Division 44
Water, Energy, Transport

Urban Freight in Developing Cities

Module 1g

Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities

gtz Transport Policy Advisory Services

On behalf of
Federal Ministry for Economic Cooperation and Development

OVERVIEW OF THE SOURCEBOOK

Sustainable Transport:

A Sourcebook for Policy-Makers in Developing Cities

What is the Sourcebook?

This *Sourcebook* on Sustainable Urban Transport addresses the key areas of a sustainable transport policy framework for a developing city. The *Sourcebook* consists of more than 29 modules mentioned on the following pages. It is also complemented by a series of training documents and other material available from http://www.sutp.org (and http://www.sutp.cn for Chinese users).

Who is it for?

The *Sourcebook* is intended for policy-makers in developing cities, and their advisors. This target audience is reflected in the content, which provides policy tools appropriate for application in a range of developing cities. The academic sector (*e.g.* universities) has also benefited from this material.

How is it supposed to be used?

The *Sourcebook* can be used in a number of ways. If printed, it should be kept in one location, and the different modules provided to officials involved in urban transport. The *Sourcebook* can be easily adapted to fit a formal short course training event, or can serve as a guide for developing a curriculum or other training program in the area of urban transport. GTZ has and is still further elaborating training packages for selected modules, all available since October 2004 from http://www.sutp.org or http://www.sutp.cn.

What are some of the key features?

The key features of the *Sourcebook* include:

- A practical orientation, focusing on best practices in planning and regulation and, where possible, successful experiences in developing cities.
- Contributors are leading experts in their fields.
- An attractive and easy-to-read, colour layout.
- Non-technical language (to the extent possible), with technical terms explained.
- Updates via the Internet.

How do I get a copy?

Electronic versions (pdf) of the modules are available at http://www.sutp.org or http://www.sutp.cn. Due to the updating of all modules print versions of the English language edition are no longer available. A print version of the first 20 modules in Chinese language is sold throughout China by Communication Press and a compilation of selected modules is being sold by McMillan, India, in South Asia. Any questions regarding the use of the modules can be directed to sutp@sutp.org or transport@gtz.de.

Comments or feedback?

We would welcome any of your comments or suggestions, on any aspect of the *Sourcebook*, by e-mail to sutp@sutp.org and transport@gtz.de, or by surface mail to:

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Further modules and resources

Further modules are under preparation in the areas of *Parking Management* and *Energy Efficiency for Urban Transport*.

Additional resources are being developed, and Urban Transport Photo CD-ROMs and DVD are available (some photos have been uploaded in http://www.sutp.org – photo section). You will also find relevant links, bibliographical references and more than 400 documents and presentations under http://www.sutp.org, (http://www.sutp.cn for Chinese users).

Modules and contributors

(i) *Sourcebook Overview and Cross-cutting Issues of Urban Transport* (GTZ)

Institutional and policy orientation

1a. *The Role of Transport in Urban Development Policy* (Enrique Peñalosa)

1b. *Urban Transport Institutions* (Richard Meakin)

1c. *Private Sector Participation in Urban Transport Infrastructure Provision* (Christopher Zegras, MIT)

1d. *Economic Instruments* (Manfred Breithaupt, GTZ)

1e. *Raising Public Awareness about Sustainable Urban Transport* (Karl Fjellstrom, Carlos F. Pardo, GTZ)

1f. *Financing Sustainable Urban Transport* (Ko Sakamoto, TRL)

1g. *Urban Freight in Developing Cities* (Bernhard O. Herzog)

Land use planning and demand management

2a. *Land Use Planning and Urban Transport* (Rudolf Petersen, Wuppertal Institute)

2b. *Mobility Management* (Todd Litman, VTPI)

Transit, walking and cycling

3a. *Mass Transit Options* (Lloyd Wright, ITDP; Karl Fjellstrom, GTZ)

3b. *Bus Rapid Transit* (Lloyd Wright, ITDP)

3c. *Bus Regulation & Planning* (Richard Meakin)

3d. *Preserving and Expanding the Role of Non-motorised Transport* (Walter Hook, ITDP)

3e. *Car-Free Development* (Lloyd Wright, ITDP)

Vehicles and fuels

4a. *Cleaner Fuels and Vehicle Technologies* (Michael Walsh; Reinhard Kolke, Umweltbundesamt – UBA)

4b. *Inspection & Maintenance and Roadworthiness* (Reinhard Kolke, UBA)

4c. *Two- and Three-Wheelers* (Jitendra Shah, World Bank; N.V. Iyer, Bajaj Auto)

4d. *Natural Gas Vehicles* (MVV InnoTec)

4e. *Intelligent Transport Systems* (Phil Sayeg, TRA; Phil Charles, University of Queensland)

4f. *EcoDriving* (VTL; Manfred Breithaupt, Oliver Eberz, GTZ)

Environmental and health impacts

5a. *Air Quality Management* (Dietrich Schwela, World Health Organization)

5b. *Urban Road Safety* (Jacqueline Lacroix, DVR; David Silcock, GRSP)

5c. *Noise and its Abatement* (Civic Exchange Hong Kong; GTZ; UBA)

5d. *The CDM in the Transport Sector* (Jürg M. Grütter)

5e. *Transport and Climate Change* (Holger Dalkmann; Charlotte Brannigan, C4S)

5f. *Adapting Urban Transport to Climate Change* (Urda Eichhorst, Wuppertal Institute)

Resources

6. *Resources for Policy-makers* (GTZ)

Social and cross-cutting issues on urban transport

7a. *Gender and Urban Transport: Smart and Affordable* (Mika Kunieda; Aimée Gauthier)

About the author

Bernhard O. Herzog, Freiburg, Germany, is a transport engineer by trade and started working in urban transport planning more than 30 years ago as a Transport Planner and Engineer in the City Engineers' Department of Cape Town, South Africa. Later on he joined the Mercedes-Benz Group and became the head of the fleet-management consulting unit of Mercedes-Benz do Brazil. Since then he has worked in this field in many different Asian, African and Latin American countries. Up until recently, he has been a member of the global management team of an international consulting firm. He is a specialist in supply chain management, logistics and transport company operation, and has been involved with numerous transport management projects in developing countries. He is also teaching at the "Graduate School Rhein-Neckar", Mannheim and has delivered numerous training courses on fleet management in countries such as Germany, Brazil, Austria, Romania and Vietnam. Bernhard O. Herzog has authored books like "Fleet Management" (Luchterhand Verlag 1997); "The Fleet Management Professional" (Heinrich Vogel Verlag 1999); and "Techniques of Project Work", (Oldenbourg Wissenschaftsverlag 2008).

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Module 1g

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Inner city freight delivery, Bangkok, 2010

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Terminology used

Area licensing scheme	Scheme, whereby access to a certain (urban) area is only granted to vehicles displaying a specific licence
B2B	Business to Business
B2C	Business to Consumer
Captive fleet	Vehicle fleet operating within a restricted space and returning to base station regularly
CBD	Central business district
City port	See "Urban consolidation centre"
CNG	Compressed natural gas, alternative road vehicle fuel
Congestion charge	Special levy for vehicles entering a congested inner city zone/ road pricing measure that charges drivers for road usage
Consolidation	See "Freight consolidation"
Cross-docking	Transhipment of goods from vehicle to vehicle, with the aim of forming (consolidating) destination specific loads (see "Freight consolidation")
Cross-docking facility	Facility to enable the transhipment of goods with the aim to form destination-specific loads
Delivery Performance	Amount of cargo (kg or m^3) delivered per hour
Drop density	Measure for the number of drops/delivery calls, which can be effected using a certain amount of vehicle kilometrage
Distribution centre	See "Cross-docking facility"
District logistics provider	Logistics provider allocated to or specialising in a specific catchment area, so that a higher delivery density/logistics efficiency can be achieved (see "micro-zone delivery")
ELP	Espace de livraison de proximité: see "Vicinity unloading facility"
ERP	Electronic Road Pricing
Forwarder	Freight service agent, who organises transportation, customs clearance and other process steps on behalf of the shipper, by contracting the respective service providers
Freight consolidation	Formation of destination- or receiver-specific loads from several origins (see "Cross-docking")
Freight consolidation centre	See "Cross-docking facility"
Freight exchange	Organisation or internet portal with protected access for shippers and carriers for the brokering of loads/freight consignments
Freight village	See "Logistics park"
Full truck load	Amount of cargo able to fill a truck or nearly fill a truck
GBP	Great Britain Pound
GDP	Gross Domestic Product
GHG	Greenhouse gases
GNP	Gross National Product
Groupage freight	Grouping of several small consignments into larger loads
Haulier	Transporter/Trucking company
Hub-satellite system	Logistics setup, whereby all goods are routed through one central hub, then dispatched to local satellite depots, from where the fine-distribution to the end-customer takes place

Hybrid propulsion	Vehicle propulsion with two alternative power sources, *e.g.* electric and diesel
LCCC	London Construction Consolidation Centre
Less than full truckload	Amount of cargo corresponding to approximately 20 % to 60 % of a truckload
Logistics centre/Logistics hub	See "Cross-docking facility"
Logistics park	Establishment providing land, access (generally in at least two modes of traffic) and infrastructure for logistics, storage and transport firms to operate from this location. Very often, these parks fulfil a cross-docking function also.
Logistics terminal	See "Cross-docking facility"
LSP	Logistics service provider
Micro zone delivery	Delivery strategy, whereby a vehicle calls on few delivery points in close proximity of each other (see "District logistics provider")
Part load	See "Less than full truckload"
Pan-operator initiative	Initiative involving more than one individual operator, *i.e.* a logistics collaboration setup
PM	Particulate matters, suspended air-borne solid particles and/or droplets of various sizes
PPP	Public Private Partnership
PTV	PTV Planung Transport Verkehr AG
Rebound effect	Phenomenon, that added traffic infrastructure capacity always induces additional traffic
Receiver	Party receiving a consignment
Shipper	Party sending a consignment
TDM	Transport Demand Management
TMA	Transportation Management Association
Traffic Engineering	Generic term for the planning, construction, maintenance and upgrading of road infrastructure
Traffic Management	Totality of measures which can be taken by local authorities to manage the flow of vehicles and the available traffic space by means of regulations, signage, road marking, road pricing, control and enforcement measures
TfL	Transport for London
Unattended delivery	Delivery process in a trusting relationship, where goods can be deposited on the receiver's premises without a personal handover
Urban Consolidation Centre (UCC)	Facility for the consolidation of flows of goods destined for the city (see "Cross-docking facility")
USD	US Dollar
Vicinity unloading facility	Short term vehicle parking with easy trolley access to several inner city shops or businesses. The facility may be access controlled, manned, guarded and offer supplementary services, such as short term storage, hand stacker hire, etc.
Vicinity unloading area/terminal	See "Vicinity unloading facility"

CONTENTS

1. Introduction

The economic development of urban agglomerations depends heavily on a reliable and friction-free supply of goods and materials. At the same time, freight transportation in urban centres contributes considerably to air pollution, noise emission and traffic congestion. Decisive action is necessary in order to optimise urban freight delivery, and thus to alleviate the negative effects.

The shape of urban freight traffic and the problems induced vary considerably among different cities. Compared to passenger transport, it also poses additional challenges: Freight transport operation is primarily a private sector issue, involving a multitude of stakeholders with different interests. This module serves to assist policy makers in developing countries by providing a comprehensive overview of the measures and techniques available to tackle the issue.

The strategies outlined in this document range from actions that may easily be implemented in the short term to advanced and innovative long-term concepts. Whenever possible, case studies both from developing as well as developed cities are used to illustrate the implementation of measures discussed.

Few strategies offered here are applicable in each and every urban agglomeration. The measures presented in this document should be evaluated individually for their practicality in the local context. It is given priority to those measures which help to reduce the most urgent problems and which can be implemented in the short term.

The document is structured as follows:

Chapter 2 describes the importance of freight transportation in urban development, and discusses the various problems caused by urban logistics operations. It also provides a quick overview of past developments and future challenges for urban goods transport in rapidly growing cities of the developing world.

Chapter 3 contains a catalogue of measures to reduce the negative environmental, economic and social impacts caused by urban freight traffic. The focus is on urban road freight as this mode is still very much predominant, partly because most city locations can only be reached by road. Possibilities for mode shift are shown wherever possible. The actions proposed are organised with regard to two aspects: The first refers to the principal stakeholder involved for each measure, which may be a local authority, a regional or national government or the private sector. Secondly, the strategies are arranged according to the respective time horizon, ranging from short- to long-term actions.

Chapter 4 provides the reader with detailed information on implementing the measures outlined in the previous sections. Balancing the interests of different stakeholders ranging from urban residents to logistics operators is the key issue here. Even where the private sector is the main actor to improve logistics efficiency, it is up to the public sector to set the right incentives and base conditions to enable this change.

The final chapter of this module summarises the lessons learnt. It shows the potential for contributing to a more liveable city, to reduce environmental damage and to foster the economic development of the urban economy.

2. Understanding the problem

2.1 Basic situation

Relevance of freight in urban transportation

Goods traffic represents a considerable portion of urban traffic volume. Although in most cities on average only 15 to 25 % of the vehicle kilometres (four-wheel and more) travelled can be attributed to commercial vehicles, it is estimated that they take up roughly 20 to 40 % of motorised road-space occupation and cause 20 to 40 % of CO_2 emissions. For particle matter (PM), the share of commercial vehicle is much higher still. Exact figures are hard to come by, but in the case of Thailand, 51 % of the road transport energy consumption is used for freight transport (Source: Fabian, 2010).

Not only do trucks and pickups contribution over-proportionate to air pollution, noise emission and congestion they also occupy a sizable portion of the available space in a conurbation. Hence the implementation of a professional and sustainable freight transport policy should be a high priority for all municipalities, big or small.

On the level of a typical metropolitan area in a developing country, on average 40–50 % of commercial vehicle freight volume is incoming, 20–25 % is outgoing, and the remaining 25–40 % are intra-metropolitan runs (Source: Dablanc, 2010). However, typical good flows vary among different functional city areas. Large urban agglomerations include industrial zones and therefore mostly act more as origin for goods transport than as destination. In contrast, city centres, be it the downtown centre or a suburban commercial centre, are usually strong net goods consumers. This implies that more goods are received than dispatched in these precincts. Delivery of sometimes small shipments to the various retail establishments is the main topic here.

Growing awareness for urban logistics issues

Many municipal administrations have recognized the dimension of the issue "urban freight" and the problems associated. Urban freight transportation and urban development are interdependent: A strangulation of the flow of goods in and out of a metropolis would certainly increase the retail price levels, impair the development of the urban centre itself, slow down economic activity and drain the financial resources from the municipal budget. On the other hand, only a stringent and long term metropolitan policy on urban transport can ensure an efficient and sustainable supply structure. Land use management and infrastructure planning lays the foundation for efficient traffic operation in the future. Freight transport and goods delivery have to be an integral part of any such policy and need to be considered carefully during the planning stage.

Box 1: Relevance of Urban Freight Transport in Europe

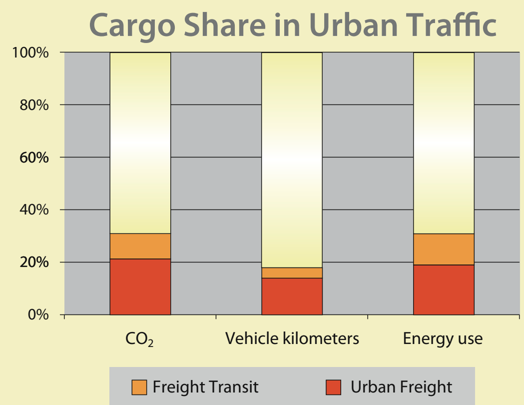
Urban goods transport (including transiting heavy Goods vehicles) accounts for:

- 18 % of the vehicle kilometres
- 31 % of the energy use
- 31 % of the CO_2 emissions

in urban areas.

It also contributes significantly to NO_x, SO_2 and particle emissions, accounting for almost 50 % of the latter.

(Source: Dablanc, 2006)



(Graphic by Dominik Schmid, based on Data from European Union, 2007)

High income economies cannot necessarily serve as role models

Many cities in Western societies have initiated different initiatives with the aim to alleviate the problems induced by urban freight traffic:

- In Italy, the focus is often on the preservation of the historic city centres by restricting goods traffic as far as possible;
- In many northern European cities, city logistics schemes have a strong environmental focus and are designed to leave the pedestrian precinct undisturbed and allow for leisurely shopping without any interference from vehicles during business hours;
- In North America, numerous initiatives have been rolled out with the aim of reducing general road congestion;
- In other cases, the protection of inner city residents from excessive fumes and noise emissions is in the foreground.

Many of these past initiatives should be seen as experiments in urban logistics optimisation. Whereas road pricing and access restriction schemes continue to grow in popularity in western economies, some of the urban consolidation centres (see Chapter 3.7.1) introduced with public support decades ago, have not found enough acceptance in the private sector or proved not to be self-sustainable.

Box 2: European experiences and applicability to the developing city context

It is clear that conditions in developing country agglomerations are not necessarily comparable and that the experiences from high-income economies cannot be translated one to one to a developing country context. Hardly any of the European city logistics schemes refers to cities larger than 2 million inhabitants. The average settlement density in these cities ranges between 300 and 6,000 inhabitants per square kilometre, which is not representative for most cities in developing countries which have between 6,000 (Bangkok) and 35,000 (Cairo) inhabitants per square kilometre.

In nearly all of the developed cities researched, more than 50 % of the city GDP was derived from the service sector, and the average GDP per capita was considerably higher than is presently the case in most developing countries.

Unlike in many European cities, urban freight planning in developing countries so far has not centred on the protection of residents from noise and the preservation of historic town centres. The focus is rather on the alleviation of congestion, air pollution and the preservation of the transport serviceability of urban centres.

Development of new models for low and middle income countries

Concepts which have proved useful in a western economy do not necessarily work in a developing country environment. Conversely, this implies that some of the concepts which have been tried in European economies with limited success, as for instance the concept of urban logistics centres, might be perfectly feasible in the cities of developing countries. Some Asian conurbations present a much higher pressure for action and may therefore be a fertile ground for the implementation of innovative urban logistics concepts, if approached in the right manner.

The measures so far implemented in low- and middle income countries may be less sophisticated, but generally it can be said that there is a high degree of public awareness and a sense of urgency concerning urban logistics problems. Some developing world metropolitan areas, such as Manila or Bangkok, can look back on 30 years of experience with city freight traffic policies.

Many initiatives are underway in prospering cities of Asia and Latin America, aimed at alleviating the negative effects of urban freight transport while securing a friction-free supply of goods into the cities. In many instances, these programs focus on the eco-efficiency of the national vehicle fleet and on the performance of the road infrastructure. Increasingly, traffic management measures can be observed, in some cases accompanied by the provision of truck parking space or of urban logistics centres.

Box 3: Asian experiences

Especially in Asian cities, many showcases for effective urban transport management can be scrutinized. Some Japanese and Korean cities have imposed restrictions on truck engine idling while the vehicle is not in operation. Cities like Bangkok, Seoul, Osaka and Tokyo have implemented public freight terminals, some Japanese and Chinese cities have made truck parking space available. Many major Asian cities like Manila or Riad have imposed truck bans in one or the other form, so as to relieve the road infrastructure during peak hours.

Figure 1

Truck ban during rush hour in Riad.

