Sustainable Urban Freight in Asian Cities
Note

Part of this publication is based on the EST background paper written by Sophie Punte, Sudhir Gota and Yan Peng “Best practices in green freight – for an environmentally sustainable road freight sector in Asia” (prepared for 6th EST Forum) and GIZ’s SUTP Sourcebook Module 1g “Urban Freight in Developing Cities”, authored by Bernhard O. Herzog.

Acknowledgements

Varunn Kaushik, Santosh Kodukula, Bert Fabian, CAI-Asia and Mr Abdul Quium, UN-ESCAP, provided valuable assistance in drafting this document.
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1 Introduction

Urban freight is a problem only if it is visible.

The economic and demographic development of urban agglomerations depends heavily on a reliable and smooth supply of goods and materials. At the same time, freight transportation in urban centres contributes considerably to air pollution, noise emission and traffic congestion. Looking at air-pollution, even in an economy with a high individual car-ownership like the US, 49% of all CO₂ emissions caused by road transport stem from trucks (US Department of Transport, Transportation Statistics Annual Report 2008). In many other countries, this ratio is much higher.

Especially large agglomerations and fast growing megacities on the Asian continent are increasingly confronted with all the negative effects of traffic overload, urban freight traffic being a large contributor. Traffic congestion, noise and air pollution have reached levels at which the quality of urban life is impacted considerably. The drafting of a dedicated urban freight transport action plan, i.e. an agenda of priorities, issues and measures to be tackled with regard to urban freight transport, is the first step in taking these challenges on in a professional manner. A sustainable and target oriented organisation of the urban freight sector, actively managed by municipal authorities, is necessary to keep Asian cities attractive and liveable well into the 21st century.

Goods distribution in cities is an intricate operation, which:

- largely depends on road vehicles and infrastructure, but
- offers many possibilities for an increase in efficiency and eco-friendliness.

An increasing number of local governments in developed economies are realizing that decisive action is necessary in order to streamline and optimise urban freight delivery, and thus alleviate its negative effects. There are many examples of appropriate measures, which have succeeded in reducing the negative environmental impacts of urban goods traffic, and can serve as showcases for proliferation. However, lack of knowledge and capacity is a main barrier in developing countries for addressing freight issues proactively. This publication is directed towards this effect, i.e. improving knowledge base on urban freight for developing cities. The main objective is to provide the reader with case studies and insights on “Avoid–Shift–Improve” approaches available in urban freight. It is as well to explain the relevance for developing cities to acknowledge the issue of urban freight, build partnerships and implement solutions to facilitate urban freight with reduced externalities.

As the situation and the nature of the problems caused by urban freight traffic varies from one city to another, a wide array of possible solutions is needed. The specific purpose of this document is to point out the problems and risks associated with urban freight traffic and offer a wide selection of tools and methods which can alleviate these problems. The options offered range from very down-to-earth measures already in place in many cities to advanced solutions, which have been tried in some developed cities, to finally some more innovative or even futuristic solutions. A special effort is made to offer options to improve the urban transport situation, which are specific to high-density agglomerations. Not every option offered here will be applicable in each urban agglomeration. However, it is recommended to evaluate individually all the possibilities presented in this document for their practicality in the local context. This paper is divided into eight sections. The second chapter after the introduction is addressed to the need for sustainable urban freight policies, the third one refers to the “Avoid–Shift–Improve” Approach, the fourth tells about urban freight policies and strategies, the fifth, sixth and seventh give examples of the “Avoid–Shift–Improve” Approach, and the eighth is dedicated to the issue of involving the private sector into these activities.
Sustainable Urban Freight in Asian Cities

2 The need for sustainable urban transport

2.1 Growing urbanisation

Currently, about 45% of Asians live in cities, compared to 23% forty years ago. But in forty years from now, it is projected that 65% of the Asian population will live in cities. Growing urbanisation strengthens the link between economy and urban areas. Economic activities in urban areas now account for as much as 55% of the GDP in low-income countries, 73% in middle-income countries, and 85% in high-income countries. In other words, on average, cities account for approximately 70% of global GDP\(^1\). Several studies have indicated that rapid urbanisation has profound implications on the increase in emissions, unless corrective measures influencing travel patterns (people and goods) are implemented now.

1. Latest estimates from the International Transport Forum\(^2\) suggest that in OECD countries, freight transport is expected to grow at a rate between 50% and 130% between 2010 and 2050.
2. In the non-OECD countries, freight activity is expected to grow at a rate of 250 to 550% in the same time span.

The projections of massive growth in freight movement are also corroborated by International Energy Agency estimates: by the year 2050, medium and heavy freight trucks worldwide will consume 1.240 billion litres of fuel (gasoline equivalent), 138% higher than the 2000 level\(^3\). The share of trucks operating within Asian countries in global truck energy consumption will increase from 19% in 2000 to 34% in 2050.

2.2 Growing importance of freight in Asia

The movement of goods and supplies plays a central role in the economic development in Asia. As Asian economies continue to grow at a rapid pace, a proportionate increase in freight activity would be expected. It has been estimated that for road freight, the travel activity (billion t/km) of heavy and medium trucks in Asia is expected to increase by 645% from 2000 to 2050 (as compared to 241% globally) and will then make up 29% of the global truck travel activity, compared to 13% in 2000. Truck traffic is of prime importance to the economy of the region. Road transportation dominates freight in major Asian countries and ranges from 43% in Vietnam, where river and sea freight transport also play a key role, to more than 95% in Pakistan.

