger Transport Executive, June 2004

⁴ For more information see: <http://www.famsweb.com/> and G.Ambrosino, J.D.Nelson, M.Romanazzo (ed), *Demand Responsive Services: Towards the Flexible Mobility Agency*. ENEA, Italy 2004

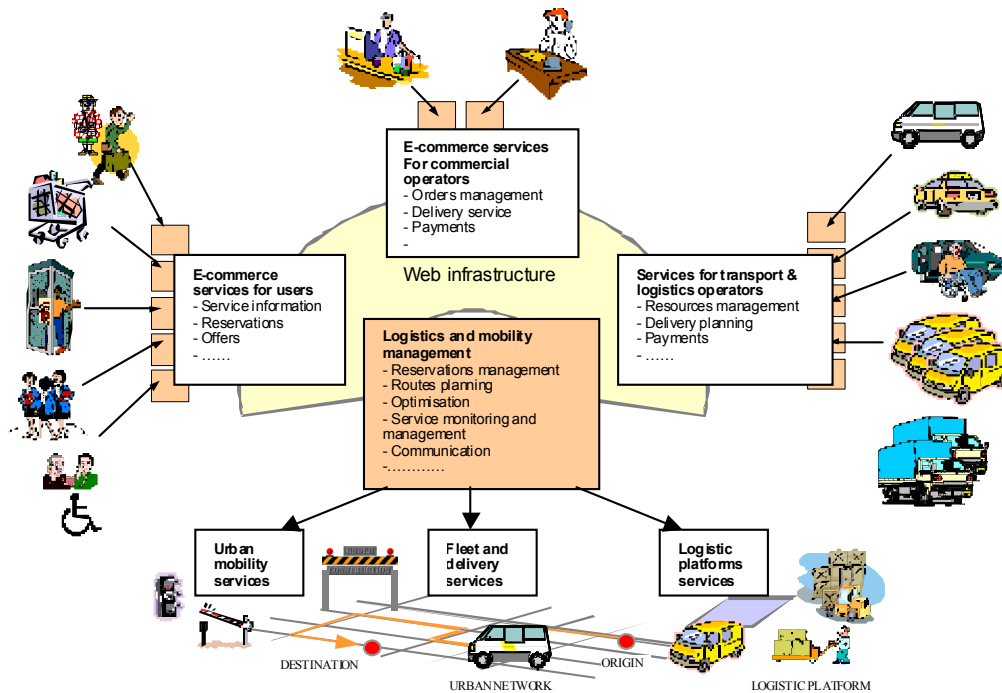


Figure 1: The AGATA concept.

In order to achieve these objectives the AGATA consortium was carefully chosen according to various criteria. It includes a number of public administrations and transport operators who offer the possibility of financial success and sustainability, partners from different countries in order to promote interregional exchange of knowledge and experience, and sites with different levels of DRT provision in order not only to develop existing services but also to learn from them and use the experiences to aid other less developed sites. In detail the AGATA consortium is composed of:

- Regione Toscana (Project Leader). Local sites: Firenze, Livorno, Piombino (Italy)
- CTP Spa / Memex/ STI (Project technical coordination): Potenza (Italy)
- Technomobility: Cagliari (Italy)
- ATAF Spa: Firenze (Italy)
- Terrassa Municipality: Terrassa (Spain)
- AREAL: Monchique and Loulé (Portugal)
- Granada Municipality: Granada (Spain)
- City of Marrakech (Morocco)

Each of the partners concentrates on a certain aspect of the flexible mobility scenario to then pool their work with the other partners. It can be said that each partner represents a brick in the construction of the AGATA agency.

The construction of this agency is divided into various different actions, including studies, pilot actions, experiences exchange, results diffusion and promotion, which will

be carried out both at a general project level and at a local level by the individual partners. Taking into consideration that each AGATA site, while having points in common, represents a different reality in terms of, for example, geography, local stakeholders, experience and existing provision, each site's local project will be developed individually following the adopted reference model. With this understanding a methodological approach to affront the complexity of the problem has been developed, together with guidelines for context analysis and for the creation of telematic systems.

The methodology is divided into two parts, the first of which particularly concerns an analysis of the territorial characteristics in order to understand fully what form of DRT service would be most socially, environmentally and economically effective for each area. This represents phase one of the project and was concluded in February 2005. The results of this initial study were compared and contrasted in order to highlight the points in common between local projects and indeed the unique aspects which differentiate each site. The second methodological aspect concerns an evaluation of the work carried out particularly in the form of interviews and questionnaires directed at local stakeholders. This serves not only to understand if the AGATA interventions are successful or not, but also to further involve those local actors who may be interested in the continuation of the AGATA services. This activity will take place from the beginning of 2006.

In order to provide a clearer picture of how these actions and methodological aspects can make the AGATA agency a reality, this paper will now give a brief overview of the work carried out in each local site. Within the project 7 demonstration projects and 4 feasibility projects will be completed. The demonstration sites are: Firenze (Florence City Council and ATAF), Livorno, Cagliari, Potenza, Terrassa, and Granada. In Monchique, Loulé, and Piombino feasibility studies are being carried out. Marrakech, not being part of the MEDOCC area, participates as third country and will carry out a feasibility study.

At sites where flexible services are more mature, demonstration projects have already been initiated. In these cases AGATA serves to consolidate and expand existing provision, in terms of geography and of services offered and operations adopted. On the other hand, a number of sites do not yet have any flexible service provision and in these cases AGATA serves to lay the essential foundations and experiment new possibilities.

The most advanced sites present in the AGATA consortium are those managed by ATAF in Florence and by ATL in the Province of Livorno. In Florence PERSONALBUS™ is ATAF's Demand Responsive Transport System for the planning and management of flexible services in low-demand areas and non-peak hours and for special users groups (disabled, elderly, etc). The service was introduced in 1997 and in a survey carried out in 2000 showed that 78% of those using the service were satisfied with the provision, highlighting the added value that such initiatives can bring.⁵ Within this service ATAF has created a TDC (Travel Dispatch Centre) which functions as the interface for users and service drivers and the service planning and management site.

In Livorno the ProntoBus service, run by the local public transport company ATL, operates a night service and an early morning service in various provincial areas. As in the case of ATAF this service is run through a centre for journey management (TDC) based on an innovative computerised platform which supports the management of

⁵ ATAF, publicity material for PERSONALBUS™ service:
http://www.ataf.net/DN@Files/personalbus/depliant_servizi_flessibili.pdf

journey requests from users and relative reservations, journey planning and resource optimisation.

Within AGATA these two sites are committed to improving the service currently available. ATAF aims to improve accessibility to the service by the development of an integrated web portal through which users can access information on routes, timetables and current state of the service in addition to making reservations for the service itself. Livorno, on the other hand, works towards improving the agency structure with further integration and coordination of the current services. It is important to note that a high level of coordination should take place between these two partners as the software used to managed their respective DRT services is the same. AGATA is an opportunity for the two to learn from one another and exchange experience.

The other local sites which form part of the AGATA consortium are currently supplied by either little or no flexible service. Those who can lay claim to some provision, for example Technomobility's local site in Cagliari in which CTM S.p.A provides an on call service for disabled people, do not yet have any form of integrated agency to manage the services. These sites have therefore undertaken to complete a period of study in order to fully understand both their own territorial reality and the feasibility of DRT in that area. In some cases this analysis will then lead to a pilot demonstration, while in others the project concentrates on an in-depth feasibility study.

Florence Local Council has based its project on a feasibility study carried out on the location and development of a transit point for goods distribution in the city of Florence. Taking this work as a basis, within AGATA an agency that uses ICT to manage an integrated, flexible service of goods distribution will be planned and developed. Technomobility, on the other hand, recognises the lack of available information regarding transport scenarios and data in the city of Cagliari and therefore works first towards the creation of a mobility database which will allow private and public actors to access important mobility details. This database will form the basis for the creation of a mobility agency. The third Italian partner, CTP S.p.A, has chosen the city of Potenza as its local demonstration site. The planned intervention consists in the study and experimentation of DRT public transport service in the rural areas around Potenza. In line with the overall project objective, this service will ultimately be managed, along with other transport services, through a multi-service agency based on a technological platform.

The two Spanish partners involved in the project will also carry out demonstration projects. Terrassa City Council aims to create an agency by means of a mobility web portal, in order to manage the development of a car-pooling service. The project works towards a maximisation of private car occupation for workers, initially in one industrial park but with the possibility of a future extension to other industrial areas, making use of GIS and an automatic SMS communication system. Granada City Council on the other hand, will implement a collective taxi service for the Granada metropolitan area, coordinated and managed by a Mobility Agency. This service will complement existing public transport by offering scheduled and non-scheduled trips in un-served areas, addressing the specific target of a nocturnal service for young people.

The partners involved in the development of feasibility study on the implementation of some form of flexible transport are AREAL and the Provincia di Livorno. AREAL's study concerns two local sites named Loulé and Monquiche, both mountainous areas characterised by a large population dispersion and large accessibility problems. Both areas suffer from inadequate infrastructure and an almost complete lack of public

transport provision. Within this local project, AGATA concentrates on an on-call service which enables population from isolated places to receive essential services, without implying either large initial investments or high operating costs. The study concerns issues of user acceptance, operational costs, organisational features, low impact vehicles and potential political involvement. The feasibility study in Piombino deals with a different territorial reality and indeed a slightly different subject matter. In the Piombino area a demand responsive service for disabled users already exists. ATM (public transport company) will carry out a feasibility study on the extension of existing DRT and the development of new provision in the Piombino area. The study will include analysis of territorial characteristics and users requirements, the definition of a service scheme, of supporting technology and of a management model.

While it is clear that the AGATA consortium represents a number of different sites that will each produce an individual and unique pilot project or study project, it should also be clear that each fits into to the overall AGATA context. Ultimately, the idea of AGATA is that each partner brings one aspect of flexible mobility to the agency framework, as aspect which can then be inserted into the guidelines and best practices in order to provide a transferable documentation both for the cities involved in AGATA and for those outside the project who may have similar interests. The experience can be used to maximise the promotion of DRT by increasing experience and learning both from positive experience and from mistakes made.

Partners also participate in the horizontal tasks included in the project. These involve methodology for data collection, projects and operational experience exchange, and results evaluation and promotion. Throughout the project general experience exchange has occurred and will continue to occur through the three-monthly meetings in which all partners participate. These meetings offer a chance for partners to present local project progress and for input and discussion to be undertaken regarding the next steps to be taken. Furthermore, a number of events have been organised to promote experience exchange and collaboration. For example, a workshop on DRT tools was held in Florence on the 9th of March 2005, organised by ATAF in collaboration with another connected project.

Innovative Aspects

Innovation in AGATA is represented on four levels. The first level is that of Transport Systems which concerns the definition of transport and flexible mobility frameworks which are both innovative and serve to integrate marginal areas. The second level is the Business Model and Work Flow Level. This concentrates on the development of the concept of a flexible service agency and the definition of its functional qualities, along with the development of innovative organisational models and work flows for cooperation and collaboration of different actors involved in the distribution of mobility services (business models and service networks, normative organisational and legal aspects). At a Technological Level, on the other hand, in each AGATA site ICT services support the agency in managing and coordinating flexible mobility services (technological platform, tele-centre for reservations, management and reservation of tourist buses, definition of e-business and e-commerce services for reservations and user information, integration with conventional transport etc) with an

evaluation of different ICT scenarios in order to identify the relationship between quality and organisation of mobility. Finally the promotion and diffusion level concerns the promotion of the AGATA approach particularly through the production of directive lines for administrations, operators and technological suppliers on the potentials of flexible services, coordination agencies, and the role of ICT.

AGATA's innovative approach thus lies in the promotion of reciprocal knowledge, continuous information, integration of activities, optimisation of the use and management of resources and coherence with international policies and legislations.

AGATA expected results and evaluation

As mentioned previously, in order to ensure that the work carried out during the AGATA project responds to real territorial needs each partner has carried out an in depth analysis of the local site in terms of geographical, economic, social, political and mobility characteristics. This information helps each individual partner to understand fully the territorial needs of the local site and thus how to go about responding to them. For example, in Terrassa the proposal of car sharing to improve industrial park mobility comes directly from a City Council directive which states one of its main goals as the improvement of industrial park commuter mobility. These areas are generally characterised by a low cover of public transport. Analysis of the data available shows that 30% of the population works in the industrial sector, most of which in the 13 industrial parks in the south of Terrassa and that the lack of public transport in these industrial parks, plus the growth in commuter traffic, has created growing mobility problems. A survey carried out showed that 85% of workers used a car to reach their place of work. Thus, having considered this data the AGATA partner was able to propose the car sharing pilot project as a serious alternative to the current unsustainable situation. The same can be said for AREAL in the Algarve. Their data analysis in the two study regions showed that the majority of the elderly population is particularly concerned with not being able to reach essential services in the nearby towns and that they would be extremely interested in an on-call transport service offered at a reasonable price.

The initial period of data collection not only serves the project at an individual level but also at a horizontal, overall project level. One of AGATA's objectives is the promotion of interregional and international cooperation, within the capacity of the project, and the aim is to achieve this in areas where it is most beneficial. The data analysis and the three monthly project meetings have proved essential for identifying points in common and points where one partner can learn from another's experience.

In terms of the expected results AGATA hopes to successfully complete a number of demonstration projects and studies which each bring something useful to the achievement of an agency for flexible mobility services. The success or otherwise of these activities will be shown in practical terms by concrete achievements, for example in political support for the service, in the passage from demonstration to operational or in the agreement of some form of private financial intervention. In addition, a number of evaluation indicators were established at the beginning of the project. These were divided into the categories of realisation indicators, result indicators and impact indicators. The realisation indicators include the number of seminars, meetings and

discussion groups held, the number of information campaigns organised particularly with regards to institutional actors and the number of actions related to promotion and dissemination. The result indicators, on the other hand, concern issues of methodology production, the number of actors involved in the project and the number of new telematic and flexible services identified and developed. Finally the impact indicators, include the evaluation of improvements to territorial accessibility, reduction of the use of private vehicle with a connected increase in the use of public transport and increased user information.

At project conclusion a series of best practices, which takes into account not only the work carried out by each local site and at a coordinated level but also the above mentioned indicators, will be defined. The best practices will be diffused through the organisation of seminars and conferences with the aim of sharing the experience and helping to promote the sustainability of the work particularly in terms of financial and political support. Sustainability is vital for such projects which often collapse after the end of ERDF funding. Thus AGATA includes analysis of possible measures for economic sustainability as a intrinsic part of the project development. For example, Terrassa has already begun a series of meetings with members of the local council and a number of transport operators who may be interested in part financing an integrated service based on the AGATA model. Another example is that of Technomobility who has worked in close collaboration with the needs identified by the regional administration in order to encourage their support. With such activities the AGATA project should have impact and results to some extent beyond the scope of its two year funding.

References

- Frosini, P., Gini, S., Agostini, F. and Huntingford, J. (2005) "Multi-services agency for the integrated management of mobility and of accessibility to transport services", *Policies and Technologies for Sustainable Goods Distribution in Urban Areas: Towards the e-Logistics Agency*, Edited by G.Ambrosino, M.Boero, J.D.Nelson, M.Romanazzo ENEA 2005
- Enoch, M., Potter, S., Parkhurst, G. and Smith, M. (June 2004) "Final Report INTERMODE: Innovations in Demand Responsive Transport", Department for Transport and Greater Manchester Passenger Transport Executive.
- Finn, B. and Ambrosino, G. (2004) "European practice and research in urban passenger transport", *MUTRF CONFERENCE 1st an 2nd, December 2004, Malaysia*.
- Ambrosino, G. et al. (2004) "Mobility accessibility services: demand responsive transport service towards the flexible mobility agency", Keynote speech, *World Conference Transed 2004*, Hamamatsu, 23-24 may 2004.
- Ambrosino, G., Nelson, J.D. and Romanazzo M. (ed) (2004) *Demand Responsive Services: Towards the Flexible Mobility Agency*, ENEA, Italy.
- Ambrosino, G. Et Al (2002) "E-business Infrastructures For Flexible Mobility Services: The European Fams Project", *Itsc2002 Ieee*, Singapore.

European Commission, Energy and Transport Report 2000-2004,
http://www.europa.eu.int/comm/transport/index_en.html

United Nations Framework Convention on Climate Change,
<http://unfccc.int/2860.php>

FAMS Project,
<http://www.famsweb.com/>

ATAF official site

http://www.ataf.net/DN@Files/personalbus/depliant_servizi_flessibili.pdf

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Updated information on project progress is continuously provided to the project leader allowing us to compare and contrast the sites and produce informed analysis on what the outcome of AGATA may be. Thus this acknowledgement is dedicated to the 7 AGATA partners and their numerous local administrative and technical partners for their contribution to the technical and collaborative progress of AGATA and thus to the production of this paper.