Photo by Armin Wagner, Riad, Saudi Arabia, 2010

2.2 Problems induced by urban freight traffic

Various problems are induced by urban freight traffic. Some of them directly affect the overall quality of life and the safety of urban dwellers. Others contribute to global challenges such as GHG emissions. This section provides an overview of the most common negative effects caused by urban freight.

Roadspace occupation

Roadspace is scarce in just about any urban agglomeration. Especially if larger than necessary vehicles are used, if unnecessary long distances are travelled in urban regions, and if the off-loading process is organised in an inefficient way, the use of urban traffic space is suboptimal.

Figure 2

Congested street by freight trucks in Pune, India.

Photo by Jeroen Buis, Pune, India, 2008

Figure 3

Hand carted freight in Bamako, Mali.

Photo by Armin Wagner, Bamako, Mali, 2005

Green House Gas (GHG) and particle matter (PM) emissions

In most cases, urban transport is relying on road infrastructure, less so on rail and waterways. As with most forms of motorised road transport, GHG emissions and local air pollution are serious consequences. Emissions of GHG such as carbon dioxide (CO_2) can be minimised by using clean vehicle technologies and through an optimisation of the logistics system. Especially with diesel-driven vehicles, the particle-matter (PM) emissions are the main problem. They are responsible for major health hazards to the urban populations, including asthma attacks and other forms of respiratory illness. In addition, air pollution can cause damage to historic buildings and other cultural resources.

Both developing and developed cities are confronted with this issue. For example in Dijon, France, urban freight transport is responsible for 20 % of carbon dioxide, but for 60 % of particulate matter emissions. (Source: Dablanc, 2010 from LET *et al.,* 2006)

Noise emissions

Whereas in developed societies, vehicle noise emissions seem to be in the focus of public attention, in many developing countries, this does not seem to be an urgent issue yet. However, studies on the effect of noise on human health give a clear warning sign. Traffic noise has severe impacts on health and overall quality of life. It may lead to stress and increased blood pressure. In the medium and long term, the reduction of traffic noise in the vicinity of residential areas is likely to become a focus in all regions.

Figure 4
Smog as a consequence of city road traffic.
Photo by PTV

Impairment of road safety

Wherever heavy vehicles mix with passenger vehicles, bicycles or pedestrians, the risk of accidents and serious personal damage is increased. In very few situations is it possible to segregate the different vehicle categories. Only professional traffic engineering, good traffic management and an efficient organisation of the logistics sector can alleviate this problem.

Damage to road infrastructure

Heavy freight trucks increase the potential for damage to the infrastructure. Especially overloading and a poor technical condition of the vehicle fleet contribute more than necessarily to road infrastructure wear and tear and reduce their service life.

Figure 5
Multi-mode traffic and lack of traffic management in the border town of Poi Pet, Cambodia.
Photo by Dominik Schmid, Poi Pet, Cambodia, 2008

Congestion/delays

Depending on the way goods traffic is organised, it may even have negative effects on traffic flow way beyond its actual share of the traffic volume. Especially in situations where no efficient parking and loading regime has been established, goods distribution sometimes becomes the main cause of traffic congestion in Central Business Districts (CBDs).

Reasons may be:

- Vehicle sizes not corresponding to manoeuvring possibilities afforded by road geometry;
- Vehicle motorisation too low to allow free flow in surrounding traffic;
- Vehicle overload, slowing down traffic flow, especially on inclines;
- On- and off-loading in second row, organised in a suboptimal manner;
- Extreme variety in transport modes and vehicles sizes;
- Frequent breakdowns and accidents, especially in bottleneck situations, *i.e.* in heavy traffic and with restricted space available.

Figure 6

Second row parking for unloading operations in Querétaro, México.

Photo by Eduardo Betanzo, Querétaro, México, 2006

In many instances, urban freight traffic is one of the major contributors to congestion during peak hours. This does not only imply travel delays and their related social cost. Traffic congestion caused by urban freight traffic can be considered the underlying problem associated with urban goods distribution, strongly influencing the other problems affected, such as environmental impact and road space usage.

To illustrate what this means in practice, a typical case example is presented in Box 4.

Box 4: The real costs of a peak hour break down

This simulation is based on the breakdown of a truck due to a faulty fuel pipe and lack of inspection. The breakdown happens to take place in a space restricted situation during peak-hour traffic. For all following traffic, this breakdown translates into an average time delay of 20 minutes.

Even if only USD 3 are calculated as time value per person and hour, the total passenger time lost amounts to nearly USD 1,000. Additional operating costs for commercial vehicles of roughly USD 500 are incurred, some 320 litres of fuel are lost and 800 kg of carbon dioxide are produced unnecessarily.

In this case example, the timely replacement of the faulty fuel pipe causing the breakdown would have cost the amount of USD 28 only.

Negative impacts on economic competitiveness and urban development

Costs of logistics strongly influence overall efficiency of the economy and reliable supply chains are crucial for every business. An efficient city transport system is one of the preconditions for continued economic development of urban agglomerations. With a collapsing transport infrastructure, overall economic activity will be hampered. Increasing costs for logistics translate into competitive disadvantages compared to other cities and investors move to other regions with a more competitive infrastructure.

Figure 7

Lorry blocking the road due to turning manoeuvre in Visakhapatnam, India.

Photo by Santhosh Kodukula, Visakhapatnam, India, 2006

A functioning city goods distribution and transport system is a major precondition for sustained economic development and thus, for poverty reduction. If a reliable and efficient supply of goods to inner city retail outlets cannot be established and ensured, commercial activity might shift to more easily accessible locations. Structures which have evolved over decades are thus dismantled and inner city activity will be reduced considerably.

2.3 A review of proven city logistics concepts

Prior to discussing possible measure to improve the efficiency of city logistics systems for developing cities, it is helpful to quickly review the past development of the sector and illustrate some logistical concepts which have proven to be economically viable and sustainable. Usually they have developed organically out of private sector initiative.

To illustrate the various development stages of basic supply items like groceries and farm produce, the following section presents various distribution systems which can be found in developed and developing cities alike. It shows how different goods take different ways on their way into the city area, and which developments have shaped the urban logistics sector.

Farmer direct selling

This form of distribution implies that a member of the farmer's family travels to town, either on foot, by bicycle or a motorised vehicle and commercialises farm produce to local retailers or directly to the end consumers. Alternatively, a farmer sends his own pickup truck to town, the truck parks besides the pavement or at a road intersection and the produce is sold to passers-by straight from the truck.

Organised street markets

Street markets are a common appearance in most cities, and may take place daily, weekly or biweekly. Sometimes these markets are specialised, *e.g.* for fruit, vegetables, seafood. From a logistical perspective, this means that farmers send their produce to an organised market place in town and sell it direct to the public. Alternatively, hawkers purchase the goods from farmers and sell at organised markets.

Table 1: Case simulation: Traffic jam due to truck breakdown

Root cause: Failure of a fuel pipe due to lack of inspection	
Value of fuel pipe:	USD 28
Duration of traffic jam caused:	45 minutes
Economic and environmental impact:	
Value of passenger time lost	USD 942
Commercial vehicle operating cost incurred	USD 545
Fuel lost	321 litres of fuel
Carbon dioxide produced	802 kg
Assumptions:	
Average time lost for following traffic (minutes)	20.0
Number of passenger vehicles affected	280.0
Average occupancy	3.4
Average time value per hour USD	3.0
Average idling consumption passenger vehicle (l. p.h.)	2.0
Number of commercial vehicles affected	75.0
Operating cost excluding fuel USD (p. h.)	22.0
Average idling consumption commercial vehicle (l. p.h.)	5.5

Table 1
Small cause, huge impact: The real cost of a peak-hour breakdown.
Table by Bernhard O. Herzog

Figure 8
Non-motorised goods transport to the market in Vientiane, Laos.
Photo by Lloyd Wright, Vientiane, Laos, 2005

Figure 9
Organised street market in Collioure, France.
Photo by PTV, Collioure, France

Wholesale and morning markets for perishables

Farmers bring their produce to a specialised morning market in the outskirts of a city. Sometimes they contract truck operators for the transportation. Shop owners and hawkers purchase produce and sell it in their shops or on local street markets, while restaurant owners purchase for in-house consumption.

From the logistics point of view, such markets already imply a certain form of load consolidation, since goods handling is organised in such a way that the loads coming from the suppliers are broken up and rearranged into area- or customer- specific loads.

Wholesale trading with inventory

These establishments do not only trade perishables, but also food products from industrialised production, packaged and non-perishable. The function is always one of a hub: The producer can deal with few business partners and logistical destinations, the retailer may be able to purchase his complete demand for supplies from one business partner. The main purpose of a wholesale function is to bundle the regional demand into larger quantities, thus increasing commercial bargaining power towards producers. The facilitation of regional and local distribution logistics is more of a side issue.

Special forms of wholesale operation

Different commodities require different wholesale setups. A good example is the beverage distribution. Soft drinks are a low value commodity /with high distribution cost. Even small shops receive consignments of up to half a delivery van's capacity. Businesses with higher beverage turnover often order directly from the bottling plant. So under most circumstances, the wholesale function described above is not economically viable in B2B (Business to Business) beverage distribution, because of high handling costs. Instead, the direct delivery from the bottling plant to the retail business is preferred.

And yet, even for this commodity, a specialised form of wholesale operation is thriving: restaurants, pubs and bars often have a wider range of upmarket products on offer, although their daily consumption is smaller. It is therefore not economical to order small consignments separately from different breweries, wine cellars and other beverage vendors. Instead, they order from a specialised wholesaler, who consolidates loads for each receiver. The main purpose of this wholesale function is to consolidate loads and prevent large trucks from having to travel distances in city traffic just for the delivery of a few crates.

Delivery of building materials

In rapidly growing urban agglomerations, up to 30 % of the transported goods tonnage is

Figure 10
Urban beverage distribution in Bangkok: A larger truck remains stationary at the roadside during the day, while the crates are distributed to retail establishments with small 3-wheelers.
Photo by Dominik Schmid, Bangkok, Thailand 2010

Box 5: Changes in distribution patterns of a soft drink manufacturer in Korat, Thailand

As a response to increasing fuel costs and in order to save labour costs, a major producer of soft drinks and drinking water in Korat has recently changed its distribution system. Formerly, trucks would depart fully loaded from the factory, located about 10 km from the city centre, and call at every potential customer to check for orders.

In the new system, orders are taken in advance by sales staff. Trucks are now only loaded with the necessary amount of containers according to the orders received, before heading for the city. They will only stop at businesses actually requiring a resupply of drinks.

Source: Own interview by Dominik Schmid, University of Giessen, 2010

building materials and construction equipment. (Source: Dablanc, 2010)

In the building materials business, especially in the low-end price segment (for example cement, bricks, roofing, etc.) load handling is often a rather costly business. One would therefore try to avoid any transhipment, and deliver any larger quantity directly wherever feasible.

In congested metropolitan areas and commercial inner city districts, the logistical bottleneck is the off-loading operation at the construction site. Sometimes, no off road parking is available at all, space is always scarce and if not organised correctly, the off-loading operation produces long vehicle queues.

City administrations wanting to minimise the traffic disturbances caused by off-loading operations at construction sites may impose strict rules with respect to the loading and off-loading regime. One example is the restriction of off-loading to a certain number of bays and certain times of the day, or the introduction of usage fees for on-street off-loading space. It is then up to the construction companies involved and the site management to organise their logistics operation to fit the city administration requirements. One practice is to organise dedicated load consolidation schemes for building materials (see Chapter 3.7.1 for further information).

Development of the "third account" transport sector

In a typical developing country situation, a large portion of the goods volume is usually moved through "own account" vehicles. This means that vehicles are owned and deployed either by the vendor or purchaser of the merchandise. In contrast, most of the logistics operations in developed countries are conducted by "third account" vehicles, which are operated by dedicated freight operators.

Own account operations tend to be logistically less efficient than third account hauliers. This is due to generally smaller vehicle sizes, lower load factors and the lack of return cargo. The latter implies that the vehicle is only loaded with cargo one-way and returning totally empty from its delivery trip.

The development of a competitive and professional dedicated freight company structure should be one of the policy objectives for metropolitan authorities. Over time, trucking companies will typically develop into full fledged logistics service providers (LSP, see below), offering additional services such as warehousing and cross-docking. This helps to improve to increase the efficiency of the logistics system.

Development of transport companies into logistics service providers (LSP)

As soon as transport companies operate more than a small fleet of vehicles, they have to take a strategic decision:

Figure 11

Own account vehicle freight transport in Johannesburg.

Photo by Manfred Breithaupt, Johannesburg, South Africa, 2007

a.) Stick with a specialization as a trucking company and just increase volume; or

b.) Diversify into different transport functions, so as to enable the formation of an in-house logistics chain and aim for the role of a logistics service provider (LSP) or logistics integrator.

Figure 12
Proprietary cross-docking facility (logistics hub) in Germany.
Photo by PTV

Alternative b) opens the way to expand into small consignment distribution and groupage operation, the latter meaning that several small consignments are grouped into larger loads. It involves the simultaneous operation of both long-haul trucks and a distribution fleet. The final step would be to open a proprietary distribution centre in a strategic location in order to be able to establish a complete logistics chain.

In this case, the logistics operator signs a contract with the shipper (sometimes with the receiver) to perform the transport from A to B, but then subcontracts other service providers to take on parts of that overall transportation. Sometimes operators also run long-haul and delivery fleets simultaneously, so as to perform both functions in-house.

A typical way to perform such transportation is to divide it up into the long-haul segment and the urban delivery. Automatically, transhipment becomes necessary, making the concept of freight consolidation more viable. The door to the optimisation of urban freight delivery is open.

The potential for implementation of consolidation schemes depends strongly on the development stage of the national road transport sector. Where pure transport operators instead of more sophisticated logistics operators dominate the sector, the introduction of a broken traffic with specialised functions for long-haul and delivery will be difficult.

Proprietary logistics centres

Proprietary logistics hubs are owned and operated by a single company for their specific

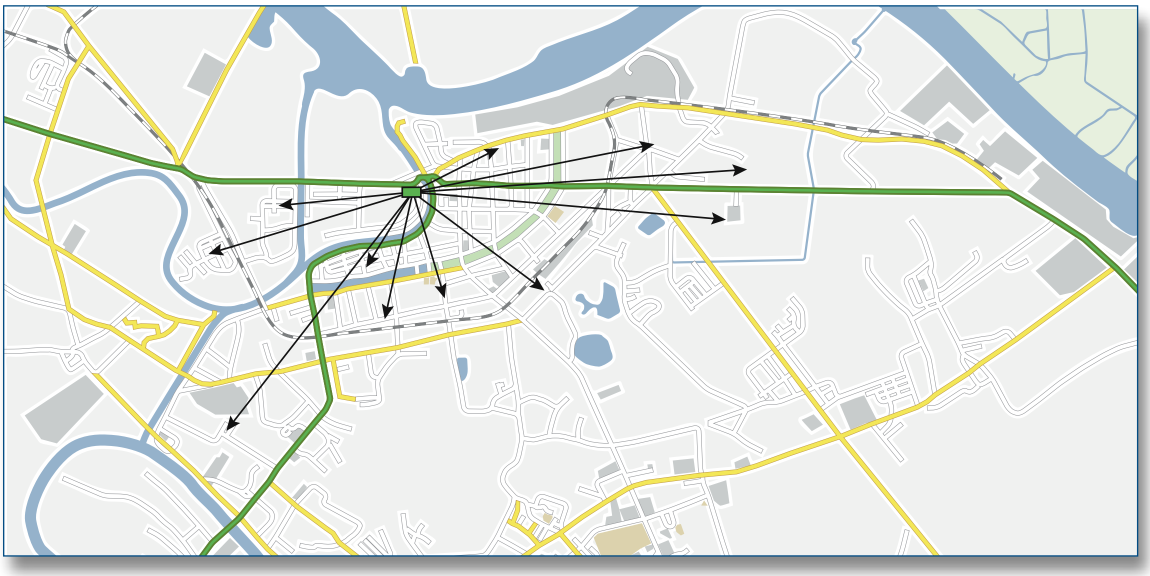


Figure 13
City served through a proprietary consolidation hub.
Graphic by Bernhard O. Herzog

business only. Parcel services have professionalized this concept. In general, they run one or several distribution centres on the outskirts of a city or close to a freeway exit. Proprietary logistics hubs are also operated by retail chains, as for instance grocery discounters.

The purpose of these distribution centres is to break the transport run into the long-haul and the delivery portion (as described in the above section on LSP). From all incoming long-distance truckloads, destination specific, route specific or area specific loads are consolidated.

At least in a developed country situation, freight consolidation for small consignments has become customary and shows that it is also economically viable.

A number of other industries have established their own logistics cross-docking infrastructure. An average metropolis in the northern hemisphere probably has dozens of logistics centres in different places. It is estimated, that more than 100 individual supply chains are needed to fulfil a developed city's requirements for goods (Source: Dablanc, 2010, from LET surveys in France).

It should be emphasised, that proprietary load consolidation operations are suboptimal, due to the fact that in a competitive situation, many different providers may send different vehicles simultaneously into the same destination.

Lessons learnt from historic sector development

The development of retail and wholesale structures is originally driven by commercial parameters. Increasingly, logistics aspects play a significant role as well. Morning markets and specific wholesale operations help to optimise logistics efficiency and decrease the burden on the traffic infrastructure. All of these concepts have evolved organically, based on private industries necessities and interests. In some cases the public sector has supported this development by providing adequate locations and spaces for the establishment of organised markets.

A progressing separation between the commercial and the physical side of a sale can be observed. While ordering, invoicing and payment are done via phone, e-mail, post and the banking system, involving no personal contact, the physical side of the business (handover and transportation of goods) is done by service providers, *i.e.* transport operators, freight forwarders or logistics operators.

In this situation, the overall logistics efficiency depends largely on the ability of the transport operator community to refine the logistics system in order not to overburden the existing road infrastructure.

The development, corporatisation and professionalization of the road transport industry are thus key factors in improving logistics efficiency. Guidance, stimulation or a certain amount of intervention on the side of the city administrations is usually necessary to achieve this.

2.4 Future challenges for urban logistics in developing cities

The review of past experiences has highlighted some developments of the urban logistics sector primarily in developed countries. Turning to the developing country setting, it is essential to consider contexts and trends that are common for most developing cities. Several of these issues directly affect the future challenges for urban logistics operations. These include:

- High population density;
- Rapid population growth;
- Lagging infrastructure development;
- Fragmented industry structures;
- Extreme diversity of urban fleets, between different vehicle categories, motorised and non-motorised;
- Extensive informal sector, such as street hawking, etc.

Urban population growth

Whereas in 2007, 43.8 % of the population in less developed regions of the world were urban dwellers, this figure is expected to rise to 53.2 % in 2025 and to 67,0 % by 2050 (Source: United Nations, 2008). While the growth of the urban populations may have slowed a little in Latin American conurbations, most Asian cities continue to sprawl. 15 of the worlds 25 megacities, defined at cities with more than 10 million inhabitants, are located on the Asian continent. This number does not yet account for a number of emerging ones in China.

Figure 14
Retailer unloading washing machines.
Photo by Dominik Schmid, Ubon Ratchathani, Thailand, 2010

Some urban centres especially in Asia face an annual increase in the urban population of beyond 3 % (Source: Brinkhoff, 2010). This growth causes higher urban density, extension of urban agglomerations and an increased demand for goods and materials.