\(^1\) WORLD URBAN FORUM 6 – The Urban Future and Prosperity of the City – concept paper

\(^2\) http://www.internationaltransportforum.org/Pub/pdf/12Outlook.pdf

\(^3\) WBCSD, IEA (2004)
2.3 Relevance of freight in urban transportation

In a typical metropolitan area in a developing country, about 40 to 50% of commercial vehicle freight volume is incoming, 20 to 25% is outgoing, and the remaining 25 to 40% are intra-metropolitan runs (Source: Dablanc, 2010). However, typical goods flows vary among different functional city areas. Large urban agglomerations include industrial zones and therefore mostly act more as origins for goods transport than as destinations. In contrast, city centres, be it the downtown centre or a suburban commercial centre, are usually strong net goods consumers.

Goods traffic represents a considerable portion of urban traffic volume. Although in most cities on average only 15 to 25% of the vehicle kilometres travelled (four-wheel and more) can be attributed to commercial vehicles, it is estimated that they account for 20 to 40% of motorised road-space occupation and cause 20 to 40% of CO$_2$ emissions. For particulate matter (PM), the share of commercial vehicles is much higher still. Exact figures are hard to come by, but a few examples illustrate the need for making freight movement sustainable:

I. In Thailand, 51% of the road transport energy consumption is used for freight transport. In China, the number of diesel-driven vehicles is expected to grow from 10 million in 2005 to 60 million in 2035. In Bangkok, delivery motorcycles make nearly 4.6 million vehicle-kilometre per day\[4\] having a significant impact on the environment.

II. In India, research shows that urban freight vehicle travel in total metropolitan vehicle travel is substantial with a 37% contribution\[5\].

III. Even in an economy with a high individual car-ownership like the US, 49% of all CO$_2$ emissions caused by road transport stem from trucks (US Department of Transport, Transportation Statistics Annual Report 2008). In many other industrialised countries, this ratio is even higher.

IV. Latest research in China indicates that cars and trucks tend to be the largest contributors to CO$_2$ emissions in urban areas. The larger cities with high industrial sectors or ports activity such as Guangzhou, Chongqing and Wuhan tend to have at least half of their energy use and CO$_2$ emission coming from trucks\[6\]. It has been estimated that in Chinese

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\[4\] See http://www.easts.info/on-line/journal_06/157.pdf

\[5\] http://www.iutindia.org/urban09/041209sess/Dr%20Gangopadhyay.pdf

\[6\] Urban Transport and CO$_2$ Emissions: Some Evidence from Chinese Cities and Young Crane Consulting (2011)
urban areas, urban freight contributes from 40 to 50% of total CO₂ emissions[7].

V. 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 costs. Traffic congestion caused by urban freight traffic can be considered the underlying problem associated with urban goods distribution, strongly influencing other problems such as environmental impact and road space usage. To illustrate what this means in practice, a typical case example is presented in Table 1.

VI. It has been established through various scientific studies that diesel engine exhaust causes lung cancer and this was recently confirmed by World Health Organization: “the risk of dying from lung cancer was three times higher for those directly exposed to diesel exhaust than those exposed to lower doses of diesel exhaust”[8]. The health impact from diesel emissions is an emerging area of concern. Since freight on roads moves primarily on diesel, reducing urban freight emissions is of prime importance, while pressure on the freight industry to address this concern is expected to increase considerably.

The following simulation on the negative impacts of goods traffic on the overall traffic situation is based on the breakdown of a truck due to a faulty fuel pipe and lack of inspection. The breakdown takes place in a space-restricted area during peak-hour traffic. For all following traffic, this breakdown translates into an average time delay of 20 minutes. The incident was observed and its duration measured in Wuhan in 2011. The economic impacts are the result of a mathematical simulation.

Even if only USD 3 is taken 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 example, the timely replacement of the faulty fuel pipe causing the breakdown would have cost only USD 28 (see Table 1).

Summing up, it is clear that in many large cities, especially in Asia, goods transport is responsible for a large portion of urban traffic load, fuel consumption and emissions. City governments throughout Asia are aware of this situation and have started to tackle this challenge. In an effort to limit the negative effects of goods transport on traffic load, congestion and air quality, many cities have embarked on programs which aim at reducing the negative externalities while maintaining the level of service for urban populations.


Figure 2: Diesel engine exhaust causes lung cancer.
The various measures, with this objective, can be grouped into three major categories:

A. Avoid vehicle movement;

S. Shift transportation from road transport to less harmful modes such as rail, waterway, electrified or unmotorised transport;

I. Improve the quality of the vehicles deployed in the operation, i.e. by demanding clean propulsion technologies.

The entire array of measures is grouped into the so-called ASI-approach and will be explained in detail in Chapter 3.