Urban mobility and freight distribution service: best practices and lessons learnt in the MEROPE Interreg III B project

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Abstract

MEROPE (Telematic instruments for innovative services for mobility and logistic in urban and metropolitan areas), an INTERREG III B MEDOCC (Western Mediterranean) area project, started in September 2002 and ended in October 2004. In particular MEROPE addressed axis 3 - *Transport Systems and Information Society*; Measure 3.4 - *Innovative communication and information technologies for the development of the territory*. MEROPE's overall objective was to investigate and develop evaluation models and telematic instruments to manage mobility and logistics in urban and metropolitan areas, in order to promote the development and application of innovative Information and Communication Technology (ICT) in support of integrated transport systems.

A total of 14 cities were involved in the project, between them carrying out 9 study projects and 7 demonstration projects oriented towards the analysis and definition of mobility, transport and logistics chain features, with particular attention to their impacts in terms of environment, sustainability and competitiveness.

This paper presents the development of the Merope project both at interregional level and in terms of the work carried out in each local site. Rather than a straightforward description of the work, however, it concentrates largely on an analysis of the project's best practices and added value. As the project is now closed both in terms of activities and financial management, its current importance lies in its sustainability and transferability. Thus this paper will analyse the innovative actions carried out in Merope, within the general economic, social and political context of mobility and logistics, in order to identify what Merope has brought to the sector and what indeed remains to be done.

Keywords: ICT; Innovation; Logistics; Microsimulation; Mobility; Modelling; New Fuels; Sustainability; Transit point; Transport; Vehicle Routing.

Introduction

The MEROPE project (Telematic instruments for innovative services for mobility and logistics in urban and metropolitan areas), was financed by the INTERREG III B MEDOCC (Western Mediterranean) programme and approved on approved on axis 3 -

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Transport Systems and Information Society; Measure 3.4 - *Innovative communication and information technologies for the development of the territory*. The project began in September 2002 and was concluded in October 2004. The main aim of the MEROPE project was to investigate and develop evaluation models and telematic instruments to manage mobility and logistics in urban and metropolitan areas, in order to promote the development and application of innovative Information and Communication Technology (ICT) in support of integrated transport systems.

MEROPE's specific objectives were as follows:

- Analysis of urban and metropolitan mobility and transport characteristics;
- Development of a shared methodological approach related to mobility and logistical reorganisation;
- Studies, analyses and simulation projects on the use of ICT technology in innovative mobility and logistics services;
- Demonstrative pilot projects related to various aspects of mobility and logistical reorganisation;
- Definition of "best practices" based on real experiences.

The 14 cities involved in the project, between them completed 9 study projects and 7 demonstration projects, oriented towards the analysis and definition of mobility, transport and logistics chain features, with a particular attention to their impacts in terms of environment, sustainability and competitiveness. Each city followed its own specific project which was then integrated and coordinated within the context of the overall project.

The seven pilot projects concerned a number of innovative programmes of work regarding different aspects of the mobility and logistics process. Between them the projects produced: a system of integrated ticket sales via internet, experimentation and enlargement of innovative goods distribution systems, a system for the control and monitoring of vehicle flows and two different systems of integrated management of parking areas including use of variable message panels, on-board information panels on public transport, and an on-line mobility data base.

The nine studies also considered a range of mobility and logistics issues. These aspects included the feasibility of a transit point for goods distribution, other goods distribution management possibilities (by road and rail), the feasibility of city centre access control systems using electronic gates, technological systems and services to support mobility management and relative methodologies and systems of parking management.

Furthermore, a number of international co-operation projects of data and methodology exchange were successfully completed and relative simulations and analysis developed. These projects involved various actors including local administrations, universities, research centres and transport companies. One cooperation project was also carried out with a third country, Morocco.

This paper will present the work carried out throughout these studies, pilot and cooperation projects and the overall project level activities. However, it will concentrate particularly not on the technical aspects of the project but on the lessons learned from the project, the 'best practices' and indeed the problems encountered. As the project is now closed both in terms of activities and financial management, the importance now

lies in its sustainability and transferability. This paper aims to identify where these features are present in the MEROPE project and what must be done to build on them.

Technical development

Project work was divided into 5 activity phases which are described in detail below.

Activity Phase A: studies

The three actions within this initial phase were undertaken between February 2003 and October 2003. The first two activities involved preliminary studies to define an executive action plan and feasibility analysis and project planning. In conclusion the first deliverable, *P1: Report on Base Data and Information for the Execution of Local Projects*, was produced. This report combined contributions from each partner which described the characteristics of the local site and the proposed MEROPE actions.

Activity A3, meanwhile, was that of local project studies and the identification of evaluation indicators. The resultant deliverable the *P2: Details of the Common Evaluation of Local Project Results*. This deliverable was developed by Universitat Politècnica de Catalunya (UPC) and CETE Méditerranée who worked together to find a model to allow for a common evaluation of project results. It provides a clear definition of the typology of the MEROPE projects and goes on to outline a structured methodological process to evaluate city logistics scenarios and the environmental impact of proposed interventions.

This first phase can be described as a “fact-finding mission”. Partners were asked to fully analyse the characteristics of their local site and consider how the Merope project could be of added value in that particular reality and how the work could be evaluated. A number of the problems identified and affronted are described below (Page 9: Problems Encountered and Solutions Adopted) but one specific issues which came to light, and which the Merope project hoped to go some way to resolving, was the lack of easily accessible information on city logistics and the lack of previous, integrated strategies of intervention. The Merope project suffered from this in terms of delays to the project timetable. However, on a more positive front, the phase served to identify the problem which the successive phases could then seek to resolve.

Activity Phase B: development of local pilot projects

Phase B, running from June 2003 to October 2004, occupied most time and most of the project budget, it being the phase in which local projects were developed. Action B1 concerned the development of demonstration projects while action B2 foresaw the development of local study projects. These actions were both concluded with a final report, *P3 Report on the Development and Completion of Local Demonstration Projects* and *P4 Development and Completion of Local Study Projects*, respectively, both of which were compiled by the project leader using contributions from each partner. The

partners followed a common model to describe the background to their project, the activities carried out and the project results.

Feasibility studies were successfully undertaken in nine sites, all producing valuable data and findings regarding the local reality and also the wider picture on mobility and logistics services. In a number of cases, the findings were reinforced through the use of simulations. The studies have provided a wealth of transferable information on mobility, logistics and the use of ICT in innovative services.

Moreover, in seven sites pilot projects and demonstrations were carried out, including projects relating to car park management, traffic flow management, goods distribution, user information, communication and environmental impacts. Each of the projects has provided an important demonstration of how innovative mobility services can be developed and integrated into existing services and what benefits they bring to the local reality.

As the MEROPE project was approved and financed under Measure 3.4: Innovative Information and Communication Technology for territorial development, a large part of phase B concentrated on the identification and development of IC technology. A number of MEROPE partners experimented with innovative technology, most notably Siena, who produced, for example, an innovative data transmission service, Genoa, who uses high tech hand held data for the management of their hub and fleet, and Florence under the supervision of ATAF, who uses GIS tracking systems for its on board information screens. Other partners experimented successfully with Internet technology and electronic information panels.

The MEROPE local projects and their results are summarised in the table below:

Table 1: Merope Sites, Actions and Results.

| <i>Site</i> | <i>Planned MEROPE activities and interventions</i> | <i>Results obtained</i> |
|------------------------------|---|---|
| Florentine metropolitan area | Technological/informative platform for mobility information, monitoring and management of intermediate services. Pilot project Goods distribution in the historical centre with transit point. Feasibility Study | Definition of Strategic Plan for application of IC and telematic technology. Creation of an integrated computerised base to provide user information on services, integrated timetables and inter modality. Methodology and relative computerised instruments for evaluation of overall accessibility to transport services. Definition of technological services and infrastructures to monitor mobility processes. Feasibility study for a transit point in Florence, with economic analysis, hypothesis for management, location and dimension of the warehouse and fleet. |
| Siena | System of integrated car park, tourist bus and traffic flow management with variable indicators. Pilot project | Development and patenting of system for control and monitoring of vehicle flows. System monitors and manages tourist buses using data provided by data collection unit. Variable messages panels inform bus operators on car park availability. |
| S. Gimignano | Feasibility study for automatic access control to the LTA and identification of technological system and typology of communication network. Feasibility Study | The feasibility study is one of the council's preliminary evaluation instruments for the possibility of creating a system of control for access to the historical centre. |

| | | |
|----------------------|---|--|
| Lucca Comune | Feasibility study and planning for the creation of a logistic service centre. Feasibility study | Cognitive investigation into the structure of a goods distribution system in the historical centre. Data exchange with UPC to develop a simulation of mobility situation in the historical centre. |
| Lucca Provincia | Development of logistics systems of goods inter-mobility and movement with software elaboration for an applicative simulation. Feasibility Study | Evaluation of potential inclination of local production fabric (Garfagnana – Media Valle del Serchio e Piana di Lucca) to use advanced logistic services for goods transportation and modal rebalancing in favour of railways. |
| Genova | Development of ICT instruments for the optimisation of goods loading and delivery in the city centre and the metropolitan area. Pilot project | Experimentation of existing project and widening of the area served to the entire historical centre. Improvement of existing service with aid of innovative ICT to manage vehicles and routes: handheld apparatus with GPS, barcode reader and GPRS transmission technology. Collaboration with CETE Méditerranée: study on reduction of environmental using following low impact vehicles for goods transportation. |
| Modena | Optimised goods distribution in urban centre through transit point. Pilot project | Action plan for the rationalisation of goods distribution in the urban area. |
| Piacenza Area | Planning of a goods flow observatory. Vast area logistics plan with logistic intervention and ICT systems. Pilot project | Urban logistic plan, web site and a database to manage an integrated system of urban logistics. Data exchange with UPC to develop a simulation of the situation regarding mobility in Piacenza. |
| Napoli (Pozzuoli) | Telecentre for improved use and management of an integrated public transport parking system. Improved accessibility to insular territory. Pilot project | Initial analysis of technological systems and services to support mobility management leading to reference framework for mobility management based on ITS systems and services. Integrated management of stopping areas. |
| Roma | Optimised goods distribution in the urban centre through a transit point. Methodology and guidelines. Feasibility study | Analysis of demand/supply with identification of a site for a logistical platform. Data exchange with LGI2P - Armines for the optimal hub location. |
| Terni | Study of urban logistics improvement with transit point. Logistics system with integrated urban mobility system. Feasibility study | Analysis of transit using electronic gates; sample survey among commercial operators; evaluation of medium term requirements (quantity, goods category, logistics bases, delivery points). |
| Cosenza | Feasibility of goods distribution control system with simulation techniques to estimate impact on mobility conditions. Evaluation of different communication strategies and structure of goods distribution process. Feasibility study | Pilot project concerning the feasibility of a goods distribution centre in the urban area of Cosenza and of the relative telematic systems for traffic control. |

| | | |
|-------------------|---|---|
| Sevilla | Identification and evaluation of current mobility models and processes. DLZM demonstration (internet use for reservation of loading zones). ICT simulation and evaluation on goods distribution. Pilot project | Study to identify system to manage reservations of loading zones for goods delivery. Two-week experimental project with the participation of various actors. |
| Palma de Mallorca | Study to define and implement a system of ticket sales via internet. Pilot project | System of integrated ticket sales via internet. |
| Marrakech | Study relative to general plan for management and regulation of traffic and mobility of people and goods. Report | Feasibility study that will lead to a logistic platform integrated in a car park in Marrakech. |

Activity Phase C: experience exchange

Activity C1, undertaken between April 2003 and May 2004, concerned project data analysis including data, experience and problem/solution exchange. This process was carried out particularly through meetings between consortium members and between the two committees developed: Steering Committee (CdP - Comité de Pilotage) and the Coordination Committee MEROPE – CITY PORTS (CdC) which provided inter-project cooperation with the Regione Emilia Romagna, project leader of the CITY PORTS project approved under INTERREG IIIB CADSES.

Aside from these regular meetings, a number of initiatives were organised concerning specific sectors of the project. All partners interested in innovative means of goods distribution were invited to a demonstrative meeting in Genoa where they were shown round the existing hub for goods delivery optimization. Methodology exchange took place between Lucca and Perugia and a common methodology was formed between Merope and the CITY-PORTS project. The experience of MEROPE was used to help develop the CITY PORTS methodology, which was then made available to the MEROPE project.

An exchange of expertise also took place between Siena and the Communauté Urbaine de Marrakech. The administration in Marrakech has been working towards a General Plan for the management and regulation of traffic and mobility, due to the city's uncontrolled rate of growth in terms of population and commercial activities without construction of the necessary infrastructure.

The activities developed by the technical office of Communauté Urbaine de Marrakech concern improvements to the viability of private transport and goods transportation vehicles in the city centre. In particular, the study aimed to identify short term programmes to improve circulation and medium term solutions to parking related problems. Thus, a series of studies on traffic characteristics and analysis on the current provision were carried out. The studies were extended to include goods distribution transport and were carried out under the technical supervision of Siena Parcheggi. The study was further streamlined to concentrate on the feasibility of a car park in the centre of Marrakech. Siena Parcheggi were entrusted with the study and have developed a project hypothesis with various construction options. The study project is ongoing.

While the final outcome of this study remains unclear, the process leading up to this point has been extremely productive. Once the initial problems were resolved the two parties were able to open productive lines of communication, promote an exchange of experience and ideas between two very different realities and to produce real results. Furthermore, the study has laid the basis for the development of what could be of notable economic importance to Marrakech. The importance of this final factor is extremely high as the INTERREG IIIB programme specifically states that one of its ultimate objectives is to extend territorial development to the whole Mediterranean Zone.

One other important example of exchange are the cooperation projects carried out between UPC, Lucca and Piacenza, between CETE and Genoa and between Armines and Rome. The UPC/ Lucca/ Piacenza project tested an evaluation methodology for a city logistic model using simulation software. The project involved exchanges of data regarding, to name but a few, traffic flows, vehicle typology, city maps including retail location. Genoa and CETE undertook an exchange of data in order to evaluate the environmental impact (through a rate of pollutant reduction) of a fleet of electric vehicles on an ecological road. Armines and Rome also carried out a cooperation project using data exchange to find the optimal location for a transit point in Rome.

Action C2, (January 2004 - project end), involved result evaluation, specifically the analysis of indicators at local sites. The conclusive deliverable was the *P5 Report on the Elaboration of a Simulation System for the Comparative Analysis of Impacts on Different Locations Relative to Mobility, Accessibility and Feasibility*, which elaborated a simulation system for comparative impact evaluation regarding mobility, territorial accessibility, communication and sustainability. This action underwent some changes from the original proposal. It was developed by UPC and CETE and rather than involving the whole project it concentrated on the cooperation projects described above. This work then formed the basis of the P5 while the rest of the project was evaluated using a series of indicators established at the outset of the project which were then included in the *P6 Final Report: Project Best Practices*. This report forms part of Action C3, Conclusions and recommendations, which proposed coordinated action between partners to elaborate project conclusions and developed a series of recommendations relating to the activities developed throughout the project. The report highlights the positive and negative aspects of the project in an attempt to provide a document that not only sums up the project but also provides guidelines which could be adopted by other similar projects.

Activity Phase D: networking

The first action in this phase concentrated on the definition and implementation of a strategic network at an institutional level and involved relationships with local councils, regions and third countries. This lasted the entire duration of the project. Through meetings and regular contact the consortium itself formed a strategic network and managed to include a number of council administrations and regional authorities in addition to various different mobility actors such as universities, research centres and public transport companies. As seen above, it also included Morocco as a third country and proved vital in establishing a good working relationship between the partners within the EU and Morocco, thus enlarging the network.

The second action, on the other hand, worked towards organising and creating a horizontal platform of information and dialogue and encouraged communication and links between partners. Again this action lasted the duration of the project and included the production of deliverable *P7 Quality Handbook*. This deliverable established how the project should be managed and run and what was expected of each partner. Following this document and maintaining constant flows of information between project leader and partners, a working horizontal platform was established.

A Working Group was also created for the integration of project methodology and results with the City Ports project and ran from March 2003 to project end. This Committee, which united representatives from the working groups of each project and experts in the relative themes, ensured the exchange of experience and of the results from the two projects. The scientific component of the Coordination Committee was formed by sector-based experts who were also representative of the various different “schools of thought” that have been developed in Europe with regards to city logistics.

The final action in this phase, again lasting for the project duration, was based on the consolidation of experience and reciprocity of network techniques and the definition of a shared informative methodology. Ultimately, rather than a shared informative methodology some good examples of individual informative schemes were created. One particular example is that of AICIA in Seville who involved a wide range of local actors from goods carriers to the local police and also set in place a training programme for those involved in using the computer systems.

Activity Phase E: information activities

Both Action E1 and E2 concerned publicity, working towards extracting project results and diffusing them through conferences, seminars and publications. This involved all partners and lasted from April 2004 to the project end.

Throughout this phase the MEROPE web site, the final version of which was presented in September 2003, was developed in collaboration between the Regione Umbria and the Regione Toscana. The web site, which can be found at www.merope.net, contains one section for the general public where information on the project, the partners and related events can be found and another section for registered users only. Registered users, in this case the project partners, can access documents related to project activities, administration and meetings, for example, power point version of all partners’ presentations which were made available shortly after the meeting itself.

Any event regarding the project was published in time to allow maximum publicity and dissemination. The web site will continue to be active for a further three years from the end of the project activities in order to allow continued diffusion of the project and its results.