Improvements in individual living and purchase power

Many cities observe a growth of the urban middle and upper class. This development leads to an increase in the consumption of goods, a hike in mobility and sometimes an increase in the space requirements for each individual. The annual goods consumption per person in a city like Paris, France was estimated to be almost 15 tons. Even in cities with widespread poverty, up to 1 ton of supplies are required for each inhabitant (including industrial consumption). Each additional job created in a developed city will generate roughly one delivery or pick-up per week. (Source: Dablanc, 2010, from LET data)

Increased motorisation

Rates of motorisation have been constantly on the hike for the last years. Shifts from non-motorised transport to motorised two wheel transport or from two wheel to four wheel transport result in an increase in roadspace occupation. As a rule of thumb, a doubling of the GNP per capita translates into an increase in motorisation of roughly 200 %. (This statement refers to a non-saturated situation, *e.g.* GNP per capita USD 5,000 equals 40 vehicles per 1,000 inhabitants, USD 10,000 equals 120).

Shifts in industrial production

As in developed countries, industrial structures are changing towards a setup with a higher division of labour and a higher degree of specialization. Whereas before the whole production process was conducted in one location, it is now spread over various steps at different locations. This leads to additional demand for goods transportation.

Inventories reduction and just-in-time production

The optimisation of transport costs would – in most cases – dictate the shipping of large consignments, allowing the full utilization of a large truck. However, in many cases, logistical structures are optimised with a focus on inventory costs and ease of production. As a consequence, smaller consignments are being shipped in certain, narrowly defined time slots. This obviously influences the average vehicle load factor negatively and thus increases the load on the traffic infrastructure.

Changes in retail structures

In wealthy parts of the population, internet shopping replaces a part of the conventional retail shopping. This trend is fuelling the growth in the parcel delivery business to end users. This type of delivery is done by light delivery vehicles, calling at many different stops for drops of minute volumes.

This type of distribution may be acceptable for B2B (Business to Business) delivery. A B2C (Business to Consumer) transportation by parcel service, sometimes referred to as e-tailing, certainly is not desirable form a traffic management and environmental point of view, unless managed in a sensible manner (see Chapter 3.3 for solutions proposed).

Shift towards industrialised food production

In the past, agricultural produce was carted into the urban agglomerations in its original form. However, a marked change in logistics structures becomes necessary at the point where food supplies change from agricultural to industrialised and packaged goods.

In the past, a large portion of food supplies would go directly from the farmer to the shop or to the end consumer (as is the case in many Asian cities). In an industrialized setup, groceries are shipped in large quantities from a factory to wholesalers or to retailers, sometimes using a hub and spoke system. A reverse logistics system for packaging material becomes necessary. Hence, a direct delivery setup evolves into a logistics chain.

Retail concentration and migration to suburban spaces

Where before, small shops would cover the needs of the inhabitants of the surrounding streets, large shopping complexes have now taken their place, often situated outside the inner city centres. These alleviate or solve many of the problems the small outlets have caused for inner-city freight transportation. However, urban development policy should make a careful evaluation whether or not this trend should be fostered and encouraged.

The dismantling of the local, walking distance retail structures creates a situation of no return, in which a great amount of motorised mobility will be required to tend to the everyday supply needs of the urban population. The extra demand for motorised passenger transport induced by this development can be quite considerable and will most likely be higher than the goods transport demand reduction.

Even though, from an urban freight logistics point of view, the thriving suburban shopping complexes appear to be a solution to many problems at first sight, it has to be remembered that, from an overall urban transport planning point of view, it is considered preferable to find ways and means of efficiently keeping conventional high capillarity retail structures alive or resuscitate them.

Industry deregulation

In some regions and countries, the deregulation of the transport sector is still in full swing. In some cases, an atomization of formerly government owned or centrally controlled fleets is to be observed. Instead of having few – perhaps inefficient – but large and compliant players to deal with, the metropolitan bodies now deal with thousands of micro-businesses, all of them under extreme cost pressure with a chronic lack of financing opportunities. In the metropolitan area of Mexico City, roughly 80,000 haulage and delivery companies are operating five or less vehicles each. (Source: Dablanc, 2010 from Olmedo, 2007)

Not only does this prevent an efficient public-private consultation process, enormous compliance and enforcement problems can be expected.

2.5 Conclusions

Analysing the prevalent trends in demographics, urban structures and industry development, it becomes obvious, that many of the developments presented above have negative effects on the traffic and environmental situation in cities, or at least represent major challenges to local authorities.

Many of the developments described above are a reality and something to be accepted as such. The urban freight policy will have to find the right answers in order to cope successfully with the challenges of the future. Relevant measures will be presented in the subsequent chapters.

Box 6: Conclusions

a.) Municipal governments are forced to intervene in the urban freight sector in order to avoid undesirable and unsustainable developments.

b.) The prevalent market trends in industry, trade and logistics are very dynamic and unfavourable for a healthy urban development if not counteracted by robust measures on the part of the public administrations.

c.) This process is time critical, since the spontaneous, market-driven developments can lead to negative, long-term and irreversible situations if no timely action is taken. It is therefore recommended to initiate short-term measures immediately, in order to achieve some quick-wins, concurrently with the development and implementation of long-term strategies.

d.) Public regulation and intervention in the urban freight transport sector should comprise infrastructure, traffic management, environmental policies, vehicle licensing and taxation, as well the transport market policy, town planning and land use management issues.

e.) Specifically, issues like an exaggerated transport market fragmentation and deregulation or a general attitude of non-compliance amongst transport operators present obstacles for an efficient sector management.

f.) A targeted support for the development and professionalization of the local transport industry is a key factor in the endeavour to achieve advanced levels of logistics efficiency.

3. The way forward: Options for dealing with urban logistics

The starting point and the development patterns are different in each city. The spectrum of actions offered in this document should therefore be a very wide one, too. Some measures could be implemented by most municipal authorities immediately, with little planning and development work. Other concepts are a lot more complex and only feasible in the mid or long term.

The sequence of chapters follows the degree of ease of implementation, starting with quick-win measures which could be implemented immediately. The final concepts presented require an intensive public-private dialogue and collaboration between the different players in the transport marketplace. Such complex strategies should be implemented only after the achievable quick-wins have been harvested.

For better orientation, measures covered in this chapter are shown in Table 2.

Any policy measure in the field of urban freight management requires a solid foundation for it to be effective. This foundation consists of good administration practice on the side of the local authorities and regional or state governments, a sound legislative framework, clearly assigned institutional roles and a general attitude of civic compliance amongst the players involved in the urban transport business (transport operators, drivers, shippers and receivers).

Issues like road transport legislation, licensing, compliance, taxation and organisational aspects strongly influence the degree of efficiency achievable in urban freight transport. These factors form the very basics of public transport management and do not affect urban freight transport alone and specifically. For this reason, these aspects are considered to be prerequisites and are not dealt with in detail in this document.

Basic requirements for an efficient management of urban freight traffic:

- Coherent policies on the transportation sector, on business licensing and on urban development;
- Clearly assigned institutional responsibilities;
- An adequate legal and organisational framework;
- Functioning road taxation and vehicle licensing mechanisms;
- A sense of civic compliance amongst the parties involved.

1. Traffic Management	4. National Development Policy
2. Traffic Engineering	5. Environmental Policy
3. Urban Planning	6. Transport Sector Policy
7. Logistical Efficiency	

3.1 Traffic Management

The term “Traffic Management” refers to all measures which can be taken by local authorities to manage the flow of vehicles and the available traffic space by means of regulations, signage, road marking, road pricing, control and enforcement measures. This is a differentiation over the term “Traffic Engineering”, which refers to the planning and construction of road infrastructure.

A thorough assessment of a city’s core freight traffic problems stands at the beginning of all traffic management on a community level, which is often handled by the Traffic Department or a comparable authority. The first priority is to handle bottleneck situations, where freight transport contributes significantly to congestion.

Some of the basic instruments that can help organise city freight traffic efficiently are:

- Signage;
- Light signalling;
- Road marking;
- Implementation of one-way schemes and circular routes;
- Installation of physical barriers;
- Issue of access permits;
- Road pricing and transport demand management.

3.1.1 Enforcement

An effective enforcement is the pivotal element in the management of urban traffic space.

Table 2: Categorization of measures covered

Principal stakeholder	Category	Problems addressed/ Measure	Congestion/ Traffic volume	GHG emission and local air quality	Noise	Road safety	Infrastructure damage	Time horizon
Local governments	Traffic Management	Enforcement	✔			✔	✔	Short
		Avoiding through-traffic	✔	✔	✔	✔	✔	Short - medium
		Access restrictions	(✔)		✔		✔	Short
		Road pricing and permits	✔	✔		✔	✔	Medium
		Avoidance of orientation traffic	✔	✔	✔			Short - medium
		Traffic space management	✔			(✔)		Short - medium
	Traffic Engineering	Loading zones and local traffic management	✔					Short - medium
		Vicinity unloading	✔					Medium
	Urban Planning	Urban Planning	✔	✔	✔	✔		Medium - long
National governments	National development policy	Legal framework, economic and spatial planning policies	✔	✔	✔	✔	✔	Medium - long
	Environmental policy	Emission standards		✔	✔			Short - long
		Selective taxation		✔	✔			Short - long
		Vehicle inspection regime		✔	✔	✔	✔	Medium - long
	Transport sector policy	Taxation, tariff regulation or business licensing	✔	✔				Medium - long
Private Industry	Improving logistical efficiency	Load consolidation / Cross-docking	✔	✔		✔	✔	Medium - long
		Improving delivery performance and route efficiency	✔					Short - medium
		District logistics provider	✔					Long
		Information	✔					Long

Where enforcement cannot be assured, further traffic management measures are likely to fail. With respect to urban freight transport, some of the core enforcement functions are:

- Prevent second row (double) parking;
- Enforce "no loading" and "no waiting" restrictions;
- Penalise overload and oversize of vehicles;
- Penalise unauthorised entry and failure to pay congestion charges (mostly camera enforcement);
- Prevent shoppers to park in designated loading bays.

An efficient policing of the scattered loading bays in commercial streets seems to be the biggest challenge for city traffic officers. Too many offenders bank on the fact that they only require a few minutes of stopping. However, a delivery truck finding an illegally occupied loading bay is obliged to keep circulating in flowing traffic and return later on or park in second row.

Support from the local business people in the policing of loading spaces close to their establishments is very helpful and sometimes indispensable to achieve efficient enforcement. Practice shows that "trucks only" loading areas are much easier to monitor than the regular loading zones, which allow any private individual to stop for a certain amount of time.

Box 7: Freight policy in the City of Seoul

The city of Seoul is famous for its comprehensive policy on freight in street management, which has led to interesting results. In the city's largest commercial area (the Ensanche), a "freight motor squad" consisting of forty agents circulating with motorbikes has been organised to control all on street loading/unloading zones. This has prevented illegal long term parking and made these zones available to delivery truck drivers.

(Source: Dablanc, 2010)

Any kind of regulation needs good communication, enforcement and control. Criteria should be easy to control, and sufficient and well trained enforcement staff needs to be available. The example of Medan, Indonesia shows what happens it this is not the case: Large-size trucks have been prohibited from entering the central business district since 2004 but interviews with truck drivers revealed that most of them were unaware of the ban (Source: Dablanc 2010, from Kato and Sato, 2006).

3.1.2 Avoiding through-traffic

For through-traffic, the city itself is not the destination. Instead it only passes through the city area on its way to other destinations, causing additional congestion. This is often the case for traffic destined to ports or airports, going through the city centre or sub centres instead of being routed onto ring roads and around the worst points of congestion. Wherever toll roads in the vicinity of a conurbation are introduced, toll-avoidance flows through the city areas are to be expected.

Box 8: Truck restriction in Manila

Restricting large trucks in cities has been one of the most popular measures in developing countries, due to road limitations. The policy in Manila is one of the earliest and well-known cases of large truck restrictions. It dates back to 1978 where trucks with a gross weight of more than 4.5 tons are not allowed to travel along eleven primary arterial roads from 6 o'clock in the morning until 9 o'clock in the evening. Ten other roads are prohibited during peak hours. Alternate routes are available to reach the port of Manila.

(Source: Dablanc, 2010, from Castro and Kuse, 2005)

The first condition for avoiding unnecessary through traffic is the availability of alternative routes. Through-traffic avoidance is therefore primarily a road infrastructure or mode shift issue. However, in many cases detrimental through traffic flows for goods transport occur in spite of alternative routes having been put in operation. Truck drivers often insist to use a more direct or apparently more attractive route, although reserved for local traffic only.

Local governments can use a wide range of measures to respond to this phenomenon. This includes the following options:

- Signed street closures for all commercial vehicles;

- Signed access restriction for commercial through traffic with intensive enforcement;
- Physical street closures for commercial vehicles (height restricting gates or narrowly spaced bollards);
- Road design, giving priority to the alternative route and making it the more convenient route rather than the one through the city;
- Placement of tollgates for any commercial traffic, including through traffic and local traffic, at critical points of convergence (*e.g.* bridges or tunnels), provided that there are no viable avoidance routes.

Generally, measures to avoid through-traffic should be applied carefully, in order to not create any hindrance for authorized traffic. Traffic restriction measures should therefore not be placed at the beginning or the end of the road section to be protected from through traffic. Rather they are to be located in the centre, at the point of the least local traffic volume (see Figure 15).

3.1.3 Introducing access restrictions

A fairly easy measure to implement is the imposing of access restriction to certain urban areas. This can be done in order to control congestion and air pollution or to protect local commerce, tourism, and residents. These access restrictions may consist of signs as depicted in Figure 16. Alternatively, physical restrictions such as automatic booms, height restricting bars, retractable bollards, etc. can be used (Figure 17).

In most cases, the purpose of the restrictive measures is not to close a certain area for motorised vehicles completely, but to restrict access for

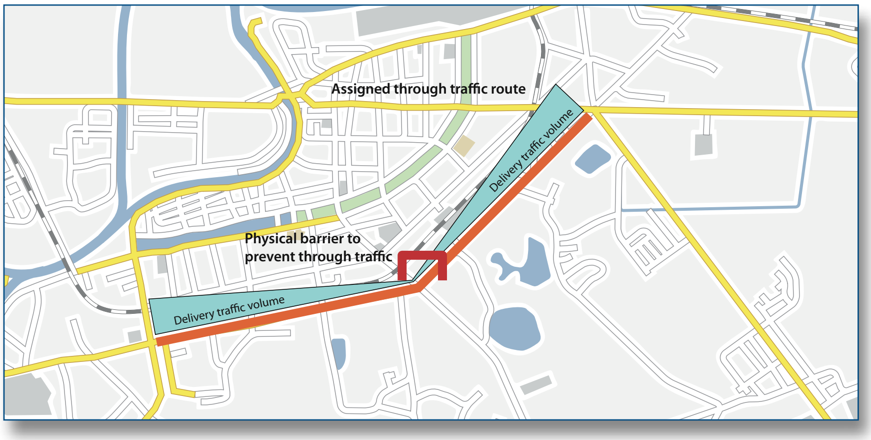
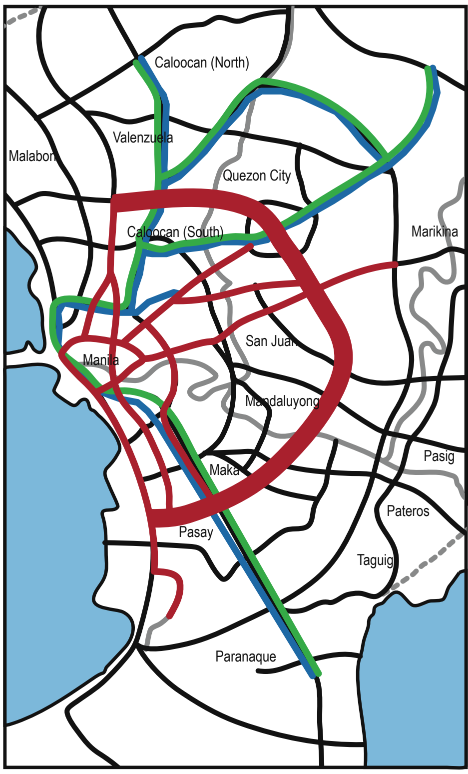


Figure 15
Avoiding through traffic through physical barriers.
Graphic by Bernhard O. Herzog

Figure 16
Unloading restriction in the City of Groningen.
Photo by Manfred Breithaupt, Groningen, Netherlands, 2005

Figure 17
Access control by retractable bollards.
Photo by PTV



Truck Ban 1 (EDSA only)	6 AM to 9 PM everyday except Saturdays, Sundays and Holidays. No cargo truck shall be allowed to travel or pass along EDSA.
Truck Ban 2 (10 major routes)	6 AM to 9 AM and 5 PM to 9 PM everyday except Saturdays, Sundays and Holidays. No cargo truck shall be allowed to travel or pass along these routes.
Definition of Cargo Truck	"Cargo truck" as used in the ordinance refers to motor vehicles, whether loaded or empty, having a gross vehicle weight of 4,500 kg or more, principally intended for carrying cargo.

Truck Ban Hours:
- 6 AM – 9 PM
- 6 AM – 9 AM; 5 PM – 9 PM
- Alternate route from Port Area to Outside
- Alternate route from Outside to Port Area

Figure 18
Metro Manila truck ban.
Source: Jun T. Castro *et al.*, 2003

Box 9: Good intentions, negative results

Restricting vehicle sizes is usually based on the hope that this will force operators to develop a cross-docking scheme (see Chapter 3.7.1). This would encourage the use of small vehicles for deliveries instead of routing heavy long-haul trucks into the city.

In reality, the outcome is often the exact opposite: Instead of developing professional city logistics structures, involving cross-docking, large numbers of small distribution vehicles are used for long distance transportation all the way from the origin to the inner city destination. This is an outcome which is not in the interest of transport policy-makers. In a similar vein, a truck-ban can lead to the proliferation of a light truck fleet which then operates at unsatisfactory load factors. In Seoul, for instance, light own-account trucks have become popular as a consequence of the truck restriction and are now flooding the streets.

(Source: Dablanc 2010, from Kato and Sato, 2006)

Figure 19
Small distribution vehicles in Bangkok (Figure a/b).
Photos by Dominik Schmid, Bangkok, Thailand 2010

vehicles based on selective characteristics like delivery times, vehicle size or weight. Typically, commercial goods traffic to inner-city centres is allowed in certain time windows only. This measure is commonly referred to as a "truck ban". Figure 18 shows the geographic extent of the Manila Truck Ban.

Some other examples of time-window related truck-bans for certain arterial roads or inner-city zones can be found in Bangkok, Tokyo and many Chinese cities. It is also common in large Chinese cities to ban trucks above five tons from the city centre during peak hours.

Permanent truck bans should be carefully analysed in terms of their overall economic and ecological efficiency. One of the classic measures to alleviate congestion in inner cities is to restrict the maximum gross weight or size of the vehicles allowed to enter the area. In many cases, this regulation is justified due to roadway geometry and a general lack of space. In other cases, this policy actually lowers logistics efficiency and leads to unintended negative effects.

Contrary to popular opinion, the use of smaller vehicles alone is not able to reduce congestion. A comparison of the logistics performance parameters of different vehicle sizes shows that – in principle – the use of larger vehicles reduces the impact on the environment and allows a more efficient use of road space (see Table 3).