2.4 High-income economies cannot necessarily serve as role models

Many cities in developed countries have taken special initiatives which aim at alleviating the problems induced by urban freight traffic. Depending on the specific geography, different approaches were used:

- In Italy, the focus is often on the preservation of the historic city centres by restricting goods traffic as much 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.

Many of these past initiatives should be seen as experiments in urban logistics optimisation. 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 into a developing country context. Unlike many European cities, urban freight planning in developing countries has not been centred on the protection of residents from noise and the preservation of historic town centres so far. The focus is rather on the alleviation of congestion, air pollution and the preservation of the transport serviceability of urban centres.

2.5 Key trends for the future

The above discussion can be summarised into four key messages for urban freight in the future:

I. Urbanisation and market economy would evolve with progressing development and growth.

II. Urban freight demand will increase along with the challenges – health and pollution, carbon emissions, fuel consumption, noise, congestion and other negative externalities.

III. Climate change and pollution risks will force governments, the private sector and the general public to reduce freight movement emissions.

IV. Diesel emissions are now considered carcinogenic and the impact of diesel emissions on health is an area of increasing concern and cause of pressure on the freight industry.

| Table 1: The real costs of a peak hour break down (Results of case simulation) |
| 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 |
| Number of passenger vehicles affected: 280 |
| Average occupancy: 3.4 |
| Average time value per hour (USD): 3 |
| Average idling consumption passenger vehicle (l. p. h.): 2 |
| Number of commercial vehicles affected: 75 |
| Operating cost excluding fuel USD p. h.: 22 |
| Average idling consumption commercial vehicle (l. p. h.): 5.5 |
3 Sustainable urban freight: the “AVOID–SHIFT–IMPROVE” approach

An integrated approach employing avoid, shift and improve strategies is needed in addressing the road freight transport issues in Asia[9].

- **Avoid** strategies refer to reducing the need for movement of goods, i.e. through sustainable urban planning, and for the movement of vehicles, i.e. by improving the efficiency of logistics.
- **Shift** strategies refer to transferring freight activity to more energy-efficient and/or environment-friendly modes.
- **Improve** strategies improve the energy efficiency of current road freight transport modes, their operations and technologies.

Examples provided in Table 2 are described in detail in the next sections. To significantly reduce fuel consumptions and emissions, it is believed that not only one, but a whole set of strategies must be implemented. Moreover, different strategies will be used to achieve that goal, depending on the type of trucks, of fleets, of cities and countries.


Figure 3: Freight and passenger vehicles create urban traffic congestion and pollution.
Photo by Sudhir Gota, 2007
### Table 2: Avoid, Shift and Improve strategies and policy instruments to reduce urban freight emissions

<table>
<thead>
<tr>
<th>Avoid</th>
<th>Shift</th>
<th>Improve</th>
</tr>
</thead>
</table>
| ■ Back loading and route optimisation *(i.e. milk run concept)* | ■ Shift from trucks to cargo bikes, motorbikes, NMT | **Technological solutions**
| ■ Freight consolidation centres | ■ Investments in infrastructure for railways, waterways and intermodal transfer | ■ Tyre and wheel technologies |
| ■ Logistics information platforms (freight exchanges) | ■ Economic instruments to promote investments in rail infrastructure and transport | ■ Aerodynamic equipment |
| ■ Freight company consortiums | ■ Matching vehicles capacities and loads | ■ Idling reduction technologies |
| ■ Matching vehicles capacities and loads | ■ Promotion of local production and consumption | ■ Emission control technologies |
| ■ Promotion of local production and consumption | ■ Promoting 4D’s: Density (of development) | ■ Low-sulphur diesel |
| ■ Promoting 4D’s: Diversity (of uses) | ■ Destination accessibility (for freight transport) | ■ Low viscosity lubricants |
| ■ Destination accessibility (for freight transport) | ■ Rationalizing number and location of logistics centres and improve coordination between centres | ■ Oil by-pass filtration system |
| ■ Rationalizing number and location of logistics centres and improve coordination between centres | ■ Congestion charging/road pricing | ■ Lighter weight tractor/trailer |
| ■ Congestion charging/road pricing | ■ Parking policies | ■ Hybrid trucks |

<table>
<thead>
<tr>
<th>Regulatory measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>■ Inspection and Maintenance</td>
</tr>
<tr>
<td>■ Speed management, eco-driving, driver training</td>
</tr>
<tr>
<td>■ Implementation of fuel economy standards</td>
</tr>
<tr>
<td>■ Vehicle emission standards</td>
</tr>
<tr>
<td>■ Fuel quality standards, including alternative fuels</td>
</tr>
<tr>
<td>■ Import restrictions for vehicles and engines based on performance and age</td>
</tr>
<tr>
<td>■ Test cycles for emissions and fuel economy</td>
</tr>
<tr>
<td>■ Vehicle inspection and maintenance program</td>
</tr>
<tr>
<td>■ Fuel inspection and compliance programs</td>
</tr>
<tr>
<td>■ Emission labelling programs</td>
</tr>
<tr>
<td>■ Low emission zones</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Economic instruments/incentives</th>
</tr>
</thead>
<tbody>
<tr>
<td>■ Penalties for manufacturers not meeting standards</td>
</tr>
<tr>
<td>■ Fuel taxes and lower fuel taxes for cleaner fuels</td>
</tr>
<tr>
<td>■ Excise and sales taxes for different truck types</td>
</tr>
<tr>
<td>■ Adapt registration fees to truck size, performance and age</td>
</tr>
<tr>
<td>■ Fine inefficient technologies</td>
</tr>
<tr>
<td>■ Rebates for efficient technologies</td>
</tr>
<tr>
<td>■ Buy-back and scrapping schemes for old trucks</td>
</tr>
</tbody>
</table>
4 Urban freight policies and strategies

Over the past few years, developing countries are slowly overhauling their transport facilities and policies in order to balance transport ‘benefits’ and ‘negative externalities’. However, many cities often forget freight issues when drafting urban transportation plans, which often ends up in an uncoordinated implementation of unsuitable solutions.