The MEROPE project was presented, both by the lead partner and by project partners, at a series of international, national and local events. On an international level the Regione Toscana presented the project in Danzica in June 2003 at the Cesura’03 Conference and in Vienna at the e-challenges 2004 conference on the 27th – 29th of October 2004.

At a local level dissemination was carried out in a number of different forms. The Regione Toscana organised a number of information days. One was held in Pisa in

February 2003 and the other in Lucca in March 2004 and other partners also organised local dissemination activities. In Naples, for example, CTP presented the MEROPE project using information panels during an exhibition of ecological vehicles. Moreover, numerous articles have been published in local newspapers and the MEROPE final workshop was covered by both local and national newspapers.

MEROPE was also presented at an innovation exhibition, Firenze World Vision, held in Florence, 23rd -26th September. Here some of the instruments developed throughout the project were demonstrated, for example the technology developed in Siena for the management of tourist buses and the monitoring of environmental conditions.

Another important activity concerned the seminar for project leaders involved in INTERREG IIIB Medocc organised in Rome in October 2004. The MEROPE project was presented as a management best practice and the presentation can be found on the Medocc website: www.interreg-medocc.org.

At project conclusion some partners organised local conferences to present their result and experiences. A conference entitled “Urban Logistics: an opportunity for the economy, mobility and the environment” was organised by Piacenza on the 8th of November 2004. It included presentations regarding different aspects of the project and a round table on the issue of urban logistics in general. (presentation can be found on www.piacenzamerici.it). The Regione Calabria also organised a local conference, held on the 19th and 20th of November 2004, and entitled “Project for inter-modal accessibility to Euro-Mediterranean transport in the community programme INTERREG IIIB MEDOCC”.

MEROPE’s final workshop was held in collaboration with the projects, CITY PORTS (INTERREG IIIB CADSES) and eDRUL (V Framework IST Programme – IST), on the 15th and 16th of November in Florence. It was entitled “Innovative Urban Logistic Services for the sustainability and accessibility of European cities”. The workshop welcomed 30 speakers from various backgrounds and attracted an attendance of over 200 people from various countries. The event was covered in a number of newspapers and television channels both at local and national level.

Problems encountered and solutions adopted

Attempts were made to form a political committee in order to take the choices made in Merope to a local and national political dimension. This committee held an initial meeting at the time of the Merope project meeting in Pozzuoli and welcomed participation from the Mayor of Pozzuoli, and Regional and Local Ministers from Naples, Siena, Lucca and Marrakech. While the meeting was successful and political interest was demonstrated, the committee did not continue with any kind of regularity as it was quickly discovered how difficult it is to organise inter-regional and international meetings between politicians. The solution taken in terms of political involvement was for each partner to concentrate on its local political actors and try to involve them. This proved more effective than trying to organise international committees.

One increasingly evident problem was that the MEROPE consortium was large for an Interreg III B. Being a project aimed towards concrete pilot actions, thus requiring a high level of control, 13 partners (20 with local partners) proved to be far too many. Furthermore, the MEROPE consortium consisted of partners of a varying nature,

including universities, research institutes, local and regional public administrations and transport companies and the integration between them was sometimes fairly complex.

To overcome these problems, the partners were in frequent contact, prevalently via email, in order to exchange information and data. In addition, partners had the possibility to discuss any issues at the three-monthly project meetings and a number of visits between groups of partners were organised to resolve specific problems or undertake specific activities. Furthermore, the lead partner found that it is fundamental for at least one or two people to follow all project phases, from the presentation of the project proposal, to the meetings and the relationship with the Management Authority and the Secretariat.

Another important consideration regards the programme of activities and various project phases. These were determined at the proposal stage and were based on educated estimates, however, throughout the project a number of local sites found that their original plan had to be adapted to coincide with their daily territorial events and realities. One example is Seville where the location and timetable of the original plan had to be completely changed in order to allow for metro building works. Another example is Piacenza where the initial plan to develop a goods observatory, was substituted with the implementation of a database. This change was due to the lack of attention previously paid to the issues addressed. It was therefore necessary to undertake an initial process of information collection and to reorganise it in a structured database. It became increasingly clear throughout the MEROPE project that, in general, little attention had been paid to goods distribution in urban environments. A number of partners discovered that their site did not have the history of analysis in this sector and therefore the studies started with little background data and information.

Other partners to face changes and delays include Mallorca, the Regione Calabria, Rome and Modena and Cosenza. In these cases the solution was to change the local project objectives or timetable to suit the new conditions.

Almost all those who undertook a study project had difficulties in data collection. Armines had problems regarding data typology, as the mathematical models require static data in addition to dynamic data and it was often not available. The solution adopted was to create a model which is flexible enough to fit configurations with partial data and to simulate missing data. The model is structured to allow new data insertion if and when available. I2T3 in Firenze, Rome and Terni also faced such difficulties. In Rome and Terni this was particularly related to surveys and the incomplete responses provided. In Rome the solution adopted was to hold meetings with the respondents and explain exactly what was required and why. This involvement was found to be strictly related to the success of the project.

Difficulties relating to technical operation were experienced by both Genoa, Siena and Mallorca. In Genoa electrical vehicles initially adopted as a low environmental impact solution experienced a sudden decrease in efficiency. The solution was to introduce vehicles supplied by methane gas, which proved very reliable, and to experiment with appropriate maintenance assistance to the vehicles themselves and the battery charging stations.

In Siena, for example, delays were caused by hardware malfunctions (GSM Communicators), and the necessity to integrate and encourage communication between the various systems (ACITRAFF system, software for managing the tourist bus flows, variable message screens). Siena Parcheggi held several meetings with the system supplier to face the problem of incompatibility and after several attempted solutions and

tests the issue of incompatibility was successfully solved. Delays were also created by the hardware and software testing necessary to activate the whole system.

To summarise the situation regarding pilot project implementation, the process was not simple and was hindered both by the problems identified above and by external factors which often came into play. The results in some cases were not a concrete as originally hoped and thus did not go as far to resolving logistics problems. However, overall the experience was positive in that partners did manage to learn from their mistakes produce instruments and services of direct relevance to their local territory and to gain knowledge and experience in this area.

The future of MEROPE

Initiatives and sources of finance to assure project sustainability

70% of the demonstrations provided by the MEROPE project will continue as permanent fixtures after the conclusion of the project. This is due to the fact that MEROPE was born from real territorial needs and therefore there is a widespread interest to maintain the resultant services and equipment. The projects that were developed throughout MEROPE could have a real use and impact if implemented as permanent features. Some examples of the sustainability of the technology developed include ATAF and Siena. The on board-information panels developed by ATAF have undergone an experimental stage and become permanent features on 64 buses. In Siena the system for managing tourist bus parking has also been tested and approved as a permanent feature, now in deployment phase.

Many projects do require administrative support and, more specifically, some kind of financial backing, mainly in the initial phase of setting up the project. This problem was highlighted by the experience of AICIA. During the demonstration, the reservation and use of the specified load zones by the participating carriers was free of charge. Although participation and interest in the project was relatively high, there is a lack of willingness to pay for the use of such a system. If the service were to be implemented on a permanent basis a financial commitment from the local authorities would be necessary.

In Genoa this problem has also been recognised. The goods distribution service is open to anyone (transporters, forwarding agents, or private citizens) who needs to make a delivery in the historical centre of the city and until this point it has been free and facultative. It has been recognised that stricter conditions imposed by the council, aimed at convincing users to deliver all goods to the demonstration area, would have increased the amount of deliveries carried out via the hub. The council in Genoa is currently analysing various solutions, such as tendering, to assign the distribution system (managed by the council or by a separate private company).

The sites which carried out studies also recognised the issue of financial viability and sustainability. The solution they recommended for a successful development of an eventual city logistics system was to provide an in-depth business plan outlining exactly what the necessary investment would be and to encourage public/private partnerships. Currently a solution based only on public resources is neither feasible nor sustainable. Cooperation, in terms of costs and benefits, with private entrepreneurs, directly involved in distribution, represents an effective and efficient solution.

In general, the measures taken in terms of publicity and dissemination of results should help to increase interest and awareness of mobility issues, thus encouraging possible investment.

Main impacts

One weakness regarding the multiplier effect of the Merope project was that no methodology common to all partners was developed and therefore it is difficult to present the results in a format that can be useful to local administrations at a generic level. Indeed, while local projects were compared and evaluated using common indicators, due to the fact that they were all responding to local needs they were often very different. Common analysis and presentation was not easy.

As described above the Merope consortium did make attempts throughout the project to involve the political sector. While the creation of a political committee proved too ambitious a number of successful meetings helped to promote political interest both at local and national level. In addition to the meeting held at Pozzuoli, two other seminars had a high political content. The final seminar held in Piacenza dedicated a morning to the political side of mobility issues by inviting local councillors from Genoa City Council, Piacenza City Council and the Province of Piacenza. The final workshop held in Florence also welcomed the participation of representatives from the Regione Toscana, the Regione Emilia Romagna, the Province of Florence and Siena City Council. These events are important in terms of sustainability of the project as they promote awareness and support for the measures taken.

It is political support, or indeed opposition, that will determine the long-term implementation of the services experimented throughout the project. Overall the local political reaction was generally positive and supportive but has not yet passed into concrete action. For example, the local authorities took an active role in the project carried out by AICIA in Dos Hermanas, collaborating in the preparation process. However, they showed concern for some financial and supervision aspects. As such, while they showed support for the measure, especially, it has not yet been included in any town mobility plan.

In Genoa's case the local authority was the main partner in the project and is currently working to identify the means needed to make the distribution system a permanent fixture, both in juridical, economic and in legislative terms, for example the eventual closer of the historical centre and greater restrictions of distribution timetables.

Regarding the transit analysis at the electronic gates undertaken in Terni by the Regione Umbria, the public administration is currently working towards revising access and parking permits to the LTA, meanwhile in Piacenza, the results of the survey and the study carried out within MEROPE were taken into consideration by the local council, who in the summer of 2004 committed itself to updating the General Plan of Urban Traffic 1998 (PGTU). Furthermore, from the results of the MEROPE project the Province and the Council of Piacenza have decided to undertake a further analysis and evaluation of a economical-financial character regarding the introduction of a transit point for urban goods distribution in Piacenza.

These points are considered important as indicators of the possible sustainability of the MEROPE project at local level. Furthermore, within the ambit of the project and of the mobility and logistics sector the project has helped to increase awareness of possible

alternative means of transport. The programme of publicity and dissemination was particularly successful in informing those present on the use of European funds, regional cooperation and mobility issues and solutions. Thus it can be said that, with the necessary political and financial support from various fronts, the ideas and action of the MEROPE project could have a future, either in other similar projects or in different forms.

References

- Taniguchi E. and Van der Heijden R.E.C.M (2000) "An Evaluation Methodology for City Logistics", *Transport Reviews*, Vol. 20, No. 1, pp.65-90.
- Frosini, P., Gini, S., Agostini, F. and Huntingford, J. (2005) "Urban Mobility and Freight Distribution Service: the 14 Cities of the MEROPE Interreg III B Project", *Policies and Technologies for Sustainable Goods Distribution in Urban Areas: Towards the e-Logistics Agency*, Edited by Ambrosino, G., Boero, M., Nelson, J. D. and Romanazzo, M., ENEA 2005.
- Kohler U. (1997) "An innovating concept for City Logistics", *Proceedings of the 4th World Congress on ITS*, Berlin.
- Frosini, P., Ambrosino, G., Agostani, F. et al. (June 2003) "Urban Mobility and Freight Distribution Service: the 14 Cities of MEROPE Interreg III B Project", *CESURA '03*, Gdansk.
- Frosini, P., Gini, S., Ambrosino G. et al. (October 2004) "An evaluation methodology for innovative mobility services: the MEROPE cities", *eChallenges '04*, Wien.
- Ambrosino, G. et al. (2003) "The European Project eDRUL: a B2B platform for freight distribution in city areas", *CESURA '03 Conference*, June 4-6 2003, Gdansk, Poland.
- Ambrosino, G. et al. (2002) "The European Project eDRUL for demand responsive urban logistics", *Telebalt Conference*, October 2002, Vilnius.

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The Florence transit point: a feasibility study*

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Abstract

This paper illustrates a feasibility study aimed at: analysing the actual city logistics in the Limited Traffic Area of Florence; evaluating to what extent the Transit Point solution could optimize parcel delivery and its repercussions on traffic flow in the historic centre of Florence; identifying a suitable location for Transit Point infrastructures, and examining economic and normative aspects of the proposal.

Particular attention has been given to assessing the economic sustainability of the Transit Point, under the hypothesis that areas, infrastructures and vehicles will be publicly financed, and that the Transit Point will have to find the resources to remunerate the new company through the reduction of vehicles and workers. A model for corporate governance for the Transit Point has also been proposed, in addition to a model of planning and control for proper accountability.

The study demonstrates that the realization of the Transit Point would allow for: a reduction in traffic congestion in the historic centre; attainment of a positive EBIT through public financing of the structures; a continuance of the service without changing transport or remuneration costs; an improvement of the working conditions.

Keywords: Business plan; Environmental impact; City logistic; Goods delivery; Performance measurement system; Traffic congestion; Transit point.

Introduction

The Transit Point is one of the projects under the “Strategic Plan for the Florentine Metropolitan Area”.¹ The plan includes the creation of a “Transit Point” platform (Figure 1) where non perishable goods would be delivered and then loaded onto methane-powered (or electric) vehicles for distribution to shops, offices, hotels, etc. in the historic centre of the city.

The crucial aspects of the project are:

*Although this is the result of a group research project, paragraphs 2, 4 and 5 are written by Massimiliano Bonacchi; the other paragraphs are written by Fabio Benini e Luca Mattesini; Introduction and conclusion are attributed to all three authors.

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¹ The “Strategic Plan” is a new instrument for territory management, described as the local governments' answer to all their new needs related to globalization.

1. creating a hub for goods exchange (Marchisio, 2002) where parcels destined to the centre of Florence are picked up and delivered;
2. using vehicles with low (methane) or no (electric) environmental impact;
3. optimizing the routes so that vehicles travel the shortest possible distances, and avoid covering the same road several times.

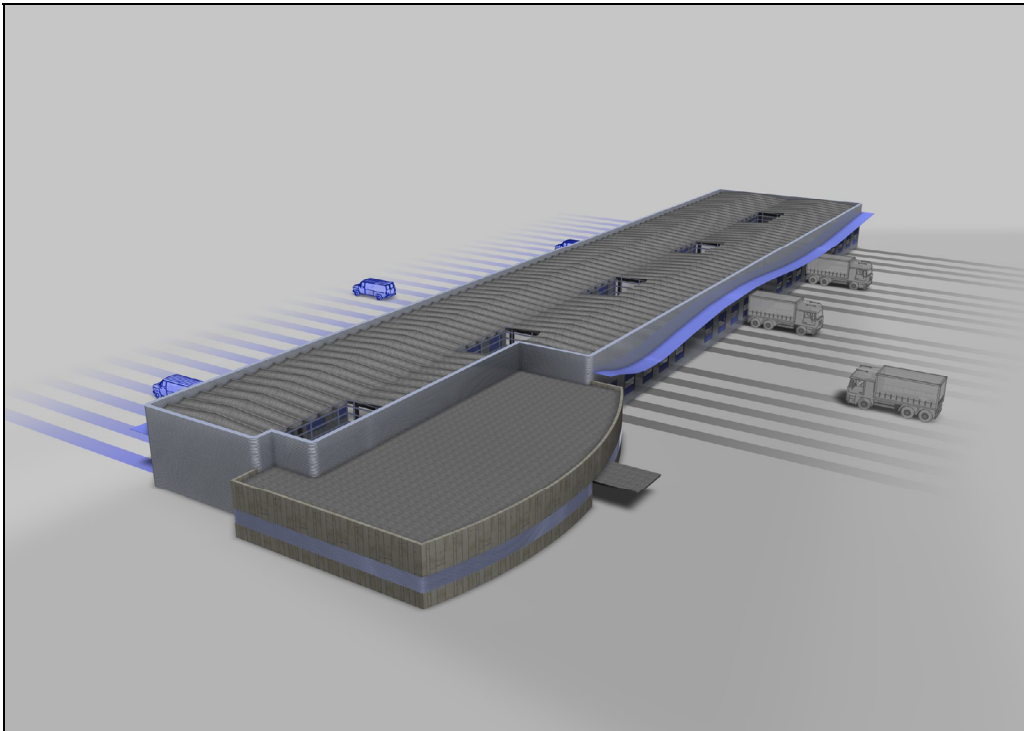


Figure 1: Florence Transit Point.

Through this project, the Municipality of Florence is determined to improve the system of urban transportation of goods.² For this reason, a “Comitato Promotore” (Sponsor Committee) was constituted in 2003, formed by the Municipality and Province of Florence, the Chamber of Commerce, and the associations of couriers and traders. The objective of the “Comitato Promotore” was to promote a feasibility study for the Transit Point.³

In this context we have formalized a feasibility plan in order for the “Comitato Promotore” to evaluate the methods through which the Transit Point will meet the aforementioned goals. It focuses on:

1. analysis of the *present situation* and possible *alternative solutions* that could be implemented in order to achieve the goals set forth by local government;
2. *regulation* aspects: the analysis of the competition regulations that influence the Transit Point management;

² On the issue of urban transport of goods see: Burlando (2003); Da Rios – Gattuso (2003); Malgieri – Galli (2002); Patier (2002); Santos (2002).

