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URBAN FREIGHT FOR LIVABLE CITIES

HOW TO DEAL WITH COLLABORATION AND TRADE-OFFS

URBAN **FREIGHT** FOR LIVABLE CITIES

HOW TO DEAL WITH COLLABORATION AND TRADE-OFFS

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FOREWORD

Arne Wittlöv, PhD, International Programme Committee Chair and former Chair of the VREF Board

In October 2012, 90 delegates from almost 20 countries all over the world participated in the fifth Future Urban Transport Conference, *Urban Freight for Livable Cities*, co-organised and hosted by the Volvo Research and Educational Foundations (VREF), together with AB Volvo and the City of Gothenburg. The conference focused on the difficult and, at times, controversial subject of urban freight, with the overarching goal of contributing to 'Livable Cities' by finding new ways of dealing with collaboration and trade-offs. The papers presented in this book are updated contributions from the speakers at the event.

Over the years, the the VREF Conferences have been explorative – meaning each conference has been built on lessons learned and experiences from earlier ones. Consequently, the format of the conferences has also changed and developed. The first conference, in 2000, was titled *Future Urban Transport; Problems and Solutions* and was an academic scientific conference, with each session focused on a specific disciplinary topic. The difficulties of dealing with the complex issue of urban transport in this way led to the articulation of the central theme of the whole Future of Urban Transport (FUT) programme: *How to deal with the complexity of urban transport development?*

The second and third conferences, in 2003 and 2006, were organised as interdisciplinary and interactive meetings. Important issues were identified and discussed, such as: complexity – can it be managed, and how?; how to assess transferability and non-transferability?, and; what is generic and what is context-specific in urban transport?.

VREF has been eager to understand how knowledge is disseminated. How do practitioners learn from academics, and vice versa? Hence, it was an important step forward when the fourth conference, in 2009, was the first to be co-organised together with practitioners – by AB Volvo and The City of Gothenburg – on the theme *Access and Mobility for Cities of Tomorrow*.

In preparing the 2012 conference the International Program Committee (IPC) for the event put Urban Freight Transport at the top of the agenda. The IPC was well aware of the need to be able to deal with short-term as well as longer-term issues, as well as passenger and freight transport simultaneously. The aim was to make the freight issue visible, but in the context of 'Livable Cities.'

The conference provided interesting insights into the challenges and opportunities facing urban freight. By sharing these insights and new ideas we hope that this book will contribute to addressing the challenges of Urban Freight for Livable Cities. ■



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INTRODUCTION URBAN FREIGHT TRANSPORT: CHALLENGES AND OPPORTUNITIES

**Arne Wittlöv, PhD, International Programme
Committee Chair and former Chair of the VREF
Board**

In a world of rapidly-increasing urbanisation, urban transport is high on the agenda for policymakers, city planners and other practitioners, as well as researchers. Due to their large and densely-housed populations and extensive commercial activities, urban areas require the delivery and collection of large quantities of goods and the provision of a wide range of services for commercial and domestic use, resulting in considerable freight activity. However, despite its importance, until fairly recently policymakers and researchers have paid relatively little attention to urban freight as opposed to passenger transport.

Policymakers have generally left freight transport matters to the private sector, which demands and supplies freight transport services. In Europe, with its historic city centres and dense living areas, the nuisance created by freight traffic has long been perceived as a problem on a local level. On a national level, governments have mainly influenced urban freight transport indirectly, through measures such as transport-infrastructure expenditures, guidance concerning transport and land-use policies, promoting environmentally-friendly transport modes and, to some extent, supporting research activities.

Little reference was made to urban freight transport in the EU White Paper on Transport published in 2001. However, shortly thereafter concern increased, resulting in various initiatives. In 2003 the OECD published a report on urban freight transport “Delivering the Goods, 21st Century Challenges to Urban Goods Transport.” Corresponding steps were taken at the European level, through the programme “EU-action 321 Urban Goods Transport,” also in 2003. Since then, several initiatives and projects have been initiated around the world.

Freight logistics has been studied and developed by the commercial sector over a long period of time. Logistics is considered to be of crucial importance for competitiveness in most commercial activities. The relocation of manufacturing, outsourcing, and increased requirements for deliveries to be on time, of the right quality and at the desired price, have forced industry in all sectors to continually improve the efficiency of logistics. Economies of scale have been successfully exploited, especially for the long-haul transport component. Business models based on creative use of advanced logistic management have been developed, and performance is measured by instant systematic data collection and processing.

Although freight transport in cities constitutes a small pro-

portion of the total freight transport length, it generates a high proportion of the cost. According to the Council of Logistics Management this 'last mile' in the transport chain accounts for 28 per cent of the total cost of transport.

Freight transport in cities tends to respond very effectively to the requirements and development of modern urban economies. At the same time, it is also a major contributor to negative social and environmental impacts, particularly to congestion, local air pollution, and noise. It is estimated that in urban environments 10 to 18 per cent of all city road traffic, and 40 per cent of air pollution and noise emissions, are directly related to commercial transport.

Until recently, policymakers have tended to view urban freight transport as a problem rather than as an essential component of urban development. As a consequence, policy measures implemented by urban planners have sought to restrict rather than assist goods-vehicle operations. Such measures commonly include:

- Vehicle time regulations,
- Vehicle weight and size regulations, and
- Lorry routes – advisory or mandatory routes for goods vehicles.

However, policymakers are now beginning to shift their view about urban freight transport, for several reasons:

- Its importance in supporting the urban economy,
- Its growth and competitiveness,
- The role it plays in ensuring that those living and working in cities obtain the goods and services they require on time, at the right quality and at the desired price, but also
- The negative social and environmental impacts that freight transport places on the urban environment and on the health of those living and working there.

Increasingly, policymakers and urban planners are now considering how they can help improve the efficiency of goods-vehicle operations in urban areas, and thereby reduce the impacts imposed by those operations. This has resulted in several policy efforts such as:

- Providing dedicated on-street space for goods-vehicle loading and unloading (i.e., loading bays),
- Supporting urban consolidation centres,



- Helping to develop night delivery operations,
- Installing shared bus and lorry lanes,
- Encouraging the use of information systems and telematic applications,
- Providing lorry maps in paper form and online,
- Providing information about prevailing traffic conditions and relevant facilities, and
- Encouraging the use of environmentally-friendly goods vehicles.

Other, more recent, policy measures being used to influence urban freight transport (as well as other motorized vehicles) include:

- Road pricing systems, and
- Low-emission or Environmental Zones.

Urban freight activities result in conflicts between economic issues on the one hand and social and environmental factors on the other. Addressing the conflicts and trade-offs associated with urban freight transport requires change and innovation in both the public and private sectors. While there are technological and organisational opportunities to improve the efficiency of urban freight operations, exploiting them fully requires collaboration between companies and also between the public and private sectors. Those responsible for urban policies and planning need to work with companies to identify appropriate and transferable solutions. In some cases this will require a major shift in attitude away from the perception of freight in cities as merely a problem. Companies need to change as well. Industry and organisations such as universities need to combine efforts to help policymakers and the wider public better understand urban logistics.

The Urban Freight for Livable Cities conference was organised to consider the challenges and opportunities currently faced by stakeholders involved in urban freight transport, as well as desired outcomes and targets within both the public and private sectors. The agents of change that are likely to be instrumental in forming, implementing and disseminating new ideas, methods, business models or technology were of central concern.

A frequently asked question in urban transport is, “what is generic and what is context specific?” The urban freight-transport issue seems to be highly context-specific and multifaceted. Therefore, it is now necessary for policymakers to address the demand for urban freight transport through joint efforts at the

local, regional and national levels of government. Integrated and holistic solutions are paramount.

The Urban Freight for Livable Cities Conference

The first theme on the conference programme – *Partnership and Leadership* – was presented by two distinguished speakers: Peter Hendy, Commissioner of Transport for London, UK, and; Michel Savy, of the Institut d’Urbanisme de Paris, Université de Paris Est. Peter Hendy gave an inspiring speech about how the Olympics had spurred Transport for London to examine ways of reducing the negative impacts of urban freight deliveries, and how this is likely to have a long-standing impact. Michel Savy set out a framework for addressing urban freight issues in a much more comprehensive way than has so far been the case.

The following day was organised in parallel workshops, with speeches and discussions focusing on the other two conference themes: *Multi-level and Multi-modal Interaction: Interaction between administrative levels and modes of transportation* and *Sharing the Urban space*.

The obstacles to achieving the need for *Multi-level and Multi-modal Interaction* were exemplified in several speeches. Tools and methods for success were demonstrated. Freight problems are particularly severe in cities that are major nodes in the global economy through their ports, airports, distribution centres and inter-modal hubs. Despite the urgent need for multi-level and multi-modal interaction, local authorities face many challenges: drivers of international trade flows are global and beyond the control of local actors; local authorities have limited jurisdiction to regulate or control national or international flows; freight problems typically do not respect political boundaries, and; the complexity and number of actors in the supply chain makes negotiations very difficult. The need for regional or even mega-regional interaction was exemplified. In the supply chain, terminals such as regional distribution centres and cross-dock terminals are spatially organised on regional or multi-city bases.

The consequences of increasing logistic sprawl were discussed. Logistic sprawl generates economies of scale for logistic industry but has massive impact on urban landscapes and an environmental cost. Examples from Paris, Atlanta, Los Angeles, Lyon and other cities were presented. Potential solutions for more comprehensive and regional planning of freight facilities were discussed.

In the speeches on the third theme, *Sharing Urban Space*, conflicts between different stakeholders caused by their needs for urban space were discussed. Freight shares both spatial and tem-



poreal space with other activities in the urban environment. Increasing cost – and difficulties – for the ‘last mile’ was discussed. Many different approaches to regulating urban freight transport have been tried. In practice when implemented, many of these solutions are short lived, mainly because one-sided approaches do not take into account the goals of other actors. A new generation of urban freight solutions is needed, with the aim of addressing the needs of all actors involved. The extent to which a particular solution succeeds in doing that should be the basis for deciding whether or not to implement a proposed solution. A multi-actor multi-criteria analysis (MAMCA) was described as an appropriate method for this.

Case studies from Berlin, New York, Gothenburg and Chicago were reviewed. The need for and development of strategic planning frameworks was presented, with Berlin’s Urban Transportation Development Plan provided as an example. There, stakeholder acceptance was achieved through consultation. The aim of the strategy is to support city-friendly commercial transport. Some practical examples on competition for urban space, results, and future measures from Berlin were given. An example from New York of multi-stakeholder cooperation between public- and private-sector partners, community advocates, and trade organisations was presented. The project – an off-hour delivery implementation project – is large, complex and requires the collaboration of all partners to fully achieve its goals.

There were several other presentations that described successful examples of innovation. Enforcement of strategies and measures is challenging, and the monitoring of effectiveness of implemented strategies is crucial. On the other hand, surprisingly rich ‘low-hanging-fruit’ solutions can be found.

During the open dialogue session, some speakers questioned why industry does not relieve some of the burden that city freight imposes on the urban environment at the expense of some ‘limited’ increase in the cost of transport. However, experience has shown that, in industry, cost is fiercely attacked wherever it occurs in the value chain. Competition forces every enterprise every day to deliver better and more-desirable products at constantly lower and more affordable prices.

The attack on cost covers the whole value chain, regardless of where, how much or how little. One cent is always one cent, and the savings trickle directly down to the bottom line. The relative size of transport cost as the share of total cost of a product was discussed, mainly from the point of view that the share is small, even insignificant. However, for some industries, transport’s share

can be as high as 10 to 20 per cent, which means it is a substantial part of the total. Many companies run with operating margins of three to five per cent. At a four per cent operating margin, which is a quite normal figure, a 'modest' cost increase of one per cent erodes 25 per cent of the total operating profit.

Economies of scale, differences in labour costs, market location, the cost of transport and many other factors all contribute to the decision-making process continually defining, and redefining, the footprint of every enterprise. And cost is shaved off in every step – that is the rule of the game.

Peter Hendy mentioned the saying "To die for a good cause," and added that this is not a good option. It is better to stay alive and fight for a good cause! That is exactly what industry is about.

Conflicting views

Not surprisingly, many discussions during the conference, demonstrated contrasting approaches to the issue of urban freight, with totally different views expressed on what can or should be done. These different views were especially noticeable in two areas: *methods of work* and *time horizons*.

Regarding *methods of work*, two contrasting approaches regarding how to move forward were observed:

- The analytical modelling approach, and
- The ad-hoc, behavioural approach.

Analytical modelling fulfils our intellectual desire to build a theoretical framework, where relationships between actors together with costs and benefits (both internal and external) are all laid out. The intention is to visualise and structure the process. With the academic's normal ambition to withstand the scrutiny of peers and others, no item is allowed to be left out, which makes the models quite complex. The process gets even more complex when data has to be collected and processed. The basic idea – that a model can describe the overall situation, and the open process in exercising the model can be helpful in creating trust between the parties involved – is great. However, lack of reliable data creates a problem with this approach. Collecting the necessary data to run the model seems an insurmountable task, causing major obstacles in this way forward in dealing with the real problem: getting stakeholders and actors to adapt. Furthermore, these models are by definition generic, but we have stated several times that the issue of urban freight transport is highly context specific.

Access to relevant data is of fundamental importance for effi-

cient and long-term decision making, as well as the development of a theoretical framework to support decision making. The vast amount of data regarding the mobility and transport of people – collected over a long period of time – has formed a knowledge base for urban development, not least for the development of public transport. Equally, because of the crucial importance of logistics for competitiveness, advanced logistic-management methods have been measured, modelled and developed. Performance is measured by instant systematic data collection and processing, enabling adjustments to be swiftly implemented.

In sharp contrast, quantitative information regarding urban freight transport is not widely available. Figures are scarce, as are methods of analysing the interaction between goods and passenger transport in urban contexts. This creates a major problem in identifying relevant indicators and in formulating policies or actions.

By contrast, the ad-hoc, behavioural model described in some case studies operates with limited amounts of data, more based on identified needs to bring stakeholders on board to react. The case from London of the Olympics is a good example, as is the example from New York on night-time deliveries. A VREF Centre of Excellence working with a project in Nairobi has expressed their research question as "How to provoke change?" where a limited amount of selected key data is the crucial provocation.

Both models have their relevance, but there is obviously a balance to be found depending on the specific situation and to what extent there is focus initiating change.

The second area beset by contrasting approaches is the different views on the *time horizon* for intervention or in studies. The alternatives are either:

- Short-term with incremental steps, or
- Long-term where completely different solutions are sought after.

In short-term approaches, like in London over the Olympics, incremental improvements are achieved. Many of us have felt that these steps are very encouraging. Others, however, feel that although the preconditions in London were very positive for in-

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However, despite its importance, relatively little attention has been paid to urban freight.
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roducing change, given the powerful authority of Transport for London and the extraordinary pressure caused by the staging of the Olympic Games, the improvements were merely limited or “incremental.” They suggest, too, that it is discouraging that no long-term view on bringing about change seems to exist.

In fact, we have to work with both approaches, recognizing that for the longer term the incremental approach is wrong – and vice versa. In the incremental approach we have to deal with the ‘paradigm of commercial freight’ on the terms of the commercial market. We must acknowledge that business builds silos, and accept to enter these silos rather than breaking them down.

In the longer-term approach we must identify the need for transport, mobility and accessibility as a whole in the urban environment – freight as well as passenger – and in the context of the overall urban structure. For action to be taken, we need to identify what constitutes such silos in order to be able to break them down. Several examples of how silos are fortified were mentioned during this conference, such as the differences in how education in personal transport and freight is structured.

So, we must be able to have two different strategies in mind simultaneously, and understand when and how to use them! Hopefully, the case histories and examples provided in this book will help to develop that understanding. ■



EUROPEAN URBAN FREIGHT: A COMPREHENSIVE APPROACH

Michel Savy, Professor, Institut d'Urbanisme de Paris, Université de Paris Est Créteil, France

Urban freight logistics may be the last and very important step of a long chain, but has been largely neglected by both researchers and policy-makers. Very little attention has been paid to the needs of either the freight industry or local communities where deliveries take place. The logistical challenges posed by urban freight requirements have slipped between various other aspects of logistical planning, such as passenger transport, road planning and national and international logistics. There is a need to consider how best to tackle urban freight logistics because of its vital place in the overall logistics industry and because of its potentially damaging environmental effects.

RATHER BELATEDLY, European urban freight is gaining increased attention. In Paris, for example, there have been several urban freight initiatives and the issue is becoming not just a matter for research but a major element of discussion and business strategy. Urban logistics is a rather untidy business that is difficult to pin down. It consists of consolidating large numbers of small consignments, and is consequently characterised by low productivity with many regular or irregular stops in areas shared by lots of people. In general, volumes are low, with the number of deliveries being one per job and per week for business services, with large differences according to the type of activity. Because of this, small vehicles, which necessarily are more expensive to run per weight carried, are the norm.

City centres are fragile environments (sensitive to influxes and/or poor management of traffic) that are not homogenous and, consequently, require individualised solutions. Further, it is important to distinguish between different parts of cities. In many cities there is a centre, a first ring and then an outer ring. These areas have different characteristics and problems. In general, space is at a premium in cities and there is competition between various users over its use. Moreover, local residents and small businesses may be affected by noise and congestion and demand restrictions on local freight traffic. In urban areas, freight contributes considerably to both environmental and social challenges: up to 20 per cent of traffic, 30 per cent of street occupation and 50 per cent of greenhouse-gas emissions are generated by freight.

Many transport operations start or finish in an urban area. More than 50 per cent of freight tons transported by road in Europe are carried for a distance of less than 50 kilometres. Terminal operations represent a major share of total door-to-door transport costs for small shipments; more than half for



parcel services. Moreover, many household journeys are devoted to shopping, i.e., the transportation of goods.

The current situation is not efficient. Typically, vehicles are relatively old, operated on an own-account basis (i.e., not by freight professionals), badly loaded resulting in low productivity, and create high levels of nuisance. There is on-going conflict between those trying to manage urban roads – such as traffic wardens and police – and those trying to deliver goods who disrupt effective street management with frequent, often illegal, stops. The problem is exacerbated as local drivers take up dedicated parking places intended for professional deliveries. There is also a major governance issue. No individual stakeholders, either public or private, are responsible for urban freight issues or management. As a result, urban freight logistics tend to spread outwards toward urban fringe areas (outer rings), because of cheaper land prices and reduced congestion. The result is longer haulage distances, higher overall costs and larger contributions to congestion and air pollution.

While in recent years there has been a trend toward hypermarkets and out-of-town stores, this may be reversed with town centres being revived. People often prefer corner shops, and as the population ages urban residents will become less mobile. Moreover, the internet has led to an increase in home deliveries, and consequently freight traffic, in urban areas. There is also expansion at both ends of the retail market; low-price shopping for the poor, and luxury shopping for the rich. Both are often concentrated in city centres.

All of these issues point the need for a new and comprehensive approach to urban logistics.