The traditional approach for solving urban freight is to ban trucks during day-time, build bypasses and truck terminals outside the cities. Some of these solutions which provide priority to passenger transport over freight movement may provide short-term relief, but may induce long term adverse impacts. Both passenger and freight transport need long-term and inclusive policies and not short-term or conflicting strategies (see Table 3).

<table>
<thead>
<tr>
<th>SNo</th>
<th>City</th>
<th>Problem</th>
<th>Strategy/Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chennai</td>
<td>Limited number of routes for goods movement. Acute shortage of parking for goods vehicles.</td>
<td>Plans to shift some of the wholesale markets and create truck terminals on the periphery of the city.</td>
</tr>
<tr>
<td>2</td>
<td>Ahmedabad</td>
<td>Ring roads not fully developed, inadequate parking facilities, increase in vehicle volumes.</td>
<td>Improvements in road network, development of a decentralised rail transport terminal.</td>
</tr>
<tr>
<td>3</td>
<td>Delhi</td>
<td>High growth rate of traffic on roads causing congestions, delays, safety issues, pollution, inadequate parking, intermixing of local and regional passenger and goods traffic.</td>
<td>Development of goods and passenger terminals.</td>
</tr>
<tr>
<td>4</td>
<td>Agra</td>
<td>Transport terminal is being developed and improved. However, many transport agencies operate from various parts of the city; it results in many cargo vehicles parking on the roads, which hampers the smooth flow of traffic.</td>
<td>Development of a ring road, parking facilities and truck terminals.</td>
</tr>
</tbody>
</table>

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

Table 4 summarises available policies for more sustainable urban freight operations and points out co-benefits. This consists in good administration practices from 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).

One good example of the above discussion is Japan’s urban freight policy. Researchers[10] have documented that in the policy, there are two main quantitative targets, i.e. ‘the load factor of trucks’ and ‘peak-hour average

### Table 4: Categorisation of measures on urban freight

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

Source: Bernhard Herzog, SUTP Sourcebook

Travel speed, in three major metropolitan areas. Japan targets an increase of the load factor in trucks from a current 45% to a 50%, and speed from 21 km per hour to 25 km per hour. The other important measures in the policy are:

1. Investments to improve the infrastructure in order to reduce both time and cost for goods transportation, based on the principle that beneficiaries should pay for part of the capital;
2. Further support to private enterprises by providing subsidies to logistics related facilities/equipment;
3. To promote improvement and to strengthen the functions of the logistics business in urban areas and joint collection and delivery points where the sorting of goods for final consumers in metropolitan areas is carried out;
4. To develop logistics facilities in the vicinity of major highway interchanges, industrial areas, and seaside industrial zones;
5. To use rail system for waste transport and as a feeder for international transport;
6. To promote deregulation in the logistics field;
7. Voluntary co-operation, such as joint collection and delivery points in urban areas and particularly in business districts; facilities for disposal of goods towards buildings; stopping facilities for on-road collection and delivery; and setting up delivery boxes; 
8. To support the development of an advanced logistics system; 
9. The development and standardisation of the “Intelligent Transport System” (ITS); providing road traffic information through bringing the Vehicle Information Communication System (VICS) into nation-wide use; 
10. Introduction of an Electronic Toll Collection (ETC) system at toll-gates; 
11. A shift from own-transport by private companies towards transport by professional carriers. 

Green freight programs (national or regional with positive effects on urban freight) are being established around the world and most are modelled after or based on the US SmartWay program\textsuperscript{[11]}. They are mainly driven by the government and private sector. The main examples are described in Table 5.

China is the first Asian country where a national program is being set up. In addition, a growing number of green freight demonstration projects and other initiatives are implemented in Japan, Australia, France, and the United Kingdom\textsuperscript{[12]}.

It is to be noted that 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. For this reason, these aspects are considered to be prerequisites and are not dealt with in detail in the examples below for the A-S-I (“Avoid–Shift–Improve”) approach.