³ The study was conducted between September 2003 and May 2004 by I2T3 staff. Three departments of the University of Florence were involved in this study: the Department of Business Administration, the Department of Statistics and the Department of Engineering.

3. *corporate governance* aspects: the analysis of laws regulating the company structure;
4. *data analysis*: number of goods, shop timetables, number of vehicles, delivery time, location for the platform;
5. *economic* aspects: the development of a business plan that shows the economic sustainability of the Transit Point.
6. *performance measurement system* to demonstrate (ex-ante) and guarantee (ex-post) that the project could unite economic result with environmental and social performance.

1. Analysis of the present situation and possible alternative solutions

The current system of urban transportation of goods in Florence, as in many other Italian cities, causes a great deal of dissatisfaction for everyone involved. While the “last mile” of the logistic chain remains a low priority for the delivery companies, they continue to complain about the extra costs associated with accessing the historic centre. In fact, most delivery companies choose to outsource Limited Traffic Area (LTA) deliveries to truck-owner-operators. These operators work in extremely unfavourable conditions, and are poorly paid. Not only must they assume the responsibility of obtaining the proper permits for entrance into the LTA, they also have to negotiate the narrow streets of Florence that make stopping and unloading almost impossible. In addition, many delivery workers also run the risk of violating traffic laws, due to time restrictions on entrance. The shopkeepers we included in this study also expressed discontent with the current system due to incompatibility between shop opening hours and delivery times. Finally, inhabitants and tourists regularly complain about traffic congestion and atmospheric and acoustic pollution in the historic centre.

Given this situation, we began our study taking into consideration two specific issues:

- the delivery of non perishable goods;
- goods delivery to the historic centre of Florence (LTA) via the Transit Point.

Supplying the city of Florence with all of the goods necessary for daily operations is an undertaking too vast to be solved by a single solution for reorganization. Therefore, we restricted our research to the specific aspect of delivery and distribution of non perishable goods, which not only adversely affects the most delicate area of the city (the historic centre), but also allows us to direct our attention to a specific group of operators: the courier companies and their delivery personnel. We chose this aspect for two reasons: the delivery of non perishable goods does not call for the use of specific vehicles such as refrigerated trucks, and it is easier to manage administratively, since such goods are tangible and limited by size and weight.

On any given day, one store may receive two or three parcels of limited weight from two or three different courier companies. Of course, this means that two or three trucks travel the same route during the course of one day. A more favourable solution, then, would be for one delivery worker to make the complete delivery, at one time, and with one truck.

The pollution caused by the prolonged amount of time that delivery vehicles move within the historic centre, and the traffic congestion due to their stops for unloading make it clear that the current system for parcel delivery in Florence is no longer sustainable. In recent years we have observed a reduction in the dimensions of the parcels being delivered, together with an increase in total number of parcels. Should this trend continue, we can expect a total collapse of the delivery system within the historic centre of Florence.

We concentrated our attention on the historic centre as it represents the weakest link in the logistic chain – the last mile. As such, we studied a sample of courier companies who regularly make deliveries in the LTA, and found the historic centre to be an increasingly inconvenient destination, because of the problems already addressed.

To alleviate the above mentioned difficulties, the Municipality of Florence proposed a Transit Point to improve effectiveness and efficiency within the system of urban transportation of goods.

Improvements in effectiveness are related to:

- a reduction of atmospheric and acoustic pollution;
- an alleviation of traffic congestion due to fewer vehicles making stops in the historic centre, with a consequent improvement in vehicular and pedestrian circulation;
- a satisfaction of the Transit Point workers due to a collective union contract;
- an increase in satisfaction of merchants who will receive goods in a single delivery, at predefined times, and from only one delivery worker.

Improvements in efficiency are related to (Figure 2):

- a reduction of the total number of circulating vehicles in the historic centre;
- a reduction in delivery time through dividing the historic centre into more distinct “delivery areas” than are currently used by the couriers, and grouping deliveries by these;
- an elimination of vehicles that travel at low capacity.

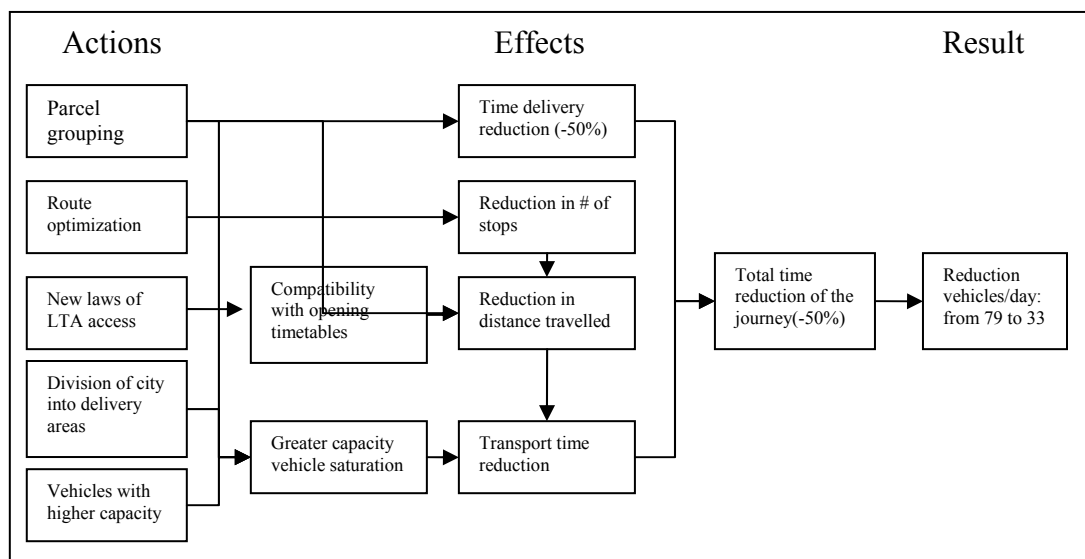


Figure 2: Transit Point efficiencies.

During the development of the current study a proposal for a “Virtual Transit Point” was considered to reduce the amount of the investment necessary. This solution would not require a physical platform where parcels are delivered, but would still include the introduction of new vehicles with low/no environmental impact with which the deliveries are made. The workers would pick up goods from a hub, where they would be grouped according to delivery destination. They would then be assigned to specific areas of the historic centre, in order to avoid multiple vehicles in the same Limited Traffic Area. It is obvious that this proposal would save money, as the construction of the platform would not be necessary. However, for it to function properly, the entire system of communication between delivery companies and workers would need to be computerized, which at this point seems close to impossible. In fact, each delivery company we interviewed for this study adopts a different method for tracking and registering deliveries. Those companies who still rely on paper for registering, for example, would be left out of the virtual solution. Given the diversity of the delivery methods currently used, and the incompatibility between them, we consider the “Virtual Transit Point” not to be feasible.

In support of the Transit Point proposal, we can look at other Italian cities where such platforms are in place and functioning: Genova, Vicenza, Padova, Ferrara, and Siena. Of course, each of these cities has its own particular characteristics, so the Transit Points in place do differ slightly from city to city. However, the underlying idea remains the same in each case: a new and sustainable model for delivery and distribution of goods into the historic centre. Inhabitants in all of these cities have observed an increase in the quality of life in the historic centre, without any alteration to the standards by which goods are being delivered. In addition, the cost related repercussions have been minimal to the operators within the system.

2. Regulation and corporate governance aspects

This project would require that the infrastructure, vehicles, and software are paid for by local government. As a result, the Transit Point would be regulated in accordance with the art. 113 of the Testo Unico Enti Locali⁴ - TUEL - (Local Government Law) as it would be considered a public service. It is very important to use TUEL as a reference, because we need to ensure that competition rules are respected. In any case, local government will not be able to prohibit the delivery of goods into the historic centre by couriers who do not use the Transit Point. However, the municipality can impose regulations on entrance that must be adhered to in order for access to be granted (size limits, time windows, and emission standards).

Regarding the corporate governance issue, the aim is to separate the planning and control functions from those related to business operation. The following model is proposed to reach these goals by:

- creating a company that owns the infrastructure (plants, vehicles, equipment), called *Transit Point Patrimonio* (TPp), whose shareholders are: the Municipality

⁴ Decreto Legislativo 18 agosto 2000 n. 267.

and Province of Florence, Tuscany Region, and Chamber of Commerce of Florence;

- choosing an entity called *Transit Point Gestione* (TPg), through tender contract, that manages the service in accordance with current norms in public service contracts.

This model aims to maintain the political and institutional responsibilities of the local government separated from the entrepreneurial management of the private entity (Borgonovi, 2003).

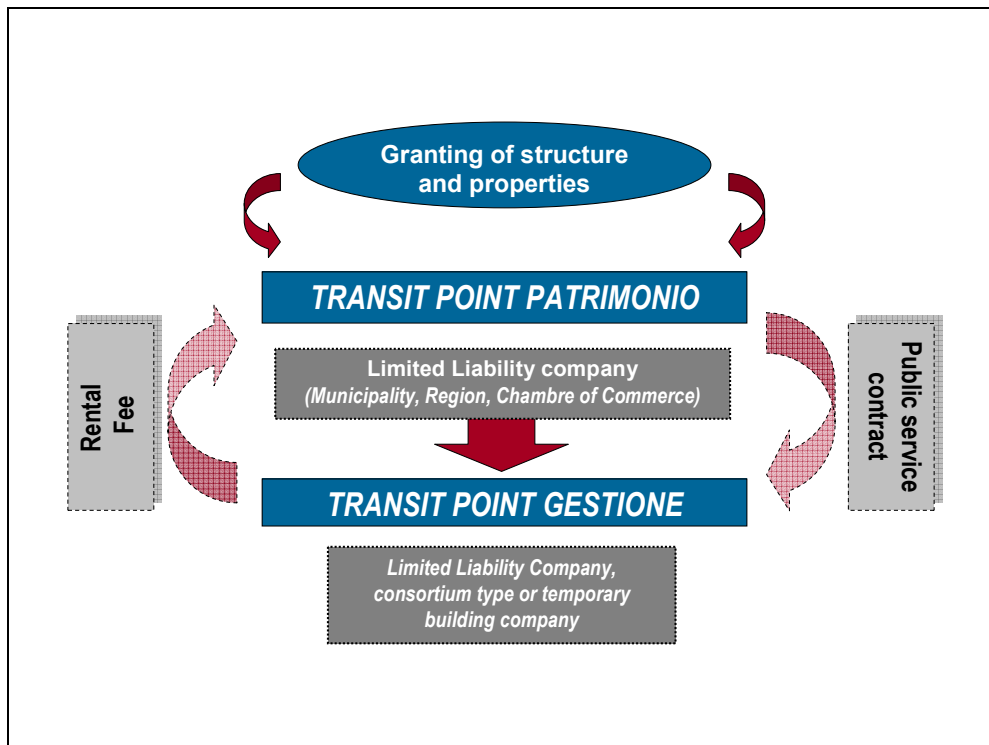


Figure 3: Transit Point corporate governance.

To give the opportunity to the “Comitato Promotore” to participate in the planning and control activities, the corporate structure of the Transit Point Patrimonio must be formed as a *dualistic model* (Figure 4). Following such a model, the shareholders’ meetings would be attended by public subjects (local government, province, region, chamber of commerce). The shareholders would then designate a *surveillance council* that would guarantee participation in surveillance to the promoters by including members of the “Comitato Promotore” into the council. The *surveillance council* has the crucial role of appointing the board of directors and approving the financial statement. The board of directors will have the responsibility of managing the enterprise.

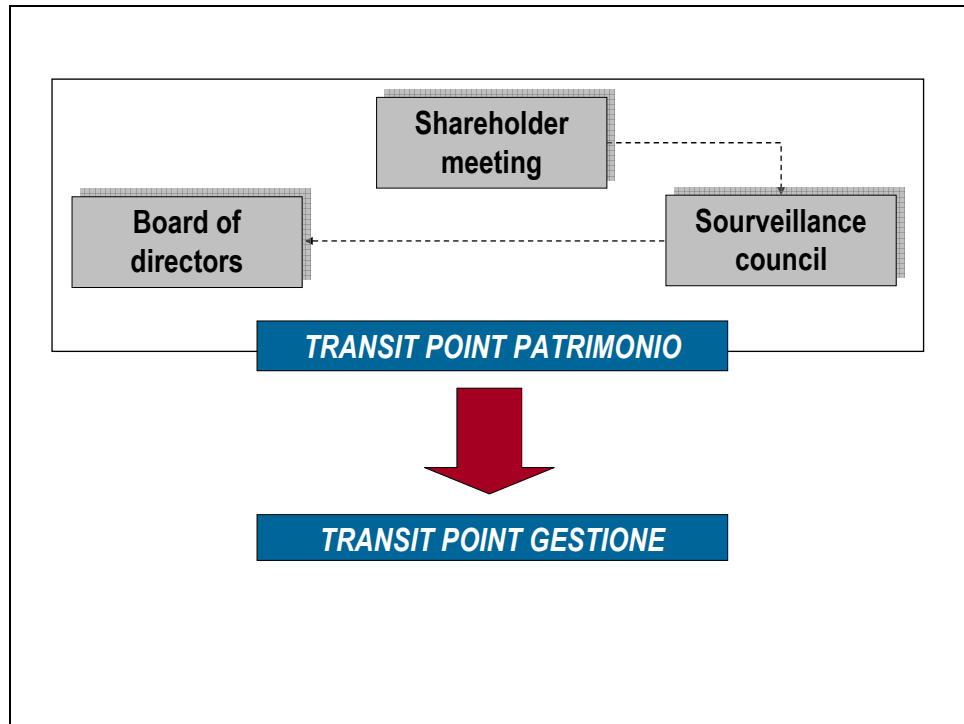


Figure 4: dualistic model.

3. Data analysis

In order to analyze the operating modalities and the amount of circulating goods in the LTA of Florence, a series of interviews were conducted with shopkeepers and delivery companies in cooperation with the Statistics Department of the University of Florence.

Specifically, between November 2003 and February 2004, we interviewed 444 shopkeepers in the historic center, divided by type of business, conducted second interviews with shopkeepers that have peak periods in February, and mapped all (120) the courier companies who regularly make deliveries in the LTA and interviewed a sample of 30.

The results of the data analysis gave us specific information about: shop timetables, delivery times, availability/accessibility of loading and unloading areas, trend of parcel flow, use of shop vehicles, courier numbers, parcel numbers, and location for the Transit Point.

a. shop timetables

From data we received, we can see that almost 56% of the interviewed shops open for business between 9am and 10am. This figure rises to 66% if we look at the hours between 8 a.m. and 10 a.m.

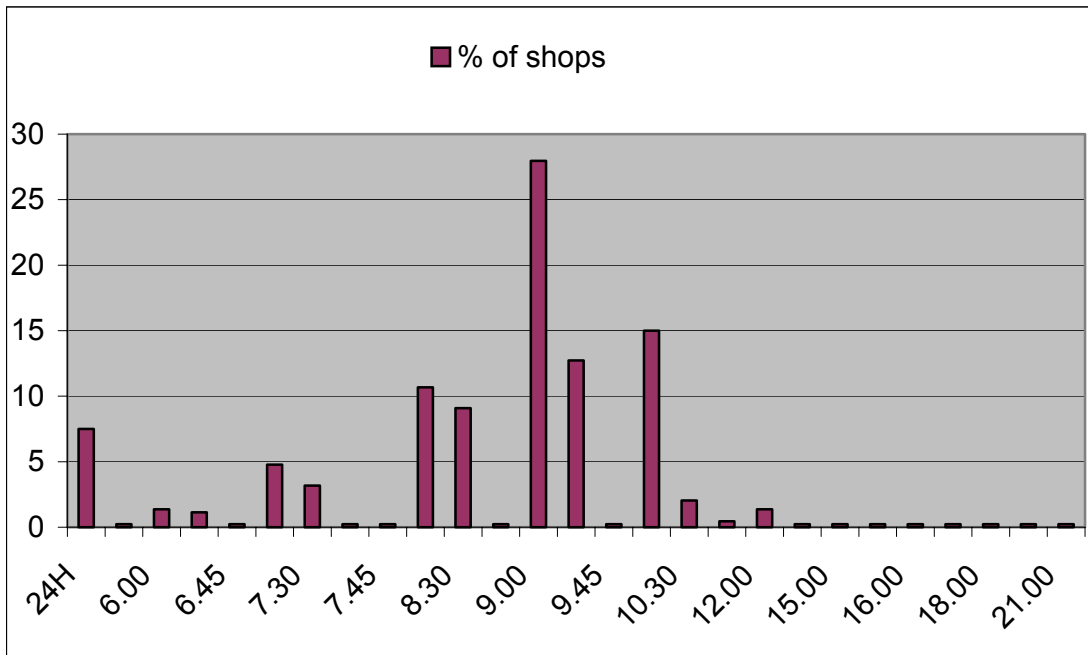


Figure 5: opening hours.
Source: I2T3 (2004).