Mitigating measures

There is a need to accommodate the requirements of urban freight while improving the local environment. City streets were once optimised to maximise traffic. Now they must accommodate different uses. As a result of growth in both urban freight and associated negative externalities, politicians – both local and national – have begun to take a greater interest in the issue. In France, a law on air pollution in urban areas has been passed. A freight plan has also been developed. In an ideal world there would be more modal shift, but in practice this has only limited potential. Freight logistics is and will remain a vital function that needs to be maintained in urban environments. It is the catalyst for jobs and the economy, and society cannot function effectively without it, given that it is required for everything

from food deliveries and construction to the removal of waste and road maintenance. When considering the acceptance of a logistics facility in a given neighbourhood, there is a trade-off between job creation and logistics nuisances. Job creation

is crucial, and urban logistics activities require both skilled and unskilled labour.

Urban freight logistics are, though, complex systems involving many stakeholders who need to cooperate for the system to run smoothly (which is often not the case at present). For example, the city of Paris has been a pioneer in negotiating new rules with industry, whereas the region, Ile de France, has

also developed policies, as has the central government. The commercial freight industry produced a white paper on urban freight logistics, realising they could do nothing without contact with politicians, which was a new world for them. All of these stakeholders had to negotiate together and find new solutions.

Urban freight must be professionalised

There are several ways that the situation can be improved. The urban freight business needs to be professionalised, with more deliveries made by third parties rather than by individual companies delivering their own products. Drivers need to be professionally trained and made aware of the broad set of issues and concerns related to urban freight. Environmental standards need to be more stringent and to be enforced by public authorities.

The size of vehicles is critical. While there is some resistance from residents and environmental groups to larger vehicles, they are more efficient and enable a reduction in overall traffic. One big lorry is better than five small vans (though freight companies will ultimately determine which is used). However, for larger vehicles to be used the street layout needs to be able to accommodate them.

There is much talk of the last mile. But, in fact, we should talk of the last 100 metres. No one in Japan is ashamed to push a trolley for 100 metres. Doing so makes the street more fluid, enabling more deliveries per day at a reduced cost. This also makes illegal parking less likely and thereby reduces the impact of deliveries.

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There is much talk of the last mile. But, in fact, we should talk of the last 100 metres.

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Another concern is to resist logistics sprawl or at least to protect existing sites, which is easier than creating new ones. The development of freight villages should be encouraged. The agglomeration effects are positive and make it possible for firms to share services and labour pools. Good sites need to be earmarked through planning. In big cities, this can add an intermediate step between a massive supply depot and final delivery haulage. However, previous attempts to create urban delivery centres and rationalise delivery processes have often failed, and there has been no follow up.

There is no panacea but there are numerous ways that the situation can be improved, including electronic lockers, delivery relays, urban logistics areas, vertical (multi-floor) warehouses, 'drive-in' retail shops, and reliable home delivery differentiation according to products (value, size and weight of consignments). All these need to be tested through trial and error. For local authorities, urban logistics has not yet become an integrated part of their remit, but it needs to be. For firms, urban logistics is a realm of both investment and innovation. There are economic, technical, political and social dimensions to urban freight, all of which need to be considered and analysed at the international scale. Urban freight is at the interface of the public and private sectors and, consequently, no single decision maker is able to transform the situation. There is a need for comprehensive innovation by and cooperation between the various stakeholders. ■

HOW THE OLYMPICS CHANGED FREIGHT DELIVERIES IN LONDON

**Peter Hendy, CBE, Commissioner of Transport
for London, UK**

**This paper summarises London's experiences
of freight management over the past few years
and outlines how the partnerships and solutions
adopted for the London 2012 Olympic and Para-
lympic Games can provide lessons to policymak-
ers for the future.**

TRANSPORT FOR LONDON'S (TfL) role is to manage the road network, balancing the needs of freight activity with the movement of people. Delivery and servicing covers a diverse range of activity, with different commodities delivered to particular locations at certain times of the day.

By weight, 88 per cent of freight in London moves by road; if translated into value or volume of goods carried, the percentage would be even higher. Freight activity makes up 17 per cent of London's traffic, rising to 25 per cent in central London. On a typical weekday in London, over 265,000 freight vehicles travel approximately 13 million kilometres, making around 630,000 journeys. Across London, around 80 per cent of inbound freight movements take place between 6am and 6pm.

Approximately 20 per cent of London's ground-based CO₂ transport emissions are produced by freight movements. If growth in freight traffic continues unmitigated, congestion will worsen, alongside greenhouse-gas emissions, and there will be a reduction in air quality.

Moreover, London is predicted to grow. Currently eight million people live in the city, and projections suggest that by 2031 the population will have risen by almost one million, alongside the creation of an extra 750,000 jobs. Freight growth is predicted to increase its share of movements, rising to around 20 per cent of all traffic in London, with analysis suggesting that van traffic will increase by approximately 30 per cent and heavy-goods-vehicle movements by eight per cent.

Freight planning prior to the Games

London's road network has little scope for expansion and, as a result, current transport policy supports a more efficient use of existing resources. The first London Freight Plan was published in 2007, to support the sustainable development of London by giving clear

guidance on the freight policies set out in the Mayor of London's transport strategy. The plan was developed with contributions from regulatory bodies, campaign groups and industry partners. This multi-modal plan recognised freight's economic contribution, but also the need to improve the environmental performance and safety record of the industry as well as reduce its contribution to congestion.

Four key projects were identified within the Freight Plan:

- The Fleet Operator Recognition Scheme;
- A freight information web portal;
- Delivery and Servicing Plans, and;
- Construction Logistics Plans.

Three other work streams were also developed, covering:

- Partnership development;
- Major freight projects, and;
- Freight data, modelling and best practice.

The Freight Plan sought to utilise Corporate Social Responsibility programmes by encouraging best practice from freight operators and their customers who generate freight activity, in terms of safety, emissions, fuel consumption and delivery timings. Where practical, the Plan also sought support through the land-use planning system and relevant policy.

Road safety

Road safety has improved in London and the involvement rate of freight vehicles in collisions is proportionately low. However, the large increase in the number of cyclists has led to an increase in the risk of conflict between heavy-goods vehicles and cyclists.

In 2011, 50 per cent of cyclist fatalities on London's streets were the result of collisions with construction vehicles. Alongside measures to review and improve the safety of street layouts, TfL has been working with the freight industry to promote driver training on safety issues and to test safety devices on vehicles undertaking construction work for TfL, such as those working on Crossrail (Europe's largest construction project), London Underground upgrades, and other major capital projects.

London 2012 Olympic and Paralympic Games

The London 2012 Games gave TfL a unique opportunity to develop its understanding of freight. TfL was responsible for



ensuring London met its 'host city' transport requirements, guaranteeing reliable journey times for athletes and officials while ensuring spectators could reach the venues. TfL also recognised the importance of accommodating the significant background demand; the availability of goods and services was vital in order to keep London moving, ensuring its businesses could thrive without impacting the Games.

Solutions were developed and implemented through TfL's Road Freight Management programme, in partnership with a range of stakeholders, including numerous regulatory bodies and companies making and receiving deliveries. The programme objectives were to:

- Ensure that delivery and servicing did not negatively impact upon the success of the Games;
- Ensure that delivery and servicing were able to continue throughout the Games period, and;
- Protect the reputation of TfL and London by ensuring the city did not run out of goods and that essential services such as hospitals were able to continue to function.

TfL's role was to provide leadership and to be the trusted source of information, creating the conditions for a range of stakeholders to work together for a common cause. For the programme to be a success, flexibility was required from the freight industry to implement the necessary changes to their operations.

A number of road restrictions were imposed during the Games. These included the Olympic and Paralympic Route Networks, established to achieve reliable journey times for the 'Games family' (the athletes, coaches and officials who were given priority), and traffic management plans around venues to reduce local traffic and parking activity.

While the Games Route Networks covered only one per cent of London's road network, they included some key radial corridors. During the Games, restrictions were put in place covering access to kerbsides, turning restrictions, and the removal of some traffic lanes (known as 'Games Lanes'). Restrictions were also applied to road use and parking in the vicinity of Games venues.

Without careful planning from business, there was a risk that delays and restrictions would impact deliveries, in particular at premises with limited potential to hold stock, such as food shops, chemists and banks. Many businesses were also concerned about a predicted increase in journey times.

Solutions

The freight programme used a simple slogan to attract attention, basing solutions around the "Four Rs," which meant encouraging businesses and freight operators to Reduce, Re-time, Re-route or Revise the mode of their delivery and servicing activity. The Travel Advice to Business behaviour change campaign, working to influence businesses and commuter travel, was already using these principles and it was crucial that freight operators and businesses received the same consistent messages.

Implementation depended on the location, sector, service or commodity involved, but some examples of the Four Rs include:

- Reduce - stockpiling goods; preventative maintenance
- Re-time - out-of-hours deliveries, changing the delivery day
- Re-route - changing the route, drop order or warehouse and depot used
- Revise mode - walking or cycling the last mile of the delivery

Case studies were developed to demonstrate these practical, low-cost solutions that were more dependent on changing business operations and processes than investments in new technology or new facilities. However, TfL did develop an online Freight Journey Planner tool to allow users to plan legally-compliant routes that avoided the busiest parts of the road network.

Success was dependent on TfL's relationship with stakeholders. Regular communication, publication of information as soon as it became available and regular meetings with stakeholders was crucial to securing their support and compliance with Games-time road changes.

Key to these relationships was the development of a Freight Forum. The membership of the Forum consisted of more than 50 key freight organisations that helped TfL to define the issues and work out solutions. In addition, it ensured that industry was actively planning for the Games. Sector-specific working groups supported the Forum, to establish the issues and solutions facing some of the most sensitive sectors in London.

TfL also needed to ensure that firms making changes to their operations were able to do so in compliance with relevant legislation. A number of activities were required, involving regulatory bodies such as the Office of the Traffic Commissioners, the Vehicle and Operator Services Agency, London's boroughs and their representative body, London Councils.

A crucial issue was around dropping off and receiving deliveries



outside normal working hours, which is often restricted by a range of statutory regulations and voluntary agreements. TfL developed a code of practice for making such deliveries, enabling operators to minimise noise disturbance for London's residents during the Games. The code also provided regulatory authorities a standard with which they could undertake enforcement action against non-compliant operators or businesses.

Communication was undertaken via direct engagement with operators and businesses at industry events, through over 3,000 door-to-door visits in areas most heavily impacted by the Games and over 200 workshops in London and elsewhere

in the UK. TfL also worked with ferry operators, ports and Eurotunnel to raise awareness among hauliers based in continental Europe. This communication was supported by radio and press advertising and the use of trade press to publicise relevant stories.

Regular bulletins were published online and emailed to 8,000 industry contacts. These provided advice and guidance in the build-up to the Games and, during Games-

time, advised of changes to the road network. A dedicated website received over 50,000 unique visitors. Information was also disseminated via third-party websites to increase coverage.

During the Games, London experienced a 20 per cent drop in daytime delivery activity and a 25 per cent to 30 per cent increase in deliveries outside of normal business hours. TfL surveys have revealed that approximately ten per cent of operators and businesses who hadn't previously made or received deliveries overnight did so during the Games. This doubled the number of businesses engaged in such deliveries and resulted in only a small number of additional complaints about noise disturbance from residents.

Making deliveries at quieter times on the road network helped make better use of road capacity during the Games and may have helped firms increase productivity (although some operators reported increased costs through unsociable hours payments). As a post-Games legacy, more deliveries could be made outside



The London 2012 Games gave TfL a unique opportunity to develop its understanding of freight.



normal working hours. This could result in the additional benefits of reducing the risk of conflict between freight vehicles and other road users. However, careful consideration will be needed to examine any long-term effects on households and other local interests.

There was also a ten per cent reduction of freight activity through a variety of other solutions, including pre-ordering or stockpiling of goods, collaboration between businesses and consolidation ('groupage' of loads on larger, more efficient vehicles). Influencing the procurement of stock and services before they enter the supply chain can therefore be seen as an important tool for reducing the number of deliveries.

The reduction in freight traffic may also have been partly attributable to mode shifts, particularly in central and East London. Here a number of operators, including both UPS and DHL, used the Games for high-profile PR activity, utilising cycle freight and even jogging couriers.

The Freight Journey Planner tool was used up to 700 times a day as operators considered the most practical route to make deliveries and the best delivery location. Increasing compliance of kerbside activity is particularly attractive in smoothing traffic flows and managing efficient bus services.

Games lessons

TfL provided leadership between many parties with a range of concerns and facilitated the uninterrupted distribution of goods and services in London during the Games. While leadership in a fragmented industry is not easy, a campaign of marketing, education and dialogue with the industry fostered a more cooperative environment. Further development of the Freight Forum should enable this to be sustained.

Having achieved such a substantial change, TfL wishes to capitalise on the improved industry engagement and the most successful parts of the Games programme, such as re-timing deliveries and enhancements to journey planning. While some Games-time changes may not be easily repeatable for commercial reasons, those that can be delivered in the future could make a significant contribution to achieving TfL's goals, such as reducing congestion and improving air quality. TfL is also working with vehicle manufacturers to identify whether changing vehicle design can help remove 'blind spots,' which are a key factor in many collisions.

Individual organisations have the ability to change their behaviour if they can be convinced of the justification to do

so. For freight this is likely to mean reductions in cost and improvements in service levels. The challenge for TfL will be to continue its successful partnership with the industry to deliver broadly-supported, mutually-beneficial solutions.

Freight currently accounts for approximately 17 per cent of all traffic in London, and population growth alone over the next 20 - 25 years suggests a minimum 12 per cent increase in freight activity is likely. If freight is not included on the agenda of urban transport policy, there is a risk of missing an opportunity to help improve air quality and road safety, reduce congestion and subsequently greenhouse-gas emissions.

There is no single solution for improving the efficiency of the freight industry. The changes needed in the long term will be the sum of small gains that may be delivered in various ways, such as through changes to delivery times, formal and informal consolidation practices and better use of route planning and travel information. TfL has learned from the successes during the Games and will partner with industry to apply these to London's future growth. ■

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TACKLING ENVIRONMENTAL ISSUES IN MAJOR CITIES

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The dominance of freight vehicles in some major cities poses particular problems for residents and commerce. This is particularly the case in trade-node cities, which are typically the largest metropolitan areas where major ports, airports, distribution centres, and inter-modal hubs are concentrated. These activities become key elements in the urban landscape, often generating significant externalities while being important contributors to the local economy.

THE PHYSICAL AND FINANCIAL FLOWS of the global economy tend to be concentrated in relatively few “global cities.” London, New York, and Tokyo are well recognised as the leading financial centres, while trade-node cities such as Shanghai, Rotterdam and Los Angeles are amongst the centres for the global movement of goods. In the United States, ten gateways account for 44 per cent of international trade, and just five container ports account for 70 per cent of container trade.

In addition to local economic benefits – which are considerable since trade has a high economic multiplier – trade has many negative local impacts. First, freight contributes to congestion on major highways and rail routes and contributes to delays at rail crossings, as well as to passenger-freight conflicts on shared routes. Second, trade-related activities tend to be concentrated within metropolitan areas and ports, airports and inter-modal facilities are all major traffic generators. Warehousing and distribution are often clustered around these facilities, or are located near each other at the periphery. Their concentration adds greatly to local transport difficulties. Third, trade-related freight is a major source of air pollution. Ocean vessels are not subject to the same regulations as surface transport and, hence, use low-grade high-sulphur-content fuel. Diesel trucks are typically the largest source of particulate emissions. Diesel trains are also a significant source of emissions. Just as trade-related freight adds to transport demand, it also adds to total emissions from the transport sector. Fourth, trade-related freight traffic generates significant liveability and environmental justice issues. Noise and truck traffic in residential neighbourhoods affect quality of life. In the US, ports, airports and inter-modal facilities are often surrounded by low-income, minority-ethnic neighbourhoods whose residents are disproportionately exposed to health risks and noise.



Addressing these problems is challenging. While the benefits of trade are broadly distributed through lower prices and a greater variety of goods in the wider economy, the disbenefits of trade are concentrated in trade-node cities. Those who suffer these costs may seek relief from government, but many aspects of trade are beyond the jurisdiction of local or state authorities. Consequently, governments may frequently rely on persuasion and negotiation rather than regulation. An additional challenge comes from the complexity and flexibility of the global supply chain. The numerous players within the chain (producers, shippers, distributors, ocean carriers and cargo owners) are highly inter-dependent and price sensitive. If, for example, rail congestion reduces reliability, cargo owners may choose alternative transport links that involve different shippers and distributors. Thus the impact of regulatory action (e.g., an emissions fee) may be difficult to predict and may lead to unintended consequences.

Governance structures are an additional challenge. Government responsibilities are tending to decentralise to lower levels (Giuliano, 2007). As a result, oversight of trade-related activities is becoming more fragmented; national governments try to promote economic competitiveness and regulate many aspects of trade (e.g., vehicle fuel and emissions standards), while local and state governments control local access and land use. Moreover, in most of the developed world, policy at all levels of government is part of a democratic process that involves many stakeholders. Given the visibility and importance of trade, as well as the number of stakeholders involved, decisions regarding how to address the negative impacts of trade have become highly politicised.

In this environment of limited and fragmented government authority, new regulatory models are emerging. There is growing reliance on consensus-based, deliberative processes, greater engagement with industry, and an emphasis on voluntary or negotiated agreements to solve environmental problems.

Los Angeles and Seattle case study

To better understand the interactions between trade-related externalities and governance structures, we conducted a comparative case study of Los Angeles and Seattle. Both metropolitan areas experience serious traffic congestion associated with port activity, and both have developed programmes to reduce conflicts between passenger and freight traffic. Table 1 provides the context for the case study.

	Los Angeles Region	Seattle Region
US rank size (2010)	2	15
Population (2010)	18.2 million	3.7 million
Employment (2010)	8.3 million	1.7 million
Local government units	5 counties, 189 cities	4 counties, 73 cities
Size	38,000 square miles	6,300 square miles
Port volume (2010)	14.2 million TEU	3.8 million TEU

Table 1: The two regions

Passenger – freight conflicts take place at, for example, level crossings where motor traffic must stop for trains. Heavy trade activity also increases rail traffic, which in turn raises the frequency and duration of traffic interruptions at these crossings. The preferred solution is grade separation – building bridges or underpasses to separate the road traffic from the tracks – but this is costly. From the perspective of the local resident, the railroad is causing the problem, and so should pay for the solution. However, from the perspective of the railroad, there is no gain from grade separation since rail capacity does not improve. Therefore, incurring the cost does not seem justified. In the US, railroads are protected by federal interstate commerce law, which prohibits states and local government from regulating them. This means that the option of forcing the railroad to fund and construct grade separations is not available.