\textsuperscript{[11]} http://www.epa.gov/smartway

\textsuperscript{[12] For an overview see http://www.greenfreightandlogistics.org}
<table>
<thead>
<tr>
<th>Program</th>
<th>Details</th>
<th>Main components</th>
</tr>
</thead>
</table>
| **SmartWay Transport Partnership** | Partners: USEPA, freight shippers, carriers, logistics companies and other stakeholders  
Location: USA  
Start Date: 2004  
Scope: Trucks  
http://www.epa.gov/smartway | - SmartWay Transport Partnership.  
- Technology Program: testing and verification program to quantify emission reductions and fuel savings from available technologies.  
- Innovative Finance helps companies to acquire fuel-efficient and emission reduction technologies through an easier access to financial mechanisms.  
- Outreach and Education includes partner recognition through the SmartWay website, logo use and awards, partner education, pilot projects, and international activities. |
| **EcoFREIGHT program & FleetSmart** | Organisation: Natural Resources, Canada  
Location: Canada  
Start Date: 2006  
Scope: Trucks, marine vessels, fleets (trucks, coaches, buses)  
- EcoENERGY for Fleets (FleetSmart) for commercial and institutional fleets via SmartDriver training, fuel management workshops, sharing of best practices, anti-idling campaigns, technical analysis.  
- Freight Technology Demonstration Fund for cost-shared demonstrations.  
- Freight Technology Incentives Program which provides cost-shared funding for proven emission-reducing technologies.  
- EcoFREIGHT Partnerships to reduce emissions through voluntary actions that can support the regulatory framework.  
- Marine Shore Power for marine vessels in Canadian ports to reduce air pollution from idling ship engines in urban centres. |
| **SmartWay Europe Program** *(This name is only used to refer to the intention to create a program in Europe similar to the USEPA SmartWay)* | Partners: Private sector companies  
Location: Europe  
Start Date: 2012  
Scope: Road freight transport  
Website not available yet | Independent voluntary program for improving environmental performance of road freight transport in Europe, reducing carbon emissions by  
- Establishing a platform for monitoring and reporting of carbon emissions, that could assist in the procurement of transportation services and based on existing standards.  
- Promoting collaboration between carriers and shippers in driving improvement actions and monitoring progress.  
- Establishing a certification system to reward shippers and carriers who fully participate in the program. |
| **Green Freight China Program (in development)** | Partners: CAI-Asia, China Road Transport Association (CRTA) and Research Institute of Highway (RIOH)  
Location: China  
Start Date: 2011  
Scope: Road freight transport  
http://www.greenfreightandlogistics.org | The proposed components includes  
- Clean Technologies  
- Freight Logistics  
- Financing Mechanisms  
- Knowledge & Capacity  
- Partnerships |
5 Examples for the “AVOID” approach

5.1 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, 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 rather than 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 preferred to passenger car shopping traffic to centralised malls.

- At the same time, provisions of other transport modes such as rail and waterways should be fostered for freight transport wherever possible. One t/mile by truck generates roughly 0.90 kg of CO₂; the corresponding figure for rail transport is 0.64, and 0.20 for barge/river transport. 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 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 transportation.

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.

It has been shown that it is better to intermingle not only residential and commercial, but also residential and industrial areas in order to make workplaces easily accessible.

In modification of the above statement, it has to be mentioned that in many cases, where traditional manufacturing, trade and small industry, generating noise, emissions and goods traffic, are lodged in old and narrow city centres, it is of course necessary to promote their...

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* As discussed earlier, a suite of strategies are required to significantly reduce fuel and emissions, and these different strategies will be suitable for different trucks, fleets and countries.
relocation to a more industrial environment. Instead of establishing one sprawling CBD, it has been accepted to be more sensible to develop various sub-centres.

With respect to the increasing volume of home deliveries due to internet-shopping, it is an upcoming challenge for local authorities to channel this volume in such a way, that the traffic infrastructure is not overburdened by its rapid growth. B2C deliveries should ideally be routed to precinct pick-up stations, so that parcel trucks do not have to service residential streets.

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 deliveries whenever they like. Such stations should be within walking distance from the destination households. Figure 4 shows an automatically operated "Packstation" in Germany. However, a conventional manned operation will do perfectly.

5.2 Demand local business community contribution

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 (see Box 1).

5.3 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, it may be an efficient way of reducing congestion caused both by through-traffic as well as inner city distribution operations (see Figure 5).

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.

Box 1

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 m².

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 m² within their premises. The purpose is to ensure enough storage space to avoid daily deliveries of small quantities.

(Source: Dablanc, 2010)
In Germany, many of the existing urban consolidation centres are bimodal (rail/road) or even trimodal (port/rail/road). Not only does multimodality improve eco-efficiency on the line-haul, but it also contributes to the viability of a consolidated cargo distribution in the urban space.

5.4 Land-banking for future infrastructure requirements

In cases 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 professionalisation, 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, i.e. 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.

5.5 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 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.

Examples:
- The Japanese central administration subsidised nine Pilot Programs on urban freight, with a strong focus on the management of loading/unloading and parking spaces, both on-street and off-street.
- In Koriyama City (Fukushima prefecture), one lane of roadway was converted into a loading area.
- In Kashiwa City (Chiba prefecture), a joint parking space for delivery trucks has been created that is managed collectively by retailers.
In Nerima (Tokyo), the “pocket loading” system provides loading space that has been secured by converting a part of an existing parking lot into a reserved delivery space.\textsuperscript{[13]}

\textsuperscript{[13]} Futumata, 2009

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**Box 2**

**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 lays 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 m\(^2\) area, 350 000 of which are 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 m\(^2\). 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)

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![Figure 6: Guarded truck parking area in Bologna. Photo by PTV, Bologna, Italy](image-url)
5.6 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 kilometre 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. In most cases, relatively expensive land close to the inner city will have to be ear-marked for this purpose.