The opening timetables have been geographically referenced as shown in Figure 6. In analyzing Figure 6, we can observe that in only one area of the city (*Oltrarno*) do most shops open at the same time. This may be because there is a higher concentration of artisan shops in this area than in other parts of the city. Opening timetables, then, are more generally dependant on the type of business conducted, and not on the location of the shop.

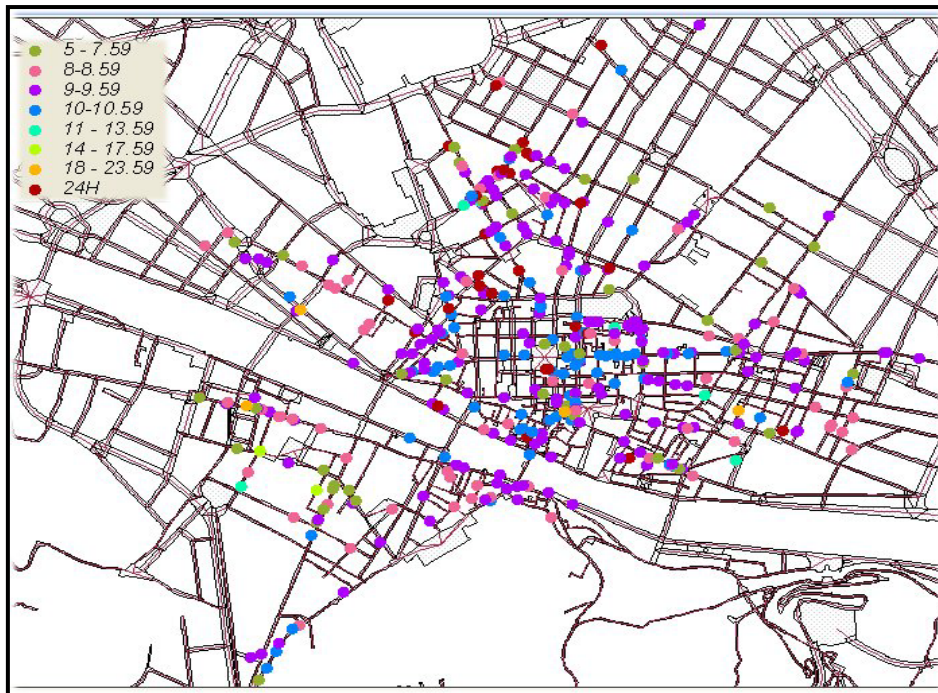


Figure 6: shop opening timetable geographically referenced.
Source: I2T3 (2004).

b. delivery time

During our investigation, delivery vehicles were legally permitted to load and unload goods in the LTA until 10am (Figure 7).

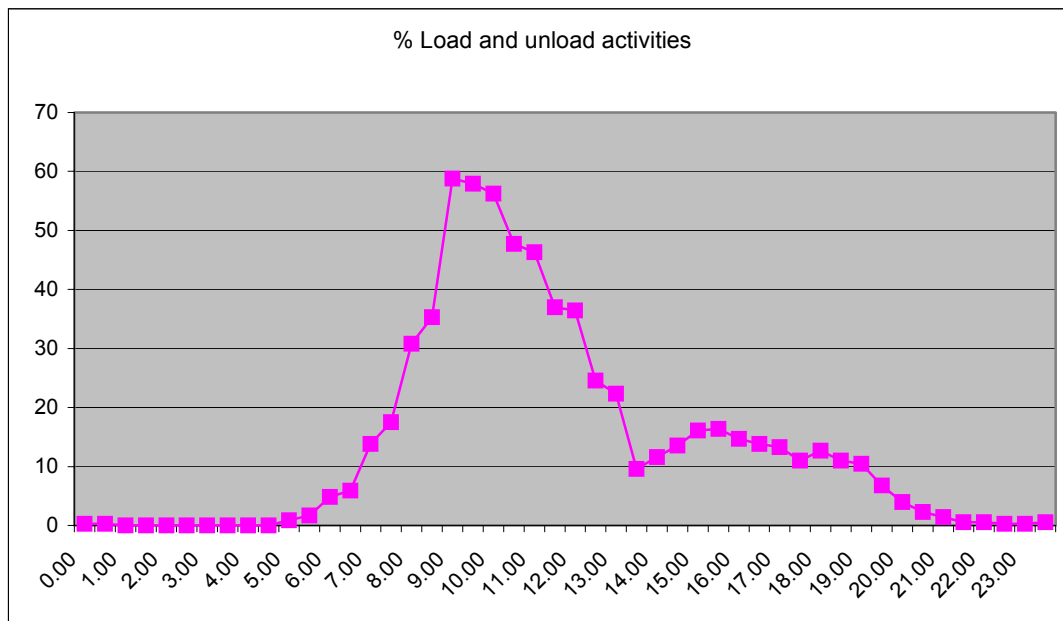


Figure 7: loading and unloading activities.

Source: I2T3 (2004).

From this figure, we observe that deliveries are highly concentrated between 9 a.m. and 10 a.m. However, it is important to recognize that deliveries continued (illegally) even after 10 a.m. They taper off to a minimum between 1 p.m. and 2 p.m., when most shops are closed for the lunch break.

c. availability/accessibility of loading and unloading areas

An important aspect which significantly affects the service of goods distribution is the availability of loading and unloading areas. The investigation results show that more than 87% of the businesses interviewed do not have such an area in proximity to the point of sale. This information turns out to be even more negative if one considers that the few existing areas are often occupied by private vehicles, making the unloading of goods difficult, and forcing the delivery workers to increase the number of kilometres travelled and time spent looking for an alternate area to stop.

d. trend of parcel flow

As was mentioned earlier, in the month of February a supplemental investigation with the shopkeepers was conducted, in order to verify the number of parcels received by looking at the delivery receipts. This was done to understand the influence of delivery peak periods on the total flow of goods. We did this because during the first

investigation it appeared that about 41% of the businesses were presenting some seasonal peak (prevalently two peak periods).

Table 1: % of shops with peaks.

| <i>N° of peak</i> | <i>% of shops with peak</i> |
|-------------------|-----------------------------|
| 1 | 39,13 |
| 2 | 58,69 |
| 3 | 1,63 |
| 4 | 0,54 |

Source: I2T3 (2004).

This information determines a non-constant flow of goods which strongly affects those shopkeepers who have seasonal goods, and who completely replace the goods they make available. Such a phenomenon determines a swinging trend of flow, as illustrated in the following diagram (Figure 8).

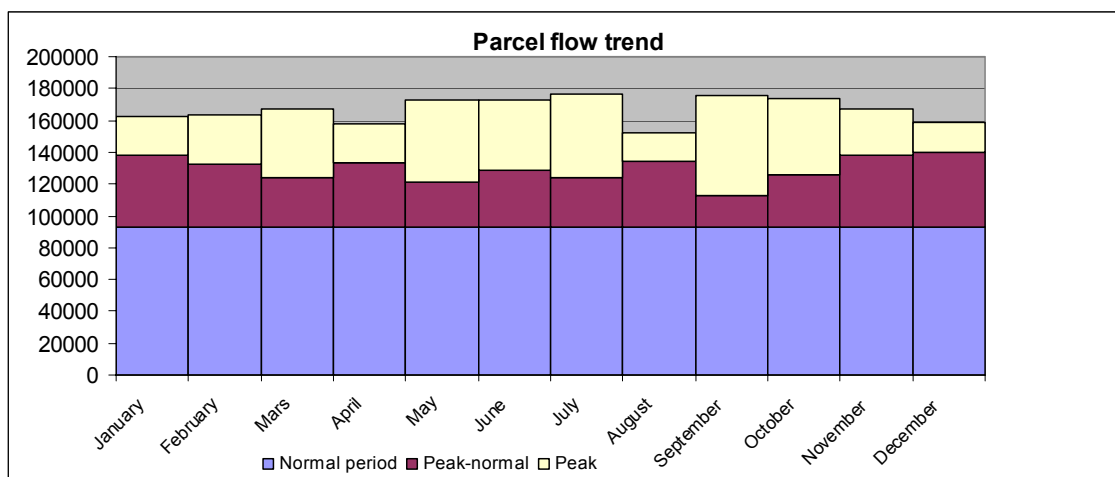


Figure 8: trend of parcel flow.

Source: I2T3 (2004).

Figure 8 shows the flow of goods from month to month. The diagram has been calculated adding three different flows that illustrate the impact of seasonal periods on the shops we interviewed. In particular:

- *Normal period*: refers to the number of goods that are delivered at a constant rate to the shops that have no peak periods. The sum has been fairly divided among the 12 months. This value is represented in the first block.
- *Peak-normal*: refers to the number of goods delivered to stores that have peak periods in what they identify as non-peak months. The “month sum” is represented by the second block.
- *Peak*: refers to the number of goods delivered to stores that have peak periods during what they identify as peak months. This value is represented in the third block.

e. *use of shop vehicles*

Results show that a significant number of deliveries are made using privately owned vehicles. In fact, 42% of the shopkeepers interviewed stated that they use their own vehicles to transport goods, and that the average number of trips made is equal to 12 per month.

Table 2: private vehicle journey.

| <i>N° of trips with privately owned vehicles in a month</i> | <i>% shops</i> |
|---|----------------|
| 0 < n ≤ 5 | 43.01 |
| 5 < n ≤ 10 | 12.90 |
| 10 < n ≤ 15 | 13.44 |
| 15 < n ≤ 20 | 17.20 |
| 20 < n ≤ 25 | 4.84 |
| > 25 | 8.60 |

Source: I2T3 (2004)

f. *courier number*

Before we conducted our survey, a complete database of couriers who operate within the historic center of Florence was not available. We were able to determine that almost 120 different courier companies make deliveries in the LTA, prevalently in the North-West area of the city. We selected a sample of 30, who account for 70-80% of total goods delivered, to participate in our survey.

g. *parcel number*

Considering that the information obtained through interviews of the shopkeepers regarding number of goods delivered, and their weight and volume probably presents some errors, and that interviewed couriers represent only about 70% - 80% of the flow, we assume an annual average number of deliveries to include almost 2,000,000 parcels.

h. *location of the Transit Point*

In order to best determine where to build the Transit Point Platform, we must take into consideration the current location of the delivery companies who most frequently operate in the historic centre. From the data we received, we discovered that there are more than 120 delivery companies, of varying size, and with different frequencies of delivery. The majority of these, responsible for the greatest number of deliveries made in the historic centre, are located in the North-West area of Florence, between Osmannoro, Calenzano, and Sesto Fiorentino (Fig 9). As such, we must necessarily look in the North-West area of Florence for a potential Transit Point location. Any other location would require an increase in distance travelled (and therefore traffic congestion) in order to connect the delivery companies to the Transit Point.

Given this situation, a preliminary investigation was undertaken to find areas that have the following characteristics:

- location in the North-West area of Florence;
- surface area of at least 7,000/10,000sqm accessible to the highway and to the historic centre.

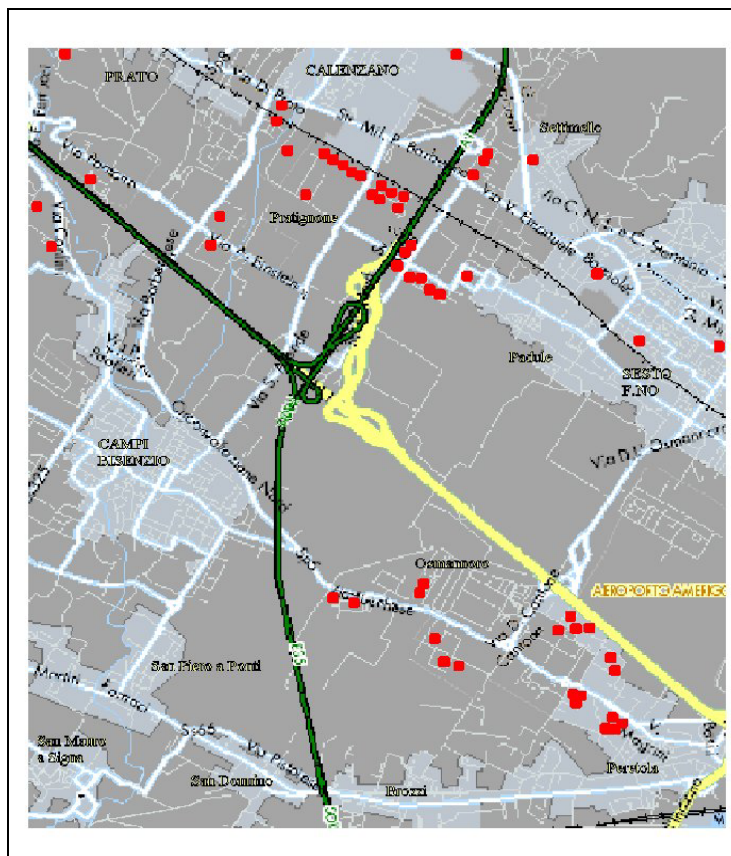


Figure 9: location of delivery companies.
Source: I2T3 (2004).

4. The income statement of the initiative

It is now possible to check the economic feasibility of the Transit Point initiative. In particular, the economic feasibility of the *Transit Point Proprietà* (TPp) and of the *Transit Point Gestione* (TPg) has been analysed.

With reference to the TPp, the main assumption is that it will not produce profit, but it would limit itself to break even. This determines the returns of the structure, which are the annual costs that the winning company of the tender contract will have to pay to offset the exact costs of the TPp. The budget will amount to the costs of the organizational structure and the costs of extraordinary maintenance of the buildings.

Therefore, the main issue is to ensure that the TPg will breakeven, and go on to make a profit. In analysing the TPg, we considered the following issues:

1. assessment of turnover;
2. estimation of cost.

1. assessment of turnover

Revenue of the TPg was calculated based on the current cost of delivery workers to the courier companies. In fact, under the transit point proposal, the amount currently paid to the delivery workers would instead be given to the TPg.

Under this hypothesis it is necessary to identify:

- a. the daily cost of a worker, that is evaluated at approximately € 130;⁵
- b. the number of workers needed, that is estimated at 79.⁶

Given the above data the Turnover of the TPg is € 2,362,100, calculated as follows: 79 (number of actual delivery workers) x €130 (daily cost of worker) x 230 (number of working days).

2. estimation of cost

In order to estimate the cost of the TPg we considered the following aspects:

- a. organizational structure (management, warehouse workers, etc.);
- b. general management expenses (services, ordinary maintenance, fee to the Tpp)⁷;
- c. transport expenses (delivery, cost of vehicles, maintenance of the plants).

a. organizational structure

The organizational structure of the Transit Point is proposed as follows:

- n° 1 director;
- n° 1 II level employee;
- n° 3 III level employees;
- n° 30 IV level warehouse workers.

Based on current contracts of the same category, the annual cost of the organizational structure amounts to € **900,514**.

b. General expenses

General management expenses are divided as follows:

| | |
|---|------------------|
| Utilities and supplies (electricity, gas, water, office supplies) | € 118,105 |
| Ordinary maintenance of the structure | € 37,167 |
| Rental fee paid to Tpp | € 65,667 |
| Total | € 220,938 |

Annual general management expenses amount to € **220,938**.

⁵ This cost is the present market price for a delivery worker.

⁶ This value was calculated according to the data analysis in which we find that each year the delivered parcels are 2 million and the daily delivered parcels are 8,696, considering 230 working days.

The estimation of theoretic number of delivery workers needed was made under the presumption that each worker would:

- make 55 stops daily;
- deliver an average of 2 parcels per stop.

Given that, today it is necessary to remunerate 79 delivery workers based on the following calculation: 8,696 (daily delivered parcels) ÷ 2 (parcels delivered at one stop) ÷ 55 (stops per day).

⁷ Notice that in the cost items, the cost of the infrastructure amortization has not been inserted, due to the purchase of the infrastructure which will necessarily take place through public funds and not through the TPg fund.

c. transport expenses

Determination of transport expenses was based on two estimates:

- cost of the vehicles (amortization, fuel, insurance, administrative expenses);
- salaries of delivery workers.

Cost of the vehicles is illustrated in Table 3, divided by category.