Within these constraints Los Angeles and Seattle each developed their own programmes to reduce the number of level crossings. The Seattle FAST program was the result of a broad, consensus-based process that took place over several years and that was formalised via a non-binding memorandum of understanding. The first phase included 12 grade separations and three truck access projects, with a total budget of US\$470 million. The program has proved to be successful. State fuel and weight taxes were passed by the state legislature in 2003 and 2005, and in 2006 FAST was expanded to 25 locations with a total budget of US\$868 million. By 2009, 14 projects had either been completed or were under construction.

The Los Angeles Alameda Corridor East (ACE) program was far more ambitious; it included four county level plans with a total budget of US\$4.5 billion. Unlike FAST, ACE was developed by a narrower set of stakeholders, principally consisting of local elected officials and public-agency representatives, and each



county plan was generated independently. ACE has, to date, been less successful. Only Los Angeles County has identified funding and built seven crossings. A comparison of the two projects is provided in Table 2.

	Los Angeles (ACE)	Seattle (FAST)
Scope	172 projects, \$4.6 B	25 projects, \$868 M
Purpose	Increase safety, reduce road congestion, reduce vehicle emissions	Increase safety, reduce road congestion, improve port access
Development process	Decentralised and consensus based at the county level, no clear leadership, mostly public-sector participation	Decentralised and consensus based, regional planning agency leadership, broad public and private participation
Plan	Formalised in LA County, unfunded portion of transport plans in other counties	Formalised by memorandum of understanding
Governance structure	ACE-LA special purpose authority under sub-regional Metropolitan Planning Organization (MPO), 1 county MPO, 1 county transport commission, 1 county transport authority	FAST special purpose authority, broad representation in board membership
Funding sources	Federal earmark funds, various state funds (bonds), local city and county, private	Federal earmark funds, federal formula funds, various state funds (fuel taxes), local city and county, private

Table 2: The ACE and FAST projects

The comparison reveals both similarities and differences. Both projects are intended to mitigate impacts on local communities, are the result of an extensive bottom-up collaborative process, and rely on funding from many sources. There are also substantial differences. The scale of ACE was an order of magnitude larger than FAST. FAST was built on a broad and strong consensus of stakeholders, while ACE consensus was more limited. In reality, ACE was comprised of four separate and uncoordinated county-level projects. Perhaps most significant, many of the FAST projects have been built, and the entire project is on track to reach completion while ACE is just beginning to show some results.

How might we explain the difference in outcomes, and how does governance structure play a role? First, Seattle is a much

smaller and more homogeneous city than Los Angeles. As such, there are fewer government agencies, and stakeholders have more access to local and state decision-makers. Over the years, strong partnerships between industry, state and local government have developed, and these formed an excellent foundation for the development and implementation of FAST.

Second, in Seattle there is more of a consensus on port growth and impact mitigation. The Seattle ports are critical for the state's agricultural exports and are one of the major economic generators. The Los Angeles ports are primarily used for imports, two thirds of which have a final destination outside the region (Leachman, 2010). Local residents are therefore less supportive of port growth. Seattle also suffers less from severe environmental problems.

The US Environmental Protection Agency rates the air quality of metropolitan areas, and imposes planning requirements for areas that do not meet national air-quality standards. Metropolitan areas are rated according to the extent to which the standards are not met. Los Angeles is designated as the only "extreme" non-attainment area in the US for air pollution, while in Seattle air quality breaches regulations for fine particulates in only one county.

Third, Seattle had the advantage of strong regional leadership from the Metropolitan Planning Organization. It was the local Metropolitan Planning Organization that established an industry round table and began discussions on how to manage trade impacts, as well as engaging the other key partners. Finally, Seattle demonstrated "ownership" of the problem, most significantly by raising new sources of revenue through increased fuel taxes. In contrast, relatively little local funding was directed at ACE, and it was all drawn from existing sources, thus competing with all the other priorities for these funds.

Conclusion

Effective problem-solving appears to be associated with four factors. First, extensive and long-term inter-governmental col-

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In this environment of limited and fragmented government authority, new regulatory models are emerging.”

laboration, both vertical and horizontal, allows the establishment of authority through, for example, new governmental agencies and pooling of funding resources. Second, public – private collaboration is essential. In the absence of jurisdictional authority to regulate, public agencies must find ways to negotiate mutually-acceptable and -beneficial solutions. Even when jurisdictional authority exists, negotiated agreements may lead to better outcomes, such as more rapid implementation. Third, strong leadership, whether from individuals or organizations, ensures there is a project champion and problem solver in the development and implementation process of the plan. Finally, community engagement, though risky, is also an essential ingredient. Local communities typically have substantial power to veto projects, but also to serve as project promoters. ■

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INEQUALITY IN TRANSPORT PLANNING

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Sophisticated decision models are often associated with developed countries that can afford state of the art technology. However, developing economies (with much smaller budgets) often need the best in class models even more. They need to squeeze every unit of benefit from each monetary unit invested.

SOUTH AFRICA IS ONE such developing nation, and is faced with a number of decision-making challenges. Based on the Gini-coefficient, South Africa is ranked as one of the countries with the most severe economic inequality amongst its citizens. Although some of the blame may indeed be laid at the feet of the former apartheid regime, inequality has actually worsened since the first democratic elections in 1994.

Government decision makers are faced with tough challenges. Where do they spend and invest the citizens' money? The choice seems to be between alleviating poverty so that the poor can be pulled into the main economy, or improving the infrastructure, efficiency and resources for taxpayers, which currently comprise a mere 25 per cent of the population that *can* potentially contribute. This is, indeed, a balancing act to reckon with.

And what is the role of transport? One of the manifestations of apartheid was the forced relocation of poor, mainly black, citizens to the peripheries of cities and towns. Twenty years into democracy, those often informal settlements are still evident and make up a sizable portion of the urban fabric. The settlements, usually referred to as townships, are ill-served in terms of social, educational and health services. Commuters frequently travel long distances to reach employment opportunities. Over the years, formal transport services have deteriorated, and paratransit in the form of small 15 to 25-seat minibuses have filled the gap. This industry has evolved to be one of the major modes of urban transportation in South Africa. For a more detailed review of the emergence and growth of the minibus taxi industry see Joubert (2013).

Stepping up to the challenge

Decision makers rely on models – abstractions of the real world – to test a number of scenarios before implementing a chosen scenario in practice. Why? It is too costly and risky to perform

‘what-if’ scenarios in reality when there is a plan to build a new rail segment, introduce a bus-rapid-transit (BRT) system, or consider funding road upgrades using tolls. It may then sound obvious that, if the models are used to test decisions that will have an impact on the real world, they should be good representations and accurate reflections of that same real world for which the decisions are intended. Unfortunately, transport models are more often than not poor representations. Consequently, they result in bad, or at best ill-informed, choices.

Consider the dominant paratransit industry in South Africa. The private ownership and its dynamic nature – such as the impromptu boarding and alighting of passengers along any portion of road – makes the paratransit mode very difficult to represent in current four-step transport planning models, or at least in the way those models have been implemented in the South African context.

In early experiments in South Africa, agent-based modelling showed useful results in trying to model the dynamic and multi-modal decision-making of South African commuters. Specifically, agents (commuters) can autonomously reach their destinations choosing multiple modes. Searching for a more scalable agent-based solution, we started implementing the open source Multi-Agent Transport Simulation (MATSim) toolkit developed by groups at ETH Zürich and TU-Berlin (Fourie and Joubert, 2009; MATSim Development Team, 2012).

Agent-based models in traffic and transport planning are still relatively new, but have proven to provide more accurate and richer result sets, albeit currently somewhat slower. That is, they are better reflections of reality. Also, they are much more intuitive to understand and to validate, an aspect often overlooked in evaluating the quality of a model’s output.

The MATSim toolkit relies on a synthetic population and a road network upon which agents execute their plans. Each agent has one or more plans, a plan being a sequence (chain) of activities that the agent wishes to perform. For example, an agent may leave *home* with its children and drop them off at *school* before going to *work*. After work, the agent may stop at the convenience store for *shopping* before returning *home*: a chain summarised as *home* → *education* → *work* → *shopping* → *home*. At the start of an iteration, each agent picks a plan from its memory, and develops it on the actual network in a mobility simulation among all the other agents. The result is congestion, as agents choose to use the same portions of the network. Next, agents evaluate the plan using a scoring function that assigns positive



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Over the years, formal transport services have deteriorated, and paratransit in the form of small 15 to 25-seat minibuses have filled the gap.

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Opening new planning doors

Disaggregated modelling approaches open up new opportunities to deal with infrastructure decision challenges faced in developing countries like South Africa. Each agent in the model can make decisions based on their socio-economic attributes. When generating a synthetic population, each household can be assigned an income, age and employment profile. Agent choices are then made as a function of household income, for example. This allows decision makers to evaluate how different groups in an economically-unequal society will respond to a specific transport intervention. And because each agent is modelled and tracked uniquely in the simulation, the researcher can observe how each agent behaves before and after a transport intervention. More specifically, it opens the door toward answering the often-debated questions “*who pays?*” and “*who enjoys the benefits?*” – the latter being rephrased as “*who should pay?*”.

When modelling a large-scale transport system at a disaggregated level, new ways of measuring become possible. Whereas formerly the main consideration was direct benefits like travel-time savings, more comprehensive metrics can now be developed. In South Africa, with many of the poor still living on the periphery of cities, a metric for accessibility was developed to account for both land-use and transport conditions.

The metric is comprised of four components. The first component is travel times to work, education, shopping and health-care facilities. The second is the transport options available to

utility to participation in activities and negative utilities to traveling, waiting, arriving late, or leaving too early. Each agent can then choose another plan from memory for the next iteration, or modify an existing plan through, for example, re-routing, re-scheduling activities or changing the location of secondary activities. The process repeats itself until system-wide stability is achieved.

In essence, the model demonstrates how agents autonomously attempt to maximise their own utility amidst other agents also trying to do the same.

a household (whether they make use of them or not). The third component is the travel time to reach the chosen mode, and the fourth is the number of facilities near enough to the household to be reached on foot.

Once accessibility was measured for each individual in the synthetic population, the measure was averaged across the members of each household to achieve a household accessibility score. The results for the Nelson Mandela Bay Metropolitan area in the Eastern Cape province are shown in Figure 1.

Intuitively we know that centrally-located affluent neighbourhoods in South Africa are more accessible than their low-income peripheral counterparts, but having a quantitative metric allows for more empirically-founded decision support.

Freight and commercial vehicles

In the past it was common practice to pre-load transport models with a small proportion of *background noise* traffic. Such traffic was then described as through-traffic and commercial vehicles. To extend the agent-based benefits obtained from modelling

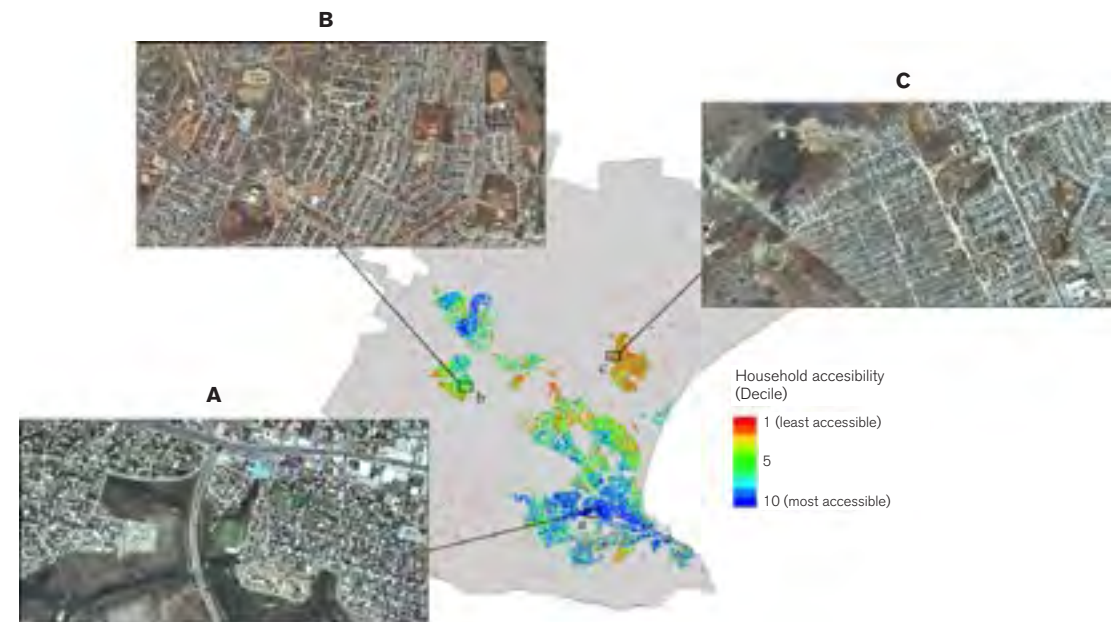


Figure 1: Household accessibility in the Nelson Mandela Bay Metropolitan area, with approximately 1.2 million inhabitants. Three areas are highlighted: a) a high-income suburban area with good accessibility to a variety of amenities; b) a formal township on the periphery of Uitenhage with mainly access to schools; and c) a semi-formal township with much smaller housing units, and only access to a single school (top right-hand corner).

person-travel to commercial vehicles, a thorough understanding of the activity-chain structure of commercial vehicles is needed. To achieve this we analysed the Geographic Positioning System (GPS) records of more than 30,000 commercial vehicles over a six-month period. The activity chains were clearly quite different from those observed for the movement of people. Most notably, the chain durations were much longer, and the number of activities per chain was greater. From a European study we know that the value of time – or more specifically the value of travel-time savings – for commercial vehicles is much higher than for commuters. Disaggregate modelling can deal with this, since each agent makes autonomous decisions based on its own attributes.

To be able to model commercial vehicles in MATSim as autonomous agents, we needed to generate a synthetic population that, like people, reflected reality. The first agent-based results in South Africa showed that commercial vehicle movements in MATSim were both spatially and temporally accurate. Yet, the activity sequencing performed less favourably in terms of vehicle kilometres travelled. Subsequent research (see Joubert and Axhausen, 2013) employed complex networks to better reflect the connectivity between facilities, resulting in more realistic activity sequencing in the chains.

An advantage of these contributions was that they simultaneously modelled both people and commercial vehicles. This has major positive implications for decision-making. Traditionally, people and goods movement were kept distinctly separate and also modelled separately. However, in reality they share the same road space. Why then were decisions related to transport infrastructure not informed with joint models? Most probably because traditional models were incapable of dealing with the very different stakeholder groups involved.

One downside of the current approach is that the activity chains of the future are assumed to be similar to those observed in the past. This may not be the case. Consider, for example, how *just-in-time* deliveries in the automotive industry changed logistics. Fleets of typically smaller vehicles make more frequent but smaller deliveries in much tighter time windows stipulated by the receiver. Changes in the production and logistics environment may again, in the future, dramatically change how commercial vehicles move. We may fail to anticipate those changes if we base our activity chain structures only on chains observed in the past.

Commercial-vehicle activity chains are actually the result



of higher-order, inter-company, supply-chain-level decisions. Researchers are starting to include these market-dynamics in agent-based models as they imitate the negotiations among supply-chain players for business. For example, *shippers* stipulate shipments that they wish to move, while *logistic service providers* negotiate for the contracts based on their modal and distribution-centre capabilities. Contracts are then awarded to *carriers* who own and operate vehicle fleets. Finally, pickup and deliveries are assigned to individual vehicles, which are then included in the mobility simulation where they share the road space with other agents, including private and public transport as well as other commercial vehicles.

Conclusion

Does agent-based modelling provide a silver bullet? Not quite. It does, however, provide new ways to ensure that models reflect reality more accurately. In doing so it opens up new doors to prepare more empirically-founded evidence when supporting infrastructure and policy decisions.

If we frame a problem as *congestion*, then we have very limited solution options; the main one being *build more roads*. By re-framing the question and problem, new domains are opened up to search for better solutions. Disaggregate modelling did exactly that in the South African context. It allowed for a more comprehensive description of the population that took economic inequality into account, and was also able to deal with the dynamics of the paratransit mode of urban transport.

On the freight side, disaggregated modelling has been a catalyst to better understanding of commercial vehicle movement. In doing so, it allowed for the important step of modelling commercial, private and public vehicle movement simultaneously in a single model. This, in turn, allows for a more comprehensive understanding of the impacts that a policy or a change in transport infrastructure will have on different stakeholders. ■

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THE URBAN CONTEXT OF INTERMODAL TRANSPORT

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There is a constant tension in the freight sector between efficient logistics and sustainable development. Narrow delivery-time windows and smaller consignments make it difficult to achieve economies of scale in transport operations, while there is increasing pressure to reduce environmental impacts. Despite innovative technology and alternative fuels, freight-sector emissions and energy use are rising. A key policy objective for the sustainable development of the freight sector is, therefore, the shift from road freight to rail. However, this is not always effective.

BECAUSE INTER-MODAL ROAD-RAIL TERMINALS, as well as shippers and receivers of rail freight, are often located in urban areas, urban transport constitutes both an important and a disturbing factor for modal-shift strategies. On the one hand, urban transport increases the reach of rail freight by linking shippers and receivers to rail and enabling the regional consolidation of goods flows. On the other hand, the urban environment, characterised by congested roads, space constraints and infrastructure limitations, restricts the efficiency of local road haulage and terminal operations. Furthermore, these operations, which are vital for the efficiency of inter-modal transport, are increasingly perceived as disturbing activities for passenger transport and the quality of life of citizens.

In this study we analysed the trade-off between local environmental impacts and global environmental gains of a modal shift of two cases of transport flows. The two cases had sharply-contrasting characteristics with respect to relative environmental advantages of rail over road. It was not the aim to draw general conclusions on the usefulness of a modal shift from these two cases. Instead, two very different types of cases were chosen in order to highlight the significance of the local spatial structure on the sustainability performance of inter-modal transport.

The first case was a transport flow in Sweden between Gothenburg and Stockholm; a relatively long distance of nearly 500 kilometres. Since rail in Sweden uses emission-free electricity, this example offers the potential to achieve substantial reductions in CO₂ emissions through modal shift. The inter-modal terminals in Stockholm and Gothenburg are located close to the urban centres, while the shipper and the receiver are located in the urban fringe. This spatial structure results in relatively long road-haulage distances in urban traffic conditions. The all-road alternative, however, also creates traffic in urban areas, since the shipper and receiver are located north of the city centres while the motorway

enters both Gothenburg and Stockholm from the south.

The second case was a flow in Germany between Hanover and Bremen, under less favourable circumstances as it involves a relatively short transport distance (130 km) and rail is to a great extent based on fossil fuels. In Bremen, the inter-modal terminal and the shipper are located in the same logistics area, in the north-western part of the city. Due to the close proximity of the inter-modal terminal and the shipper, road-haulage distances are very short. The all-road alternative, on the other hand, generates significant urban traffic, because the trucks have to cross a sensitive urban area to reach the motorway in the south of Bremen. In Hanover, on the other hand, a modal shift leads to a significant increase in urban road traffic, since the inter-modal terminal in Hanover is located close to the urban core while the receiver is along the ring motorway.