However, this statement builds on two assumptions. One is that the large vehicle operates at an acceptable load factor and is only loaded with goods designated for the area of destination. The other one is that the road infrastructure can accommodate size and weight of the larger truck.

To illustrate the potential advantages of a larger delivery truck, it is helpful to put the payload in relation to the vehicle weight. For a typical delivery van, only a ratio of 0.46 of the gross vehicle weight can be used for payload. In the case of a heavy duty truck, this figure rises to 0.73. In the next step this leads us to a closer look at the typical road space usage of freight vehicles.

A suitable parameter for specific road space usage is the ratio of square metres of roadspace used divided by the load capacity in cubic metres. Here, the van requires 6.47 square metres of roadspace per cubic metre of load capacity, whereas the heavy duty truck requires 1.92 only. In plain words: Although the 'big' truck needs more space than one 'small' van, this is easily compensated due to the fact that it takes several of the smaller vehicles to carry the load a larger truck can take on board. And all those small cars in turn use more road space than the single 'big' truck. The same applies to GHG emissions. The ratio of CO_2 generated per cubic metre of loadspace and kilometre run is 33.36 for the van and 13.24 for the heavy duty truck (for detailed information see Table 3).

There is some controversy about the issue of setting minimum vehicle sizes. The main opposing argument goes as follows: If there are consignments which can be delivered with a pick-up truck, why should a mid-size truck be employed? A far-sighted answer is that – over time – there will not be any very small vehicle loads anymore, because operators will be forced to reorganise themselves to form larger, logistically more efficient loads.

While it is generally accepted that on an overburdened road infrastructure vehicles as large as possible should be used for goods transport, there are exceptions. For example, in narrow historic city centres large vehicles tend to obstruct traffic due to slow manoeuvring and the lack of adequate unloading spaces.

Some cities have found a practical compromise to increase logistics performance: They restrict

Table 3: Logistics performance parameters of different vehicle sizes (typical /average weight and size parameters)

Vehicle Category	Van	Light Delivery Vehicle	Medium Sized Truck	Heavy Duty Truck	Truck and Trailer
Weights ratio					
Gross weight kg	3,500	7,500	15,000	24,000	40,000
Payload kg	1,600	4,400	10,500	17,500	30,400
Payload/gross weight ratio	0.46	0.59	0.70	0.73	0.76
Volume and roadspace usage					
Load capacity m^3	7.34	32.86	51.93	60.44	98.83
Roadspace occupation m^2	47.51	78.60	103.71	115.89	168.00
Roadspace m^2/load capacity m^3 ratio	6.47	2.39	2.00	1.92	1.70
Energy consumption and emissions					
Diesel per 100 km	9.8	14.5	25.0	32.0	44.0
CO_2 g/km	245	363	625	800	1,100
CO_2 g per m^3 and km	33.36	11.03	12.04	13.24	11.13

Table and data by Bernhard O. Herzog

large vehicle during the daytime and allow them into the city area at night.

Contemporary city logistics planning often focuses less on restrictions for heavy vehicles only. Instead it tends to restrict vehicles below or above certain size limits (*e.g.* below 3,500 kg and above 18,000 kg). Such restrictions may well be combined with technical requirements such as low emission engines or the availability of easy unloading features.

Such more broad-based restrictions imply that a signed or physical access barrier will not be sufficient anymore. Instead, a proper area licensing system will have to be initiated. Under such a scheme, access to a certain area is granted only for vehicles meeting the respective requirements concerning size, technical standards or equipment.

3.1.4 Selective road pricing and permits

In many cities today, no access to inner-city areas is granted unless a special permit or license has been issued by the appropriate city authority. In most cases, this requires a payment by the applicant.

Box 10: Germany's "Green Zones"

As from 1 March 2007 on, vehicle restrictions in so-called "environmental green zones" can be issued in cities and local districts in Germany. The only requirement is that they were specially marked as being green zones by the city or municipality. The first environmental green zones came into force on 1 January 2008 in the cities of Berlin, Cologne, and Hannover and can be found meanwhile all over Germany. These areas especially threatened by fine particulate matter must be marked as "environmental green zones" with a specific road sign. Only vehicles displaying a specific license badge informing about the emission standard achieved are allowed to enter the green zones.

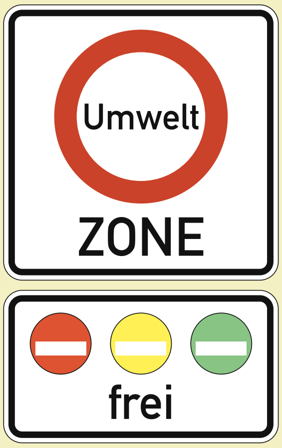


Figure 20
Road sign of the environmental zone in Germany.
Photo courtesy of Umweltzone.net

Since the access license is vehicle specific, it is possible to apply a selection process which considers several aspects. The city administration can choose the following characteristics as requirements for access to an inner city area:

- Low emission engine technologies, limitation of CO_2, NO_X and particle emissions;
- Roadworthy certificate;
- Easy unloading features, such as side doors, tail-lift, etc.
- Restrictions to vehicle maximum and/or minimum size.

Access restrictions are a pragmatic way to achieve a certain level of efficiency in city freight operation. However, these measures should be seen as a basis for follow-up action in the inner structure of the logistics system.

Example

The licensing scheme prevents vehicles to enter the city confines under 7,500 kg gross vehicle weight. Operators now use larger vehicles, but many times with an average load factor of only 25 %. Having been granted access to the city, the vehicles operate very fragmented routes, serving many dispersed drop-off points. Due to cumbersome handover and documentation requirements, each drop takes too much time, so vehicles remain in the city for much longer than actually necessary, blocking scarce loading space for hours.

In order to improve the traffic situation in the urban space, the operators' logistics efficiency is the key. It is only the operator himself who can improve his own efficiency, but it is the role of the municipal traffic management to provide incentives and guidance.

One of the options is to impose a near prohibitive charge on the use of an inner-city vehicle permit. This will make the operators do everything in their power to restrict the number of permits used and to utilise the permitted vehicles to the max. Permits can be time-slot related, *i.e.* a night permit may be cheaper than a peak-hour permit. Alternatively, they could be related to the vehicle size. A permit for a small vehicle might then be proportionately more expensive to avoid a huge increase in the number of small delivery vehicles.

Preference is to be given to usage-based forms of road pricing, *e.g.* through toll gates for cash or card payment. A detailed review of road pricing measures can be found in the respective *Sourcebook* Module 1d *"Economic Instruments"*.

3.1.5 Avoidance of orientation traffic

Orientation traffic is usually caused by drivers who are unfamiliar with the local situation. A simple measure to help drivers to find their destination is the maintenance of street name plates and the provision of clear and visible direction signs and parking provisions. Some municipalities have also issued special map material for delivery truck operations, giving details about all commercial traffic rules and access restrictions (see Figure 22). If considering the introduction of similar concepts in developing cities, it is essential to involve truck drivers at an early stage of the planning. It should be kept in mind that in some societies people are not familiar with reading and understanding maps and directions.

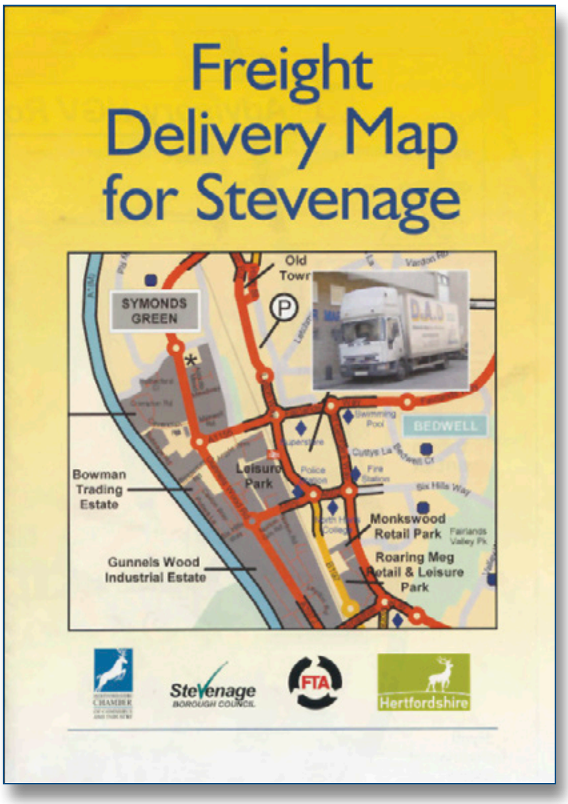


Figure 22
Freight delivery maps help reduce orientation traffic.
Graphic by PTV

Figure 21
ERP Gantry in Singapore.
Photo by Carlosfelipe Pardo, Singapore, 2008

3.1.6 General traffic space management

In many metropolitan areas, the extreme diversity of transport modes, ranging from pedestrians, via animal-hauled cart, two-wheel-, three-wheel-transport, cars, vans, light trucks to sometimes overloaded heavy trucks, presents a problem in itself.

Whenever traffic space is too scarce for space separation schemes, time sharing concepts are a good way to improve the road network and parking capacity. An innovative example is Barcelona, Spain, where the municipality has devoted the two lateral lanes of the main boulevards to general traffic in the peak hours, to deliveries during off peak hours, and to residential parking during the night. (Source: Dablanc 2010)

Wherever no mode separation can be achieved at all, speed restrictions may at least alleviate the friction between vehicle classes and reduce the accident risk. With stringent enforcement, high powered vehicles can thereby be forced to adjust to the speeds of surrounding two and three-wheeler traffic.

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3.2 Traffic Engineering

The term "Traffic Engineering" refers to the planning, construction, maintenance, operation and upgrading of basic road infrastructure. All measures related to easily changeable or removable installations such as road marking, road signs, traffic lights or barriers, are considered to be elements of traffic management.

The planning of transport infrastructure always envisages a planning horizon of well beyond ten years. Clear political decisions and strategies are needed for a sustainable outcome. For relevant policy elements see Chapter 3.3.

One key issue should be mentioned at this stage: Alleviating the current congestion by adding more and more road space is not a viable solution. ***Added road capacity nearly always leads to a higher demand for motorised mobility. This phenomenon is referred to as the "rebound effect".*** Investments into the improved segregation of vehicle modes seem to have a higher return.

Another priority should be the separation of moving traffic from parking vehicles and loading/unloading operations. Scarce roadspace should be kept free of any obstructions. The measures proposed in thus chapter thus refer to the provision of loading zones and the implementation of vicinity unloading facilities.

Before embarking on any projects, a listing of bottlenecks and hotspots in the present infrastructure should be compiled, so that the focus can be put on the most urgent actions.

3.2.1 Provision of adequate loading zones

Much of the potential for congestion caused by urban freight traffic stems from the fact that trucks and vans do not only circulate along the major arterials, but also have to stop for loading and unloading. If this operation takes place in moving traffic, an interference with other vehicles is difficult to avoid. The provision of adequate loading and unloading zones is therefore one of the prime objectives when planning for an alleviation of city centre traffic congestion.

Figure 23
Signed loading zone and loading restriction.
Photo by PTV

Loading zones can be on-street or off-street, they can be privately owned or publicly operated. The required space for one commercial vehicle has a width of 2 m and a length of 10 m to 18 m, depending on the predominant vehicle sizes. It should include a handling area of 2 m at the position of the tailgate, with level surface and access to the adjacent sidewalk system. In some cities, there is a policy to have at least one loading bay every 100 m of street extension (Source: Dablanc, 2010, Paris guidelines). Other municipalities instead provide fewer, but high capacity loading areas or terminals.

Figure 24 depicts a situation, where traffic congestion in a CBD is mainly due to lack of adequate loading space.

Figures 25 to 29 show different ways of accommodating loadings zones in the urban traffic space.

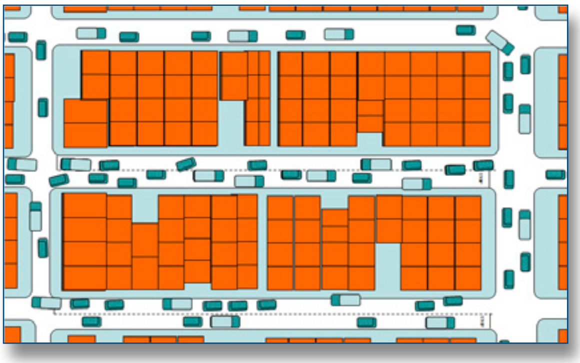

Figure 24
Congestion due to lack of unloading zones.
Graphic by Bernhard O. Herzog

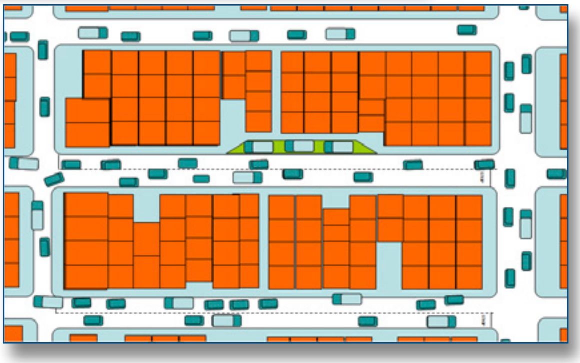

Figure 25
Lay-by unloading.
Graphic by Bernhard O. Herzog

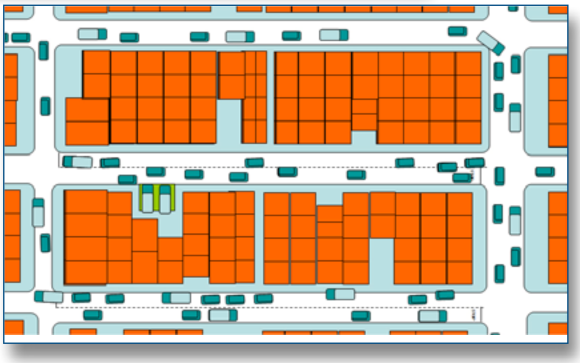

Figure 26
Private property unloading.
Graphic by Bernhard O. Herzog

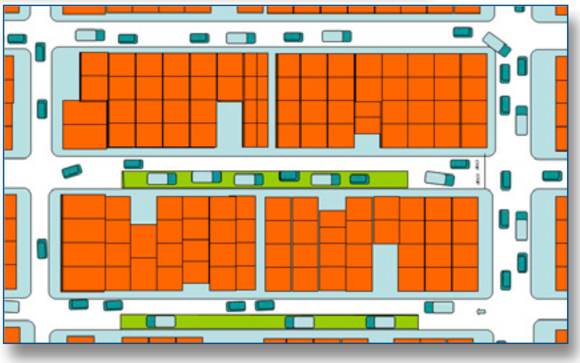

Figure 27
One-way system to make way for ample off-loading space.
Graphic by Bernhard O. Herzog

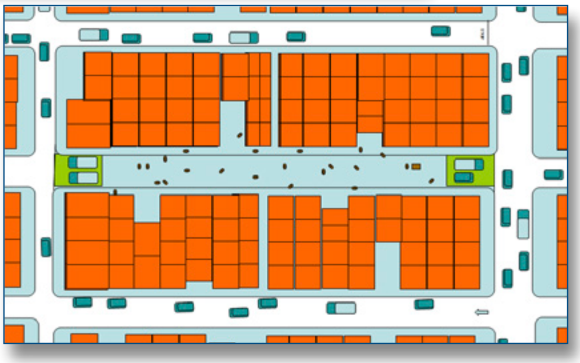

Figure 28
Combination of off-loading zone and pedestrian precinct.
Graphic by Bernhard O. Herzog

3.2.2 Unloading goods: organisation of the "Last Yard"

Delivery routes into the inner-city centres are often referred to as "the last mile". Likewise, the organisation of the goods vehicle parking next to a shop and the unloading operation could be referred to as the "last yard".

Unloading spaces are most often scarce and taken up illegally by passenger cars. Delivering trucks then park in second row, obstructing the moving traffic. Subsequently, access to open loading bays is obstructed and the vicious circle is closed.

As a general rule, it can be said that loading spaces are more difficult to implement and more difficult to enforce, the closer they are to the receiver's shop or business.

A measure to solve this problem is the provision for a non-motorised form of short distance transport between truck and shop entrance. In the context of this *Sourcebook* module, this practice will be referred to as "vicinity unloading", meaning that the goods vehicles park in a designated loading zone nearby one or several drop-off points. The goods will then be carried or carted across a short city distance to the handover point (see Figure 29).

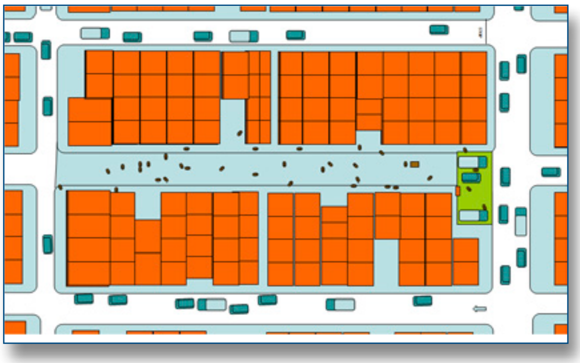

Figure 29
"Vicinity unloading"-facility, guarded and serviced.
Graphic by Bernhard O. Herzog

Operating a larger unloading area poses less compliance and enforcement problems than having dispersed individual loading bays. Depending on the size and conditions, it could be possible to provide physical access control, guarding, provision of sack-barrows or hand-stackers and even short-term storage, if needed.

In any case, there will nearly always be a certain walking distance to cope with. If goods are delivered into high-rise buildings or to shopping malls, hand-stackers, trolleys or carts have to be used for the last yard.

Business people will often welcome such measures, as this will provide a more leisurely shopping atmosphere. Centralizing vicinity unloading facilities at a distance to the individual retail establishments opens up possibilities to develop more local pedestrian zones.

Box 11

French cities like La Rochelle or Bordeaux have expanded the idea of a vicinity unloading facility and are providing a squad of "flying delivery men", who receive goods from the vehicles and deliver them in the urban vicinity on special non-motorised vehicles.

This way, the delivery truck does not have to wait for the delivery to be completed (Source: Dablanc, 2010). These facilities are termed "ELP" (Espace de livraison de proximité), a space approximately 30 m wide and accommodating 3 to 5 commercial vehicles (see Figure 30)

Figure 30
"Espace de livraison de proximité" in Bordeaux, France.
Photo by PTV

Each ELP itself is manned with 1 to 2 staff, who help with the off-loading operation and prevent illegal parking.

For detailed information on ELP's the reader may consult the publication "Best urban freight solutions"/"BESTUFS" (http://www.bestufs.net).

Wherever carting of goods over a small distance between vehicle and destination is required, some problems will have to be addressed:

Additional manpower

If vehicles are not able to stop directly at the receiver's shop entrance, additional manpower will be required for the unloading process. At the same time, vehicle performance is expected to improve, due to a higher unloading volume per stop. In most cases, the extra unloading personnel will accompany the vehicle as helpers or assistant drivers, in some cases helpers may be stationed at the vicinity unloading facility. In the macroeconomic perspective, it is to be considered as beneficial to buy a higher vehicle performance by employing additional labour. The base equation is an increased investment in the local labour market against a considerable reduction in the cost of vehicle procurement and operation, often imported and foreign exchange consuming.

Security

Security issues can be solved in different ways depending on the location. For a shopping mall delivery, a guarded parking lot is to be expected, anyway. For inner-city boutique shop deliveries, probably the operator will have to staff his vehicles with at least 2 drivers/loaders, one to perform the delivery, the second one to remain with the vehicle. Providing security and policing for a larger precinct unloading zone will always be easier than for fragmented loading bays close to shop entrances.