5.7 Consolidating freight loads: the principle of cross-docking

Many long-haul trucks approach a city from different origins. Generally, their loads are composed of partloads or groupage cargo (meaning that they are destined for different receivers). Since it is usually uneconomical (and uneconomical) 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 in the area or routes which are optimized according to the receivers, based on the information given in the freight documentation (bills of lading, delivery notes, etc.). This process is called load consolidation or cross-docking.

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 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 (see Figure 7). They are located in RomKlao, Bhuddhamonthorn and Klong-Luang.

Figure 7: Location of public truck terminals in Bangkok. Graphic by Dr. Narong Pomlaktong
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:
I. a public cross-docking facility is made available to the transport industry, and at the same time,
II. an access restriction is imposed for vehicles above certain size limits (in this case, everything above a 10 wheeler), so as to make cross-docking a viable option from a microeconomic perspective.

Specialised forms of consolidation centres are facilities to support urban construction projects. 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 transshipment is organised informally in the public space, as shown in Figure 8.

The impact of consolidation centres on reducing vehicle kilometre travel is significant and it has a positive impact on air quality and reduces other externalities. For example, Fukuoka consolidation centre in Tenjin-Japan impacts have been quantified as follows:
- Number of trucks operating reduced by 61 %;
- VMT reduced by 28 %;
- Parking time reduced by 17 %.

The positive impact of consolidation centre can be enhanced by providing some exclusive privileges or by providing regulatory support in terms of movement/access and parking.

The image shows an informal distribution centre for bricks, with a photo by Eduardo Betanzo, Querétaro, México, 2006.

6 Examples for the “SHIFT” approach

6.1 Shift to non-motorised-transport (NMT)

One of the largest initiatives in understanding and promoting cargo bikes in Europe is CYCLE Logistics project. It’s an EU funded project implemented from May 2011 to 2014 and spanning across 12 countries. The main stakeholders in this project partnered by European Cyclists’ Federation (ECF) are local authorities, the private sector, cyclists’ groups, communications experts and energy agencies. In order to promote this shift, CYCLE Logistics will push for behavioural change across a broad spectrum of stake-holders:

- Individuals will be informed on how to use their bicycle to transport goods;
- Businesses will be motivated to use bikes or cargo bikes for delivery, with the goods sector being pressed to increase deliveries by cycle;
- City governments would be encouraged to facilitate the cycle movement by providing conducive infrastructure.

CYCLE Logistics aims at saving 1 300 tonnes of fuel resulting in savings of 3 500 tonnes of CO₂, have 2 000 new cargo bikes in use in European urban areas and see at least 10 000 trips shifted to intermodal transport chains.

Another good example is “La Petite Reine” project in France. La Petite Reine is French slang for bicycle (literally ‘the Little Queen’), and operations started in Paris in 2001 with a turnover of just EUR 28 000. The growth of the initiative can be compared with the growth of the public bike sharing scheme in Europe. By 2007, the company was operating in four cities (Paris, Bordeaux, Dijon and Rouen), with 50 employees, 53 bikes and a turnover of EUR 1.3 million. Estimates suggest that the company transported 700 000 packages, over a total of 210 000 km. In the process, they displaced nearly 600 000 t/km of van transport in Paris alone – largely accounted for by the difference in the weight of the vehicles used – and saved 204 tonnes of CO₂ emissions or approximately saving 79 000 litres of diesel.[15]

6.2 Shift to cleaner vehicles

Shift to cleaner vehicles can be induced by following “carrot and stick” policy. “Carrot” refers to providing incentives to use cleaner vehicles or purchase cleaner vehicles by scrapping old vehicles. “Stick” refers to regulations to restrict use of old and polluting vehicles. A good example for this is the practice of issuing green and yellow labels for vehicles. To reduce air pollution in cities, the diesel trucks are labelled green and yellow in China. Green labels are applied to diesel vehicles which correspond to China National III emission standards or above, whereas yellow labels are for diesel vehicles below China III standards. By restricting the entry of yellow label vehicles, the authorities are trying to reduce pollution in some big cities by allowing only cleaner vehicles inside the cities. Nearly 20% of vehicles are “yellow-label vehicle”[16].

Another good concept is the use of electric delivery vehicles at places where the electricity is generated using renewable sources. A good example is the “Cargohopper”, which is an electrically powered goods vehicle. Since April 2009, it delivers light-weight ambient retail goods and parcels into the historic centre of Utrecht (Netherlands) from a transfer site close to the city centre. It is run by a single logistics operator, Hoek Transport, who also manages a suburban warehouse located some 11 km

from the city centre\textsuperscript{17}. This scheme allows companies to deliver their goods at a warehouse outside city limits, and the operator delivers the goods inside the city limits using an electrically powered goods vehicle. Between April 2009 and October 2010, Hoek Transport estimates that Cargohopper has made more than 12,000 deliveries of around 66,000 parcels/boxes. On that basis, it is estimated that Cargohopper undertook the work of approximately 16,500 conventional goods vehicle trips into central Utrecht. This equates to a reduction of 122,000 vehicle-km and 34 tonnes of carbon dioxide.