Finding the optimum road-and-rail trade off

An analysis of the case-study results confirms that modal shifts can result in reduced climate and air-pollution impacts, due to the general environmental benefits of rail in terms of energy use and CO₂ emissions. However, these benefits are achieved at the expense of higher traffic impacts in more sensitive areas. To compensate for these additional traffic impacts, a sufficient distance needs to be covered by rail to achieve enough savings in CO₂ emissions on the long-haul section of the journey. The break-even distance for achieving an overall environmental benefit depends on the relative advantage of rail over road in terms of climate impact and the relative disadvantage of the local haulage over single-mode road in terms of traffic impacts. Assuming the introduction of alternative fuels in the road-freight sector (which could potentially decrease the comparative environmental benefits of rail), and gradual increases in congestion problems in cities, the break-even distance for a modal shift is likely to increase in the future. This makes it difficult to reduce CO₂ emissions in the freight sector through a modal shift from road to rail.

The characteristics that are most critical to local environmental impacts are the haulage sections in urban areas required to travel to and from rail terminals. Due to freight rail operations being based on night-time trips, these local urban road-haulage operations have to take place in the morning and afternoon peak traffic hours, and hence contribute to urban congestion.

Taking a geographical perspective on the environmental-improvement potential of rail freight reveals that modal shifts are mainly beneficial for inter-city regions, while externalities in origin



and destination cities can increase significantly. Despite the fact that a modal shift might be beneficial at large, for cities aiming for a high quality of life rail freight can be a disturbing factor, since a modal shift increases impacts on congestion and air quality. This can have negative implications for modal shift strategies, since investments in inter-modal terminals – which are a prerequi-

site for future growth of rail freight – are likely to be opposed by local authorities if they lead to greater negative local effects.

The scale of the geographical trade-off is largely determined by the relative locations of the inter-modal terminal and shipper and receiver in the spatial structure. This can vary significantly. In many cities inter-modal terminals are located close to the city centre, while the shippers and receivers of inter-modal freight are located in urban fringe areas with good connections to surrounding ring high-

ways. In such cases, the local haulage and rail distance travelled in urban areas is further than the urban driving distance of single-mode road transport. An alternative terminal location closer to shippers and receivers can significantly decrease the distance of local haulage trips in urban areas and, hence, decrease its traffic impacts. These savings can be substantial, and can even result in lower externalities than for all-road solutions, if the terminal and the shipper are located near each other. The significantly smaller traffic impacts in urban areas can encourage local authorities – rather than forcing them – to help integrate intermodal road rail transport (IRRT) in the urban spatial structure.

To understand the broader implications of freight movements in an urban context, the integration of urban-transport and modal-shift strategies is required. This would mark a major departure from current thinking in urban transport planning, which sees increased urban rail traffic and road haulage as a threat to local sustainability, and will require revisiting transport planning procedures in urban areas (which mainly focus on passenger transport). By better understanding the operations and impacts of freight transport, local authorities can embrace inter-modal transport as an opportunity rather than viewing it as a risk. This would encourage city planners to include rail freight in their long-term development plans. This could create new possibilities for rail freight that are needed to create a sustainable freight-transport system in the face of ever-increasing volumes of road transport. ■

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LOGISTICS SPRAWL IN PARIS, ATLANTA AND LOS ANGELES

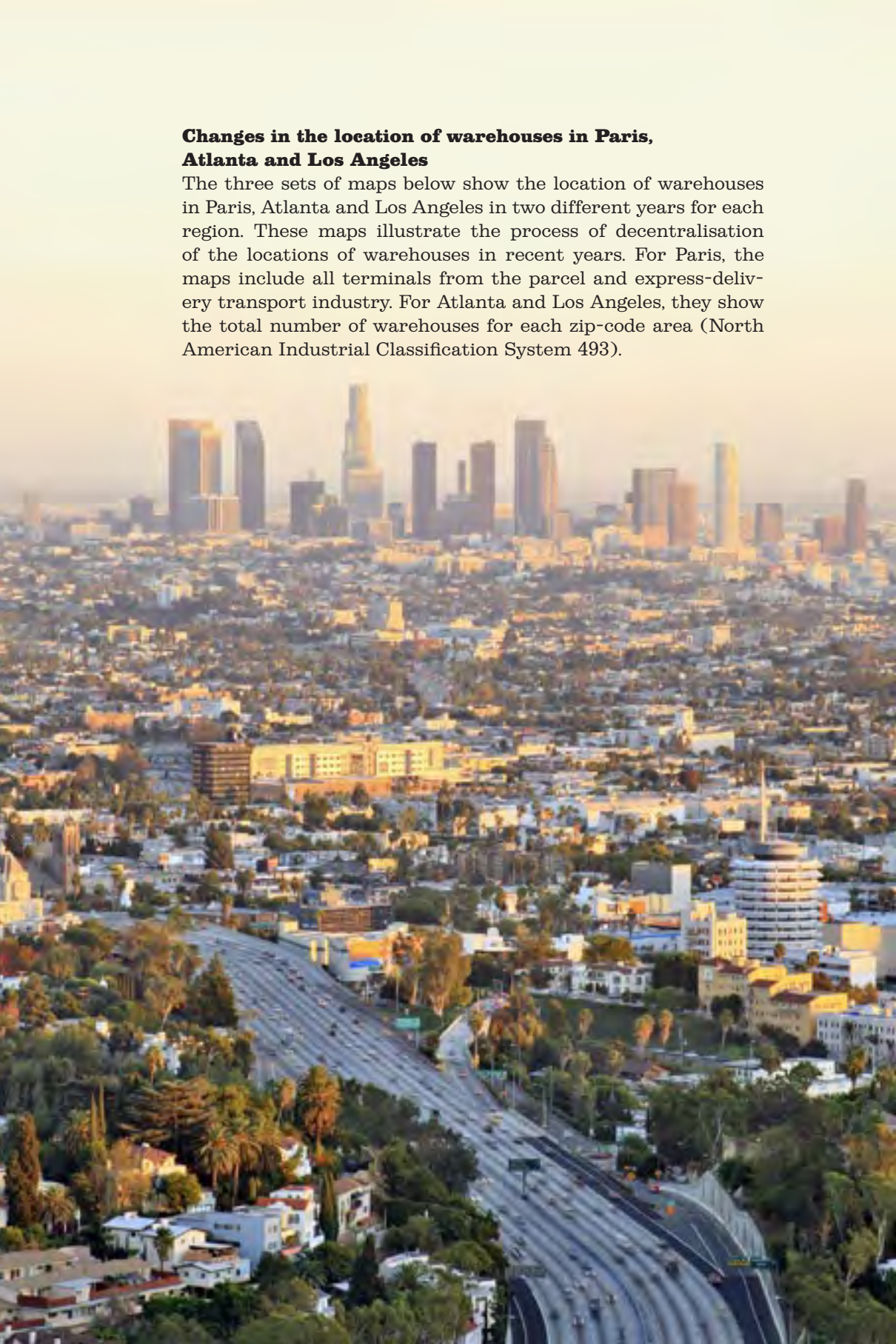
**Laetitia Dablanc, PhD, Director of Research,
IFSTTAR/University of Paris-East, France**

The dominant spatial pattern for freight facilities in metropolitan areas has changed over the past three decades. A new phenomenon of logistics sprawl has emerged, with enormous significance for such areas. It has been allowed to develop because of wider changes in logistics processes. The sprawl phenomenon generates economies of scale for the logistics industry but has massive impact on urban landscapes and, inevitably, results in considerable environmental costs.

IN THE 1980s, THE UNITED STATES and many other parts of the developed world entered a “new distribution economy,” dependent on efficient and increasingly-globalised networks of goods distribution and just-in-time operations. This led to a reduction in large inventories of intermediate and finished products, and to a concomitant rise in hub distribution centres. Modern global supply chains require more logistics facilities, and the way these are spatially organised is a response to the need for an efficient goods-distribution network.

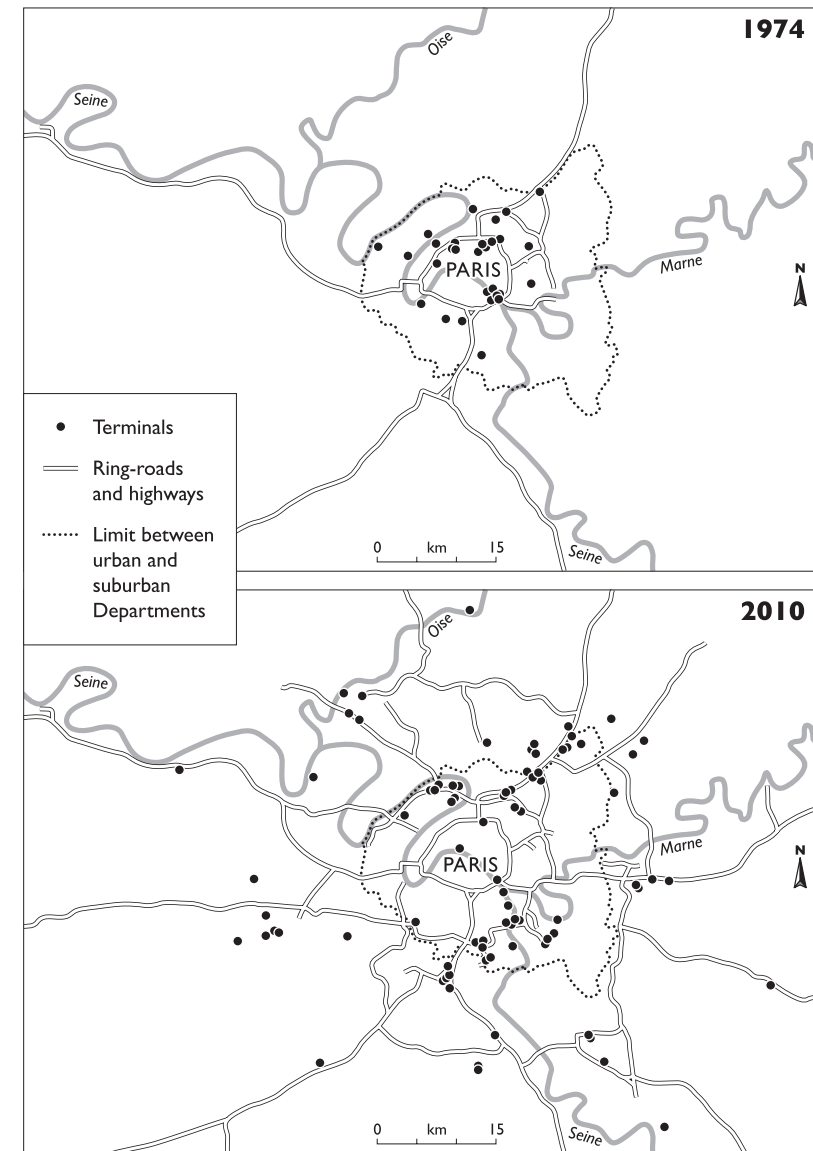
There is a direct correlation between the characteristics of this new system of distribution centres and the phenomenon of logistics sprawl, with the concentration of freight facilities in large conurbations. Logistics sprawl contributes to the unsustainable characteristics of large metropolitan areas by generating congestion, CO₂ emissions and air pollution. The initial consequence of the de-concentration of terminals is an increase in distances travelled by trucks and vans to deliver commodities to urban areas, where jobs and businesses remain more concentrated. One estimate of the impact of relocating cross-dock facilities for the parcel delivery industry serving the Paris region on net CO₂ emissions is an additional 16,500 tonnes annually (Dablanc and Andriankaja, 2011).

In large urban regions – mega-regions – the issues and problems are compounded. The concept of a mega-region is particularly suited to the analysis of freight-transport systems, because freight’s market areas, driven by global supply-chain organisations, are largely disconnected from one single city and are better understood in a mega-regional context. Terminals – such as regional distribution centres and cross-dock terminals – are spatially organised on a regional and multi-city basis.



Changes in the location of warehouses in Paris, Atlanta and Los Angeles

The three sets of maps below show the location of warehouses in Paris, Atlanta and Los Angeles in two different years for each region. These maps illustrate the process of decentralisation of the locations of warehouses in recent years. For Paris, the maps include all terminals from the parcel and express-delivery transport industry. For Atlanta and Los Angeles, they show the total number of warehouses for each zip-code area (North American Industrial Classification System 493).



Paris, 1974 and 2010. Dablanc and Andriankaja, 2011



Atlanta, 1998 and 2008. Dablanc and Ross, 2012



Los Angeles, 1998 and 2009.

Indicators of logistics sprawl

Using a technique called “centrography,” an indicator of sprawl has been calculated for warehouses as well as for economic activities in general. This technique uses the average distance of terminals to their “barycentre” i.e., the centre of gravity of the warehouses in the metropolitan areas. This average distance has

increased because of the spread of warehouses into the outskirts of cities:

- by 10 km in Paris (from 6 to 16 km)
- by 5 km in Atlanta (from 28 to 33 km)
- by 9 km in Los Angeles (from 42 to 51 km).

The same sprawl indicator for all establishments (representing economic activities in general) has increased:

- by 2 km in Paris
- by 2 km in Atlanta
- by 0.5 km in Los Angeles.

This suggests that, since logistics has decentralised more than economic activities in general, there has been a concomitant increase in truck-kilometres to connect urban destinations with freight terminals. This means that congestion related to truck traffic in these three metropolitan areas has increased as a result of logistics sprawl.

Addressing logistics sprawl

In one of the few academic studies of local planning and freight issues that used the Chicago metro area as an example, Cidell (2011: 832) notes the challenges facing local governments confronted with the development of freight facilities: “New jobs are welcome, but the low per-acre tax revenues and absence of sales taxes associated with this type of development are often resented.” Looking at how municipalities in Northern California cope with distribution centres, Hesse (2002) also notes a reluctance to attract logistics land uses, even though most cities – including those with an emphasis on hi-tech industries – do not actively discourage goods-distribution firms.

In the three cities in this study, attitudes towards warehousing activities are varied, with many local government agencies perceiving them positively, as a way of compensating for the loss of manufacturing jobs. Consequently, the study found a range of policies from local governments in the three cities:

- Trying to prevent logistics growth in traditional manufacturing areas: the city of Vernon in Los Angeles.
- Looking to logistics as a way to revitalise industrial areas: Fulton Industrial Boulevard in Atlanta.
- Looking to logistics as a strategic sector for accelerated local

economic growth: Henry County in Atlanta, Moreno Valley and Inland Empire communities in Los Angeles.

- Looking beyond logistics: Gwinnett County, turning to office and high-rise development, in Atlanta.
- Promoting clean freight activities in the urban core: Paris.

It is striking that there is no regional coordination on issues of warehouses and logistics sprawl in any of the three cities. Land-use and building-permit decisions are made strictly at the local level (cities and counties). In the Paris region there are more than 1,280 municipalities, each having jurisdiction over land-use and building-permit decisions in their area. In many cases, each government agency competes with the other municipal/county governments – especially their neighbours – and they are often critical of one another. As one county representative in the metropolitan area of Atlanta said, “We love planning, but other counties do not and are ready to accept anything without any care given to conflicts of use, environmental justice or transitional planning.” Such lack of regional coordination results in an absence of attention to regional consequences in all three regions. Scarce public resources are depleted in strictly local, or even unnecessary, projects, such as highway interchanges, port dredging and investment in intermodal facilities.

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The current piecemeal approach to logistics planning must be abandoned.
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Potential solutions

The current piecemeal approach to logistics planning must be abandoned. Greater coordination would foster the development of a common approach to logistics, enabling planning and zoning undertaken at the various local and regional policy scales to be consistent. Joint decision-making regarding industrial locations and support for critical logistics networks might include revenue-sharing, with coordinated approval of site locations and shared provision of infrastructure. An initial benefit would be a region-wide approach to infrastructure and logistics planning, leading to a more coherent ranking and selection of freight projects and a more comprehensive approach to congestion mitigation, resulting in turn in improved freight and commodity movement.

In the future, metropolitan areas and states will be increasingly

called upon to facilitate efficient supply chains and logistics activities. Both the public and private sectors need to optimise warehouse locations and distribution networks, and improve transportation system performance. Both must give explicit consideration to the environmental impacts and quality-of-life concerns frequently reported by members of the communities most directly affected by the location and operation of supply chains. Freight and logistics planning must therefore become an integral part of planning for metropolitan areas, counties, and cities. Coordinating these approaches is also essential, due to tight public budgets.

At the local level, better freight facility management should include efficient warehouse siting and accessibility, adequate infrastructure and the consideration of construction, operation and maintenance costs. The local employment base, including the development of training programmes for warehousing jobs, is an important issue. It is also important to promote zoning regulations that allow for logistics operations in residential and mixed-use areas with specific architectural requirements.

At the metropolitan level, comprehensive transportation plans must include freight transport and warehouse siting. Promoting logistics parks and freight villages can also be part of the solution. Local decision makers must insist that the transportation planning process take studies of freight and commodity movement and supply chain operations into account. The inclusion of freight planning would allow regions to examine economies of scale and strategies for increasing the efficiency of logistics and supply chains through better coordination of infrastructure-planning and land-use decisions.

Finally, freight transportation policy would benefit if the policies of metropolitan areas on transportation planning were coordinated at the mega-regional scale, rather than, as today, only being considered at the local or metropolitan-area level. As a result of globalisation and the increase in scale of logistics activity, the region has become an increasingly important unit for planning. Mega-regions that connect metropolitan centres spatially and functionally provide an opportunity to achieve much greater efficiency and economies of scale through greater coordination and joint infrastructure planning across cities, regions, and states. Freight and logistics planning within mega-regions is better able to meet the challenges inherent in today's economy. The mega-regional level is where economic growth is concentrating, increasing the need for logistics services and facilities. It may also be a level where political and local rivalries are more diluted, making it easier to foster regional coordination. ■

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ADDRESSING THE URBAN FREIGHT ISSUE IN FRANCE

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The interaction of several trends in the way world trade and consumer desires are changing has created a need for a new way to tackle the issue of urban logistics. On the one hand, there is globalisation and the consequent increase in the distances that goods are transported. On the other, there is the desire in many areas to increase population densities in town centres, to reinvigorate them and – as a component of these changes – the increase in e-commerce. These trends lead to a need to differentiate between global and metropolitan logistics.

LOGISTIC TERMINALS HAVE LOST OUT to competition from housing and leisure activities in densely-built areas, and consequently been moved from the hearts of towns to the outskirts. This has been accompanied by a series of negative effects: a rise in the number of kilometres driven; increased congestion both by trucks and the cars of the employees in the industry, and; a reduction in productivity as a result of the extra mileage. Where warehousing is concentrated on the outskirts of cities, the delivery systems necessarily result in damaging impacts – both economic and environmental – because of the distances required to be covered by lorries and vans.