Table 3: estimation of cost of the vehicles.

| | <i>Types of Vehicles</i> | | |
|-------------------------|--------------------------|-----------------|-----------------|
| | Daily 35 | Daily 50 | Daily 60 |
| Amortization | € 2.145 | € 2.470 | € 2.730 |
| Insurance | € 2.000 | € 2.000 | € 2.000 |
| Ordinary maintenance | € 214 | € 247 | € 273 |
| Administrative expenses | € 1,000 | € 1,000 | € 1.000 |
| Fuel | € 991 | € 991 | € 991 |
| Lubricant | € 50 | € 50 | € 50 |
| Tires | € 100 | € 100 | € 100 |
| Total | € 6,501 | € 6,858 | € 7,144 |

To better understand these figures, we must take into consideration:

1. Types of vehicles used:
 - n° 15 Daily 35 (weight transported: 1,200 Kg);
 - n° 04 Daily 50 (weight transported: 2,200 Kg);
 - n° 14 Daily 60 (weight transported: 2,800 Kg);
2. Cost of the vehicles amounts to:
 - Daily 35 € 21,450;
 - Daily 50 € 24,700;
 - Daily 60 € 27,300;
3. we estimate the amortization to take place over 10 years;
4. the maintenance expenses are estimated at 1% of the cost of the vehicle;
5. costs of fuel, lubricant, and tires are estimated based on average cost at present;
6. daily distance traveled is estimated at 50 Km per day

The daily cost (considering 230 working days) of the vehicles is:

- Daily 35 € 28
- Daily 50 € 30
- Daily 60 € 31

Taking into consideration the number of delivery workers necessary (33),⁸ and the cost of each vehicle, the total daily cost to the TPg for these factor was calculated and is illustrated in Table 4.

We have estimated the annual (gross) salary of each delivery worker at € **23.500** based on current remuneration figures. Dividing by 230 working days, the daily cost is € **102**.

Table 4 shows the daily cost of the delivery workers with relation to the type of vehicle used.

Table 4: estimation of daily cost of delivery workers.

| | <i>(A) vehicle</i> | <i>(B) worker</i> | <i>(A+B) daily cost</i> |
|-----------------|--------------------|-------------------|-------------------------|
| Daily 35 | 28 | 102 | 130 |
| Daily 50 | 30 | 102 | 132 |
| Daily 60 | 31 | 102 | 133 |

Taking into consideration the number of delivery workers necessary (divided by vehicle category), and the relative remuneration, the total annual cost to the TPg was calculated and is illustrated in Table 5.

Table 5: estimation of total cost of remuneration to delivery workers.

| | |
|-------------------------------|--------------------|
| 15 workers who use "Daily 35" | € 450,019 |
| 4 workers who use "Daily 50" | € 121,435 |
| 14 workers who use "Daily 60" | € 429,027 |
| Total | € 1,000,481 |

With this information, it is possible to proceed with the calculation of total operating expenses of the TPg, and the Earnig Before Interest and Taxes (EBIT) which amount to € 240,166 as shown in Table 6.

Table 6: Transit Point Ebit.

| | |
|------------------|--------------------|
| Revenues | € 2,362,100 |
| Cost: | |
| Personnel | € 900,514 |
| General expenses | € 220,938 |
| Cost of delivery | € 1,000,481 |
| Total | € 2,121,933 |
| EBIT | € 240,166 |

The income statement shows that the Transit Point is, from economic point of view, feasible given its efficiency in reaching an economic balance.

⁸ Thanks to the efficiency gains, the number of workers will be reduced from 79 to 33 (see Fig. 2).

5. The performance measurement system

The model for corporate governance that we propose requires that the public company (TPp) exercises the institutional function of planning and control so that the management of the TPg can satisfy the greatest number of stakeholders. Since sustainability has been identified as the principal goal of the TPp, it has to guarantee that the TPg will be in a position to reach it, through the service contract. It must require that the TPg is accountable for the economic, environmental, and social repercussions of its operation.⁹

To support the company in its efforts to reach sustainability, we propose a “strategic map” (Kaplan and Norton, 2004), in which goals and management programs are clearly stated. The company, then, would no longer produce reports made up exclusively of economic results, but would produce more comprehensive statements that help to understand the context within which certain results are obtained.

The strategic map is indispensable:

- within the TPg for the construction of a set of performance indicators that describe causal relationships between operations and realization of strategic goals;
- between the TPg and the TPp where it would guarantee that the actions taken by the entity TPg are coherent with the objectives stated by the TPp.¹⁰

In short, the strategic map serves to stimulate the relationship between the conduct of the private company (TPg) and the objectives of the public company (TPp). It will be able both to show to what extent goals have been reached, and to give explanations for eventual shortcomings (Figure 10).

The business report should highlight, for example, how the goal *reduction of traffic congestion* can be reached through the use of adequate software that could optimize the delivery routes, reducing both the *number of trips taken* and the *number of vehicles required*. Closely linked to this is the *reduction of pollution*, which can be realized through the introduction of *ecological vehicles* that *travel shorter distances* due to the optimization of the routes.

Having a single provider who takes care of all deliveries will guarantee *improvement in the quality of service* in two ways: by organizing receipt of the merchandise, and by saving the time it would take to conduct business with multiple providers.

From an efficiency point of view, the model proposed will result in considerable monetary savings, due to a number of factors. Since *fewer vehicles will be needed, less money will be spent on fuel and maintenance*. In addition, the vehicles will be ecological, and therefore eligible for *government grants*. Finally, the reduction in number of delivery workers will also contribute to savings.

With regards to the indicators, we propose the set of measures as presented in Table 7. Notice that they are a combination of *primary* and *secondary* measures. Through the primary measures, it will be possible to establish the parameters to be inserted in the service contract by which effectiveness will be measured (reduction of atmospheric and acoustic pollution, reduction in customer complaints, reduction of circulating vehicles

⁹ On the issue of sustainability accounting see: Epstein-Roy (2001); Bonacchi-Rinaldi (2005).

¹⁰ In fact, using only indicators (even if positive) could lead to actions by the private company that are not consistent with the intent of the public company.

in the historic centre). The secondary measures, instead, bring to light the cause-and-effect relationships between actions and results (number of delivery workers used, average distances in km travelled by the vehicles, number of clients who use the Transit Point).

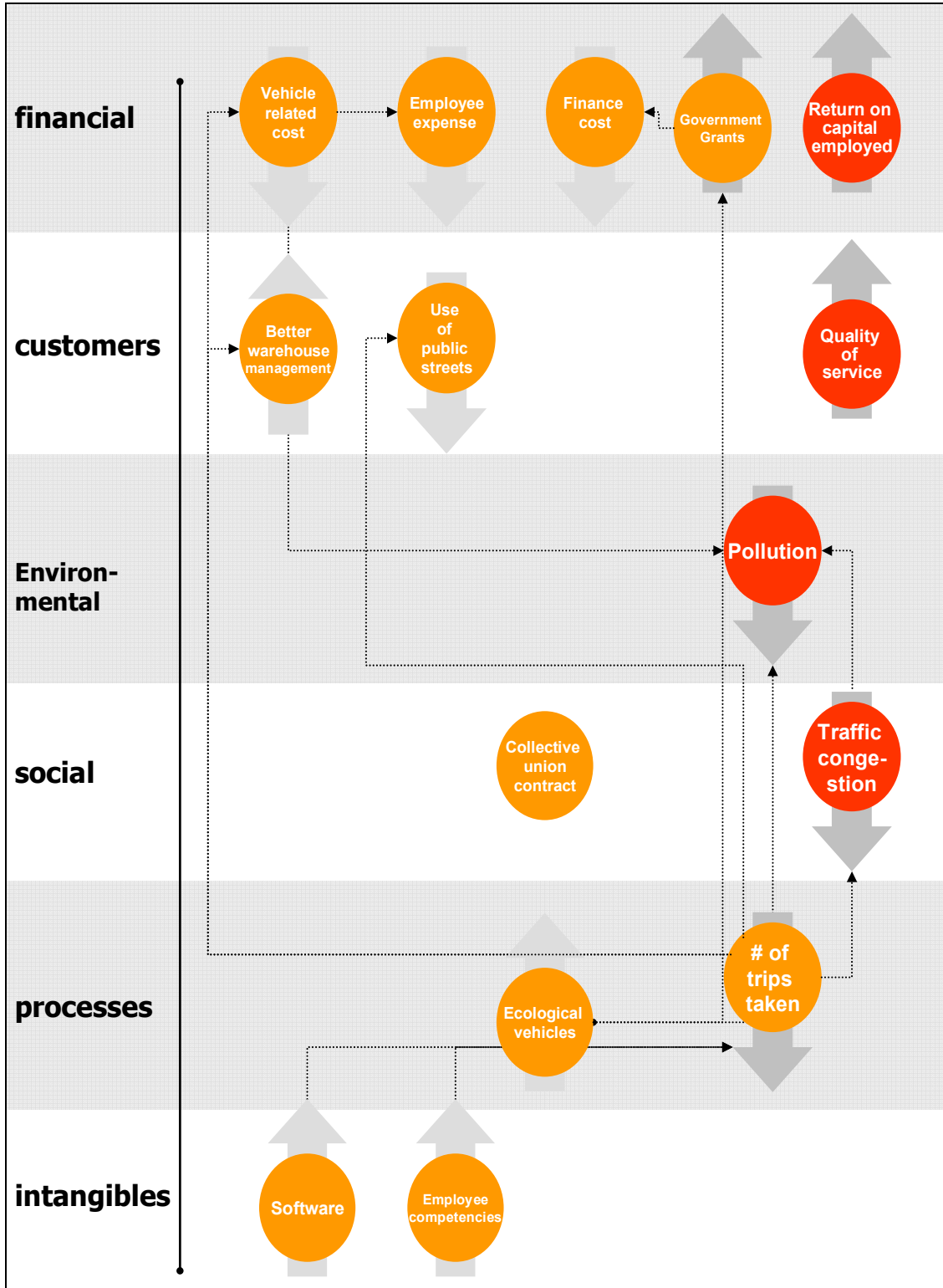


Figure 10: Transit Point strategic map.

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| STRATEGIC MAP | STRATEGIC OBJECTIVES | INDICATORS | | TARGET | ACTIONS | BUDGET |
|---------------|---|--|---|--------|---------|--------|
| | | Primary measures | Secondary Measures | | | |
| | Return on capital employed | Economic Value Added | - number of delivery workers used | | | |
| | Obtain Incentives for ecological vehicles | € of financing given to TP | - number of applications won/presented | | | |
| | improve the quality of service | number of complaints | - parcels not delivered on time - parcels lost - lost calls at call centre | | | |
| | reduce pollution | noise level in historic centre level of carbon particles level in the air | - electric vehicles/available vehicles | | | |
| | reduce traffic congestion | # vehicles used | - market quote of TP | | | |
| | reduce number of trips made | parcels delivered/vehicles used | - average km traveled for each vehicle | | | |
| | constant monitoring of parcels | # parcels delivered with electronic badge | - # of clients with information system compatible with TP standard - automated production of delivery documents/total # produced | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Table 7: reporting structure.

Conclusion

The current system for urban transportation of goods has significantly adverse effects on traffic congestion and the environment. Unfortunately, it is a problem that continues to grow (Burlando 2003). We conducted this study in order to more closely examine a possible solution to this problem.

From this work, we found the following aspects to be crucial:

- a. the need to unite the institutions (Municipality and Province of Florence, Chamber of Commerce) with the parties who have an economic interest in goods transportation (associations of couriers and traders) into one entity (i.e. “Comitato Promotore”)
- b. the importance of public financing of the structures;
- c. the importance of clear rules of corporate governance that oversee the relationship between the public entity that owns the infrastructure and the private company who manages the service;
- d. the importance of finding a suitable location for the platform;
- e. the need for new traffic regulations that would deter persons from using their private vehicles, and favour the use of those of the Transit Point
- f. the need to find a group of entrepreneurs who are interested in managing the TPg.

Both the institutions and associations of couriers and traders involved in the study formally recognized that realization of the Transit Point offers the possibility of improving the quality of life in the historic centre while increasing efficiency in the delivery of goods.

In particular, other than reaching the goal of reducing traffic congestion in the historic center, the realization of the transit point allows for:

1. the attainment of a positive EBIT through public financing of the structures;
2. the possibility of offering the service without changing transport or remuneration costs;
3. an improvement in the working conditions of the delivery workers who operate in the historic centre.

For these reasons, we find it fitting to underline that realization of the transit point is perfectly in line with the principles of sustainable development as defined: *development that meets the needs of current generations without compromising the ability of future generations to meet their needs and aspirations*” (WCED, 1987). Principles, in our view, to which both national and local governments should always aspire.¹¹

¹¹ This is the first and most widely accepted definition of sustainability, that was given in 1987 at the World Commission on Environment and Development (also known as the Brundtland Commission). It is important to note that this definition has had numerous effects on legislation, such as the Legge Regionale Toscana 16 January 1995, n. 5 whose objective is “Norms for Government and Territory”, and includes as the title for article 1 “Sustainable Development”. On the issue of transport sustainability see: Burlando and Musso (2003); Danielis (1996).

References

- Bonacchi, M. and Rinaldi, L. (2005) "A performance measurement system for sustainability", paper presented at the 3rd conference on performance measurement and management control, Nice, France, September 22-23.
- Borgonovi, E. (2003) "Criteri di scelta per le politiche dei servizi pubblici", *Azienda Pubblica*, n. 3.
- Burlando, C. (2003) *Aspetti economici del trasporto urbano di merci*, Padova, Cedam.
- Burlando, C. and Musso, E. (2003) "Mobilità urbana e sostenibilità", in: Senn L. Percolo M., *Trasporti e sostenibilità ambientale*, Milano, Egea.
- Da Rios, G. and Gattuso, D. (2003) *La mobilità delle merci nell'area metropolitana milanese*, Milano, Franco Angeli.
- Danielis, R. (1996) *I trasporti e l'ambiente*, Torino, Giappichelli.
- Epstein, M. J. and Roy, M. (2001) "Sustainability in Action: Identifying and Measuring the Key Performance Drivers", *Long Range Planning*, n. 34.
- I2T3, (2004) *Studio di fattibilità per il Transit Point di Firenze*, Firenze, <http://www.i2t3.unifi.it>.
- Kaplan, R. S. and Norton, D. P. (2004) *Strategy Maps*, Boston, HBS Press.
- Malgieri P. and Galli G. (2002) *La distribuzione delle merci in città*, Quaderno n. 3, Milano, Ricerche Trasporti (<http://www.ricerchetrasporti.it>).
- Marchisio, A. (2002) "Le piattaforme di distribuzione urbana: esperienze europee a confronto", in: *Sistemi di trasporto*, luglio-dicembre.
- Patier, D. (2002) *La logistique dans la ville*, Paris, CELSE.
- Santos, T. (2002) *Trasporto merci in ambito urbano – soluzioni innovative e casi di buone pratiche*, AmbienteItalia, settembre.
- WCED, (1987) *Our common future*, Oxford, Oxford University Press.



Urban freight logistics in the European Union

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Abstract

The paper recalls the main challenges of the European urban freight policy: the environment, the need for sustainable growth and quality of urban life. These are then interpreted by the member states. Some states have a top down prescriptive approach some others do not. The BESTUFS project, promoted by the EC, collects and disseminates best practice across the EU. It has identified a deep weakness at a local level, whilst also a wide range of pilots and successful exceptions.

Keywords: Urban freight logistics; BESTUF project; Best practices.

1. EC goals and objectives

1.1 *Kyoto and Gulliver*

In the twenty five member states of the European Union (EU-25), the commitment to the Kyoto treaty drives Energy and Transport policy and practice. Kyoto gave prime motivation to the European Commission (EC), the executive arm of the EU. This is combined with the 'Gulliver' effect, a scenario of an EU giant held down by its reliance on imported energy; 49% in 1998, forecasted to rise to 71% by 2030 without intervention [1]. These two key arms of energy policy lead to derived transport policies that affect cities and freight.

In May 2004 the EU enlarged to 25 member states, taking in much of Eastern Europe. With associated and candidate states, the EU is now the economic and political confederation of most of continental Europe. Energy and Transport policy is handled by the Directorate for Energy and Transport (DGTREN) and is already spoken of in terms of the EU-30.

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1.2 Energy and CO₂

The EU is committed to reducing emissions of six greenhouse gases to the 1990 base level, less 8% by 2008-2012 [1]. Without intervention the EU will fail to meet its Kyoto obligations, especially in the area of CO₂ emissions where the same sources show emissions by 2030 at +22% higher than the 1990 base.

Various policies are either in place, being discussed or being reviewed. Primarily for transport these are the promotion of renewable energy from 6% to 12% of total energy sources used, particularly to 20% of fuel sources for transport [2], and decoupling transport growth and economic growth.

1.3 Clean urban transport

In the longer term the EC is investing research and development funding to promote the hydrogen economy, a world where clean pollutant-free hydrogen fuel cells will power transport. In the shorter term it is promoting Clean Urban Transport through the objectives of achieving 20% of transport fuel as renewable by 2010.

Through the CIVITAS [2] initiative DGTREN is promoting a variety of measures for sustainable urban transport. It is, however, very passenger biased. Only recently has it explicitly developed the objective: "New concepts for the distribution of goods by means of introducing innovative logistics services using clean and energy efficient vehicle fleets, dedicated infrastructure and information services".

CIVITAS is energy focussed but this drives demand management such as congestion charging, promotion of public transport, and modal shift. It has recently been very much in favour of renewable energy such as biogas, bio diesel, and natural gas and rather opposed to funding measures for electric vehicles.

1.4 Decoupling

Transport accounts for 28% of all CO₂ emissions in the EU, and 84% of that is attributable to road transport. Although trucks account for only 10% of all transport operations in urban areas, they produce over 40% of pollution and noise. Forecasts show that in the EU-15 heavy goods vehicle (HGV) traffic will increase by 50% by 2010, without intervention. In the new member states, despite previously having planned economies that biased transport to rail, rail haulage decreased by 43.5% from 1990-1998 and road haulage increased by 19.4%.