A good example for scrapping old trucks is the one time incentive measure adopted by Hong Kong in 2007. This scheme allowed truck owners to replace their pre-Euro and Euro 1 commercial vehicles by Euro 4 type of vehicles. It has been estimated that if all pre-Euro and Euro 1 vehicles would be replaced with Euro 4 models significant improvements in roadside air quality would be realised, more specifically – vehicle emissions of RSP and NO\textsubscript{x} will be reduced by 74\% and 38\% respectively\textsuperscript{18}.

\textsuperscript{17} http://ec.europa.eu/transport/themes/urban/studies/doc/2012-04-urban-freight-transport.pdf

\textsuperscript{18} http://www.eltis.org/study_sheet.phtml?study_id=1532&lang1=en
7 Examples for the “IMPROVE” approach

7.1 Implementing fuel economy standards for heavy duty vehicles

The Japanese Government introduced the first fuel economy standards for new medium- and heavy-duty diesel vehicles that will come into effect in 2015. These apply to diesel fuelled, type-approved commercial vehicles with a gross vehicle weight greater than 3.5 t, including trucks, but do not apply to heavy vehicles fuelled by gasoline, LPG or other alternative fuels. Each manufacturer is required to meet the fuel economy target for each type of vehicle based upon a sales-weighted average for that category (see Table 6).

<table>
<thead>
<tr>
<th>Vehicle type</th>
<th>Vehicle class</th>
<th>Fuel economy (km/l)</th>
<th>Improvement (per cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck</td>
<td>Tractor</td>
<td>2.67 2.93</td>
<td>9.7</td>
</tr>
<tr>
<td></td>
<td>Other truck</td>
<td>6.56 7.36</td>
<td>12.2</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>6.32 7.09</td>
<td>12.2</td>
</tr>
</tbody>
</table>

Note: The 2015 average target and relative improvement assume a constant 2002 vehicles sales mix.

Table 6: Summary of Japanese fuel economy regulations for trucks\[1\]

The US recently announced a decision to introduce fuel economy standards for heavy trucks. The fuel economy standards are jointly being developed by US EPA and the National Highway Traffic Safety Administration and will affect trucks built from 2014 to 2018.

7.2 Introduction of fixed or progressive emission standards

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 may be a costly and time consuming operation. To reduce air pollutant emissions from trucks, governments can adopt and tighten standards for vehicle emissions and fuel quality as shown in Table 7. To guide governments, the “Road Map for Cleaner Fuels and Vehicles in Asia” was prepared through a multi-stakeholder approach that guides Asian governments to reduce transport emissions by improving these standards\[19\]. Vehicle emissions standards are gradually strengthened across the world, including in Asia. However, the focus is in first instance on light duty vehicles with as a result that standards for heavy duty vehicles are lagging behind and thus relatively high emitting trucks are still added to the fleet. An exception is Singapore, where vehicle emissions standards for heavy diesel vehicles were given priority because of air pollution impacts. Also in Singapore, the fuel quality standards of diesel are more.

\[1\] See http://www.dieselnet.com/standards/jp/fe.php

\[19\] See http://cleanairinitiative.org/portal/node/3632
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Stringent than gasoline. Other examples are India and China, where fuel quality is being improved at a faster rate in few cities when compared to entire country, i.e. 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.

The impacts of such an action are:

a) It offers incentives and allows stakeholders to assess roadblocks in progression. The industry also has time to adjust to the changing fleet specifications.

b) Benefits are restricted for urban vehicles which move only within the cities. For vehicles which are bought in cities (relatively cleaner) but which operate outside the cities, the poor fuel quality can adversely impact the engine.

7.3 Inspection and maintenance

The aspect of good ‘maintenance’ is a key component of an Inspection and Maintenance (I/M) system. The concept of an inspection and maintenance program is simple, i.e. to link inspection and enforcement with maintenance. The efficiency of vehicles over a period of time due to usage reduces results in higher emissions and fuel consumption. In order to reduce this intensity of deterioration, maintenance and repair of vehicles are essential. Under the I/M program, the government requires the vehicles to be inspected and tested to check the emission rates and road worthiness, i.e. if the vehicles conform to regulations governing emissions, safety or both. However, it is important to note that an I/M system is not a silver bullet solution to reduce air pollution. I/M can only delay the growth of emissions by a few years due to increase in number of vehicles and activity.