Pavement Surface Quality

Pavement surfaces between the loading bay and the shop entrances should fulfil certain minimum quality criteria. This may be the largest investment for the municipal authority when implementing a vicinity unloading scheme. In many instances, this can be complemented with the implementation of a local pedestrian precinct.

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3.3 Urban Planning

Even though traffic management and traffic engineering solutions can provide a certain alleviation of the problems currently posed by growing city freight traffic, the long term challenges are best met by a far-sighted policy on urban development, land use and spatial planning.

To give a few examples:

- Good town planning practice promotes public transport and preferentiates it over individual transportation. With regard to urban logistics, provision should be made for an adequate infrastructure for truck operation, all the way into the CBDs. This should be preferentiated over passenger car shopping traffic to centralised malls.
- At the same time, provisions other transport modes such as rail and waterways should be fostered for freight transport wherever possible. One ton-mile by truck generates roughly 1.90 lbs. of CO_2, the corresponding figure for rail transport is 0.64, for barge/river transport is 0.20. These alternative modes thus offer strong environmental advantages (Source: Victoria Transport Policy Institute, 2010).
- For short distance delivery, the use of non-motorised transport such as bicycles is often a good option. The infrastructure should be designed to support this mode.
- Smart land-use planning should generally aim at combining residential and commercial areas in close proximity to each other, in order to make workplaces more easily accessible. Exceptions apply where traditional manufacturing, trade and small industry generate noise, emissions and goods traffic in old and narrow city centres. In this case, it may be necessary to promote their relocation to a dedicated industrial environment.

- Developing various urban sub centres can alleviate congestion in CBDs and foster more balanced urban patterns.

An important objective from the point of view of urban logistics is to preserve traditional high capillarity retail structures. The availability of a wide range of goods at many places all over the city decreases the population's demand for mobility, by keeping distances short. To support such traditional structures often means the municipal government will have to work against prevalent retail industry trends. If no counteraction takes places, conventional retailing in small establishments is going to be replaced by shopping centres and malls usually located at the outskirts of the city. This increases the overall demand for mobility and fosters individual motorised transport, as malls are most often not within a comfortable range for walking and cycling and/or poorly served by public transit.

However, this does not mean that the development of shopping complexes and malls must be avoided at all cost. Also, not just any form of conventional retail is desirable and should be preserved and promoted. There may be good reasons to restrict roadside hawking and grocery stalls. The objective is not to freeze any development in this sector, but to steer it decisively in a direction which benefits not only the investors involved, but also the general public.

In the long term a steady increase in the volume of internet shopping is to be expected also for low- and middle income countries. Urban planners should consider this trend at an early stage. For example, in narrow residential locations with no proper commercial vehicle access deliveries to end consumers may be routed to precinct pick-up stations, where people can pick up the parcels delivered whenever they like. Such stations should be within walking distance from the destination households. Figure 31 shows an automatically operated "Packstation" in Germany. However, a conventional manned operation will do perfectly.

Figure 31
Pick up station "Packstation" located inside the central railway station in Frankfurt am Main.
Photo by Stefan Belka, 2010

Involve the local business community

In most cases it is necessary to require the local business community to contribute to the facilitation of smooth urban logistics and traffic flow. This can be achieved via adequate planning regulations by municipal authorities. For example, metropolitan building regulations demand the mandatory provision of adequate loading space for all new developments. In zones with extremely constrained space, multi-purpose buildings could be envisaged, with the basement or ground floor serving for parking and loading, the others for retail and offices. This is already customary in many Asian conurbations.

Box 12: Examples of local business community contributions

Case example 1:

Tokyo off-street parking ordinance of 2002 obliges all department stores, offices or warehouses to provide for loading/unloading facilities when they have a floor area of more than 2,000 m^2.

Case example 2:

In Barcelona, Spain, the municipal building code of 1998 requires all new bars and restaurants to build a storage area with a minimal size of 5 m^2 within their premises. The purpose is to ensure enough storage space is available to avoid daily deliveries of minute quantities.

(Source: Dablanc, 2010)

Promote intermodality on a metropolitan level

Many large cities are located adjacent to inland waterways, river-mouths or alongside the sea. Such a geographic gateway location opens many interesting possibilities for future development with respect to intermodal logistics concepts.

If suitable pieces of land are available alongside an inland waterway, sea port or rail line to establish distribution logistics centres (see Chapter 3.7.1 for details), this may be an efficient way of reducing congestion caused both by through-traffic as well as inner city distribution operations.

In an intermodal situation, *i.e.* with goods arriving by ship or by rail, it is usually much easier to make delivery in consolidated loads viable than for pure road transport operations.

In Germany, many of the existing urban consolidation centres are bimodal (rail/road) or even trimodal (port/rail/road, see Chapter 3.7.1 for the example of Bremen). Not only does multimodality improve eco-efficiency on the line-haul, it also contributes to the viability of a consolidated cargo distribution in the urban space.

Land-banking for future infrastructure requirements

In cased where it is no yet necessary to establish urban freight consolidation centres, it may be reasonable to make a provision for future implementation. When road infrastructure reaches a critical degree of loading, the transport industry has reached the right degree of maturity and professionalization, or the necessary funding will be available, consolidation schemes are then much easier to implement. Such provision will have to be integrated in the spatial planning process, *e.g.* via Land-banking. This is a practice, whereby a certain amount of public space is reserved for special future requirements when a certain city area is developed, or when an infrastructure project is implemented. From the perspective of urban freight transportation, it would be essential to make provision for two different kinds of installations: Waiting areas for trucks, and the above mentioned distribution centres.

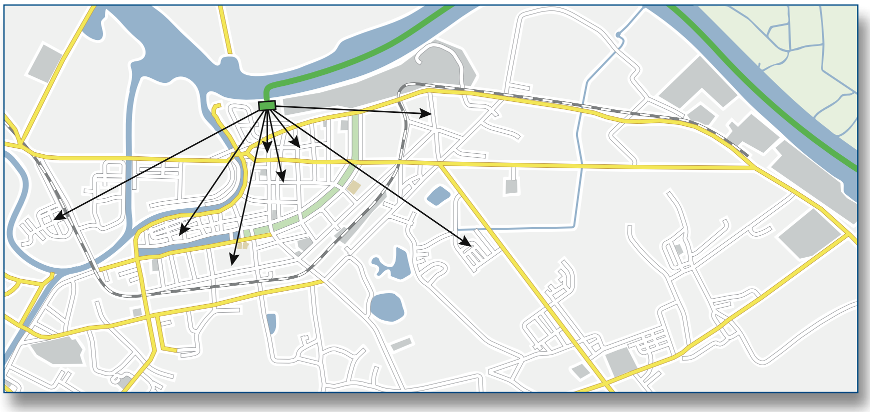

Figure 32
Portside intermodal load consolidation.
Graphic by Bernhard O. Herzog

Waiting areas for trucks before entering the restricted city access zone

If not already the case today, it may become necessary at some stage to close certain high density areas for daytime delivery. Long term truck parking is then a major issue for urban areas. Wherever time period specific access restrictions are in place, large numbers of trucks will need parking while waiting for the time window which allows inner-city deliveries. Such

Box 13: Bologna Freight Village

In the heart of an important economic/manufacturing area, crossed by five major railway lines and four highways, Bologna serves as an essential national and European hub for merchandise transit. The city is located at the crossroad of the north-south highways, on which is moved 35 % of the merchandise that comes through Italy and 16 % of the continental traffic, depending on the constantly increasing traffic flows.

12 km from the city centre lies one of the largest Freight Village in Europe, an intermodal logistic complex, rail and roadway infrastructure, equipped to handle the transit of goods both at a national and international level. This 2,000,000 square metres area, 350,000 of which indoor, sees a daily movement of about 5,000 heavy trucks. Directly accessible from the A13 Bologna-Padua Highway, it is crossed by 7 km of railway structures covering 650,000 square metres. 100 domestic and international companies operate within the Freight Village, including transportation companies, custom officers, warehouses, a service station and carwash, post office and several restaurants and snack bars.

(Source: Promo Bologna, 2010)

Figure 33
Guarded truck parking area in Bologna.
Photo by PTV, Bologna, Italy

parking areas could obviously also be used for distribution centre functions. Few municipalities have yet provided organised truck parking lots, but several private guarded truck parking yards have been launched.

An essential point for waiting areas is the provision of electrical power supply for temperature controlled vehicles. Otherwise, trucks have to keep their engines running to operate the air conditioning necessary for certain goods, which negatively affects GHG emissions and local air quality.

Spaces for the installation of urban logistics distribution centres

It is likely that at some point in the future city delivery conditions will become so restrained, that operators are either voluntarily going to use load consolidation schemes, or that it will become necessary to enforce this practice by public intervention.

It is of utmost importance to plan such centres in appropriate locations. Freeway access and ample space are only two major preconditions. In order to prevent what is called "logistics sprawl", with negative effects on overall kilometrage generation, the logistics establishments must be placed in immediate vicinity of their respective catchment areas. This means that the distance between the consolidation centre and the inner-city delivery area must be kept as short as possible. This means in most cases that relatively expensive land close to the inner city will have to be earmarked for this purpose.

More details on land use planning in the urban transport context can be found in GTZ *Sourcebook* Module 2a: *Land Use Planning and Urban Transport*, http://www.sutp.org

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3.4 National Development Policy and Legislation

Legal framework

One of the first prerequisites for a coherent policy implementation on a metropolitan level is the passing of adequate legislation on the national or provincial level. Many of the base conditions for a safe and efficient urban freight transport operation are determined here. For example, National Highway Codes or Road Transport Codes, regulate road vehicle dimensions, admissible weights and technology

Box 14: How national legislation and regulation can affect urban transport

- **Small vehicles receive preferential treatment due to lower taxation, emission standards, fuel taxation, drivers licensing, etc. (or due to difficult access to finance for larger/newer vehicles)**:

  Result: Large numbers of small vehicles clog up inner city streets, while fewer and larger vehicles could alleviate congestion and added pollution.

- **No functioning vehicle inspection system is in place**:

  Result: Frequent breakdowns of commercial vehicles in bottleneck situations cause regular blockages and congestions.

- **Driver training and licensing system is not working efficiently**:

  Results: Frequent accidents cause excessive congestion. Parking manoeuvres take more time than necessary. Additional orientation traffic is generated (see Chapter 2.1.5).

- **Road traffic taxation is low and not covering for the social costs of road usage**:

  Result: Unnecessary and inefficient trips are generated, load factors are low.

- **Emission standards missing, too lenient or not enforced**:

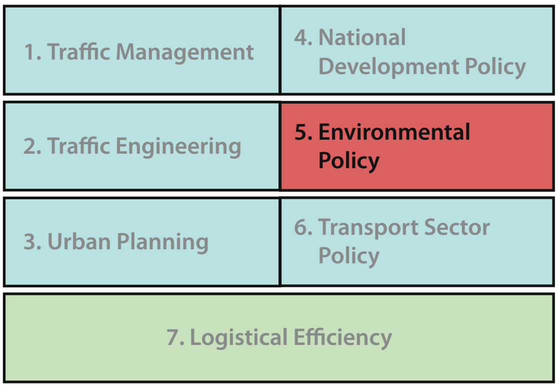
  Result: Air quality suffers more than necessary.

requirements. Vehicle registration fees, taxation, driver training and licensing, as well as the vehicle inspection regime are usually also determined on a national level.

A national transport policy should generally address issues like fleet mix and vehicle sizes. An example would be to eradicate two-stroke engines in traffic altogether, due to their undesirable effects on air quality, or to design tariffs on vehicle imports with economic and ecologic efficiency in mind.

Box 14 provides some examples on how national legislation and regulation can affect urban transport.

National and provincial legislation should allow for local governments to impose their own access restriction, local vehicle licensing and taxation schemes.



3.5 Environmental Policy

High priority should be placed on the improvement of the environmental performance of the national vehicle fleet, with special focus on those vehicles being stationed in or entering the urban territory. Generally, agencies like the ministry of transport can influence the levels of pollution caused by the national vehicle fleets. The following measures could be considered:

Introduction of fixed or progressive emission standards

- Introduce minimum emission standards for all road vehicles being imported or for new registration. These standards can be tightened over time, in line with the modernization of the national fleet.
- Introduce regular vehicle inspection or extend the programme of the existing inspection in order to ensure testing and enforcement of the legal emission levels.
- Introduce minimum standards for the existing fleet, thereby forcing low performers out of operation.

Push and pull measures

- Apply selective road taxation, giving preference to low emission vehicles (*i.e.* lower tax burden for more eco-efficient vehicles);
- Tighten up the vehicle inspection regime for vehicles in high emission classes.

Deployment restrictions

- Introduce stricter standards for urban operation as opposed to the national/provincial legislation, *e.g.* through access restrictions on high emission vehicles for the entire urban area or for specific environmental zones (see Chapter 3.1.4) Impose time-window related restrictions;
- Sell access permits at selective prices, according to the emission standard fulfilled.

Tightened vehicle inspection regime

- Introduce adequate vehicle inspection intervals with emission testing;
- Introduce mobile roadside truck inspections with emission testing.

For developing countries, it is obviously not possible to renew the national vehicle fleet within a short time span. Even retrofitting an ageing fleet with emission reducing technology is a costly and time consuming operation. A pragmatic solution may be to leave the provincial and national emission standards at a level which can be fulfilled by older vehicles, but clamp down on vehicles stationed/registered in the urban area or entering the urban areas regularly.

Of course, this increases administrative efforts. However, comparatively simple and mature solutions are on hand, consisting mainly of the sale of a specific permit, based on the technical vehicle characteristics, valid for a certain period of time.

Enforcement will have to be strict and efficient, especially in the beginning of the permitting project.

Emission reduction in road vehicles is not just about alternative propulsion techniques. There are also strategies which can be implemented

Figure 34
Inspection performed on a Pickup.
Photo by Reinhard Kolke, Surabaya, Indonesia, 2001

in the short term, with reasonable investment. Examples are the introduction of low sulphur diesel fuel and the retrofitting of existing fleets with exhaust treatment technologies, such as particle filters.

Box 15:

The **Clean Air Initiative for Asian Cities** (CAI Asia) promotes reductions of air pollution and greenhouse gas emissions in transport, energy and other sectors by translating knowledge to policy and action.

CAI Asia began as a multi stakeholder initiative by ADB, WB and USAID in 2001. The CAI Asia Center was incorporated in 2007 as a non stock, non profit corporation in the Philippines. The CAI Asia Partnership has 170 organisational members and Country Networks exist in eight Asian countries.

In the context of environmental friendly freight solution and to support Guangzhou's efforts to improve air quality in preparation for the 2010 Asian Game World Bank and CAI-Asia implemented a pilot project aimed at improving fuel economy and reducing CO_2 emissions and air pollution from trucks. Preparations are now underway for a broader freight and logistics program in Guangdong Province and China, in collaboration with World Bank, Cascade Sierra Solutions and U.S. EPA, and making use of the US experience with the Smartway program for freight.

For further information on the Guangzhou project please go to http://www.cleanairinitiative.org/portal/node/2469

For more in depth reading on clean vehicle technologies and air quality management, reference is also made to the following GTZ *Sourcebook* modules:

- 4a: Cleaner Fuels and Vehicle Technologies
- 4b: Inspection & Maintenance and Roadworthiness
- 4d: Natural Gas Vehicles
- 4f: EcoDriving
- 5a: Air Quality Management

All modules are available free for download at http://www.sutp.org.

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3.6 Transport Sector Policy

Desirable developments, like a shift from own account transportation to third account transportation, or of a defragmentation of the transport industry, can be initiated by taking the right decisions on a political level. This mainly concerns taxation, tariff regulation or business licensing.

The fee structure for vehicle licensing and the national taxation policy is able to exert considerable influence on the development of the transport industry and logistical structures.

One of the objectives could be to assure that road transport is forced to cover most (ideally all) of the social cost and environmental damages incurred by it Following this target with persistence will foster eco-efficient transport modes such as rail or waterway.

In many countries, non-motorised transport is still an important pillar in the logistical system, especially the urban logistical system. Incentives can be introduced to maintain or even intensify non-motorised transport, *e.g.* through state-funded construction of bicycle ways and other non-motorised transport infrastructure.

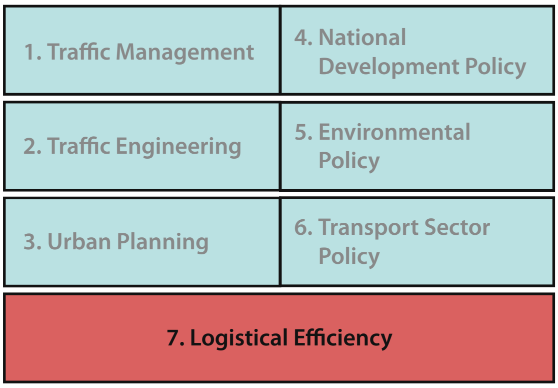
Increasing the tax burden on motorised road transport is something that will eventually not burden the transport industry, but the shippers or the product end-users. However, one of the desired side-effects of an increased cost level for road transport will be an advanced degree of transport optimisation. Shippers and carriers have numerous possibilities to optimise and streamline their operation, if forced to do so by higher tariffs. This includes:

- Use of logistically efficient packaging;

- Increase in the size of the consignments;
- Increased vehicle load factors;
- Increased vehicle utilization rates.

Shippers, carries and logistics operators are well able to tap these potentials if given the right incentives in the form of higher factor costs. This can be achieved for instance through the following instruments:

- Raising licensing fees;
- Raising taxes on vehicle importation, purchase or operation;
- Raising fuel tax;
- Raising road taxes;
- Limiting vehicle sizes and vehicle operating hours.



3.7 Improving Logistical Efficiency

Logistical efficiency is the key to the alleviation of the urban traffic and environmental problems caused by freight traffic. It aims at delivering the same amount of goods with less vehicle deployment (meaning fewer vehicles, smaller vehicles, fewer kilometres travelled).

In principle, this is the common interest of transport operators and local governments. The transport industry will work at improving logistical efficiency out of its own initiative, but the development may be too slow to offset the growing volumes of goods to be delivered.

Therefore, the public sector has to intervene in order to speed up the development process. Relevant interventions have already been shown in previous parts of this document.

The following section presents some basic principles of logistics and proposes mechanisms which can be used by private sector stakeholders to optimise their logistics operations.

3.7.1 Consolidating freight loads: The principle of cross-docking

Many long haul trucks approach a city from different origins. Generally, their loads are composed of part loads or groupage goods. This means that they are destined for different receivers.

Since it is usually uneconomical (and unecological) to send this long-haul truck to call at all the various urban drop-off points, the load is broken up at a logistics centre. Such a facility is sometimes also called distribution centre, urban consolidation centre (UCC), truck terminal or freight consolidation centre. If the centre provides the space, the collective services and the access (generally multimodal) not only for a single, but for several logistics, storage or transport operators, the appropriate term would be "freight village" or "logistics park".

Upon arrival of a long haul truck at the consolidation centre, all the goods are unloaded. They are then dispatched onto delivery vehicles operating area- or receiver specific city routes, based on the information given in the freight documentation (bills of lading, delivery notes, etc.). This process is called load consolidation or cross-docking.

Figures 35 and 36 demonstrate the systematic principle of a direct delivery versus a hub and spoke delivery via a distribution centre.