The European single market and competition policies have progressively liberalised and deregulated road freight for over a decade, and economic growth has been matched and exceeded by transport growth. As Europe has moved from a 'stock economy' to a 'flow economy' of JIT, kanban, lean manufacturing and increasingly centralised distribution, haulage transport growth is outstripping economic growth.

Sustainable development is a key EU mantra, and as such it is a key policy of DGTREN to decouple economic growth and transport growth. It is how to achieve this that is an interesting area of policy and measures.

1.5 Economic importance and congestion

Transport is one of the essential drivers of industry, trade and integration in the EU. It accounts for some €1,000 billion annually, generates 10% of the Union's GDP and employs some 10 million people [3]. However, the move to a single market and deregulation has been imbalanced, with road transport outpacing the state monopolies of the railways. In the EU rail freight accounts for 8% of the market share, compared to circa 40% in the USA.

The economic importance of transport is being impacted as road traffic increases. Some 10% of the road network suffers daily traffic jams, 20% of the railway network is classified as bottlenecks. It is estimated that 6% of all fuel consumption is directly related to congestion. It is believed that 0.5% of the Community GDP is being spent on congestion and that by 2010 this will rise to 1% [3].

Combined with a chronic failure to invest in new infrastructure (public investment in infrastructure fell from 1.5% in the 1980s to 1% in the 1990s), this has led to two top level strategies being developed:

- Infrastructure and/or Congestion Charging, to discourage congestion and pollution whilst funding infrastructure;
- Modal shift and Intermodality, to shift back to a greater rail share, seen as more efficient and less polluting.

It is not the focus of this paper to discuss these further, but they are key parts in the jigsaw that is EC activity in urban logistics.

1.6 Cities of tomorrow

Europe is the most urbanised continent in the world, with 80% of the population living in towns and cities:

- 20% live in conurbations of more than 250 000 inhabitants (London and Paris are the only two European agglomerations with around 10 million inhabitants);
- 20% live in medium-sized cities (50 000 to 250 000 inhabitants);
- 40% live in towns with 10 000 to 50 000 inhabitants [4].

To this end, the EU developed the European Urban Forum and the City of Tomorrow and Cultural Heritage projects. Whilst it has been rumoured that these have been sidelined since 2000, it has generated both projects in urban land use and transport research. Little of these have approached the issue of urban logistics, although one project, CITYFREIGHT, is funded by the latter.

It does mean, however, that there is a quality of life dimension to urban policy in the EU that intertwines with the environmental and economic aspects.

2. But, what about the trucks?

2.1 States rights

The EU is a confederation of sovereign states. It has yet to have a constitution and just to mention the word ‘federalist’ in some states is enough to be harangued as a modern day Napoleon or Hitler. To that end, the EC can agree policy with Member States and the comparatively weak European Parliament, but actual action is carried out at the state level. Until we have our own ‘virtual Gettysburg’ there can be a significant disconnection between EC policy and member states.

In the arena of urban freight, itself a niche caught between the environmental concerns, quality of life concerns and that of economic competitiveness, there is often a yawning void. In this void logistics companies compete tooth and nail to meet ever rising customer needs, city governments react with ignorance to a transport group that is widely disliked, and national governments devolve responsibility to cities that have few ideas of the nature of the problems let alone how to solve them.

Some countries have addressed the issue. The UK has a sustainable distribution policy document as a daughter paper to the UK transport White Paper. It is largely focussed on carbon reduction through training, benchmarking, fleet modernisation and co-operative policy setting. The French have a requirement for a distribution strategy in each of the seventy ‘plan de déplacements urbains’ (PDU) that local government has to produce. Maybe seven of those are actually a freight strategy of any worth. Germany adopted a bottom up approach, with a surge of enthusiasm for ‘city logistics’ in the 80s and 90s. Others, such as Italy or Spain have no modern urban freight policy at a national or local level.

A questionnaire by BESTUFS showed that once city government is reached, 25% of cities have no-one in charge of freight policy, and 44% have less than half a full-time employee working on the subject. Most resources at the local level are focussed on public transport and then cars. Whilst half of cities reported that they met regularly with freight actors, half said they had no freight policy or planning at all. Since the sample that answered was self-selecting we must assume that the numbers with no policy or plans are actually a far greater majority [5].

2.1 BESTUFS

Best Urban Freight Solutions (BESTUFS) is a Thematic Network funded by DGTREN under the Fifth Framework Programme. It is co-ordinated by PTV, with core partners ARRC, NEA, Rapp Trans, and more recently, CDV and Transman. It is not a research action, but a network through which practitioners, experts, academics and policy makers can share best practice in the arena of urban freight.

These interest groups include:

- Commercial interest groups (shippers, receivers and transport service providers).
- City administrations and policy enforcement agencies.

- Civic interest groups, individuals, user groups.
- On-going projects including demonstrations already involved directly or indirectly at national and European levels.
- Relevant national and European level directorates for city planning, transport facilities and services.
- Relevant systems and technology providers.

It started with the year 2000 and ends with the year 2003. In 2003 it was extended to cover the new states that will join on 1st May 2004. BESTUFS II followed in 2004, extending through to 2008.

Although not a research activity in EC terms, it performs a secondary research role. It hosts workshops on urban freight themes, publishes the presentations, writes best practice handbooks, makes recommendations and has compiled clustering reports of EU research and demonstration into this area at local, national and EU level.

To date BESTUFS has hosted 14 workshops, 5 conferences, published 17 newsletters, 4 best practice guides, 3 research clustering guides and maintains a website of all this material at: www.bestuufs.net.

2.3 Areas and activities.

At the first BESTUFS workshop the key themes of relevance to urban freight were identified (see *Table*). They were, in no order of importance:

Table1: Key themes to Urban Freight.

| <i>No.</i> | <i>THEMES OF RELEVANCE TO URBAN FREIGHT TRANSPORT</i> |
|------------|---|
| 1 | Urban freight platforms. |
| 2 | Traffic planning and policy. |
| 3 | Access restrictions. |
| 4 | Weights and dimensions. |
| 5 | Transport units. |
| 6 | Unusual transport modes. |
| 7 | Tolls and heavy vehicle fees. |
| 8 | Intermodal urban freight aspects. |
| 9 | E-commerce. |
| 10 | Door-to-door freight transport aspects. |
| 11 | Telematics for urban goods transport. |
| 12 | Environmentally friendly vehicles. |
| 13 | Co-operation of transport operators. |
| 14 | Interfaces between public and goods transport. |
| 15 | Improvement of Public Private Partnerships (PPPs). |
| 16 | Economic improvements. |
| 17 | Environmental improvements. |
| 18 | Improvements for citizens/inhabitants. |
| 19 | Win-win situations. |

2.4 Workshops and conferences

From this the network has held the following workshops and conferences:

Table 2: Workshops and conferences held and connection with BESTUFS key themes.

| BESTUFS Key Themes | Workshops and conferences | | | | | | | | | | | | | | | | | | |
|--|---------------------------|-----------------------------|---------------------|------------------------|-----------------|-------------------------|------------------------------|----------------------------------|------------|--------------------------------|--------------------------------------|-----------------------------------|-------------------------------------|---|--|-----------------------|----------------------------|---------------------------|--------------------|
| | Urban freight platforms | Traffic planning and policy | Access restrictions | Weights and dimensions | Transport units | Unusual transport modes | Tolls and heavy vehicle fees | Intermodal urban freight aspects | E-commerce | Door-to-door freight transport | Telematics for urban goods transport | Environmentally friendly vehicles | Co-operation of transport operators | Interfaces between public and goods transport | Improvement of Public Private Partnerships | Economic improvements | Environmental improvements | Improvements for citizens | Win-win situations |
| Intelligent Transport Systems and Urban Freight | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| Night delivery: a further option in urban distribution | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| Successful private public partnership enhancing urban goods transport | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| Land Use Planning and Business Models for urban Distribution Centres | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| City Access Fees and urban Pricing: What are the Consequences for urban Freight Transport? | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| Rail based Transport: A disappearing Opportunity or a Challenge for urban Areas | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| Changing urban Transport due to E-commerce and E-Logistics | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| Optimised City Distribution Vehicles as demanded by Transport Operators and Cities | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| City Access, Parking Regulations and Access, Access Time Restrictions, Enforcement Support | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| Identification of thematic network priority themes | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| Urban Freight and the Environment | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| Freight Policy, Laissez-faire or Planned? | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |

Three Best Practice handbooks have been published electronically:

- Statistical data and city access.
- E-commerce and urban freight distribution.
- Road pricing and urban freight platforms.

Whilst many of the themes and areas explored by BESTUFS are of great interest to any logistician or policy maker, we have chosen Urban Freight Platforms to focus on in this paper, both within and without the classical German ‘city logistics’ concept.

3. Urban freight platforms

3.1 City logistics

In the 1980s Germany was awash with ‘city logistics’ plans whereby the city and business would co-operate to form an integrated urban freight scheme. Routing systems would work with shared user urban freight platforms. The objective was to reduce trips, increase utilisation and rationalise urban freight. In 1985 the ‘Logistik Heute’ magazine reported more than eighty projects.

At an EU level the concept was taken up by other governments and the EC. Projects such as the ELCIDIS freight platform in La Rochelle were trialling the delivery of consolidated freight in the historic centre. Cities such as Nuremburg and others trialled combined recycling and freight consolidation.

3.2 Doubts

Others showed more caution. Trials in the UK and a survey published by the University of Huddersfield [6] led many to suggest that this model was deeply flawed. The authors, and others, believe that a publicly owned or initiated urban freight platform is doomed. It is anti-competitive; it allows equal access to all players and therefore removes competitive advantage. Public bodies are empirically shown to be poor operators of competitive activities; and they will also tend to sell on the project, making it partial and a competitor to other logistics operators. Private enterprise already has urban distribution centres, suited to the network of the company; it is likely that public hubs will not be optimally placed to suit commercial players. Where a hub is not logistically tenable then the platform may well introduce a delay into delivery.

These doubts seem borne out. Of the eighty or more German schemes in 1985, only fifteen survived into 2002. The ELCIDIS project added a day to every delivery, and despite harsh access restrictions, they only captured 50% of the targeted volumes. Operators preferred to deliver fast using their own networks. Many urban freight platforms collapsed as competitors chose to move to their own facilities, or as public bodies sold the platform to one partner or another, thus leading to an exodus of the other actors. Research by STRATEC in Belgium showed that the core concept was often flawed, that by forcing large trucks to offload at a hub, which then distributed by small vans, the total trips and congestion was actually greater not lower!

3.3 Successes

Some examples of the urban distribution centre have worked. The ‘baulog’ concept, which is one of a distribution platform consolidating logistics flows into a large building project worked well with the rebuilding of Potsdamer Platz in Berlin and the Hammarby Sjostad building programme in Stockholm. Here a developer can impose a top down solution and force compliance, with the added benefit to contractors that the centre also was secure and site thefts fell.

Another successful example is at Heathrow airport where a consolidation centre accepts all deliveries to the franchises around the airport and then delivers to the shops. This works, again, because the franchisee is also the airport owner, and effectively controls the entire supply chain from door to counter. A delivery reduction of 66% trips was achieved and the logistics provider is trialling it at other shopping malls around the UK.

It does seem that urban freight platforms are a top down solution, and thus they can only yield true benefits in a controlled supply chain with a single player able to set the agenda. Cities, for all the wishes of some planners and greens, are not such a place.

4. Conclusions

European urban freight policy is driven by the environment, the need for sustainable growth and quality of urban life. This is then interpreted by the member states. Some states have a top down prescriptive approach such as France, others have a localised pragmatic approach, such as the UK. Many have no national approach at all, such as Italy.

The BESTUFS project has been an EC project to collect and disseminate best practice across the EU. It has identified a deep weakness at a local level, whilst also a wide range of pilots and successful exceptions.

The 'boom' subject of the 80s and 90s; city logistics and urban freight platforms has proven a conceptual failure. It has succeeded only in controlled environments where its conflict with free market competition is irrelevant.

References

- European Commission (2001) *Green Paper: Towards a European strategy for the security of energy supply*. Luxembourg: Office for the Official Publications of the European Communities.
- European Commission (2003) *Civitas Initiative Website*.
- European Commission (2001) *White Paper: European transport policy for 2010: time to decide*. Luxembourg: Office for the Official Publications of the European Communities.
- European Commission (1997) *Towards an urban agenda in the European Union*.
- Ruesch, M. and C. Gluecker (2001) *City Inquiry: European Survey on Transport and Delivery of Goods in Urban Areas*. RAPP AG: Zurich.
- Whiteing, A. E. (1996) *Freight in Urban Areas: A European Comparative Study of the Potential for Urban Freight Trans-shipment Facilities*. University of Huddersfield, Huddersfield.



The impact of inadequate off-loading facilities in commercial office buildings. Upon freight efficiency and security in urban areas

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Abstract

Substantial impediments to freight efficiency and security exist in the “last mile” of the logistics supply chain in New York City’s Central Business District (CBD). The “last mile,” a largely invisible obstacle in the transportation infrastructure, is a euphemism for the activity that takes place in close proximity to the destination, or delivery point, of product ranging from pharmaceuticals to copy paper. The challenges shippers face in moving products and services to small and large business in New York City are representative of the freight mobility problems that occur in congested urban areas worldwide.

In focus groups and interviews, carrier and shipper representatives repeatedly reported that inadequate off-loading facilities in commercial office buildings (COBs) were a major barrier to freight efficiency in New York’s CBD. These findings were supported in surveys completed by 82 property managers who provided information on their buildings’ age, size, composition of tenancy by industry, number and size of loading bays and the number and capacity of freight elevators. Time and motion studies of vehicular deliveries to loading docks at six COBs with floors ranging from 25-64 were carried out to determine dwell times and truck size.

Despite a 300% increase in truck deliveries to COBs located in the CBD over the past twenty-five years, New York City has not revised zoning regulations for off-loading facilities since 1972. To that end, requirements for the number and size of loading bays and freight elevators in five major American cities were compared with those of New York City. It was found that loading bay requirements for New York City were the lowest of the cities surveyed. There were no requirements for freight elevators in the cities under study.

Following the terrorist attacks of September 11, 2001, loading dock security, which was always a concern, became a major issue for COB property managers. This has led to the imposition of more rigorous security procedures at many off-loading facilities that have increased the cost of moving goods into the CBD and doing business in New York.

The formulation of guidelines for an appropriate number and size of loading bays and sufficient freight elevators and the development of strategies for retrofitting existing off-loading facilities will offer broad societal benefits that will increase freight efficiency and security and decrease energy consumption, on-street congestion and air pollution.

Keywords: Freight efficiency; Security; Off-loading facilities; Loading bays; Freight elevators.

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Introduction

The operation and management of goods movement in the United States is private, competitive and well established. Radical changes took place in the motor carrier industry beginning with transportation deregulation in the 1980's. In addition, new technologies such as E commerce along with supply chain management, Just-In Time, and inventory reduction/quick replenishment, among other operational practices have enabled the freight industry to cut the costs and delivery times associated with moving goods into New York City's Central Business District (CBD). However, a major finding of the *Goods Movement in New York City* study revealed that substantial impediments to goods movement in Manhattan's CBD were fundamentally associated with the pick-up and delivery process in the "last mile" of the logistics supply chain (1). It is recognized that enroute barriers, including congested arteries and highways, are both separate and secondary to the "last mile" which is a euphemism for the activity that takes place in close proximity to the origin, the pick-up, and the destination, the delivery, of goods and services. The findings further revealed that inadequate loading docks and insufficient freight elevators in commercial office buildings (COBs) lead to delays, theft, damage, and summonses and severely diminish freight mobility and security enforcement.

In the past, freight deliveries were not a high priority for the owners and managers of commercial real estate. Post-September 11, 2001 the real estate sector has been forced to recognize that secure off-loading facilities are a critical concern for both tenants and owners. But while developers acknowledge that improved loading dock security in new COBs is necessary, these facilities are not viewed as a marketing tool and remain largely invisible. In addition, options to ameliorate security problems in new and existing off-loading facilities in commercial business areas are limited. Traditional brick and mortar solutions are not viable in a "built" environment where inadequate off-loading facilities in commercial buildings thwart efforts to upgrade security. Nevertheless, the long-term impacts of 9/11 suggest that this may be an opportune time for commercial building owners and property managers to collaborate with shippers and carriers to support the development of design elements that ensure secure freight deliveries. Improving off-loading facilities will not only reduce security threats and insurance expenses, but it will also lower cost and time in transit, decrease on-street congestion and reduce energy consumption and emissions.

The challenges New York City faces in moving products and services to small and large businesses in the "last mile" are representative of the problems occurring in congested urban areas throughout the United States and Canada (2, 3). Moreover, security issues related to the "last mile" are a national and worldwide problem that must be addressed to insure the personal and commercial security required for a healthy business environment.