France is one of the leading countries in researching urban freight logistics. *The Programme de Recherche Marchandises en Ville* was launched in 1990 and provides a solid theoretical and methodological basis for such research. The metropolitan area of Bordeaux has proved to be a fertile research testing ground, for instance through pilot projects such as the Espaces Logistiques de Proximité, which facilitated deliveries in the centre of the town while construction work on the tramway system was underway.

There has been a series of successful initiatives by local authorities across France addressing the management of deliveries over the so-called 'final kilometre':

- The establishment of logistic terminals in urban areas, notably in parking complexes (Paris, Bordeaux, Lyon),
- An assessment of what has been learnt from early programmes to tackle the issue of the final kilometre (In Lyon, a programme to reconfigure delivery areas has been in progress since 2007.), and
- The establishment of local delivery centres created by public-private partnerships (Lyon, Grenoble), which have sometimes led to the signing of agreements between public and private partners (Paris, Toulouse).

Now, a change in scale is necessary for public policies: from last-mile logistics to urban logistics. At the metropolitan level, authorities face great pressure to reduce the negative effects of freight traffic; action focussed only on the final kilometre is not sufficient.

There have been some ambitious attempts to adopt policies aimed to reduce emissions of greenhouse gases emanating from deliveries. In Lyon, a project aims to reduce the number of truck movements and to improve the organisation of deliveries. The aim of the resulting Plan for Climate and Energy, approved in 2012, is to cut CO₂ emissions by 15 per cent across the metropolitan area and to reduce the actual tonne-kilometres operated locally by five per cent, through the better organisation of urban logistics.

France has a complex federal government structure that hampers the creation of clear policies on matters such as urban freight that demand a coherent response. Urban-freight policy is a mix of issues related to spatial planning, transport and economic development. Responsibilities for these policy areas tend to overlap. There are 22 regions, 96 departments and 36,569 municipalities. Large urban areas incorporate many municipalities that form agglomerations or urban communities. Each level of government has some say over various issues.

- Major multi-modal infrastructures are the responsibility of the national government.
- The regions deal with economic development.
- Spatial planning and transport are shared between national government and the regions.
- Land-use policy is the responsibility of the municipalities, with the exception of some inter-municipal structures.
- And finally, inter-municipal governments are responsible for local planning and road management.

The overlapping of administrative competencies results in a loss of efficiency in freight policies and begs questions as to who feels responsible for the freight issue. There needs to be cooperation and trade-offs between administrative and spatial layers, and between public and private stakeholders. From the local authority point of view, there are four key drivers for improving freight transport in urban areas:

- (1) Innovation in technology,
- (2) Innovation in organisation of freight transport,
- (3) Spatial planning, and
- (4) Decision-making systems.



All four, in varying levels, need to bring together private and public stakeholders.

Technological innovation

Technological innovation is the aspect of urban transport development that probably least concerns local authorities. However, local and national governments can help to implement the most advanced technologies, for example by subsidising new vehicles, generating or taking part in experiments alongside private companies, and through the grouping of public procurement processes, such as the pooling of electricity buyers initiated by the French state. They can also support environmental improvements by imposing new regulations, creating a competitive advantage for companies that are “best-in-class” from an environmental point of view.

PIEK Night-delivery Experiments in Paris

PIEK Night-delivery Experiments, in Paris, was a cooperation between the Ile-de-France Region, the City of Paris, and the private sector through Club Demeter (an association of supply-chain decision makers) and Cemafruid (a certifying organisation). A trial was established with 90,000 Euro of funding from the Ile de France to support a study and experiment. Discussions were held with Club Demeter and Cemafruid, and a six-week experiment was initiated with two companies (LR Services and Casino), partially with PIEK (a system of certification for lorries) vehicles – which are certified – and special loading and unloading equipment. Noise levels were monitored and the results were assessed (use of public space, noise and greenhouse-gas emissions).

The experiment – which began with ten shops and restaurants located in Paris and in municipalities close to Paris, – has now become permanent, with the exception of one shop. The private partners were much more flexible and interested in the night deliveries than was expected, despite the increased cost. To develop the scheme fully, the public partners need to offer a competitive advantage through specific local regulations such as time windows for deliveries. The certificate *Certibruit* may be part of the solution. This certificate can be obtained if a delivery is carried out with a minimum amount of noise associated with all aspects of the delivery process: opening and closing of doors, engine noise, drivers’ conversations, radio and so on. In the experiment, signs were put up in shops to instruct drivers to turn off their engines and radios, to talk softly and to unload

carefully. Developing night-time delivery services requires consultation with public authorities and local residents.

Better regulation in Lyon

When private players do not spontaneously organise logistics services, gaps occur in the attainment of general-interest objectives. City authorities can play a role in filling the gap, by ensuring that the right conditions are in place for establishing supply-chain organisation patterns. For example, local authorities can help operators to obtain sites in the centre of town at a low rent, to help promote the business model of local logistical operations, as has happened in Paris and Lyon.

More directly, traffic and parking regulations are in the control of municipalities. In Lyon, in 2007 a new regulation was adopted that required delivery vehicles to have low CO₂ emissions and created an upper limit of 30 minutes for a delivery. A clear regulation allowing deliveries between 7am and 7pm was introduced, rather than the complicated patchwork that existed previously. At the end of 2012, this clear set of regulations was adopted more widely across Lyon and the centre of Villeurbanne, a nearby community with a dense central area. Negotiations are now underway with other municipalities within Greater Lyon. As a result of the regulatory changes in Lyon, average stays in delivery bays have been reduced by 50 per cent (from 50 to 25 minutes), use of delivery bays has increased by 30 per cent, and double parking has been reduced by 20 per cent. A similar harmonisation exercise is currently underway in Bordeaux, encompassing 27 local communities.

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Generally, public policies related to urban freight are still in an experimental phase.
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Innovation in construction traffic

There are organisational solutions to urban freight in addition to technological ones. Coordination between authorities and the private sector can work to reduce environmental degradation. A good example is construction traffic, where the creation of a single delivery point that enables coordination and consolidation of the flow of goods to and from work sites can greatly reduce the number of deliveries. This has worked well in London – with



Crossrail traffic – and Stockholm. The unique logistics provider plans all delivery rounds to the work sites: vehicles arrive at the right moment (a “buffer” area is located near the consolidation centre, not near the works site). Such an arrangement is being developed in Lyon for a major series of developments in the Part-Dieu area of the city, starting in 2014.

According logistics their rightful place in the urban setting

To create sustainable urban logistics, it is essential to use the planning process to identify sites that can meet the needs of the freight industry and are suitably located near transport hubs.

In the past in France, developers have often sought to build on the outskirts of cities rather than renovate existing buildings, because doing so has proved to be more cost effective. This is not a sustainable model. City-centre buildings and sites must be recycled and kept in use. By ensuring that delivery procedures can be efficient in city centres, local authorities can do much to reassure developers that retaining and using inner-city buildings is worthwhile. This could be written into local land-use plans. In order to reduce kilometres driven and to improve the efficiency of local deliveries, two types of sites are needed: those needed for purely logistical purposes – such as distribution centres and small warehouses – and those that generate activity for urban goods flows.

Supporting urban logistics also means not adopting damaging policies. The tax of 32 Euro/m² on new warehousing in Paris, which has to be paid when a construction planning permit is granted, reduces the viability of logistics facilities for investors who are already worried about earning a decent rate of return. Consultation with residents and firms is required; in France it is very easy to prevent a project by instituting legal proceedings against building permits. Measures to prevent the abuse of such proceedings are very weak. Therefore, prior consultation and negotiations are important.

Public-private partnerships may be needed to overcome the reluctance of investors to commit themselves to constructing urban logistics terminals. Rents for premises are low and the financial operation is difficult to balance, and technical standards are not widely understood. There is a need for a framework committing both public and private partners to creating an investment fund aimed at recoverable acquisitions of holdings with private investment capital. Such a fund could be dedicated to the realisation of renting multi-storey logistics buildings in urban areas. Operating costs would be offset and pre-marketing

efforts guaranteed. The resulting increase in profitability created by such a process, together with the acceptance of a limited rate of return in the expectation of a healthy operation, would allow such schemes to get started. When rates of return become acceptable for private investors, mainly through the depreciation of buildings and increased income from rents over time, the public-sector partner could sell its shares.

Conclusion

Generally, public policies related to urban freight are still in an experimental phase. There are experiments and partial solutions, but no comprehensive solution. There is a need to create a public discourse about freight deliveries in urban areas: what logistics plans also match well with broader public interests?

Policies must be adapted to the needs of each particular city. Planning tools must be used to ensure that suitable logistics are maintained and developed in city centres. This would all be made easier if the overlapping powers of local authorities were coordinated. As both public and private stakeholders are affected by urban freight logistics, dialogue, negotiations, and trade-offs between them are essential. Consultations can be conducted on various levels, depending on the local institutional context regarding urban freight policy.

In the 1970s, a debate began in France over the movement of people in the face of environmental concerns. Public transport was encouraged, plans were developed to get people out of cars, and cycling, walking and carpooling were promoted. However, this debate has not yet really begun for freight transport, despite studies and research indicating what needs to be done. It is known, for example, that a delivery to a distribution centre is less damaging environmentally than a home delivery. Similarly, deliveries by large trucks are more efficient from an environmental point of view than several deliveries by smaller vans. It is also true that it is economically beneficial for companies to renew their fleets regularly, to operate in places near or in towns, and to make efficient use of their warehousing. Often, therefore, environmental and economic requirements point in the same direction. However, when that is not the case public authorities should enforce best practice and push for what is best for society as a whole. ■

SHARING URBAN SPACE: A STORY OF STAKEHOLDER SUPPORT

Cathy Macharis, Professor and Sara Verlinde, Research Associate, Research group MOBI, Vrije University, Brussels, Belgium

The core issue related to European urban freight is simple. While it is an essential component of the economic and commercial life of a city – because citizens need the goods and food that are delivered almost invariably by road – the trucks and vans making these deliveries generate a host of negative impacts, including distress to local residents

THE KEY CHALLENGE is to address the negative impacts associated urban freight without further complicating deliveries. Innovative technological and logistics measures need to be tested to take on this challenge. In recent years, several city planners have been implementing their own specific solutions, aiming to support the growth in freight movement activities while maintaining residents' quality of life. But not all promising concepts are as successful as expected once put into practice, because some result in unexpected side-effects.

A good example is the unsuccessful implementation of urban freight consolidation centres in cities like Leiden, Malaga, Nuremberg and Utrecht. The causes of failure include the fact that not all stakeholders – each with their own agendas – were involved early enough in the decision-making process. Moreover, there has been a lack of systematic assessment of the potential effects of different measures. Therefore, there is a clear need for a comprehensive approach to evaluating whether or not a measure is likely to be successful and which amongst a range of alternatives would be the most appropriate. In order to compare measures, such an approach should include an evaluation toolbox that is applicable to any urban freight measure within the urban and inter-urban context, and across regions in the European Union.

Based on these ideas, a new assessment framework has been developed for evaluating urban freight measures, within the European research project STRAIGHTSOL. To ensure a thorough evaluation, this new framework consists of multiple tools using different methodologies. One key feature is an analytical tool encompassing all stakeholders and examining all potential effects. It was developed as a Multi-Actor Multi-Criteria Analysis (MAM-CA), which takes into account the involvement of various stakeholders in the decision-making process and considers all potential impacts of the measures on both society and business.

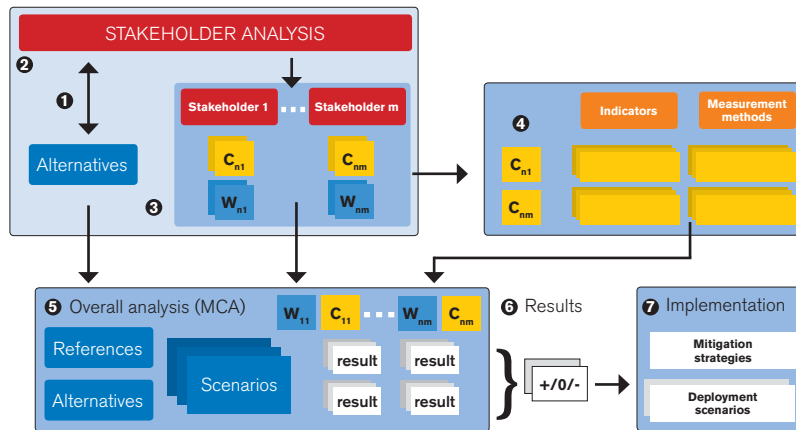


Figure 1: Multi-Actor Multi-Criteria Analysis (Macharis, 2004)

The MAMCA analytical tool

Using MAMCA allows researchers and decision makers to evaluate alternatives, such as policy measures, scenarios and technologies, with respect to the objectives and needs of the different stakeholders involved in the decision-making process. The methodology was developed by Macharis and has been used for many applications, mainly in transport-related decision-making problems.

There are two main phases in the analysis. The first is primarily analytical but also serves to collect the information needed to perform the analysis. The second phase consists of the actual analysis achieved through a synthesis of the information. These two phases are divided into four and three steps respectively, as depicted in Figure 1.

The first step is to define the problem and examine alternative solutions. In the second step all of the relevant stakeholders and their objectives are considered. Their objectives are then translated into criteria for the third step. Weights are assigned to the different criteria in order to assess the relative importance of these objectives for the stakeholders. The fourth step links one or more measurable indicator(s) to each criterion. These indicators allow the evaluation of every alternative measure with regard to a given criterion. The indicators can be either quantitative or qualitative. The fifth step involves the aggregation of the information from the previous steps into an evaluation matrix. The actual results are generated in step six, using a Multi-Criteria Analysis (MCA) that provides insights regarding the advantages and disadvantages of impacts for each stakeholder. The final step

is the definition of mitigation and deployment strategies for new policies based on these new insights.

Stakeholders in city distribution

A good overall understanding of the stakeholders involved in distribution of deliveries in cities is essential for the successful implementation of new policies. We define stakeholders as individuals, or groups of individuals, that are able to influence the objectives of an organisation or who can be influenced themselves. We distinguished five relevant groups of stakeholders in the urban and urban-inter-urban freight-transport context:

- (1) Shippers,
- (2) Recipients,
- (3) Logistics service providers,
- (4) Local authorities, and
- (5) Citizens living in the area under consideration.

These stakeholders interact in different domains in which supply and demand come together, such as the transport market, public space and traffic (Figure 2). They clearly have different objectives, e.g., enforcement for authorities or business opportunities for logistic service providers. These objectives (represented along the lines between stakeholder groups) are the key parameters on which assessments of new policies should be based, so that the

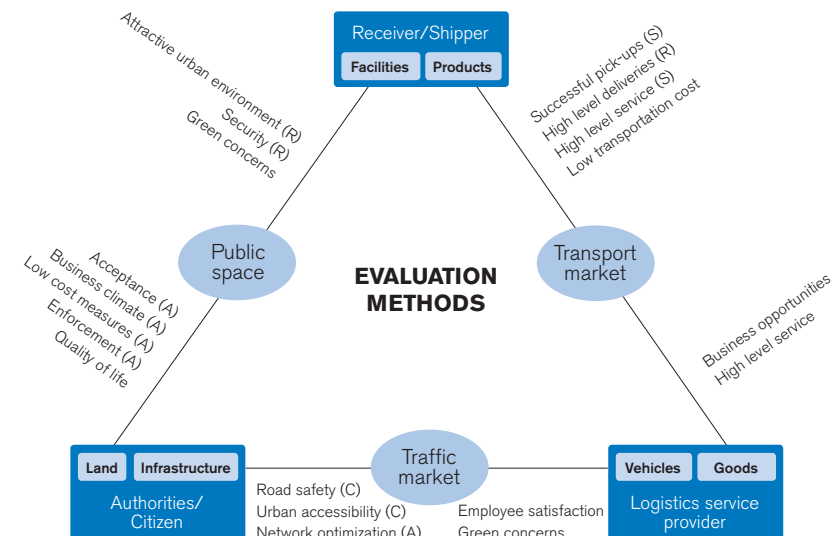


Figure 2: Stakeholders and their criteria (VUB-MOBI setup, 2012)

advantages and disadvantages for each stakeholder are clear. The workings of the MAMCA analytical tool become clearer when applied to an actual example. The international express-delivery service provider TNT Express came up with a new concept to ensure that their inner-city deliveries were reliable, fast and sustainable. Called 'the mobile depot,' this concept enables TNT Express to effect last-mile deliveries and pick-ups from a specially-designed trailer equipped with a loading dock and warehousing facilities. Each morning, the trailer is loaded at the TNT hub outside the city with all inner-city deliveries

for that day, and then driven to a pre-determined central location. From there, final deliveries are carried out by dispatch riders on electrically-driven tricycles. In order to ascertain whether the concept works in practice, it will be tested in a demonstration in Brussels for three months as part of the STRAIGHTSOL project. Following the demonstration period, the old and new situation (and also an intermediate situation) will be compared using an MAMCA.

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The needs of each stakeholder have to be taken into account.

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The needs of each stakeholder have to be taken into account. TNT Express needs to keep its customers satisfied and retain its current benefit/cost ratio. The customers are concerned that the new concept might change the pick-up or delivery routine and want to ensure that their deliveries remain as smooth as possible. Additionally, some residents of Brussels may be concerned about the visual intrusion of the mobile depot itself. The local authorities have an interest in the concept, as the mobile depot will be parked somewhere in the city centre and may cause disturbances. On the other hand, it is expected that there will be fewer vans driving through the city centre. In general, authorities are in favour of low-cost ideas that benefit both citizens and companies. The fifth and final stakeholder group is the citizens, who want to maintain accessibility to a wide range of products but, at the same time, want an attractive physical urban environment with little congestion, safe traffic, no noise nuisance, as few emissions as possible and little negative visual impact. The potential for success of the mobile depot depends on how well it addresses the objectives of the various stakeholders.



Conclusion

Transport and urban development projects are often a source of major controversy, as they can generate significant benefits as well as disadvantages for various local actors. Methodologies are needed that can incorporate different points of view in order to find sustainable solutions for transport, mobility and logistics. MAMCA can be used in the context of complex transport-policy decisions, allowing all of the different stakeholder perspectives to be taken into account and structuring the discussion by assessing the relative weights of all the factors involved. ■

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RESPONDING TO THE CHALLENGE OF COMMERCIAL TRANSPORT

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Today's objective for urban areas is to enable and support efficient and "city-friendly" commercial transport. This refers equally to supplying goods, waste disposal, and traffic. Following principles of sustainability, authorities in Berlin aim to identify and apply measures and new approaches that can help address the challenges of urban commercial transport.

TO SUCCESSFULLY SHAPE CONTEMPORARY transport processes it is necessary to consider all aspects of the system. From an administrative perspective, urban transportation strategies are developed to integrate commercial and freight transport approaches into transport development plans and policies. But efforts devoted to this topic vary considerably from place to place. In some European cities, like London, there is a strong focus on commercial transport, while this issue has barely been addressed in other cities. The objective for planning authorities is to find a way to ensure that the vital functions of commercial transport are maintained efficiently, while simultaneously enhancing the quality of urban transport and urban living conditions. The challenge, therefore, is to establish a balance between long-term strategic planning and short- or medium-term measures to solve acute commercial transport problems.