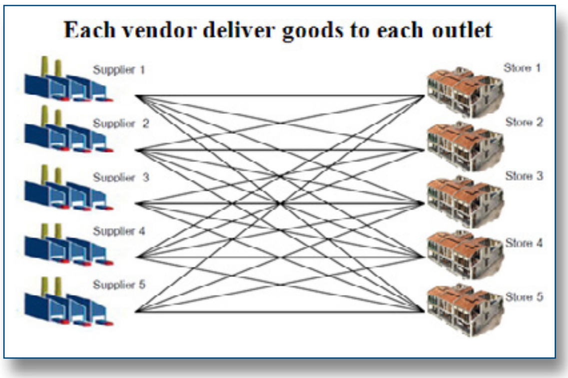


Figure 35
Traditional trade without distribution centre.
Graphic by Dr Narong Pomlaktong

- No logistical arrangement;
- Multiple trips;
- High transport cost.

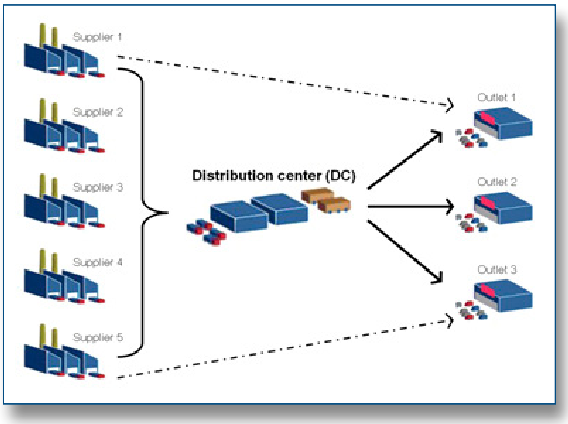


Figure 36
Modern trade with distribution centre (hub and spoke).
Graphic by Dr Narong Pomlaktong

The inner workings of a freight consolidation centre can be seen in Figure 37. Each cross-docking facility typically consists of a receiving side and a dispatching side. Long haul vehicles dock at the receiving ramp and offload. The cargo is then allocated to the respective destination routes. In the dispatch terminal, goods are then loaded onto the respective vehicles for distribution.

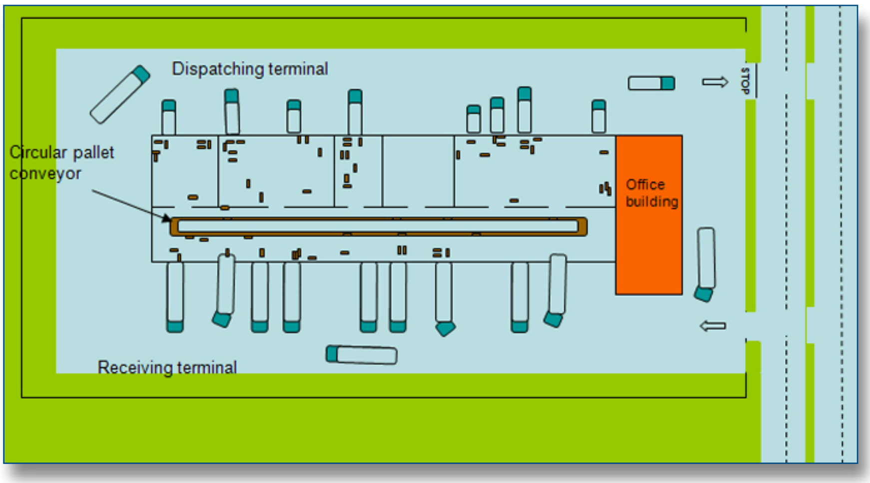


Figure 37
Typical layout of a freight consolidation centre.
Graphic by Bernhard O. Herzog

Modern facilities have a circular pallet conveyor, running between the receiving and dispatching terminal to facilitate the cross-docking process. This conveyor resembles a bag carousel at airports, represents the heart of the terminal operation and performs the core hub function.

The actual loading of the delivery vehicle can be organised to save time during the off-loading in the city area: The boxes for the first calls on the run are placed closest to the tailboard, those which will be dropped off later on, deeper into the vehicle. This principle is called "drop-oriented loading".

The daily optimisation of the city routes and the efficient loading of the transport vehicles can be supported by adequate transport planning software tools.

The private sector has always operated terminals of this kind. Since 1990, many European cities have initiated additional public or at least pan-operator terminals (operated by more than one carrier) and have given them substantial support. Some of these projects have a multi-modal functionality and are organised in the form of a logistics park. In such a co-operation, the public sector provides the necessary land. The various logistics providers rent space within the terminal for their cargo handling or storage operation. Almost all the schemes which have received public support were organised in the form of public-private-partnerships (PPP).

However, not all of these public initiatives have developed successfully. In some cases, the use of the urban consolidation centre has proofed to be not commercially viable for the operators. They would therefore not adopt this model for the major flows of goods, unless forced to do so by accompanying measures such as selective truck bans or fiscal incentives.

Nevertheless, many publicly supported consolidation schemes are up and running successfully all over Europe, North America and in some Asian cities. Selected successful examples include:

- The logistics park in Bremen, Germany ("GVZ") is covering an area of approximately 5 square kilometres, hosts 135 logistics and trade companies and employs more than 5,000 staff altogether. It features a truck-terminal, a container-terminal, warehousing and goods handling. Other services including: gasoline stations, truck services, customs, restaurants.

  For further information see also the following links:

  - http://www.eltis.org/study_sheet.phtml?study_id=137&lang1=en;
  - http://www.gvz-org.eu.

The consolidation centre in La Rochelle, France: The project, running since 2001, is considered one of the most successful consolidation centre schemes. It combines several measures:

- Creation of an urban loading/unloading platform;

- Use of electric vehicles for city centre deliveries;
- Accompanying measures (ban on heavy trucks, subsidies for operation).

Since the end of the trial stage in 2003, the project is continued with ongoing support from the local authorities. A gradual reduction of direct subsidies is envisaged (Source: Dablanc, 2010).

In most cases, the practice of load consolidation saves the operators substantial cost and time. The only disadvantage is the fact that each load has to be handled four times: Loading at the point of origin – unloading at consolidation centre – loading at consolidation centre – unloading at the receiver. For direct delivery, only two handlings occur (load at the point of shipper – unload at receiver).

The following problems have to be addressed specifically:

a.) The availability of large spaces with easy highway access is a prerequisite for the operation of a freight consolidation centre. Space is needed not only for manoeuvring of vehicles, but also for the temporary stocking and internal conveyance of goods.

b.) The operation of a freight consolidation centre is sophisticated and requires complex, well established processes. Only professionalized transport operators or dedicated logistics centre operators seem to be able to handle this.

c.) To make a freight consolidation centre really useful for the needs of a city, it should be a pan-operator setup. This means that all or most of the major logistics companies who operate in the inner city area are represented in this centre. Of course, this implies a certain degree of industry concentration, but also a preparedness to collaborate within the framework of a logistics chain.

In a pan-operator setup, the whole terminal will be subdivided into the individual operator sections. Often, the receiving end is public domain and accessible to any long haul operator. The dispatch end is operated individually by the distribution operators. Costs arising from the public domain part of the terminal are shared by the logistics operators according to rented space ratio or freight volume ratio.

Figure 38

Tri-modal freight consolidation centre in Bremen (Germany).

Photo by Dr Thomas Nobel (ISL)

It is not the objective to concentrate all cross-docking activity in one enormous facility. Due to its size it would have to be set up in a green-field location outside of the city, as shown in Figure 39. This setup is considered undesirable, because it would cause long haul traffic arriving from the opposite direction of the city to go through or around the urban centre before cross-docking can take place.

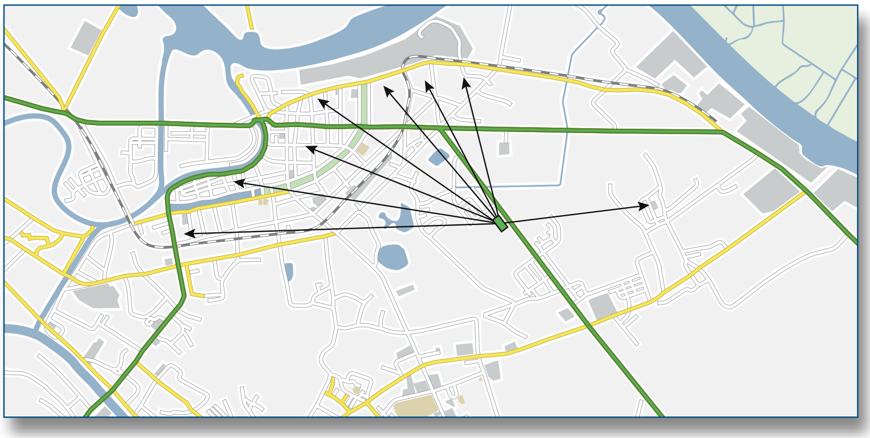


Figure 39

Single hub cross-docking facility in remote location.

Graphic by Bernhard O. Herzog

Instead, consolidation centres should be decentralised and located in the proximity of the delivery areas as far as feasible (see the related issue of Land banking in Chapter 3.3). This concept is visualised in Figure 40.

The Bangkok metropolitan area offers an interesting showcase of an efficient, publicly induced cross-docking operation. The overall objective is to ban heavy goods vehicle traffic from the city centre and certain parts of the

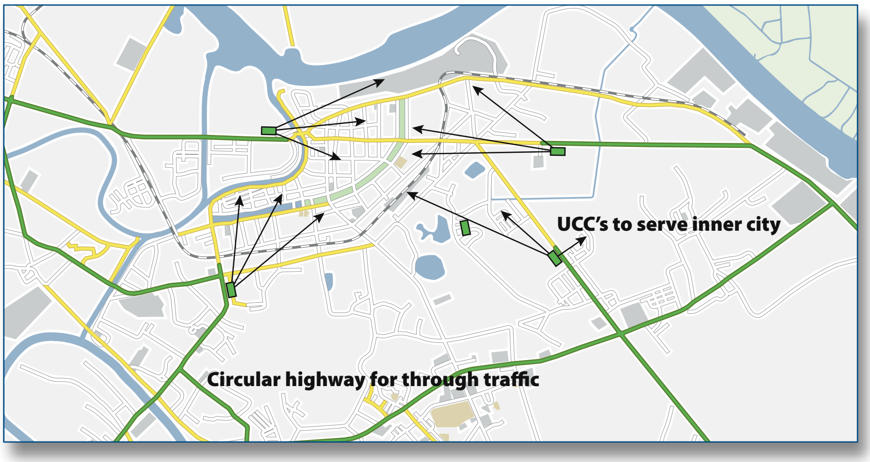


Figure 40
Multiple hub cross-docking in strategic locations.
Graphic by Bernhard O. Herzog

city. This measure is combined with the provision of public goods distribution centres (truck terminals). In order to contribute to the reduction of the total volume of large trucks flowing into urban areas, three truck terminals on the outskirts of urban areas and in the vicinity of outer ring roads have been established. They are located in RomKlao, Bhuddhamonthorn and Klong-Luang.

It is expected that the public truck terminals will come into full operation as soon as the heavy truck ban under phase 4 will come into effect. It will introduce access restrictions for heavy trucks (trucks with 10 wheels or more) within the Outer Ring Road in order to reduce traffic congestion, the number of road accidents and pollution (Source: Pomlaktong, 2010)

This project is a typical example of a public intervention into the urban logistics system which works twofold:

a.) a public cross-docking facility is made available to the transport industry, and at the same time,

b.) an access restriction is imposed for vehicles above certain size limits (in this case, anything above a 10-wheeler), so as to make cross-docking a viable option from a micro-economic perspective.

Specialised forms of consolidation centres are facilities to support urban construction projects. As outlined in Chapter 1.3, construction materials account for a significant part of urban goods transport. Instead of sending all long haul trucks unscheduled to the construction site, suppliers are sent to accessible locations nearby.

The simplest variant, which does not involve any load consolidating, is to call vehicles in by radio as soon as an off-loading bay becomes available. Another practice is to consolidate vehicle loads at a location outside of the critical inner city zone. This is done in different ways: Sometimes, the transhipment is organised informally in the public space, as shown in Figure 42.

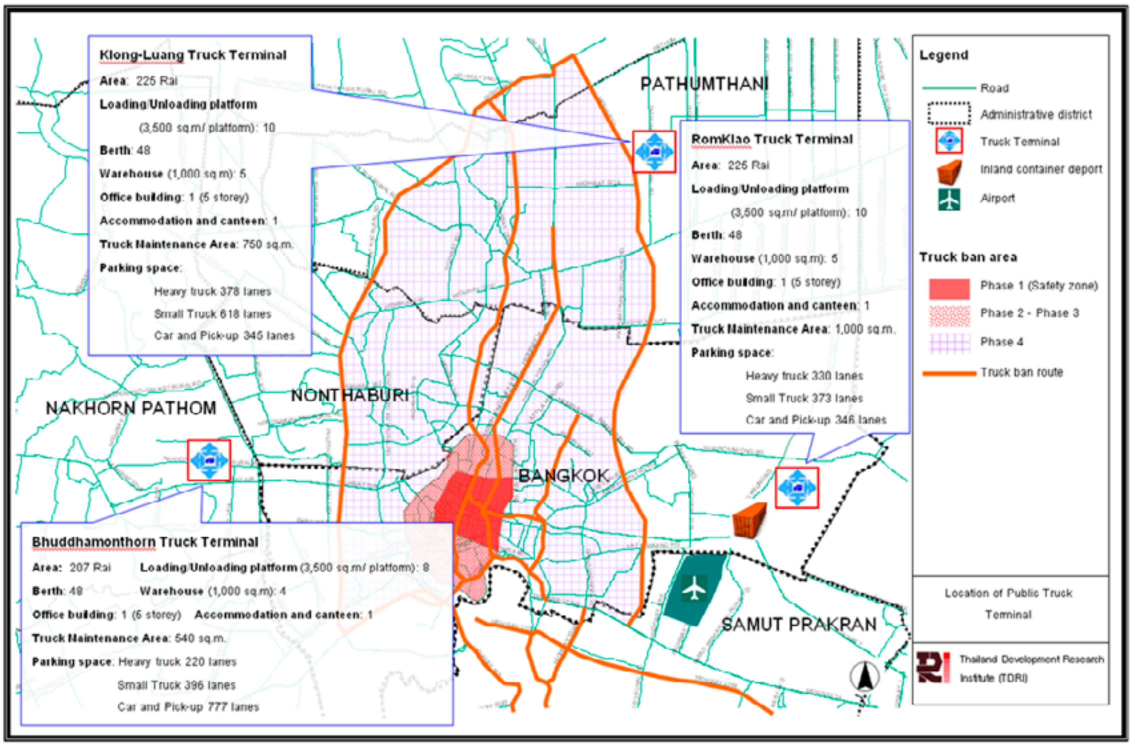


Figure 41
Location of Public Truck Terminals in Bangkok.
Graphic by Dr Narong Pomlaktong

For a more professional operation, it often suffices to have a paved space available, big enough for forklift trucks to operate between several vehicles, so as to consolidate consignments into destination specific full truck loads. This form of city logistics optimisation is often not an organic development born out of private industry necessities. Typically, a city was forced to impose tight restriction on off-loading in order to prompt the industry to organise logistically efficient solutions

If construction material load consolidation is done on a permanent basis, the likely setup is a closed shed, built at the height of a vehicle load floor, with vehicle docking bays on at least two sides of the building, so as to enable horizontal transhipment of palletised material.

Figure 42
Informal distribution centre for bricks.
Photo by Eduardo Betanzo, Querétaro, México, 2006

Box 16: Building Material Consolidation Schemes in Europe

Some cities, such as London and Stockholm in Europe, have initiated building material consolidation schemes. The London Construction Consolidation Centre (LCCC) was implemented in 2006 with funding from Transport for London (GBP 1.85 million) and private investors (GBP 1.35 million). A 2007 assessment showed that the scheme achieved a 68 % reduction in the number of vehicles and a 75 % reduction in CO_2 emissions. In addition, the number of failed deliveries decreased significantly. Deliveries from the LCCC to sites achieved 97 % delivery reliability (*i.e.* 97 % materials of the correct type and quantity were delivered within 15 minutes of the scheduled time). The standard achieved without use of a consolidation centre is 39 %. Other advantages included greater delivery flexibility, as companies can order smaller quantities for each site while suppliers can send full loads to the LCCC.

(Source: Dablanc, 2010 and TfL, 2009)

Figure 43
The LCCC in South Bermondsey (London).
Photo by Transport for London (TfL), South Bermondsey, United Kingdom, 2009

Figure 44
Inside the LCCC.
Photo by Transport for London (TfL), South Bermondsey, United Kingdom, 200

3.7.2 Delivery Performance and Route Efficiency

Even in the presence of distribution centres it is still possible that the delivery truck will have to travel long distances through the urban space between dispersed delivery points.

Additional effort is thus required to optimise the delivery route structure itself. A good quantitative measure of the efficiency of a logistical setup is the "delivery performance". The delivery performance expresses the amount of cargo (kg, sometimes m^3) delivered on average per hour.

An efficient route planning process can optimise this parameter. This involves:

a.) making sure that the right drop-off points are grouped into one run,

b.) giving the driver guidance on how to optimally do his work, *i.e.* provide adequate documentation on sequence and geographic location of drop-off points, and

c.) allowing for a drop-oriented loading of the vehicle (as discussed in Chapter 2.7.1).

However, on a strategic level, the most important parameter for the realization of a high performance urban logistics system is the so called "drop density". The drop density can be measured by the average distance travelled to effect one drop, or conversely, by the number of drops effected per kilometre travelled. In a very fragmented market, which is typical for developing cities, it is difficult for one operator to contract enough cargo in one neighbourhood to achieve a high drop density. Most likely, he will be forced to plan dispersed delivery routes as shown in Figure 45.

In order to optimise the logistics efficiency of this operation, it would be necessary establish delivery routes with a higher delivery density (less km and time per drop), as shown in Figure 46. The following chapter proposes an efficient way of achieving this goal.