Review of urban goods movement and "last mile" studies

The study of *Goods Movement in New York City* began with 13 industry sector focus groups ranging from Apparel to Publishing to Small Package Carriers. Findings were consistent across sectors despite assumptions that differences would occur based on the

value of the goods. In fact, no such differences were found. As expected, participants frequently cited intractable street congestion as a barrier to efficient freight delivery operations. Surprisingly, they repeatedly mentioned inadequate off-loading facilities and inadequate curb space for commercial vehicles as serious obstacles.

In stage two of the study, 59 shippers and 15 carriers completed 74 Freight Mobility Surveys that mapped performance and time for the last link of the supply chain, from the freight terminal to the end customer in the CBD. Findings were broken down into four categories. Security related barriers identified included inadequate dock facilities and insufficient freight elevators, increased turnaround time and decreased productivity, installation and operation of special locks and alarms and costs for an extra person on the truck (4). To evaluate the impact of inadequate off-loading facilities a two part pilot study was conducted. The COB Dock Survey, which solicited information on the characteristics of loading docks was completed by 28 property managers and Time & Motion Reports of Vehicular Deliveries to Docks were carried out at two COBs. The study's findings, supported by the limited data collected, indicated that insufficient loading dock facilities, compounded by a marked increase in deliveries, appeared to increase dwell times.

To ensure a more representative sample, stage three of the study expanded data collection of both categories evaluated in the pilot study. Buildings were classified according to guidelines developed by the Building Owners and Managers Association (BOMA), a national/international real estate industry association. BOMA uses a combination of factors such as rent per square foot, building finishes, system standards and efficiency, building amenities, location/accessibility and market perception, to rank buildings. Premier Class A buildings with market presence compete for major firms and have above average rents for a given area. Class B's are a step below on the primary factors cited above.

The initial sample of 28 COB Dock Surveys was expanded for a total of 82 buildings. There were 59 Class A buildings, most of which had been built between 1950 and 1985. See Table 1A for information on the number of rentable floors and rentable square footage of the Class A buildings. Forty seven Class A buildings had operating freight docks, seven had separate freight doors, and five had neither a dock nor a freight door. Data available on 58 Class A's revealed that four had four or more elevators, twelve had two elevators; twelve had three elevators and one building had a single freight elevator.

Table 1A: number of rentable floors and rentable space of class A commercial office buildings.

Class A Buildings: n=59

| Number of buildings | Rentable floors | Average rentable space ^a |
|---------------------|-----------------|-------------------------------------|
| 8 | 6-15 | 230.2 |
| 31 | 16-39 | 512.3 |
| 20 | 40 or more | 1,269.2 |

^aIn 1,000s of square feet

A majority of the 23 Class B buildings surveyed were built between 1910 and 1929. They tended to be significantly smaller than the Class A buildings. Table 1B presents the number rentable floors and rentable square feet of the Class B buildings. Only two

Class B's had operating freight docks. Eleven had freight entrances, four had sidewalk freight doors and four received freight through the main lobby. In addition, one building received freight via a basement door under the entrance stairs and one received it through a "freight hall" from an adjacent building. Sixteen Class B's had a single freight elevator, six had two freight elevators, and one had two elevators that were used to move both passengers and freight.

Table 1B: number of rentable floors and rentable space of class B commercial office buildings.

Class B Buildings: n=23

| Number of buildings | Rentable floors | Average rentable space ^a |
|---------------------|-----------------|-------------------------------------|
| 10 | 5-10 | 130.0 |
| 11 | 16-39 | 201.7 |
| 2 | 40 or more | 550.0 |

^aIn 1,000s of square feet

Time and motion studies were carried out to collect the number of daily vehicular deliveries to loading docks and the number of floors and rentable square footage in six Class A buildings. As shown in Table 2, the number of floors and the rentable square footage for the six COBs were compared to the number of daily deliveries. The number of floors ranged from 25 to 54 and the rentable space ranged from 632,000 to 2,164,000 square feet.

Table 2: number of rentable floors, rentable space, and deliveries per day at six buildings.

| Building | Floors | Rentable Space ^a | Deliveries Per Day | | | | Total Number |
|----------|--------|-----------------------------|--------------------|----|------------------|----|--------------|
| | | | In dock Number | % | On street Number | % | |
| 1 | 45 | 632 | 14.6 | 61 | 9.5 | 39 | 24.1 |
| 2 | 25 | 717 | 6.6 | 24 | 21.0 | 76 | 27.6 |
| 3 | 54 | 1,744 | 35.5 | 87 | 5.5 | 13 | 41.0 |
| 4 | 41 | 1,365 | 56.0 | 79 | 14.6 | 21 | 70.6 |
| 5 | 29 | 2,164 | 66.3 | 67 | 32.0 | 33 | 98.2 |
| 6 | 50 | 1,000 | 27.6 | 46 | 32.5 | 54 | 60.1 |

^aIn 1,000s of square feet

The data suggested a strong positive correlation between the rentable square footage and the number of daily deliveries. (See Figure 1)

FIGURE 1 Correlation of Number of Daily Deliveries with Rentable Space

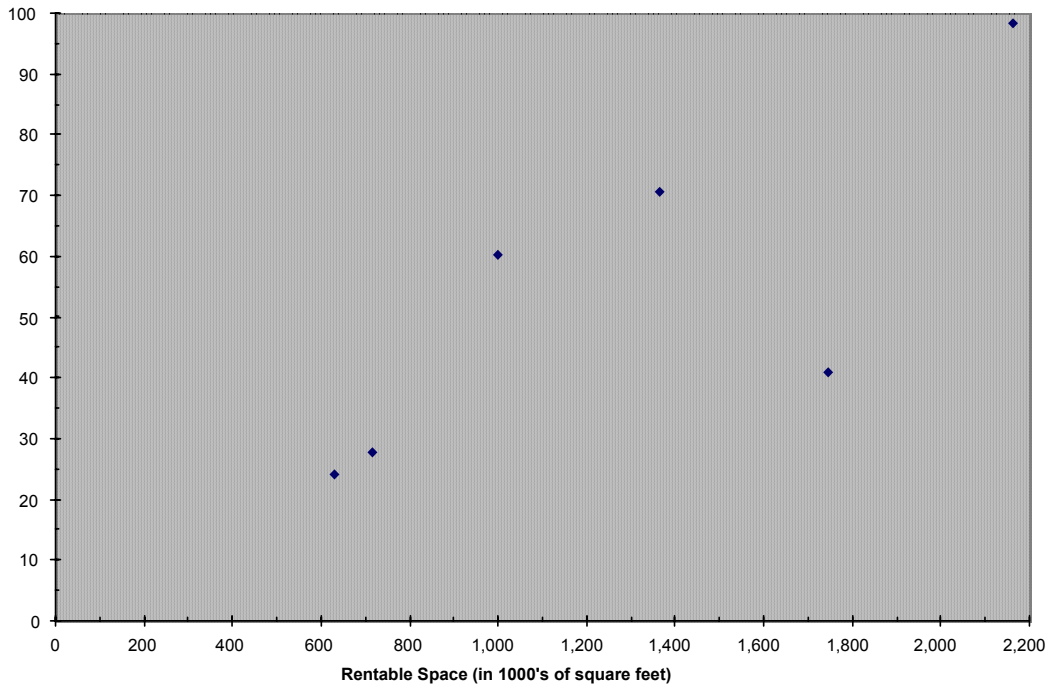


Table 3 presents the number of deliveries per day and a breakdown by time of day. The overall average number of deliveries per day was approximately 55-1/2, with individual building averages ranging from 24.1 to 98.2.

Table 3: number and percentage of total deliveries in morning and afternoon at six buildings.

| Building | <i>Deliveries per day</i> | | | | Total Number |
|----------|---------------------------|----|------------------------|----|--------------|
| | Morning ^a | | Afternoon ^b | | |
| | Number | % | Number | % | |
| 1 | 14.6 | 60 | 9.6 | 40 | 24.1 |
| 2 | 17.3 | 63 | 10.4 | 37 | 27.7 |
| 3 | 25.7 | 63 | 15.3 | 37 | 41.0 |
| 4 | 42.8 | 61 | 27.8 | 39 | 70.6 |
| 5 | 59.7 | 61 | 38.6 | 39 | 98.2 |
| 6 | 34.0 | 58 | 26.2 | 42 | 60.1 |

^a 8:00 a.m. to 12:30 p.m.

^b 12:30 p.m. to 5:00 p.m.

About 60% of the observed deliveries took place during the morning. Information on dwell times is presented in Table 4. Throughout the standard business day, across COBs, the average dwell time in the dock was approximately 31-1/2 minutes, while the average length of dwell time in the dock ranged from 22 to 48 minutes.

Table 4: dwell times in dock and on street in morning and afternoon at six buildings

| Building | <i>Dwell Times (in minutes)</i> | | | | | |
|----------|---------------------------------|-----------|------------------------|-----------|---------|-----------|
| | Morning ^a | | Afternoon ^b | | All Day | |
| | In Dock | On Street | In Dock | On Street | In Dock | On Street |
| 1 | 24 | 23 | 21 | 25 | 22 | 24 |
| 2 | 47 | 27 | 51 | 19 | 48 | 26 |
| 3 | 51 | 15 | 35 | 10 | 45 | 14 |
| 4 | 34 | 20 | 32 | 16 | 33 | 19 |
| 5 | 24 | 15 | 19 | 17 | 22 | 16 |
| 6 | 40 | 38 | 30 | 35 | 36 | 36 |

^a 8:00 a.m. to 12:30 p.m.

^b 12:30 p.m. to 5:00 p.m.

Regulations for off-loading facilities in commercial properties

An examination of the current status of New York City's zoning requirements for off-loading bays was carried out to determine their relationship, if any, to inadequate off-loading facilities that exacerbate security and freight mobility obstacles. It was found that the City's loading bay requirements have remained constant since 1972, despite major changes in transportation /distribution patterns and an increase of approximately 300 percent in deliveries to the CBD over the past 25 years (6). A report by the Department of City Planning's (DCP) Transportation Division stated that the number of berths required for large COBs by other major urban areas was more than double New York City's current requirements (7). In that report the Transportation Division proposed that the City's Zoning Regulations should be reviewed, revised and upgraded to respond to the accelerating increase in freight deliveries due to transportation deregulation, among other factors.

Increased freight deliveries to CBD's is not only a New York City problem, it is a nationwide phenomenon. To compare the current status of loading dock regulations (promulgated in 1972 to the present) in Atlanta, Boston, Chicago, Dallas and Seattle, zoning staff were contacted in each city. Table 5 summarizes the loading bay requirements for buildings of one million square feet (MSF) and controlling agencies in each of the five cities. While New York requires four loading bays per MSF, the other five cities require between six and ten loading bays per MSF. Zoning staff in each city reported that no recent changes had been made in the requirements for the number of bays despite a significant rise in freight deliveries.

Table 5: loading bay requirements for buildings of one million square feet and controlling agency in five U.S. cities.

| City | Required Bays | Controlling Agency |
|---------|---------------|--|
| Atlanta | 6 | Bureau of Buildings |
| Boston | 8 | Zoning Commission, Dept. of Transportation |
| Chicago | 6 | Dept. of Zoning |
| Dallas | 10 | Dept. of Development Services |
| Seattle | 9 | Dept. of Design, Construction and Land Use |

Freight elevators are an integral component in supporting efficient goods movement within COBs. A sufficient number of freight elevators will speed up turnaround time and free up the loading bays, which fosters security inside and outside the building. There were no specific requirements for the number and size of COB freight elevators by either New York City's DCP or its Department of Buildings. However, the latter department does require at least one elevator for buildings of more than four stories. In concert with New York City, no zoning criteria mandating a specific number of freight elevators were found in the five cities discussed above. It appears that decisions about the number and size of freight elevators in COBs are made by developers and their architects.

Security

Post September 11th, 2001, the Federal government recognized that critical infrastructure protection (CIP) is essential to ensure security in the public and private facilities that impact the economic vitality and safety of the United States. Both existing and newly constructed off-loading facilities in commercial properties nationwide are prime candidates for CIP. Under these circumstances, it was anticipated that security at off-loading facilities at commercial properties would be increased and upgraded.

Shippers and carriers, representing national organizations and terminal operators at local facilities, were queried about the impact of recently implemented security measures upon freight deliveries in the CBD. The motor carriers support improved security because they recognize that trucks could be a means of carrying out a terrorist attack as well as a prime target. However, both shippers and carriers have reported that in some instances an overreaction by newly hired COB security staff, who have had limited experience with carriers, has led to significant decreases in productivity and reliability of the delivery cycle and has also increased on-street congestion. Examples abound. In extreme cases, vehicles have been denied access to loading bays, or forbidden to park on the street outside buildings so all freight must be hand delivered, which contributes to on-street congestion. The less extreme, but time-consuming practice of screening delivery vehicles, including their undercarriages, using x-rays, metal detectors and dogs before permitting entry to the docks increases both waiting time and congestion.

Shippers and carriers also report that an increased emphasis has been placed on verifying that persons who enter buildings for the purpose of making deliveries are who they claim to be, work for the companies they claim to work for, and are expected by the tenants they claim to be servicing. Although drivers support this effort, many also feel that invasive personal security checks, such as copying a driver's license (an identity theft issue) have significantly increased delivery time, causing back-ups that have compromised security. The additional security measures instituted at the off-loading facilities have escalated time and labor costs for the carriers to levels that were not sustainable, leading to the imposition of surcharges.

Anecdotal data obtained in the course of collecting COB and dock delivery data revealed that post-September 11, 2001 security improvements, instituted on a building by building basis, have increased costs for both owners and carriers. A cost-benefit analysis would elucidate the impact on costs of improving off-loading facilities. It has

been hypothesized that improved security should lead to a decrease in insurance premiums, which would offer incentives for owners to institute or build-in needed upgrades. Inadequate COB off-loading facilities primarily impact the freight carriers, while building owners, who are solely responsible for their construction, improvements and management, did not consider them a problem. Since off-loading facilities are not a marketing tool in leasing or selling commercial real estate, developers have generally only met the standards required. Transportation planners have pointed out that the current concern with security has highlighted and may have the potential to improve the long term problems of inadequate off-loading facilities identified by the freight industry in studies cited above.

Waiting trucks not only hinder security, they contribute to congestion and related air pollution. Transportation and environmental studies carried out by City agencies have suggested that trucks on the street could be a factor in preventing the City from meeting air quality/ environmental standards. However, it should be noted that revising loading dock codes to increase security and freight efficiency is generally a low priority for zoning staff in major cities who have many pressing responsibilities and limited personnel.

Summary and recommendations

Security and safety are integral to an open society like the United States of America. Following the terrorist attacks of September 11th, Federal, State and local governments must address these issues systematically and in a coordinated fashion. The efficient movement of goods and services is essential to provide the materials required by social, economic and business sectors. It has been recognized that all nodes in the logistics supply chain must be secure. The studies discussed above identified the “last mile” of the logistics supply chain, at the drop off/pick-up point in COBs, as an obstacle to supply chain security. It is evident from the findings presented that appropriately sized off-loading facilities significantly improve security because trucks lined up on the street constitute a security threat. Moreover, trucks that rapidly move in and out of the city add value to the motor carriers, in saved costs, as well as to the people on City streets who benefit from lower levels of air pollution. Decreasing turnaround time and on-street congestion at COBs also increases freight mobility and efficiency while reducing energy usage and costs. The recommendations to follow will benefit society as well as the freight industry

Recommendations:

- Identify design elements that will ensure secure freight receiving facilities in future commercial buildings.
- Investigate and develop retrofitting strategies that increase security and freight efficiency at existing loading docks.
- Document security training procedures for dock workers, including device and behavioral recognition techniques, that facilitate fast and secure movement of vehicles through receiving areas.

- Provide guidelines for sufficient loading bays and freight elevators that ensure security at off-loading facilities in commercial properties.
- Carry out a cost-benefit analysis of the impact of upgrading off-loading facilities in commercial properties.

References

- Morris, A. G., Kornhauser, A. L. and Kay, M. J (1998) "Urban Freight Mobility: Collection of Data on Time, Costs, and Barriers Related to Moving Product into the Central Business District", *Transportation Research Record* 1613, pp.27-32.
- Pivo, G. and Carlson, D. (1998) "Learning From Truckers: Truck Drivers' Views on the Planning and Design of Urban and Suburban Centers.", Presented at *Annual Meeting, Transportation Research Board*, Seattle, WA.
- City of Toronto Planning & Development Department, Metropolitan Toronto Transportation Department, and the Ministry of Transportation (1993) "*Retrofit Strategies for Loading/Delivery Facilities in the Central Area*", Ontario, Canada.
- Morris, A. G., Kornhauser, A. L. and Kay, M. J (1999) "Getting the Goods Delivered in Dense Urban Areas: A Snapshot of the Last Link of the Supply Chain", *Transportation Research Record* 1653, pp.34-41.
- Morris, A. G. and Kornhauser, A. L. (2000) "The Relationship Between Freight Facilities in CBD Office Buildings and Truck Traffic", *Transportation Research Record* 1707, pp.56-63.
- New York City Department of Transportation (1992) "*Off-Loading Dock Study*", New York, NY.
- New York City Department of City Planning (2000) "*Freight Synthesis Year II Report*", Transportation Division, New York, NY.



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