In this article, a short analysis of the current status of urban commercial transport from a German point of view is provided, the requirements from an authority's perspective are explained, what can be done utilising existing instruments is discussed, and current developments in the city of Berlin are described. However, one aspect needs to be emphasised clearly from the outset: the framework for potential action varies widely from city to city. This is not only a question of financial or human resources, but of political pressure, the economic background of regions, their spatial setting and the extent of local-citizen initiatives. Even in cities that do not have a vibrant local economy, commercial transport can pose a severe challenge if, for example, roads or railways serve as heavily-used corridors for freight transport.

Differences in the legal framework also effect strategic options and/or potential mitigation measures. Debates about urban commercial transport – and especially urban freight – are influenced by various fields of interest ranging from "traditional" transport sciences, land-use planning, (civil) engineering and



environmental studies, through to legal considerations. All of these aspects of commercial urban transportation systems need to be considered when establishing a specific regional or local approach. Therefore, it is as necessary to look at processes – such as how to identify the relevant stakeholders, how to structure exchange of knowledge, or how to develop joint planning processes between different communities – as it is to discuss specific projects/results or approaches.

There is an increasing need for transport planners to identify efficient methods for achieving the aims of transport policy. Classic measures alone – such as building infrastructure – cannot address the complex problems related to urban commercial transport. Moreover, new infrastructure is difficult to build in existing urban areas, due to potential opposition, long-term planning processes and lack of resources. Therefore, addressing these problems has become a more complex process related to the exchange of knowledge between public authorities, the political level, the private sector and academia. These stakeholder groups are all needed to help develop new concepts for urban freight. But solutions would often require shifting financial and human resources to freight-related issues, which is currently difficult to realise given shrinking public budgets and work forces.

Commercial transport needs to be put on the public agenda. Despite being the backbone of economic development, it results in numerous challenges that need to be addressed. For example, commercial transport has far-reaching consequences for air quality, climate, noise levels and traffic safety. This explains why the European Union “White Paper on Transport - Roadmap to a single European transport area” (2011) focuses more on the topic than ever before.

The EU White Paper sets out many challenges and ideas for the future development of cities. Based on the fact that oil will become scarcer in future decades and on the need to reduce greenhouse-gas (GHG) emissions, the following aims are described in the White Paper:

- To reduce the use of conventionally-fuelled cars in urban traffic and to achieve essentially CO₂-free city logistics in major urban centres by 2030,
- To shift 30 per cent of road freight exceeding 300 km to other modes – such as rail or waterborne transport – by 2030, and more than 50 per cent by 2050, and
- To achieve zero fatalities (or at least close to zero) in road transport by 2050.

In addition to this European macro perspective, a micro perspective is set out for planning authorities in cities. The challenging objectives are to:

- Ensure the vital functions of commercial transport as the backbone of urban economies and lifestyles,
- Enhance the quality of urban transport, and
- Enhance urban living conditions.

Across Europe there are different approaches to coping with freight in urban areas, ranging from comprehensive approaches to single projects.

Challenges facing urban commercial transport in Berlin

Berlin – the largest city in Germany (about 900 km² with about 3.5 million citizens) – is situated in the heart of Europe. Berlin had about 10 million visitors in 2011 and hosted 600 fairs and congresses. Berlin also houses the headquarters of various companies and other important offices, especially in the fields of communication, transportation technology, life sciences and industrial production. As the centre of the capital region Berlin-Brandenburg, the city plays an important role in European transport networks, with excellent connections via rail, roads, inland waterways and aviation to Europe and beyond.

Commercial transport is one of the primary components of economic development. However, it also poses numerous challenges. For example, commercial transport has far-reaching consequences for air quality, climate, noise levels as well as traffic safety. Berlin's Senate Department for Urban Development and the Environment (SenStadtUm) aims to improve the performance of commercial transport, increase its efficiency, and ensure the accessibility of areas of concentrated commercial activity.

Commercial Transport in Berlin

Between 1997 and 2009, freight traffic volumes on Berlin's roads decreased by 50 per cent, from 127 to 65 million tonnes. This development was due to a decrease in construction activities and structural change in the local economy. However, most logistic systems and operations in Berlin today still rely on commercial road transport. About one third of the local car traffic is commercial. Every workday there are 500,000 trips and about 11.5 million vehicle kilometres driven in Berlin for commercial purposes. About 90 per cent of these trips are

currently undertaken with light-duty vehicles (LDV, < 3.5 t gross weight). However, heavy-duty vehicles (HDV) cause the most problems and create pressure for action regarding air quality, noise and GHG emissions.

The only regulatory framework for commercial freight in Berlin is the Environmental Zone (*Umweltzone*), which addresses road traffic and vehicles in general and does not differentiate between private and commercial use. The framework defines a low-emission zone (LEZ); an area covering the entire inner city (about 88 km² with one million inhabitants). The LEZ was introduced in a two-stage process:

- By January 2008, diesel vehicles had to meet Euro 2 or Euro 1 requirements, and be retrofitted with a particle filter; and
- Since January 2010 diesel vehicles have had to at least meet Euro 4 requirements or Euro 3 retrofitted with a particle filter.

The LEZ had significant effects on commercial transport, as the truck fleet modernised rapidly. The Green Sticker ratio (vehicles meeting certain emission standards) increased by approximately 40 per cent for HGV in the run up to the introduction of stage 2).

Rail transport is an important element of urban freight in Berlin. The SenStadtUm is intended to maintain and improve regional railways for future use, strengthen multi-modal hubs that include railway systems, and increase the importance of this mode of transport. The quantity of goods transported by rail in Berlin decreased from 10.9 million tonne kilometres in 1997 to 4.2 million in 2009, again due to structural changes in the economy, a decrease in major construction projects and reduced demand for raw materials in the energy sector. Many railroad branches were consequently abandoned due to lack of demand. Today, about 12.5 per cent of Berlin's freight transportation is operated by rail.

Berlin's ports serve as important hubs between the different modes of transport, and are also valuable inner-city areas for production and storage. Therefore SenStadtUm was designed to



The challenge, therefore, is to establish a balance between long-term strategic planning and short- or medium-term measures to solve acute commercial transport problems.



maintain and improve Berlin's inland-waterway transportation infrastructure for future use, strengthen multi-modal hubs that include the waterway system, and increase the share of this mode of transport. In 2011, 3.5 million tonnes of cargo were shipped along Berlin's inland waterways (mainly bulk goods like building materials, ores, scrap metal, iron and steel). However, the

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One of the key elements of transport planning in Berlin has been the creation of platforms for commercial transport that bring together different stakeholder groups.

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transport of other goods increased in importance. For example, the new Siemens SGT5-8000H gas turbine (340 MW, length: 13 m, height: 5 m, weight: 444 tons) is transported on the waterway from its inner-city production facility to the inner-city tri-modal hub Berlin Westhafen.

The German national government is currently implementing measures that will make barge transport to western locations more efficient and competitive. Moreover, several projects will increase the capacity of Berlin's inland waterways. The Havel-Oder- waterway will improve inland water transport from Berlin to Szczecin, Poland, in the east and

the completion of the new Niederfinow boat lift will enable local waterways to accommodate special loads like heavy turbines or wind-turbine generators.

Planning policies

Various approaches are being applied in Berlin to ensure that urban commercial transport fulfils overall planning objectives.

Infrastructure-related approaches

Infrastructure-related approaches to urban commercial transport focus on the development or maintenance of infrastructure in the city, such as inner-city harbours, existing railroad infrastructure, and locations with potential to develop freight-related facilities such as urban consolidation centres. These approaches must also consider the accessibility of industrial and commercial activities.

One of the aims of Berlin's land-use planning is to ensure that attractive and integrated sites suitable for industrial, commercial and office uses are available. An increase in the industrial performance of the city depends on reliable access to such ar-

eas and efficient freight networks. From a transport planning perspective, it is therefore obvious that it is necessary to decide clearly on profiles and priorities of different locations to meet specific requirements on a long-term basis.

Communication

One of the key elements of transport planning in Berlin has been the creation of so-called "platforms for commercial transport" (*Plattformen Wirtschaftsverkehr*) that bring together different stakeholder groups. From 1996 to 2002, these platforms connected all of the different commercial-transport stakeholders within Berlin's major shopping areas, such as transport service providers, retail, offices, public transport, the chamber of commerce, the crafts council, the specific boroughs, and SenStadtUm. The platforms were needed because of the difficulty in supplying those areas and increasing conflicts, particularly about the space required to load and unload vehicles.

This communication activity, which was jointly financed by the chamber of commerce and the SenStadtUm, was successful. There was a high level of participation of local actors, continuous participation of local authorities and consensus on the different requirements needed to improve local conditions. Some of the results can still be seen, even though the formal platform activities have ended. Loading zones have been established, and even the concept of combined lanes for buses and lorries are a visible result. Other approaches, like creating networks for joint procurement (comparable to the "Delivery and Servicing Plans" in the UK; c.f. Kaj Wågdaahl 2011) have only been partially successful.

The results described above illustrate clearly that regular and sustained communication about the policies of politicians, the local economy, and effects on residents has a positive effect on the acceptance of freight-related activities like loading and unloading.

Another communication-related approach is support for research and development. This might sound rather simple, but a close collaboration with universities and research facilities in research projects is vital. For example, research projects are often not required to present to public authorities. While discussing research results is useful, it is even more beneficial when stakeholders are part of the process, to give relevant input or even to suggest changes in the direction of certain project developments. This approach has worked well in Berlin for commercial-transport-related questions. Collaboration not only

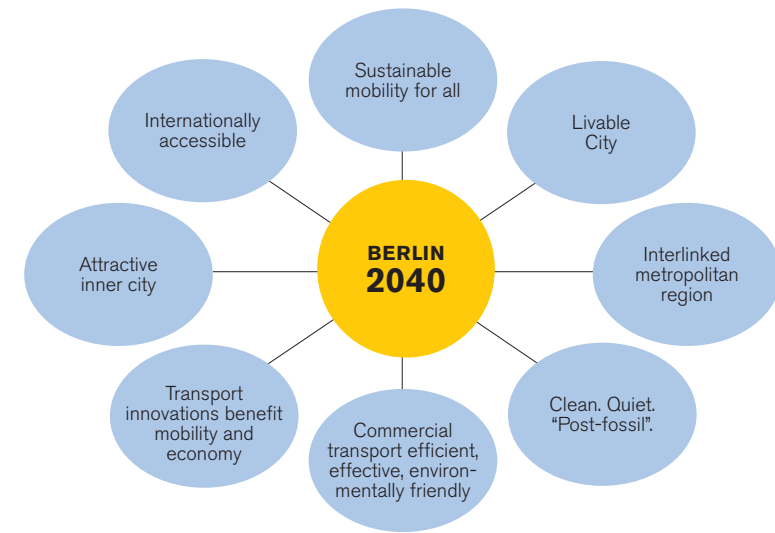
provides theoretical models but also practical applicable solutions. Examples include the EU Seventh Framework Programme project CityLog, the “model region E-mobility” Berlin-Potsdam projects with a focus on E-logistics, and the German E-mobility showcases (“Schaufenster Elektromobilität”) including large-scale demonstration and testing of electric light-goods vehicles (LGVs) and heavy-goods vehicles (HGVs) in Berlin.

A consistent and integrated strategic approach

Approaches to the freight issue must include all transport modes and stakeholders. The backbone of transport planning in Berlin is the “Urban Transport Development Plan” (UTDP, *Stadtentwicklungsplan Verkehr*), approved by Berlin’s federal government in March 2011, which provides a strategic framework for the next 15 years (c.f. *Senatsverwaltung fuer Stadtentwicklung und Umwelt*, 2011). The aim of the UTDP is very clear: Berlin wants to be at the forefront of sustainable urban mobility – for residents as well as to strengthen the competitiveness of the city. The UTDP is the road-map for Berlin’s transport policy and links with other fields of urban development, such as housing, environment, public budgets, and demographic and social trends.

Widespread acceptance of the policies adopted for implementing Berlin’s UTDP has been ensured through extensive consultative processes, including a series of sessions of the “Roundtable on transport.” This activity brought together all stakeholder groups, ranging from Berlin’s political parties and the local boroughs to the chamber of commerce, the crafts council, transport providers, and environmental groups, with an external moderator for the process. The result was a set of commercial-transport strategies and measures, including a specific strategy called “supporting commercial transport.” The aim of this strategy is to set the framework to support city-friendly commercial transport. For urban freight transport, one of the objectives continues to be to shift freight transport to rail and waterways. Therefore, it is seen as important to maintain and develop rail and waterway infrastructure and inter-modal interfaces in the city and the region. For urban freight transport as well as service traffic, providing secure (infrastructural) accessibility between origins and destinations continues to play a key role. The scheduled measures to influence the economic potential of the region also include traffic-management measures and making use of technological potential, such as renewing fleets to reduce emissions.

In addition to the medium- and long-term strategy of the



Vision from the “Urban Transport Development Plan” – *What should mobility in Berlin look like in 2040?*

UTDP, there is also a more specific plan focusing on urban freight transport and service-related transport activities: Berlin’s integrated commercial-transport plan (c.f. *Senatsverwaltung fuer Stadtentwicklung und Umwelt*, 2006). It defines several main areas of action concerning priorities for urban freight transport (combined bus and lorry lanes, delivery zones, low-emission zones and enforcement of penalties) and the conservation of necessary urban rail infrastructure and logistic areas. The most recent version of this plan was completed in 2005 and has been approved by Berlin’s parliament. Like the UTDP the commercial transport plan is the result of a broad consultative planning process, including all stakeholders.

Berlin’s SenStadtUm is currently updating this strategic approach. In addition to classic topics – like ensuring the accessibility of locations for urban freight – the updated plan will also include new approaches to providing adequate routes for oversize and overweight loads, and new city-friendly strategies for urban logistics, such as alternative fuels.

Lessons

In many German cities, commercial transport is estimated to comprise one third of all trips by road vehicles. However, while this general picture appears quite similar, there are often significant differences between cities. The specific local and

regional composition of commercial transport is highly dependent on economic structures and existing infrastructure. Transport planning needs to take these local conditions into account. Nevertheless, experience from Berlin and elsewhere clearly indicates that designing efficient, accepted, and (politically) enforceable strategies for urban commercial transport requires:

- Awareness of the topic and the different stakeholder groups,
- Developing a partnership for the process from all involved stakeholder groups,
- Comprehensive data,
- Political will and pressure to act,
- Clear responsibilities (Who should I talk to as a company?),
- Financial and non-financial support.

Despite local differences, it is now more necessary than ever to exchange knowledge between cities about both successful and failed approaches, as background information to starting processes locally. Doing so will provide a valuable contribution to the economic success of urban society and highlight the key role commercial activities continue to play in metropolitan areas. ■

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REDUCING THE LOAD WITH URBAN CONSOLIDATION CENTRES

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There are numerous barriers to organising urban freight transport in a more sustainable and efficient way. Transport companies and logistics service providers tend to view urban freight transport on a larger scale than a single city, and are often unfamiliar with a city's local problems. Meanwhile, for their part, local authorities try to minimise disturbances due to urban freight transport by imposing many regulations, which can reduce the efficiency of the transport companies. Incompatible interests make it difficult to find solutions to improving the efficiency and sustainability of urban freight transport. One possible solution is the creation of consolidation centres to reduce the number of deliveries in city centres.

LACK OF COMMUNICATION between the sender, the delivery company and the recipient is a problem that is inherent to freight deliveries in city centres. While urban freight transport originates with businesses ordering goods, the carrier responsible for the actual delivery is usually hired by the shipper. Therefore, recipients usually have no direct communication with the carriers, although it is their opening hours and access points that determine delivery conditions. Neither carriers nor local businesses seek solutions to this communication problem. Carriers do what they are asked to do, which is to deliver shipments at a particular address as requested. However, carriers do not feel they have the ability to change the system. Recipients, on the other hand, do not consider themselves as part of urban freight-transport problems.

Recipients *can* help bring about change, by shifting freight deliveries to more suitable times or to better locations, in order to retain access to limited urban space for its other functions. This is especially the case for unorganised urban freight deliveries. Many large stores and other heavy freight users do organise their logistics efficiently, but smaller businesses that need large numbers of small shipments are responsible for a high proportion of urban truck and van journeys. These small deliveries are usually undertaken by different carriers rather than being bundled together for one recipient. Yet, the recipients have a keen interest in ensuring that their local space remains desirable for customers and therefore are in a position to force through changes in urban logistics activities. Recipients hold the key to breaking the impasse, but are not aware that they have this ability!

Binnenstadservice: involving recipients

The example of Binnenstadservice shows what is possible. Binnenstadservice is a company running a new type of urban consoli-

dation centre that provides a new service to local recipients of deliveries. The creation of such centres results in both local impacts and national effects on carriers and shippers. This example shows that it is possible to convince recipients to become part of the solution, though there are hurdles to overcome.

In April 2008 Binnenstadservice (BSS) opened a consolidation centre in the Dutch city of Nijmegen (161,000 inhabitants). The medieval city centre, located on a small hill with a historic street layout, contains many small, independent retailers. The BSS consolidation centre is located 1.5 kilometres from the city centre. BSS aims to provide logistic services to local inner-city stores, regional consumers, carriers and local government. The objective is to minimise the number of truck trips in the city centre.

BSS's business approach differs from many recent failed initiatives with consolidation centres. First, BSS offers services to recipients rather than carriers, offering them a better service, which is an incentive for them to join the scheme. BSS's clients are small independent retailers. The company offers a basic service to its customers: bundling deliveries from multiple suppliers to a single store and delivering the goods at a time convenient for the retailer. This service saves small store owners time. Retailers can purchase additional services from BSS, such as:

- Storage (so that retailers no longer have to use their shop to store goods or rent space elsewhere),
- Home-deliveries (for example, for large goods such as refrigerators and computers),
- Value-added logistics including return logistics (for example, clean waste), and
- E-retailing possibilities in the city of Nijmegen.

In the first year of BSS's operation, customers did not pay for the basic service of receiving and delivering goods. BSS received a subsidy from the local authorities to start up the business and to demonstrate that the concept worked. After the initial subsidy, the business model changed; customers paid a small fee for the basic service, which made it possible for BSS to break even. BSS's concept is simple: retailers inform their suppliers of a change in delivery address and carriers deliver the goods to the consolidation centre. BSS deliberately focuses on small and independent retailers, since their deliveries are usually not optimised or bundled, in contrast to those of retail chains. Basically, BSS takes care of all concerns with respect to efficient flows to and from its customers.