Figure 45
Dispersed delivery routes.
Graphic by Bernhard O. Herzog

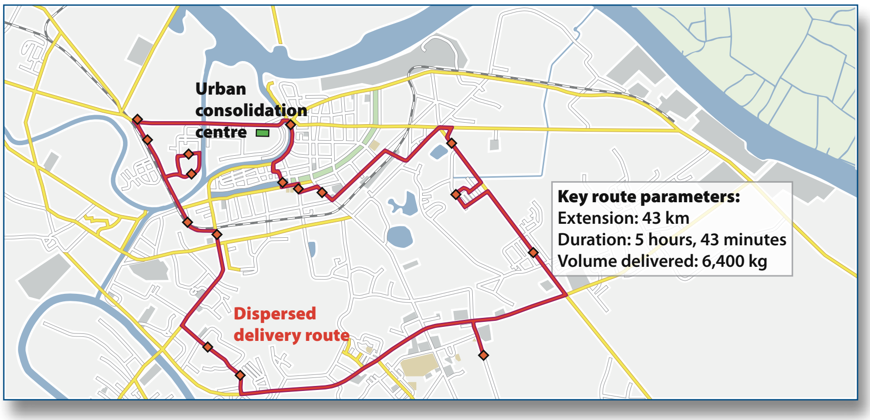
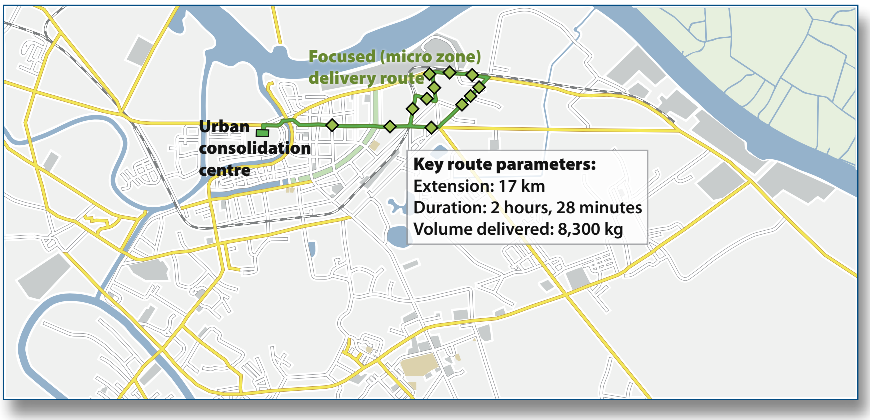


Figure 46
Focused delivery routes.
Graphic by Bernhard O. Herzog



3.7.3 The concept of a district logistics provider/micro zone delivery

The inner cities or local city sub-centres are a place of intense logistics activity. Between 20,000 and 30,000 deliveries and pick-ups per km^2 per week can be expected in a middle or high income economy (Source: Dablanc, 2010 from LET). This figure includes courier and express transactions.

It is therefore beneficial for cities to promote a situation in which each city area has one or several preferred service providers, referred to also as district logistics providers. This can be done by concessioning providers for certain delivery areas only or by introducing regionally selective access licensing.

The innovative concept of district logistics is also referred to as "micro zone delivery. It has a huge potential for increasing logistics efficiency, and its implementation in cities with bad traffic problems is quite realistic.

Micro zone business communities could join forces to organise a high efficiency and low cost delivery system to their block or street section, using just one logistics service provider. The goal is to have region-specialized providers who can work with a high logistical efficiency, due to improved drop density.

A practical example could work like this:

- Micro zone business communities (*e.g.* a number of neighbouring businesses) have appointed their specific district logistics service provider who is operating a proprietary consolidation centre or is rented into an urban freight consolidation scheme/logistics park.
- The members of the district business community now instruct their suppliers to deliver to the local consolidation centre of the appointed district logistics provider.
- The district logistics provider receives the consignment at his premises, breaks them up and groups them into fixed delivery runs, from once a week to twice a day. This will resemble a goods shuttle operation with fixed delivery time windows. Thus the logistics chain will become more predictable. The shuttle will also take care of reverse logistics (remissions, pallet returns, possibly even plastic and paper waste removal).
- If the infrastructure allows, deliveries can be done by trolley/hand-stacker from one or a few central unloading stops, thus combining the micro zone delivery scheme with the vicinity unloading concept (see Chapter 3.2.2).
- When receiving goods, shop owners will deal with one business partner only, preferably they will be served by the same driver every day. In a relationship of trust, receiving procedures could possibly be organised more creatively and be simplified. The “unattended delivery” could become common practice, whereby counting and checking would not have to take place during the delivery process, but say within 24 hours after delivery. In order to enable out-of-hours deliveries, the driver might receive keys for lockable assigned storage places with outside access.
- In a further development stage, retail businesses could have their buffer inventory stockholding contracted in the district logistics provider’s depot, instead of using expensive uptown shop space.

For the implementation of a district logistics scheme, the availability of urban logistics centres is certainly an advantage, but is not absolutely a prerequisite.

Box 17:
What is a “hub-satellite system”?

In logistics terms, one speaks of a hub-satellite-system if load consolidation from all origins is effected in a “hub”-distribution centre, from where all destinations are served. The “satellite” centre is a local establishment, which consolidates for local distribution.

In a sense, the urban distribution concept presented in this handbook is a hub-satellite setup, with the hub being an urban distribution centre, which breaks up the loads into district-specific runs. These deliveries are referred to with the term “last mile”. Ideally, there is only one run to each micro-zone in the city.

When the delivery vehicle pulls into the assigned micro-zone, the “satellite” operation begins. This could be referred to as being the “last yard” of the transport chain. Depending on local circumstances, the truck will now go down one or several street blocks and make the various deliveries. In some cases, it will even be possible to use one loading bay only, and distribute the various consignments by trolley or cart, as is described in Chapter 2.2.3.

3.7.4 How information can reduce traffic volume

Another complex issue, which shall be briefly be mentioned in this document, is the supporting of logistics processes through information.

Virtual container yard

Port cities with their gateway position nearly all suffer from the heavy goods traffic generated by the harbour. Containers are transported from the harbour to receivers in the industrial areas within the conurbation or in the hinterland, causing detrimental cross-town transport flows. After unloading, the empty containers then have to be channelled back into the system in order to be reused for outgoing sea transportation.

Today, this is done by moving the empties back to either an off-dock container depot, or, as is mostly the case, the marine terminal itself. The containers then are stored until redeployment. When it is to be used again, the box is moved empty once more to the site of the exporter/shipper to be filled with goods.

This setup is logistically inefficient and it exacerbates the strain on the urban transport infrastructure. The Southern California Association of Governments is working on a scheme to promote the direct transfer of empty containers from the receiver to a suitable shipper, thus making two empty runs through the congested port cities unnecessary. A study has been prepared with the aim of identifying possibilities and benefits potentials ("Empty Ocean Container Logistics Study" by The Tioga Group, 2002).

The concept developed promotes an internet-based real time information exchange to facilitate the organisation the direct exchange of empty containers between road carriers. It is also referred to as "virtual container yard".

The system is an example of a system, which emerged from the region. Today, more than 40 terminals in Southern California participate in the so called eModal portal. In Southern California alone, roughly 2 million sea containers are moved empty from inland destinations back to portside locations annually. If only 10 % of this number could be converted into a street interchange system, about 400,000 truck movements per year would become obsolete.

Other tools

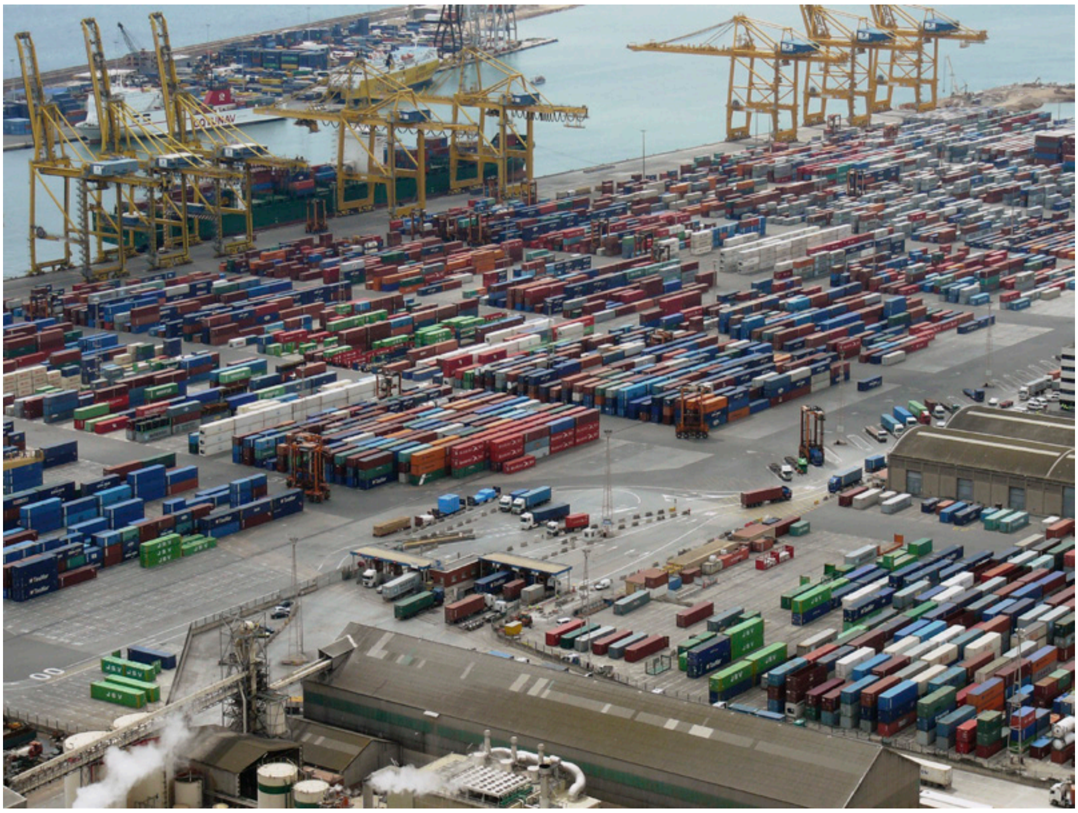
A number of other tools based on providing better information for more efficient urban logistics are available. They generally rely on modern information and communication systems.

One of these concepts is that of a "freight exchange", helping to reduce empty runs and to increase the average load factor. Generally, a freight exchange is run in the form of an internet based platform with protected access for shippers and carriers. Shippers post their shipments to be effected and carriers apply for the assignments or bid rates for the specific runs.

For detailed information, see http://www.timocom.co.uk

In addition, route planning and scheduling applications can assist considerably in the optimisation of the urban drayage operation and can easily improve logistics efficiency by 10 or 20 % if applied correctly. GPS-tracking helps control the movement of goods vehicles on a company level and on board navigation is also becoming more and more common, even in the transport sector of low-income countries. They can contribute to the reduction in orientation traffic.

Figure 47
Container Terminal.
Photo by Stefan Belka, 2010



For detailed information on how information systems can support urban freight management, see the following GTZ *Sourcebook* module:

- GTZ *Sourcebook* Module 4e: *Intelligent Transport Systems* http://www.sutp.org

4. Implementation aspects

Most of the measures outlined in Chapter 3 rely heavily on a close cooperation between public and private players for implementation. The third part of this module is dedicated to this underlying topic.

The demand of co-operation between public and private stakeholders varies. Measures concerning infrastructure planning, traffic engineering or traffic management can be implemented on the basis of a political or planning decision, even though an intensive dialogue with the stake holders is always advisable.

Another category of measures, such as the cross-docking and district logistics concepts, require the strong cooperation of the business community and the logistics operators. The public sector merely takes the roles of a coordinator or regulator. Here, the decisive issue is the dialogue and interaction between private sector and public bodies.

Some of the key questions to be answered in the following sections are the following:

- How can policy measures support the development of a sustainable urban freight system?
- How can the private sector be persuaded to implement certain measures?
- Which policy instruments are available?
- How can public awareness be raised?
- How can the course of the spontaneous development be corrected by means of regulation, intervention or incentives?

4.1 City logistics: a public-private challenge

4.1.1 Actors and their roles in urban logistics

In contrast to many forms of urban passenger transport, urban logistics is primarily a commercial, market-driven activity. Hence, the issue involves other and more stakeholders.

In the public sector, national, provincial and municipal authorities are concerned. On the side of the private industry players, three interest groups are relevant:

- Shippers (*e.g.* manufacturer of goods), located in the city and outside the city;
- Receivers, private, commercial or industrial;
- Transport operators and logistics service providers.

In most cases, the shipper arranges for the transportation of goods. He may either chose transport operator or delivers the goods with his own vehicle fleet (a so-called proprietary fleet). If shippers contract a transport operator, they do not usually want to be involved in the logistics details of the delivery and leave that up to their service provider. If they deliver the goods in their own trucks, their perspective is pretty much that of a transport operator.

Figure 48
Dedicated delivery truck, operating for a third party logistics company.
Photo by PTV

The goods receiving community, especially the inner-city retail businesses, is the group most affected and most interested in urban logistics issues. This group may be approached first to gain private sector for urban transport policies and initiatives. Moreover, shoppers, residents and the general public are affected by urban freight transport planning issues as well and should be involved as far as possible in the decision-making process.

The next section outlines the different goals of actors involved, and investigates whether their interests clash or actually converge.

4.1.2 Stakeholder interests

In most cases, the shipper contracts a logistics provider to deliver the goods to a specified receiver in the urban space. In turn, the transporter may contract sub-service providers to perform the delivery.

The receiver hardly ever enters into a contractual relationship with the transporter. His speaking partner is the vendor/shipper. Hence the receiver in the urban space has got little influence on how exactly the goods are delivered in the city centre.

Finally, the interests of the urban public primarily concern the availability of infrastructure and the quality of urban life. Shoppers and residents, both part of the urban public, have additional specific interests.

The goals and interests of the various groups involved are summarized below.

Shipper:	Expects reliable and low-cost delivery;
Transporter:	Is forced to cut operational cost wherever possible;
Receiver:	Expects prompt and reliable delivery, even in small quantities; Desires an urban environment free of traffic congestion and disturbances, so as to attract more prospective clients;
Shoppers:	Are attracted by easy access, availability of parking and a leisurely atmosphere;
Residents:	Expect low noise and low GHG emissions;
Urban Public:	Demand affordable road infrastructure, preservation of historic buildings,control of emissions and congestion.

4.1.3 City and city logistics providers: where do interests clash?

The two interest groups who seem to have a high potential for conflicts of interest are the transport operators and the city community. In their plight to deliver at the lowest possible cost, transport operators and logistics providers often counteract the cities' efforts to provide an attractive and undisturbed urban space. However, these operators are key actors to improve the efficiency of urban logistics. To understand the motivation of this interest group, a quick look at some economic principles of urban transportation is helpful.

Based on the principle of profit maximization, it is obvious that revenues have to be maximized while costs must be minimized. In an urban delivery setup, the main revenue drivers are:

- Number of drops;
- Delivery volume.

By increasing the number of drops on one route, the delivery volume usually also increases. In a delivery operation, the route planners design routes so as to make them operable in one shift, which means that a driver with his vehicle can do all the deliveries without returning to the depot.

The vehicle size to be chosen ideally corresponds to the resulting delivery volume. If the one-shift-adequate route results in a larger volume than the vehicle can accommodate, a larger vehicle size is chosen or – if this is not possible – the shift is broken down into two or more runs with intermediate depot calls.

The number of drops the delivery team can perform during a given period of time (*e.g.* one hour) depends on the geographic distribution of destinations. The ideal situation is to have all calls within a small area. This can be achieved if the operator commands a high market share or has a strong local focus, both resulting in a high delivery density and high logistical performance (see Chapter 3.7.2).

Table 4: Vehicle classes: capacity, emissions and operating costs (typical/average parameters, costs calculated at low cost country factor prices)

Vehicle Category	Van	Light Delivery Vehicle	Medium Sized Truck	Heavy Duty Truck	Truck and Trailer
Gross weight kg	3,500	7,500	15,000	24,000	40,000
Payload kg	1,600	4,400	10,500	17,500	30,400
Load capacity m³	7.34	32.86	51.93	60.44	98.83
CO_2 g per m³ and km	33.36	11.03	12.04	13.24	11.13
Operating cost per m³ and km	0.79	0.25	0.22	0.25	0.17
Operating cost per ton of payload and km	3.65	1.85	1.09	0.85	0.55

Table by Bernhard O. Herzog.

An additional important factor determining the vehicle delivery performance is the amount of congestion encountered in the delivery area.

On the operating cost side, the main performance drivers are:

- Size/tonnage of vehicle deployed;
- Kilometrage incurred;
- Time consumed.

In his own best interest, the operator will choose a vehicle size which is suitable for the delivery task on hand. Table 4 shows that the operating costs as well as GHG emissions per cubic metre of loading capacity are decreasing with an increase in vehicle size.

Provided that a reasonable load factor can be reached, operators tend to employ the biggest vehicle size adequate given the conditions of infrastructure and traffic situation, which is generally the most eco-efficient solution, too. The operator will also try to reduce the kilometrage incurred and the time consumed for the delivery operation.

Table 5 summarizes the result: A professional optimisation of the logistics operation of each individual logistics provider will usually also improve the situation with respect to the problems caused by urban freight traffic as laid down in Chapter 2.2. There does not necessarily have to be a clash between community and private transport operator interests. Supporting favourable developments in the logistics industry and company driven changes, instead of resorting to regulatory interventions, also saves the administrative costs associated with enforcement of the latter.

Table 5: Logistics operators' objectives largely coincide with socio economic goals

Logistics operator optimisation objectives	Effect on socio-economic parameters
Deploy appropriate vehicle size	■ Reduced road space usage
Minimize kilometrage	■ Reduced GHG and noise emissions ■ Reduced congestion
Minimize time consumption	■ Reduced road space usage ■ Reduced congestion

Table by Bernhard O. Herzog

However, this statement is based on the assumption that the supply of urban retail establishments is approached in a professional delivery operation, involving the use of suitably located distribution centres, adequate vehicles, professional route planning etc.

In contrast, many metropolitan areas the inner city delivery operation is merely an extension of the long haul operation, employing typical long distance vehicles. If one would encourage the operators in this situation to divert to a broken transport with transhipment and possibly load consolidation, they will include the transhipment cost in their calculation and might possibly come to the conclusion that this is less viable for them. The next section explains what can be done in this case.

4.1.4 The chicken and egg dilemma

A freight consolidation setup causes extra cost and complications due to the transhipment

Table 6: Cross-docking in the microeconomic perspective 1: Assuming an individual trucking company will change to cross-docking out of own company initiative

Example: Cost involved in the delivery of a 12 ton truck load to 19 drop-off points			
Before	**time (hours)**	**km**	
City delivery run with heavy duty vehicle (HDV)	9.6[a)]	145.0[a)]	
Cost structure (USD per unit)	30.0[b)]	0.3[c)]	
Total costs (USD)			**331.50**[d)]
In cross-docking situation	**time (hours)**	**km**	
Cross-docking handling costs (USD)			145.00[a)]
Light delivery vehicle 1	3.1[a)]	63.0[a)]	
Light delivery vehicle 2	4.8[a)]	59.0[a)]	
Light delivery vehicle 3	2.7[a)]	33.0[a)]	
Sums	10.6	155.0	
Cost structure (USD per unit)	17.0[b)]	0.12[c)]	
Total cost delivery (USD)			198.80[e)]
Total costs (USD)			**343.80**

Graphic by Bernhard O. Herzog

a) assumed values
b) assumed fixed costs per service hour
c) assumed variable costs per km
d) (9.6 × 30) + (145 × 0.3) = 331.50
e) (10.6 × 17) + (155 × 0.12) = 198.80

procedure. If such an individual operator in isolation chooses to introduce a cross-docking operation, this operator will have to bear the additional cost of transhipment without being able to reap the benefits of a relieved traffic situation, as shown in Table 6.

Conclusion*: Change from a direct transport in a congested environment to a broken transport in a congested situation: Not interesting*

However, if cross-docking became mandatory for all operators, the additional cost are offset by the advantages of a smoother flow of traffic, leading to savings in time and fuel (see Table 7).

Conclusion*: Change from a direct transport in a congested environment to a broken transport in a free traffic flow situation: Yes!*

Even though an external impulse is necessary to change private transport sector operation, the end result is beneficial to everybody, including the general public, other traffic participants and the transport operators themselves.

4.2 Public-private dialogue: condition for joint action

4.2.1 Involving relevant stakeholders

The success of any measure taken to improve urban freight transportation depends on the widespread acceptance by the stakeholders and the public. This applies for basic measures such as access restrictions as well as advanced concepts such as consolidation centres.

It is therefore essential to institutionalize a consultation process and seek an intensive dialogue with all parties who may be involved in or affected by an individual measure. For public-private dialogue, Figure 49 outlines the recommended sequence:

Table 7: Cross-docking in the microeconomic perspective 2: Assuming that cross-docking will become mandatory for all operators and congestion will be alleviated

Example: Cost involved in the delivery of a 12 ton truck load to 19 drop-off points				
Before	**time (hours)**		**km**	
City delivery run with HDV		9.6[a]	145.0[a]	
Cost structure (USD per unit)		30.00[b]	0.30[c]	
Total costs (USD)				**331.50**[d]
After introduction of mandatory cross-docking resulting in a 30 % decrease in congestion, translating into a 17 % reduction in trip times	**time (hours)**		**km**	
Cross-docking handling costs (USD)				145.00[a]
	(Values from Table 6)	*(Values resulting from mandatory cross-docking)*	*(Values from Table 6)*	
Light delivery vehicle 1	3.1[a]	2.573	63.0[a]	
Light delivery vehicle 2	4.8[a]	3.984	59.0[a]	
Light delivery vehicle 3	2.7[a]	2.241	33.0[a]	
Sums	10.6	8.798	155.0	
Cost structure (USD per unit)		17.00[b]	0.12[c]	
Total cost delivery (USD)				168.47[e]
Total costs (USD)				**308.86**

Graphic by Bernhard O. Herzog

a) assumed values
b) assumed fixed costs per service hour
c) assumed variable costs per km
d) (9.6 × 30) + (145 × 0.3) = 331.50
e) (8.798 × 17) + (155 × 0.12) = 168.47

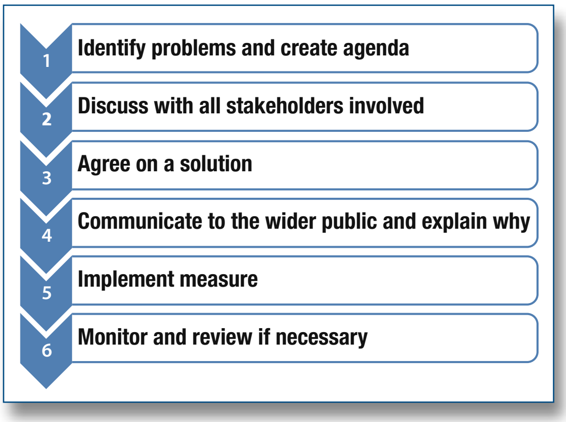


Figure 49
The six steps of a public-private dialogue.
Graphic by Stefan Belka, 2010

In the United States, the concept of TMA (Transportation Management Associations) is an established instrument for public-private dialogue concerning transport matters.

Transport Management Associations (TMAs):

- Are public-private partnerships that address localized transport-related issues;
- Operate under a variety of organisational structures and are funded through membership dues or some combination of other sources;
- Provide an institutional framework for travel demand management programmes and services;
- May link the local business community and public institutions.

Box 18: European Freight Partnership

The European Civitas Initiative promotes the dialogue and supports the implementation of various projects ranging from energy efficient, clean, environmentally friendly and sustainable transport issues in different cities in Europe.

Based on the experiences of La Rochelle the main action is to develop the strategic planning for city logistics. This will also lead to the definition and mapping of freight zones. Furthermore this will be accompanied by the establishment of a Freight Forum for Preston and South Ribble, to share best practice and the elaboration of Freight Quality Partnership for central Preston.

(Source: Civitas, 2009)

Similar public-private exchange forums are in place in the United Kingdom (called freight quality partnerships) and in other countries. The idea is to define a circle of knowledgeable and concerned persons, representing the various interest groups with a fixed membership, to discuss all issues on the agenda in periodic meetings.

This public-private consultation process can be intensified through the use of a metropolitan freight portal on the web. This portal can help to disseminate information and so to intensify the public dialogue.

4.2.2 Capacity building

Especially when the local transport industry is fragmented with many independent players, it is sometimes difficult to establish an effective dialogue. Here, the road transport associations or other professional bodies can take up the role as a valuable mediator.

Training and capacity building activities are something:

- which the operators are normally very interested in,
- the associations are able and willing to organise,
- the municipal or national institutions assigned with the optimisation of the urban freight sector could use to convey their key messages to the sector, and
- that can contribute considerably to road safety in the urban territory, bearing in mind that accidents are a major contributor to peak hour congestion.

These messages can be brought to the operators via training workshops organised jointly by the transport authorities and the operators associations.

The main target groups are certainly the vehicle owners and the management, but employees of truck companies may also be involved.

Some topics suitable for operator/freight worker trainings are:

- Vehicle operating costs and consequences for operations planning;
- Route planning and organisation;
- Drop specific loading;
- How to reduce driver fluctuation;

- A culture of road safety: driver management and incentives;
- Load lashing;
- Start of shift vehicle inspection;
- Drivers' performance: Knowledge of basic commercial transport legislation, geographic orientation, driving and parking skills, eco driving, safety, customer oriented behaviour, basic vehicle maintenance, etc.

The objective is to raise the average operators' level of proficiency, but also to strengthen the community sense amongst the operators, paving the way for increased cooperation.

4.3 Promotion of good purchasing practice

4.3.1 Low emission vehicles: city institutions as first movers

The use of low emission vehicles for goods transport reduces GHG emissions and improves the local air quality. Cleaner technologies are available today, but generally they are more expensive than conventional technologies. Therefore, it is unlikely that operators will introduce low emission vehicles out of their own initiative. It may put them at a competitive disadvantage.

As a result, it is up to the transport authority and city traffic regulators to impose restrictions on the use of high emission vehicles or stop them from entering the urban area.. The introduction of new technology can either be stimulated by lower road taxes, by other forms of subsidisation, or by penalizing old, high emission vehicles. The implementation of these measures is fairly easy if planned carefully.

If the policy is to promote alternative fuel vehicles such as hybrid or CNG, the policy implementation may be a challenge. Often, the obstacle is a vicious circle starting with a lack of fuelling infrastructure, leading to the absence of vehicles, leading to the non-viability to invest in infrastructure.

In large cities, besides the parcel services, police and other services, the municipality or the metropolitan government are the only bodies operating large so called captive fleets. This means that the vehicles return to station after each shift where they can be refuelled. Only a large captive fleet operator is in a position to act as a first mover and invest in both alternative fuel vehicles and fuelling infrastructure. A project of this kind might well be the breakthrough for other operators, who follow once a fuelling infrastructure is available.

Figure 50
CNG propelled Ford Transit operating as a delivery vehicle for pharmacies in the greater Koblenz area, Germany.

For detailed information on this see the following GTZ *Sourcebook* modules:

- 4a: Cleaner Fuels and Vehicle Technologies
- 4d: Natural Gas Vehicles

4.3.2 Public sector role model function

Metropolitan institutions can introduce public procurement procedures with a view to adopt a contracting policy which would be desirable for all urban businesses as well. Examples of displaying a role model function are:

- Contract environmentally correct freight operators only;
- Organise the supply chain so that the majority of deliveries can be full truck loads.

A municipal government displaying role-model purchasing and supply chain management practice increases its credibility, and creates public awareness. This hopefully leads the way to better purchasing throughout the urban business community.

4.4 Promotion of the urban freight consolidation centre idea

4.4.1 How to get started

The micro- and macroeconomic benefits of the various varieties of load consolidation have been presented in detail. This section deals with the question how to make it happen.

As we have seen in Chapter 2.3, many forms of load consolidation have evolved organically, without any intervention of public bodies, such as wholesale markets and proprietary logistics centres operated by retail chains.

In the long run, a professionalized transport and logistics sector with a high degree of integration is a decisive element in promoting load consolidation practices. In the meantime, the establishment of private city logistics initiatives and cooperation schemes will be able to improve matters. Such initiatives can be supported by:

a.) making the necessary spaces available at convenient locations,

b.) providing high quality traffic access and infrastructure, and

c.) possibly offering other incentives, like offering preference for freight centre tenants when tendering district logistics provider concessions.

In order to involve independently operating private hauliers in load consolidation, or the larger operators which have not embarked on consolidation by themselves, it is advisable that municipal authorities take the initiative, preferably in close collaboration with the transport operators professional associations and the retail business community. Such an initiative is long term and involves many facets, as for instance:

- Creating public awareness;
- Involving all relevant stake holders;
- Raising funds for the implementation;
- Developing a professional operations concept.

In the European context, it has not been the municipal authorities alone who have initiated, nurtured and fostered the numerous city logistics centres in operation. There has been fundamental support from national governments and the European Union. Also, it has proved very useful to have a governing body, representing the various city logistics operations towards the public authorities and the general public.

In Germany, it is the "Deutsche GVZ-Gesellschaft" (DGG), Bremen, which is taking this role. The various German city logistics centres (see Figure 51) are not only supported, but also monitored and researched by this organisation. It serves as an important knowledge platform to ensure that lessons learned are disseminated amongst the members and interested parties.

See: http://www.gvz-org.eu

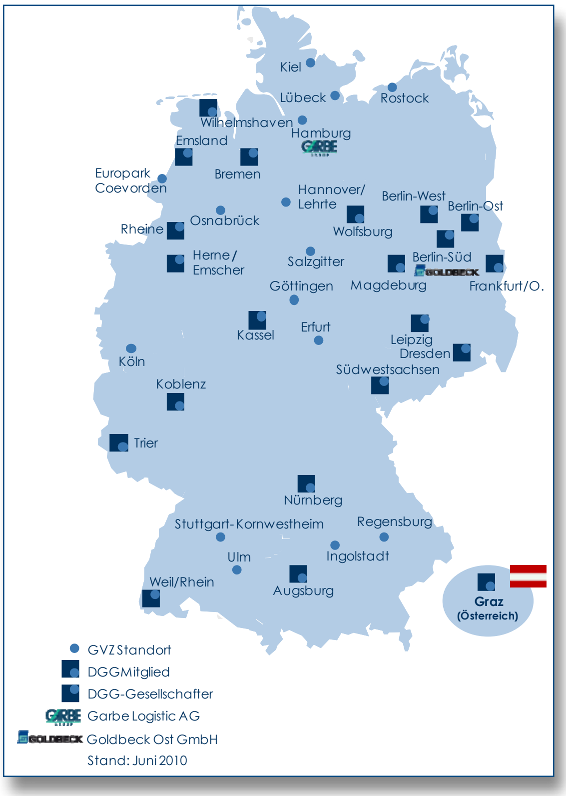


Figure 51
Locations of German Urban Logistics Centres.
Graphic by Deutsche GVZ-Gesellschaft (GVZ), 2010

4.4.2 Organisational setup of a freight centre

Obviously, there are many different varieties of a freight consolidation centre. One example of what the institutional concept could look like is presented here.

In a first step, the city provides the land for the construction of the freight consolidation centre. A consortium of private investors buys an operating concession, plans, builds and operates the centre.

A cooperative society is then founded in order to involve all stakeholders in the matters concerning the freight centre, with the operational consortium being the prime member.

The delivery operators of the city area sign up to become members of the cooperative society and rent handling space according to their needs.

The operating consortium provides the following services:

- Security and access control;
- Industrial housekeeping and facility management;
- Operation of receiving terminal and distribution to delivery terminal section;
- Operation of the central materials handling system, freight documentation, etc.

Other ancillary services may be offered on demand, including:

- Warehousing;
- Vehicle secure parking;
- Vehicle care, maintenance, fuel;
- Drivers' accommodation, restaurants, etc.

In Europe, many of the public freight consolidation centres are organised in the form of a Private public partnership (PPP).

Box 19: Public-private partnership (PPP)

PPP's describes a government service or private business venture which is funded and operated through a partnership of government and one or more private sector companies. These schemes are sometimes referred to as PPP, P3 or P3

PPP involves a contract between a public sector authority and a private party, in which the private party provides a public service or project and assumes substantial financial, technical and operational risk in the project. In some types of PPP, the cost of using the service is borne exclusively by the users of the service and not by the taxpayer.

Further information on PPP can be found in the GTZ *Sourcebook* modules including:

- 1c: Private Sector Participation in Urban Transport Infrastructure Provision
- 3c: Bus Regulation and Planning

Both of these are available at: http://www.sutp.org

4.5 Promotion of district logistics and micro-zone delivery schemes

This concept, which has been presented in detail in Chapter 3.7.3, should be considered a long-term measure due to its complexity. However, once a pan-operator freight consolidation scheme is in place, it will just be a short step to achieve the micro-zone delivery scheme. To support such a concept, three approaches are available:

- ***Convincing the local business community;***

The first option is to convince local businesses to establish their own schemes to make their shop deliveries cheaper and more reliable. The municipality might support such initiatives by providing strategically placed loading bays and by providing a high quality pavement surface between vehicle parking and shop entrance. The establishment of pedestrian zones is a further option. The main supporting arguments for the development of an urban hub/satellite logistics scheme from the view of the business community are:

- Long-haul transport ends at consolidation centre and not in narrow retail streets:

  Result: Savings in long-haul transportation cost
- City delivery is regular, predictable and efficient:

  Result: Savings in delivery cost
- Possibility to organise low-cost out-of-CBD but quick access storage with the logistics-service-provider in the consolidation centre:

  Result: Savings in warehousing possible
- ***Convincing transport operators***

Private operators who already have a high market share might decide to initiate their own micro-zone schemes. The city authorities can help this process along by providing proprietary access-controlled unloading spaces and/or reducing the city entry licensing fee.

The main supporting arguments from the operators' perspective are

- Stable, predictable freight volume and vehicle deployment schedule;
- Continuous relationship with customers (receivers);
- Reliable business for the time of the concession period;

- ***Enforcement through regulative measures.***

Finally, some more robust measures are necessary on the part of the local authorities in order to provide the momentum for change required and to "get the ball rolling".

Restrictive and selective handling of access permits:

For instance: only operators renting adequate space in the corresponding freight consolidation centre will receive access permits.

Tendering out sole delivery concessions for certain catchment areas:

For instance: Only the concessionary is allowed to deliver any load smaller than 100 kg.

5. Summary

The relevance of urban freight traffic is increasingly recognized in developed and developing cities alike. Efforts to reduce its negative impacts are driven by a wide range of motivations, which very much depend on the local context. The preservation of historic city centres and noise reduction are prevalent issues in many European cities. Most developing cities so far have focused on the contribution of urban freight transport to congestion, a problem which may indeed be considered a root cause for further negative impacts such as increased GHG emissions and detrimental effects on the local air quality.

Developing cities face numerous challenges with direct impact on the future demand and structure of urban logistics. Among them are the rapid growth of urban populations, increasing motorisation and raised standards of living, but also the dismantling of historic inner city retail structures. Some of these trends could and can be observed in urban agglomerations of the Western hemisphere as well. The huge efforts necessary in the latter regions to reverse or at least stop undesired developments imply that the earlier these issues are tackled in developing cities, the less costly the necessary measures will be, and the greater the social, economic and environmental benefits.

The actions proposed in this document comprise both proven concepts, illustrated with case studies from a wide range of cities all over the world, and innovative measures. It emphasizes the need for co-operation between public and private actors to improve the efficiency of urban freight operations and, as a consequence, to mitigate its negative impacts. As goods transport in urban areas is mostly in the hands of a multitude of private companies, ranging from micro businesses to global players, the importance of dialogue between all stakeholders cannot be underestimated.

There is no single master plan, and no predefined set of necessary measures to reduce negative impacts of urban freight traffic. Policy-makers will have to choose actions suitable to solve to most urgent problems, and may have to adapt them to the specific local context. However, there are certain aims a municipal authority can strive to achieve. They characterize a situation in which urban logistics can be managed in an efficient and sustainable manner.

Whatever the approach may be: cities and metropolitan areas have to develop and implement a viable strategy for the optimisation of the urban freight system. The environmental sustainability, economic development and overall quality of urban living depend on it.

Table 8: Characteristics of sustainable urban freight operations

Spatial planning, retail policy, business licensing
■ Inner city retail structures have remained intact. All city dwellers are able to cover their daily demand of groceries and household goods within walking distance. ■ Shopping centres and malls are only in locations where the surrounding traffic infrastructure can accommodate the necessary freight traffic. ■ When planning and establishing new districts and large buildings it is mandatory for developers to provide a delivery access plan and to prove the integration of smooth freight operations.
Transport infrastructure planning/traffic engineering
■ Circular freeways and ring roads are available to accommodate through- and round-traffic. Especially heavy trucks can avoid the city centre on the way to their destinations. ■ Likewise, city sub-centres are kept free of through-traffic thanks to the availability of urban expressways. ■ The city road infrastructure can accommodate the necessary city goods traffic, excessive congestion only occurs during peak times.
National fleet policy, vehicle registration and taxation
■ Rail and waterway transport modes are promoted wherever reasonable. ■ Vehicle emission standards are mandatory countrywide and enforcement is in place. They are supported by a country-wide adequate vehicle inspection system. ■ Vehicle operating costs are structured so that low-efficiency logistics operations are not viable and will leave the market (*i.e.* through fuel taxation).
Traffic management on a community level
■ For the inner city-centre, sensible access restrictions with regard to environmental and technical standards and vehicle size are established and enforced. ■ Wherever feasible, pedestrian precincts are marked, with loading zones nearby. The quality of pavements allows for non-motorised freight transport with trolleys and carts on the “last yard” delivery of goods. ■ Where necessary to avoid congestion during daytime, certain districts are open for night delivery only. Adequate parking areas are available for trucks waiting for the entry period to start ■ Different forms of motorised and non-motorised traffic are segregated as much as possible, *e.g.* goods vehicles, public transport, individual motorised traffic and bicycles.
Organisation of “last mile” logistics
■ Within the city territory, only full truck loads or part loads with a load factor of above 60 % go directly to the destination. Other part loads and single parcels consignments are consolidated in appropriate locations, so as to form area specific loads. ■ There are load consolidation centres at strategic locations in town. ■ Precinct pick-up stations are installed to avoid unsuccessful delivery attempts for home-shoppers who are not available during business hours. ■ A high degree of logistics efficiency can be achieved in road transport, *i.e.* high load factor and high delivery route density.

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http://www.gvz-org.eu	Consolidation centres, logistics parks	German, English
http://www.bestufs.net	City logistics	German, English
http://www.osmose-os.org	Sustainable city concepts	English
http://www.transports-marchandises-en-ville.org	Urban freight transport	French
http://www.lowemissionzones.eu	Clean air technologies	English
http://www.fav.de/Pro_TELLUS.html	Sustainable city transport	English
http://www.idsia.ch/mosca/intro.phtml	Logistics chain management	English
http://www.smartfreight.info	Urban freight transport	English
http://www.start-project.org	Urban freight transport	English
http://www.civitas-initiative.org/news.phtml?id=458	Freight consolidation, sustainable, city logistics	English
http://www.timocom.co.uk	Freight exchange	English
http://www.freightbestpractice.org.uk	Innovative freight transport concepts	English
http://www.cargaurbana.org.br/ws	Urban freight transport	Portuguese
http://www.niches-transport.org	Sustainable urban transport	English
http://www.vtpi.org	Innovative transport concepts	English
http://www.transportenvironment.org	Sustainable transport concepts	English
http://www.fin.gov.bc.ca/tbs/tp/climate/carbon_tax.htm	Carbon tax	English
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