BSS is not yet able to receive goods with a short shelf life, such as fresh food or frozen products. However, BSS does offer its services to non-retail businesses, such as hotels, offices and the local town hall. BSS uses clean transportation to deliver goods – an electric bicycle and a natural gas truck – in order to reduce local emissions.

BSS started with twenty clients. Most retailers had little contact with the carriers delivering their goods. The initiators and staff of BSS had good relationships with retailers in Nijmegen, which made starting up easier. After one year, BSS's client-base had increased to 98 stores, greatly increasing BSS's workload.

Growth of the concept

Within its first year of operation BSS's success in Nijmegen stimulated the expansion of the concept to other cities and a national franchise organisation, Binnenstadservice Netherlands (BSS NL), was created. Local franchisees can adopt the concept and start a BSS depot in their city if they comply with BSS NL rules. In this way, the various local BSS depots have the same interface for a carrier, no matter what city they operate in. Some of these depots use electric trucks.

By 2012, ten local BSS depots – all designed based on experience from BSS Nijmegen – had been established, in: 's-Hertogenbosch, Arnhem, Dordrecht, Gouda, Maastricht, Nieuwegein, Nijmegen, Rotterdam, Tilburg and Heerlen. The franchisees pay a small amount to BSS NL to become part of the Binnenstadservice organisation. As in Nijmegen, their clients are principally local shop owners. Some of the depots use electric trucks.

Expansion

Expanding the concept by opening more local depots will result in the creation of a network that will help hauliers. As more cities obtain BSS depots, BSS NL will become a more important partner for carriers that operate nationally across the Netherlands. Such carriers are usually not interested in solutions that only encompass one city, so the network of BSS depots will make the concept more attractive. BSS NL is in the process of establishing contracts with carriers.

During the first year in Nijmegen, carriers began to realise that the concept offered advantages, such as not having to deal with local regulations, limited time-windows, vehicle-size restrictions and low-emission zones, all of which can increase costs. Moreover, the new system offered them enough time and

space to load and unload their vehicles easily. The contract between BSS NL and a carrier states that the carrier will pay BSS NL a fixed fee for every delivery to a BSS depot. This fee can differ per carrier, depending on the number of drops per day, the size of parcels and the cost-reduction a carrier achieves by delivering to BSS.

Local and national effects

Air-quality was monitored in Nijmegen during BSS's first year of operations. Although there was a small reduction in the number of vehicle kilometres in the city centre and a corresponding decrease in emissions, air quality did not improve. Nor did traffic noise levels improve significantly. However, since both the number of large trucks and deliveries were reduced, there was less noise disturbance for residents.

The effects for carriers using BSS in more than one city were evaluated. Two case studies of carriers showed that considerable savings can be achieved if the number of cities with a BSS depot increases. These case studies show actual results, as well as results based on scenarios in which more BSS depots would be used. For the 'future-growth' scenarios, the effects were based on the carriers' clients in the respective cities and the way they handle recipients in cities where they deliver to a BSS depot. These case studies show that in cities with a BSS depot carriers could make fewer stops, with reductions of as much as 90 per cent for carriers that had many small deliveries per city. These small deliveries take time but little vehicle capacity, so deliveries for more cities could be bundled into one vehicle.

There were, however, considerable variations depending on: the number of cities with BSS depots; the distance between cities and the carrier's depot; the number of carrier's recipients joining a local BSS depot, and; the degree to which stores could be reached (which depends on physical and legal restrictions). For a scenario with six towns with BSS depots, carriers could save up to five per cent in kilometres travelled and costs. For 20 cities savings increased to 15 per cent, and for 40 cities more than 20 per cent.

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Recipients hold the key to breaking the impasse, but are not aware that they have this ability!

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Conclusion

Binnenstadservice started as a bottom-up initiative; the local authority manager for the city centre observed the requirements of local shop owners and created BSS, which focusses on their needs. As the concept grew, the advantages for carriers also became clear. The Binnenstadservice example shows that it is possible to break the urban freight-transport impasse, even where most stakeholders are not aware that they have the power to influence the system. BSS offers a solution to the most diffuse component of urban freight transport; i.e., the many small deliveries to local shops with a relatively high number of truck trips combined with low vehicle-utilisation numbers. BSS has made a positive contribution to reducing disturbances from unloading trucks in cities and to improving traffic safety.

Obviously some deliveries – such as food and catering supplies, and heavy-goods lorries destined for construction sites – are not suitable for the BSS solution. Other solutions have to be found for such deliveries. Research shows that the majority of heavy- and light-duty trucks in Dutch cities are used for services, construction, money transport, offices, and waste. While a positive example, the experience of Binnenstadservice nevertheless shows that it can take considerable effort to encourage stakeholders to find a solution and that it can be a very slow process.

There is no silver bullet that can solve all urban freight-transport issues. Differences among cities in logistic flows and in volumes require a variety of solutions. BSS's concept works best for the flows of unorganised deliveries. The challenge is to adapt the BSS approach in order to find solutions for other freight applications.

In urban contexts, freight transport is an important part of the local economy and employment and, at the same time, one link in a larger supply chain. It is therefore important to look for solutions that fit in with urban policy objectives *and* the business model of the supply chains. Therefore, solutions require a combination of local policy, new technology and wider logistics solutions. ■

THE GOOD, THE BAD, AND THE UGLY: LESSONS FROM THE OFF-PEAK DELIVERY PROJECT IN NEW YORK

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It seemed a very simple idea. Reduce traffic congestion in New York City (NYC) by encouraging more deliveries at times when businesses are normally not operating. But plans for off-peak deliveries in NYC raised enormous controversy and became, in turn, a science mystery, a political thriller, a melodrama, a comedy, a Greek tragedy and a good drama with a happy ending.

THE PROBLEM IS ALL TOO OBVIOUS. New York – and especially Manhattan – is a bustling city that is congested for much of the working day with commuter traffic, buses, vans, and trucks. Congestion is not only a growing problem, it is also a costly one; road congestion in NYC is estimated to cost some US\$13.4bn annually, which obviously affects the bottom line of countless businesses.

The Pilot project

In Manhattan freight vehicles make over 100,000 deliveries each day. Taking even just a few of those vehicles off the roads during the day makes a big difference, with huge benefits to other road users. It has been estimated that 80 per cent of deliveries are wholesale, retail, and shipments of food that do not necessarily require daytime delivery. An off-peak delivery solution that reduces truck idling and frees up kerb space offers obvious attractions to many shippers and businesses. Delivering at night is quicker, and therefore less expensive. It is much easier to find kerb space and, of course, there is much less traffic. Best of all, there is unlikely to be anyone around to issue a parking ticket. Truckers reported that this could save as much as \$1,000 per month for every vehicle. On the face of it, this is a win – win situation. However, convincing all of the stakeholders involved is no easy task.

A scheme was developed through a collaboration between the United States Department of Transportation, the New York City Department of Transportation, Rensselaer Polytechnic Institute, Rutgers University, and ALK Technologies, to explore the impact of freight vehicles making their deliveries during off-hours. At first, no one seemed to support the idea. Some city agencies thought that they should not interfere with private-sector activity. On the private-sector side, however, there was a division.

Several companies thought that it was a good idea, but “it would never happen in NYC” because the public agencies would not help. Others suggested it was a great idea, but for “somebody else.” A handful of companies decided that they should take the lead in a pilot project. Trucking firms and receivers received cash incentives for participating in the project. Payments ranged from \$300 per truck for small carriers up to \$3,000 in lump sum payments for large receivers and major trucking firms.

The transport industry was broadly in favour, though there was awareness that the receivers – the customers – were concerned about the additional costs such as over the need to employ people for extended hours. Then there was the issue of residents. Deliveries can be noisy and the last thing people want is to hear trucks arriving and departing all night, as well as the rattle of trolleys being pushed into delivery areas.

Thirty companies agreed to participate, shifting their delivery window to between 7pm and 6am. These included Foot Locker, Sysco, Whole Foods Market, and eight trucking companies. Receivers found that fewer deliveries during normal business hours allowed them to focus more on their customers, and that their employees were more productive because they waited around less for deliveries delayed in traffic. Carriers found that their trucks could make more deliveries in the same period of time, they saved money on fuel costs and could use a smaller fleet by balancing daytime and night-time deliveries, and that legal parking was more readily available. Their drivers, too, reported feeling safer and less stressed. Some of the improvements were very marked. In some instances, the night-time delivery trucks experienced an improvement in delivery speed by as much as 75 per cent as well as a complete elimination of parking fines. In some cases, the amount of time spent unloading and loading trucks was reduced from an average of 90 minutes to just 30. Depending on the extent of the implementation of the policies, economic savings of between \$100 and \$200 million could be made annually in travel-time savings and pollution reduction.

The pilot project produced one surprising result. The companies that received deliveries using their own staff reverted to

regular hours when the pilot project ended, as they could not keep paying for the added labour expenses. In contrast, all of the receivers that gave access to their vendors and allowed the deliveries to be made un-assisted remained in the programme. The reason was increased reliability. With deliveries during regular business hours, the receivers do not know when the deliveries are going to arrive, which forces them to have a safety inventory, which costs money. With off-peak deliveries, supplies are waiting for them when they open their stores.

Successes and failures

The scheme was not only about shifting delivery times, but also used new technology to ensure that the off-peak delivery programme could create a self-sustaining urban freight-management system that reduces congestion by combining GPS technology with innovative traffic management. Participating businesses allowed GPS-equipped vehicles to capture data about how off-peak deliveries impacted traffic patterns and saved businesses time and money. There are numerous lessons:

1. The path to sustainability entails behavioural change. We need to understand decision-making behaviour, and how to study behavioural change for the better. Changing behaviour is not easy as it requires the right combination of incentives and penalties, and these must be transparent. Policies that foster sustainability have to account for the selfish behaviour of all agents involved. It is important to define policies based on incentives and penalties that benefit all, or at least the vast majority of key players. This leads to policies that all involved stakeholders will support, and helps to ensure that they will be long lasting and sustainable. On the other hand, policies that impose costs on some stakeholders will be challenged.
2. For years, trucking-industry representatives have been saying that they cannot react to pricing. While nobody believed them, the research proved that they were telling the truth. It was this realisation that led to the idea of encouraging off-peak deliveries.
3. The freight industry in NYC played a key role in supporting off-peak deliveries and asked the NYC Department of Transportation (NYCDOT) to foster the practice. NYCDOT listened to them and things moved forward.



On the whole, the freight industry knows what it is doing.



4. Private-sector behaviour is difficult for outsiders to fully understand. On the whole, the freight industry knows what it is doing. Outsiders do not have full access to the information they have; when they do things that seem crazy to outsiders there is usually a good reason. Behavioural research is critical for successful policy making.
5. If problems were easy to solve they would have been solved already. There is no escape from complexity. Unilateral solutions do not work in complex systems, since there are too many interconnections that lead to resistance to change. Proper stakeholder engagement requires: constancy over time; development of trust; transparency of actions and purpose; patience, and; two-way communications.
6. Pilot projects are vital. They allow real-life trials of untested concepts and are an excellent way to iron out problems. They are enlightening, as they create new insights and are a great way to gather the attention of policymakers. Moreover, in the eyes of the private sector, they serve to validate the viability of new concepts. However, they must be solidly designed. Pilot testing a poorly-designed concept can lead to 'false' failure of a good idea.
7. Urban freight is a multi-faceted enterprise with impacts on: economy, environment, quality of life, equity, sustainability, liveability and land use. It is important to get support from non-transportation stakeholders and advocates within economic development, energy conservation, sustainability and environment. There are ample opportunities to find win-win-win-win strategies that impact all stakeholders positively and to build coalitions of stakeholders. Do not assume that any group is 'the bad guys'; resistant stakeholder groups can later become allies to the cause. Exploit successes to push for changes in legislation that foster sustainability.

Building on success

The Off-peak Delivery Project demonstrated an innovative, cost-effective approach, showing that 21st Century technology and collaboration between transportation agencies and businesses can be a win-win solution. New Yorkers and visitors to the city will spend less time in traffic, and businesses will spend



less money on fuel and lost time. The success of the scheme has been widely recognised. In June 2012 the Federal Highway Administration (FHWA) and Environmental Protection Agency (EPA) issued \$450,000 in grants for small- to medium-size cities to implement off-peak goods movement /delivery programmes based on the NYC pilot project. Moreover, numerous other cities – such as Boston, Washington and Atlanta – are considering encouraging off-peak deliveries. New York City is planning to expand the project to encourage more shippers, trucking firms and receivers to sign up for an expanded programme.

In short, off-peak deliveries increase the economic competitiveness of urban areas, reduce congestion, improve environmental conditions, enhance liveability, and increase quality of life. In essence, they can help bring about what citizens want: vibrant economies in great places to live. ■

IMPACTS OF COMPACT DEVELOPMENT ON FREIGHT ACTIVITIES IN US CITIES

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Retail supply chains can stretch over hundreds or even thousands of kilometres. While the movement of most goods can take place with relatively little conflict with other users of transportation infrastructure, the last part of the journey, usually called the “last-mile,” typically poses the most serious challenges in terms of cost and reliability. There are several contributing factors that make it challenging to deliver goods over this last mile. Many such factors stem from the fact that, in most cases, this part of the journey occurs in a dense urban environment, where many different stakeholders share the same space.

A **EXAMPLE OF THE MOVEMENTS** of a retail freight shipment for the last-mile portion of its journey within a supply chain for a retail business is presented in Figure 1. The bottom half of the figure shows various entities that have jurisdiction over the infrastructure and spaces through which goods must travel. Naturally, when different stakeholders are concentrated within a limited space, each carrying out their own activities, the potential for conflict over issues such as noise, vibration, safety, aesthetics, and general nuisance tends to increase. Also, infrastructure design requirements – such as wider streets and generous turning radii to accommodate trucks – may conflict with the interests of other users (such as pedestrians) and increase the overall cost of infrastructure.

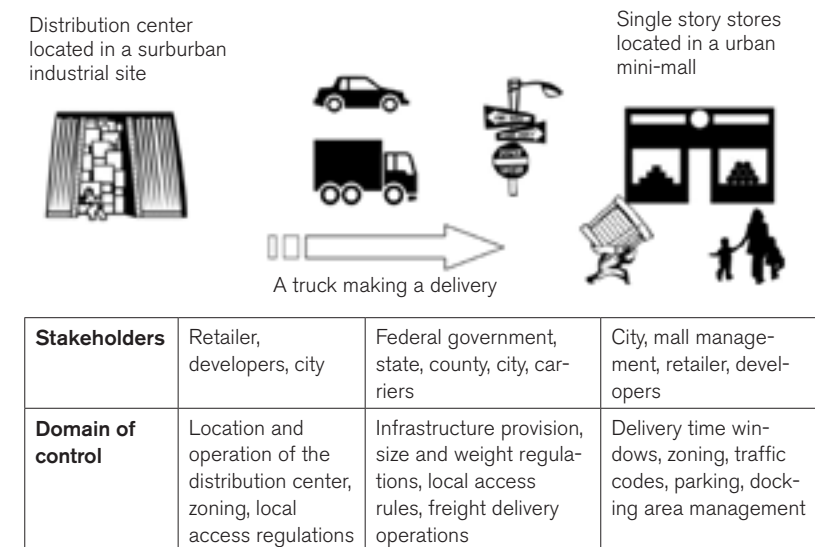


Figure 1: An example of last-mile movement of retail goods

Trends toward Compact and Multi-modal Built Environments

In recent years, there has been increased effort in cities in the United States to build compact, multi-modal communities, often anchored by transit stations, to reduce automobile use. Policymakers at various levels of government have implemented far-reaching initiatives to reduce dependence on automobiles (see California Senate Bill 375 and the CMAP Go To 2040 plan for examples). In addition to the goal of curbing carbon emissions, this trend toward compact built environments is partly driven by migration of the population to urban areas, often to city centres. According to the Brookings Institute (Frey, 2012), census data from 2010 and 2011 show that population growth in the central areas of major US cities outpaced that of the suburbs. As a result, large big-box retailers (the big supermarket chains) are starting to regard smaller neighbourhood stores – often one tenth the size of the big-box stores in the suburbs – as a viable market, with a strong growth potential in the United States.

While these are laudable and long-overdue efforts following decades of suburban sprawl and auto-centric transportation policies, there have been hardly any meaningful dialogues on their impacts on movements of freight, especially for the last-mile portion. It is reasonable to hypothesise that, at least in some cases, inherent conflicts between freight providers and other stakeholders can be exacerbated when the intensity and density of land use increase.

Potential impacts of compact built environments include increased likelihood of friction between truck operators and other travellers (safety, congestion and noise nuisance), street designs not accommodating large trucks, smaller retail stores that require more frequent deliveries by smaller vehicles, increased intensity of demand for goods (due to greater population density), and separation of purchasing behaviour by the consumers into three categories: small-box, big-box and on-line stores (although the actual impacts of this last point are not clear).

Perhaps the most significant recent trend in US cities in conjunction with efforts to build compact and multi-modal neighbourhoods is the “Complete Street” movement, which “... aims to develop integrated, connected networks of streets that are safe and accessible for all people, regardless of age, ability, income, ethnicity, or chosen mode of travel” (Smart Growth America, 2012). Common approaches to applying the Complete Street concept include traffic calming, kerb extension, lane reduction, pedestrian islands, sidewalk expansion, street furniture and landscaping.



Implications for Last-mile Freight

With these broad trends as a backdrop, we have examined strategies that are being implemented in major US cities and elsewhere to improve the efficiency of the last-mile delivery of goods, and assessed their compatibility with the objectives of the Complete Street movement. The results of the analysis are summarised in Table 1. The freight strategies are categorised into three types: physical treatments, management practices, and strategic initiatives that target policy development and the institutional environment.

We found that many freight-friendly strategies and Complete Street practices are indeed compatible. Strategies such as better signage, preservation of alleyways, better management of loading zones, and effective dissemination of information that can facilitate better truck navigation, are undoubtedly beneficial for all stakeholders, because they will separate trucks from other travellers or cut down on congestion. In some cases, for example, shared-pavement spaces (among pedestrians, cyclists, motorists and delivery trucks) and flexible lanes that can be converted to parking spaces, loading zones, bike lanes, or bus lanes depending on the time of day, can only be effective in managing freight delivery activities if there is proper coordination among the stakeholders to identify approaches that will not negatively impact some stakeholders (including truck operators). For example, street furniture, which is a popular tool to protect cyclists and pedestrians from automobiles in a shared-pavement setting, needs to be carefully designed and placed so that it will not block access to buildings by carriers delivering goods. Essentially, we found that measures to improve the efficiency and safety of freight deliveries are likely to reduce conflicts with other travellers.

The only strategy that is likely to have negative impacts on other stakeholders is the consideration of freight movement in determining the allocation of funding for infrastructure projects. This is because, in most cases, funding allocations are zero-sum games. Hence, projects that benefit freight movements – such as wider and more physically-robust roads and bridges – will take resources away from Complete-Street types of projects. Of course, this will not apply to cases where funding is allocated to implement the measures listed in the physical treatments, but in terms of expenditure and scale these are likely to be dwarfed by major highway projects.

While many of the strategies shown in Table 1 – especially physical treatments – are relatively straightforward and eco-

nomical to implement, we found that there are only a handful of cities in the US that have implemented or tested them. Even in those few cities that have, efforts have been limited to the jurisdictional area of the principal city of the region and hundreds of smaller cities in the region have been left out. Furthermore, the management strategies suffer from a lack of viable means of enforcement that will not impose additional expenditures and resource requirements on local government. In other words, we found that, while these are promising ideas that are ripe for implementation, it will take further efforts – especially in the area

Type	Strategy	Benefit other users?
Physical	Incentivise improvement of dock facilities	Yes
	Review requirement for loading dock and off-street parking/loading zone in city codes and ordinances	Likely
	Improved signage for truck routes, parking regulations, loading zones	Yes
	Wider outside lanes	Possibly
	Shared sidewalk space	Possibly
	Flex lane	Possibly
	Preserve or build alleyways	Yes
Management	Loading-zone allocation plan	Yes
	Dedicated officers to manage loading zones	Yes
	Off-peak delivery	Yes
	Metered loading zones	Possibly
	On-line parking/truck route/loading-zone information	Yes
	On-line obstacle database	Yes
	Consolidation	Yes
Strategic	Dynamic pricing of loading zones	Possibly
	Consideration of freight movement in land-use planning	Yes
	Consideration of freight movement in project evaluation	Not likely
	Development of Complete Street Guideline with Trucks	Likely
	Freight advisory committee	Possibly
	Charrette to generate solutions in a collaborative manner	Likely

Table 1: Strategies to improve last-mile deliveries and their multi-modal compatibility

of institutional coordination and policy development – to pave the path toward actual implementation.

Institutional Issues

To this end, we have examined institutional aspects of the relationship between truck activities and the built environment, using key stakeholder surveys (Kawamura and Sriraj, 2012). We interviewed 24 people in the Chicago region with knowledge of the freight industry, including: government staff (eight), non-

profit entities (five), real-estate businesses (five), and the freight and logistics sector (six). In a semi-structured interview, each interviewee was asked a set of questions in the areas of 1) the effect of the built environment on freight operations, 2) the effect of infrastructure provision and performance on supply-chain operations and planning, and 3) the importance of the freight infrastructure system in selecting supply-chain facilities. While a detailed discussion of the findings is not within the scope of this paper, we made some discoveries that are relevant to the present topic.

We consistently found that respondents from all sectors felt that inadequate infrastructure – such as restrictive lane width and turning radii, and especially deficient or erroneously-marked vertical clearances at viaducts – are the most pressing inconveniences that affected freight operations. We found, however, a clear disconnect between the respondents from the freight industry and others when it came to the effectiveness of the responses to freight issues. Often, government representatives felt that there were adequate remedies and systems in place to address the freight industry's concerns, such as vertical clearances. However, respondents from the freight sector largely dismissed those efforts as inadequate or not useful. Furthermore, we did not find any evidence that government officials were aware of such sentiment, since there is very little communication between these two sets of stakeholders. In addition, we found that in some cases it was clear that policies were put

in place without a realistic mechanism to actually enforce them. Moreover, while government staff would point to policies that, in theory, were addressing issues such as lack of loading zones or poorly-coordinated development of industrial parks, in some cases they did not have a mechanism to assess the effectiveness of those measures, and we found from other respondents that those problems persisted.

One critical factor that contributed to the problems attributed to freight deliveries is the absence of adequate forums where stakeholders – especially those from the freight industry – can communicate with each other. Today, it is relatively common to find a freight advisory board or similar entity within a regional planning body. However, at the municipal level there are very few effective examples. Since regional planning bodies are not responsible for the day-to-day operations of the transportation system, issues associated with the provision, operation, and management of infrastructure tend to fall through the cracks. We did not find evidence that truck operators or even industry associations contacted municipalities to voice their concerns, although they were clearly frustrated with the inconvenience they experienced on a day-to-day basis. As such, the onus is with the government to reach out to the freight industry. Establishing a freight advisory board with a regular meeting schedule and clearly-defined objectives is an important initial step in that direction. For many years, the city of Seattle has hosted an active and engaged freight advisory committee. There are also success stories within regional agencies such as the Delaware Valley Regional Planning Commission (Philadelphia), the Chicago Metropolitan Agency for Planning, and others.

There are several practices that would help establish and maintain effective freight advisory boards:

- Involve residents and businesses from various sectors, especially food and construction businesses.
- Involve transient users, such as truck operators, who do not have political representation in the areas where they operate (solicit interested members through industry associations).
- Employ staff with ground-level knowledge of freight.
- Involve cycling and pedestrian advocates.
- Review proposals for all major transportation projects and policies.
- Galvanise stakeholders and deliver quick results to keep them engaged.



One critical factor that contributed to the problems over freight deliveries is the absence of adequate forums where stakeholders can communicate with each other.



Summary

More dense development can increase challenges to the movement of freight. We found that effective management of trucking and delivery activities would benefit other stakeholders, such as pedestrians and cyclists, and that there are many opportunities to incorporate freight-friendly measures when applying Complete-Street practices. However, information collected from surveys of key stakeholders indicates that, in practice, institutional issues are significant barriers to implementing such strategies. We believe that establishing an effective stakeholder-involvement process – for example freight advisory committees – at the city and regional levels is the most important step toward addressing institutional hurdles and paving the path for building true Complete Streets that benefit pedestrians, cyclists, motorists and freight. ■

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LESSONS FROM MANUFACTURING INDUSTRY

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There have been numerous attempts to improve the performance of urban freight while simultaneously reducing its negative environmental impacts. The results, however, have been disappointing, and most pilot projects have not survived without subsidy. This may be due to the fact that the solutions have been designed and evaluated without taking into account the particular characteristics of different city areas. A supply-chain management approach may be applied to urban freight transport where the complete process is taken into consideration, emphasising the role of customers as well as transport suppliers.

FROM A GOVERNMENT PERSPECTIVE, measures to improve urban transport include changing infrastructure and implementing rules and regulations. From a transport industry perspective they may encompass consolidation, buying new vehicles or implementing better IT systems. A supply-chain management approach to creating better urban freight-transport systems starts with the recipients and their needs, as well as addressing problems such as limited space.

The characteristics of different city areas, which affect urban freight performance, can be identified in terms of urban structures and different types of built environment, as well as characteristics of the recipients. Urban space consists not only of the streets on which vehicles are moving, but also the space surrounding them. Even though we regard urban space as rather well-known territory, it is somewhat uncharted, at least when it comes to urban freight.

Urban space

The space available for transport and other business activities in urban areas is limited, and in city centres the cost of land and building space is particularly high. These areas are very crowded and have many different potential users. Today there are many small shops in malls or on centrally-located streets, but few of them have special goods-receiving areas or personnel to deal with deliveries. Moreover, many other types of small companies offering professional services, such as lawyers and consultants, require shipments and parcels to be delivered every day.

One way of reducing congestion is to have more off-peak deliveries. However, this may cause new forms of inconvenience, because of the potential need for extra storage, equipment such as refrigerators or even personnel handling security. High land costs have contributed to the fact that shops in city centres have



limited warehouse space and goods-receiving areas, which creates additional requirements on transport systems. However, this does not seem to have been considered as an important factor when designing urban transport systems. Many shops, especially small ones, would prefer to have frequent deliveries all the way to the door – and sometimes all the way to the shelf – eliminating the need for storage and receiving space as well as goods-handling personnel.

The efficiency and effectiveness of urban transport systems can be enhanced by considering how best to utilise space, new technologies and collaboration between stakeholders. Different measures that are available need to be matched with the characteristics and requirements of particular urban areas, including the requirements of stakeholders. An urban logistics and distribution model for Sustainable Urban Transport, SUT, has been developed in Gothenburg. The purpose of the model is to provide a range of possible solutions suited to specific areas and different stakeholders' expectations. The model is comprised of two parts: urban area characteristics and stakeholder requirements. The characteristics include aspects such as urban infrastructure, logistics infrastructure and available vehicle technologies. Stakeholders' requirements are grouped into different common topics, such as accessibility, environment, cost, quality of life and delivery requirements, the characteristics of the goods, and any special needs.

Comparison with material supply in industry

Supply systems with similar characteristics to those for distribution in city centres can be found in other contexts. If someone explained that they had problems with lack of space, congestion and a mix of pedestrians and trucks, one would probably guess that they are talking about the challenges of urban distribution. In fact, managers at, for example, automotive assembly plants experience the same types of problems. Even the background to the problems is similar. The constraints are partly due to customers requiring a wide diversity of products; the variants require space, regardless if it is in a plant or in a shop. In both cases the space is either not available or very expensive.

Different types of traffic share space in an assembly plant: forklift trucks, delivery trucks, and pedestrians. This causes congestion and accidents. Consequently, plant managers attempt to avoid mixing traffic types if they can. This example can be compared to a city centre, where local authorities want to avoid similar problems in the same manner. Even the scale of a city

centre and an assembly plant can be similar in terms of area, receiving nodes and distances travelled by distribution vehicles. By studying modern in-plant logistics solutions it is possible to learn more about the effect of an increased focus on the recipient in combination with an increased emphasis on the flow of goods.

Could cities learn from modern productions systems?

Modern production philosophies focus on the process, the material flow and the requirements of the user, rather than only considering what can be delivered and how to use individual resources. This is also needed in the area of urban transport. The manufacturing industry has undergone a paradigm shift – from intermittent supply of large quantities to smooth flow, matching actual consumption at the assembly line – and this has resulted in small quantities of deliveries at each node. The storage is in the flow, rather than at the point-of-use, and there has been a shift from storage at the assembly line to storage outside the factory.

At an assembly plant that has shifted its supply system, plant managers initially thought that the new system would be more expensive. However, after analysing the total effect they realised that this was not the case. The time spent assembling components could be reduced by as much as 50 per cent, the ergonomics for the assembler (i.e., the receiver of the goods) was improved, and the transport cost lowered, due to better utilisation of vehicles and a more even flow of goods determined by the assembler. There was a change from forklift trucks acting as “taxis” that had to wait for assignments, to delivery trains working in the same way as public transportation. If a city centre could be compared with a production system, there is potential for improving urban freight in similar ways.

Urban consolidation and service centres

Manufacturers in the automotive industry have introduced the use of strategically-located logistic centres, as well as new vehicles that are adapted to the flows in plants. This can be compared to the micro terminal and its electric vehicles established in Gothenburg. This started as a city-development project in collaboration with real-estate owners and other stakeholders, and has since evolved into a commercial solution where a real-estate service company operates the terminal and the local transport in a specific area. Staff can add services to the delivery function, which also benefits from their access and knowledge of the build-

ings. Deliveries of goods are combined with post and the small electric vehicles used also have a return flow, bringing back clean waste (such as packaging). The centrally-located consolidation and service centres do not replace traditional terminals outside the cities. Rather, they should be viewed as filling a service function for a small area with special characteristics, including a need for very small vehicles.

An extra terminal in the city inevitably adds cost, and there are concerns that this will have to be paid by the purchaser of the transport. It has also been argued that it is difficult or even impossible to make a business case for such changes, since the total cost of an urban distribution centre must be offset by the benefits of the solution. The challenge is that the total benefits are distributed over several different stakeholders. For instance, the supplier, transport provider, recipient and society at large all may experience difference levels of benefits. However, these benefits may be very hard to measure, and there are large uncertainties hidden in estimates. Moreover, it is hard to aggregate these benefits and obtain a grand total that can be monetised to cover the costs of the terminal.

New evaluation tools and business models are needed in order to make alternative distribution solutions viable.

Evaluation

There are no tailor-made assessment methods for urban freight-transport measures that cover all of the required elements. In response to this, the Collaborative Urban Transport System (CUTS) project has been initiated in Gothenburg, where a model is being developed for the analysis of total

urban transport flows. The purpose of the model's assessment and evaluation framework is to improve the efficiency and effectiveness of urban logistics initiatives. This can be achieved by defining an evaluation framework that links logistics goals with freight transport efficiency and urban characteristics, from the points of view of all of the different stakeholders. In this way, the framework can facilitate cooperation and communication between stakeholders, which is key to any successful urban logistics initiative. Limiting assessments to transport operations, and

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Supply systems with similar characteristics to those for distribution in city centres can be found in other contexts.

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excluding land-use and logistics issues, will not lead to sustainable solutions. At the same time, assessments need to go beyond environmental indicators, including costs and logistics quality parameters.

Contextual differences

Goods distribution in urban areas is not just a matter of delivering goods in city centres with all the challenges that ensue, such as lack of loading bays and personnel to take care of receiving deliveries. In fact, a large portion of goods transport is directed to industrial and shopping areas with very different characteristics. The supply-chain management strategy behind large supermarket retailing is a neglected phenomenon. From this perspective, the ideal approach is to reduce the cost of efficient consolidated deliveries as much as possible, while at the same time allowing consumers to handle the last-mile problem using private cars. However, this solves one problem while creating another, i.e., the environmental impact of passenger cars. This example highlights the importance of addressing the complete supply chain and maintaining a systems perspective.

In the urban-freight and city-logistics literature, the relationship between goods and passenger transport in urban areas mostly focuses on conflicts like congestion, loading and parking, and the potential to use public-transport lanes for urban freight in central business districts and dense inner-city areas. There is little discussion about the relationships between the use of passenger and freight vehicles and how freight transport is being made more efficient by transferring goods movements to passenger transport without performing a total-cost or environmental analysis. Home deliveries are one aspect that needs more attention.

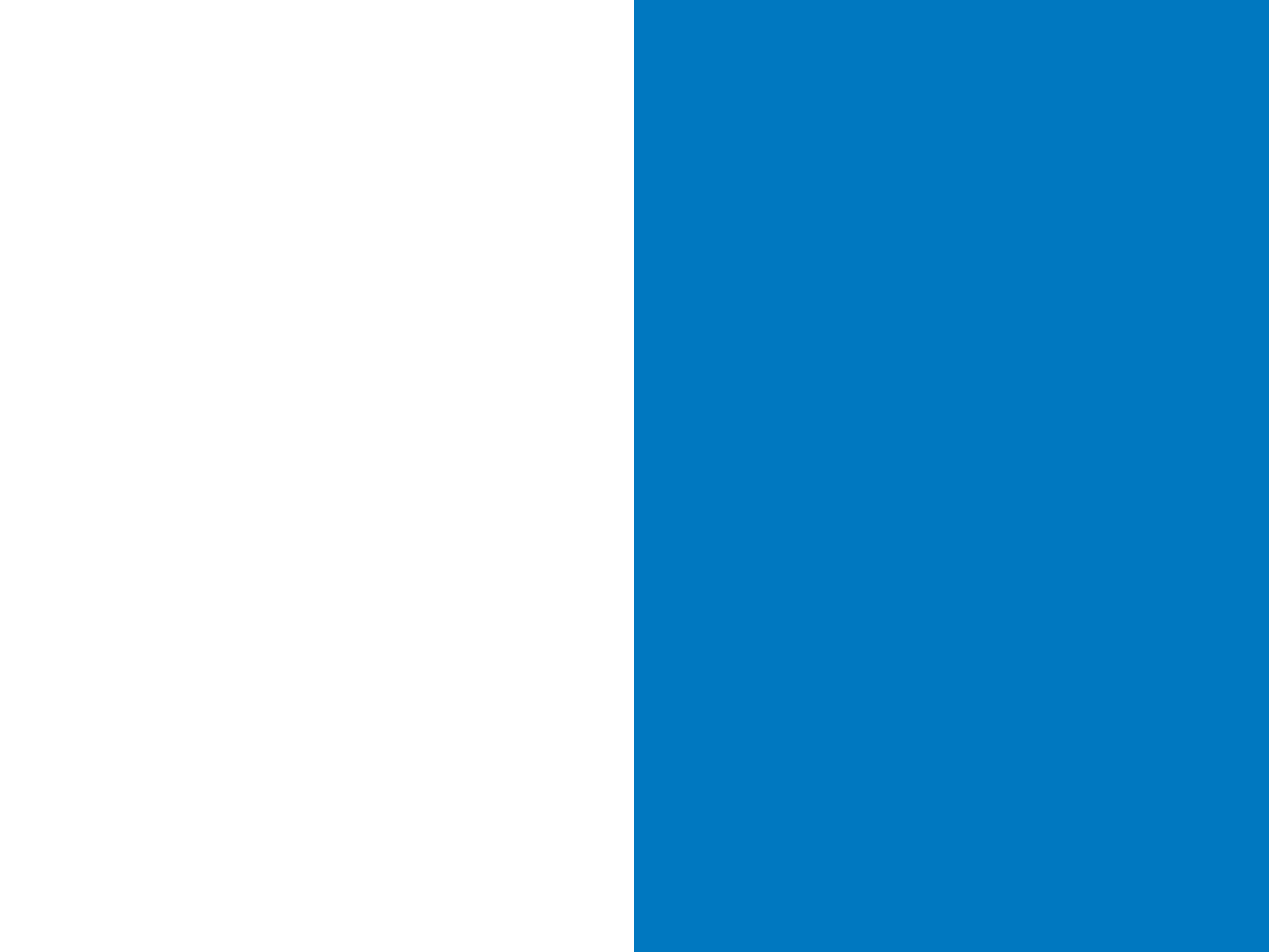
There is potential to enhance the efficiency and effectiveness of urban transport systems by taking into account how best to make use of available space, introducing new technologies and developing collaborations between stakeholders. A systematic assessment and evaluation of the characteristics of the city environment and its stakeholders – not the least the receivers of the goods – is prerequisite to ensuring that the right solutions are developed.

Understanding how traffic is generated

In order to develop a novel approach, a good theoretical understanding of how the properties of urban land use and transport infrastructure affect transport is needed. While this has been



used for passenger-trip generation, there is a lack of this kind of theoretical understanding, as well as modelling software and databases, when it comes to understanding how urban land-use and transport-infrastructure variables affect goods vehicle movements. One example of the type of work needed is the employment of disaggregated land-use data, combined with an urban-transport network system, for a test site in an industrial and shopping area outside the centre of Gothenburg. Here, a GIS application is linked with statistics on the businesses in the area, information about transport volumes, and origins and destinations (routes) from local companies, which makes it possible to analyse how different aspects of urban form relate to freight activities, distances travelled, frequency, energy use, CO₂ emissions and accessibility. ■



Urban transport is rising high on the agenda in many cities. However, relatively little attention has been paid to urban freight compared to passenger transport. This book aims to make the freight issue more visible, by sharing experiences and new ideas from across the world.

Urban Freight for Livable Cities is based on the 2012 international VREF conference with the same name. The conference was organised to consider the challenges and opportunities currently faced by stakeholders involved in urban freight transport, as well as desired outcomes and targets within both the public and private sectors. The papers presented in this book are updated contributions from the speakers at the conference.