For details please see GIZ sourcebook module 4b on Inspection and Maintenance at http://www.sutp.org

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Table 7: Implementation of Brazilian national program for vehicle emissions control (Proconve) for heavy-duty vehicles[1]

<table>
<thead>
<tr>
<th>Phase</th>
<th>Implementation</th>
<th>Technology improvements</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROCONVE Phase 1</td>
<td>1987 – Urban buses 1989 – 100%</td>
<td></td>
</tr>
<tr>
<td>PROCONVE Phase 2</td>
<td>1994 – 80% 1996 – 100%</td>
<td></td>
</tr>
<tr>
<td>PROCONVE Phase 5 (Euro 3)</td>
<td>2004 – Urban buses 2005 – 40% 2006 – 100%</td>
<td>Engines with fuel injection and injection pressure up to 1 500 bar.</td>
</tr>
<tr>
<td>PROCONVE Phase 6 (Euro 4)</td>
<td>2009 – 100%</td>
<td></td>
</tr>
<tr>
<td>PROCONVE Phase 7 (Euro 5)</td>
<td>2012 – 100%</td>
<td></td>
</tr>
</tbody>
</table>

The main objectives of I/M program are:
1. Identify high emitting vehicles and get them repaired;
2. Identify unsafe vehicles and get them repaired;
3. Check the validity of the vehicles’ documentations;
4. Enhance driver consciousness on vehicle pollution and safety.

Figure 9: Roadworthy inspection performed on a pickup. Photo by Reinhard Kolke, Surabaya, Indonesia, 2001

The common trend across Asia is that inspection frequency is more stringent for commercial vehicles when compared to passenger vehicles. For example, in India every commercial vehicle has to go for a mandatory fitness test. The renewal period for fitness certification in general is two years for new commercial vehicles (after registration) and every 1-year thereafter, whereas for private vehicles no mandatory periodic fitness check is required. However, there exists a system of re-registration of private vehicles after 15 years of initial registration or 1st registration. This means that after 15 years of operation, a private vehicle has to go for fitness to get re-registered, which will then remain valid for the next five years.

7.4 Technology retrofits to improve fuel economy

Common examples for technology retrofits are:
- Idle reducing technologies;
- Technologies to reduce PM and NOx.

Case Example: Guangzhou Green Trucks Pilot Project –
To support Guangzhou’s efforts to improve air quality in preparation for the 2010 Asian Games, the World Bank and CAI-Asia Centre implemented a pilot project that aimed at improving fuel economy and reducing CO₂ emissions and air pollution from trucks in Guangzhou.

The pilot project aimed at addressing three problems, related to truck fleet in Guangzhou and the wider Guangdong province: fuel costs and security; air pollution and associated health impacts; as well as greenhouse gas emissions and climate change. The technology component of this project consisted of:

i. Tyre equipment package to reduce the weight and rolling resistance of the tyres consisting of aluminium wheels (heavy-duty trucks (HDTs) only), low rolling resistance tyres and a tyre pressure monitoring system;
ii. Aerodynamics equipment package to reduce air resistance and drag consisting of a nosecone, cabin fairing, and trailer skirts.

Three companies participated in the pilot: Star of the City Logistics (SOCL), Xinbang Logistics (XWBL), and Baiyun District Guangzhou.

At SOCL, tyre and aerodynamics equipment were tested on two long-haul heavy duty trucks. Investment costs were USD 16,333 and the estimated annual savings amounted to 3,557 litres of diesel (6.64 %), 9 tonnes of CO₂, 33 kg NOx, and 1.5 kg PM₁₀. The equipment had a payback period of 5.1 years. One of the interesting observations was the low performance of the aerodynamic equipment because of the low speeds. For Baiyun District Guangzhou Company, tyre equipment was tested on two garbage trucks. Investment costs were USD 6,320, and annual savings would amount to 2,520 litres of fuel (18.5 %), 6.71 tonnes CO₂, 23.53 kg NOx and 1 kg PM₁₀. Considering the longer life of low rolling resistance tyres, payback period was only 1.5 years.
Private sector participation in improving urban freight

While the public sector is responsible for facilitating and regulating urban freight transport, the private sector is responsible for carrying out the actual movement of the freight, i.e. for freight operations. Urban authorities in developing economies do not have a good track record in involving a diverse set of urban freight transport stakeholders in decision-making. Urban freight is considered as a private sector problem and the government often does not intervene until and unless it is a serious problem (visible – congestion, pollution, accidents). The following points underscore the need for private sector to be actively involved in the urban freight planning and implementation:

1. Poor data and insights available on freight and thus there is a need to gather better information on the urban goods movement;
2. To gain knowledge about, adopt, adapt and implement successful approaches from around the world;
3. In general, freight sector gets its funds from both public and private sector. However, considering the economy and competition for limited funds for transport sector (with other sectors) and within transport sectors, partnerships may help in pushing for funding good projects;
4. To develop policies, regulation, legislation, and funding and financing mechanisms (both comprehensive and specific) to support coordinated urban goods movement;
5. Encouraging and branding efforts by private sector.

It has also been recently estimated[^21] that by 2016, more than 50% of Global 1000 logistics companies will be required to increase focus on sustainable logistics services and report verified environmental data. The traditional approach of the private sector towards urban freight was on two main factors, i.e. cost and speed. However, an increase in emissions is reorienting focus towards the third pillar in decision making, i.e. sustainable movement of goods. Since the freight sector mainly consists of private operators, they can play a crucial role in solving the urban freight problems by taking various initiatives as described in the "Avoid–Shift–Improve" approach. Examples: implementing technologies, providing and undergoing training on eco-driving and raising awareness, and implementing emission reduction technologies in company fleets. Industries affecting urban freight within a city are the retail industry, the hotel industry, the construction industry and the home shopping industry.

The private sector needs to be involved in the data collection process as the current information available is limited and ad hoc. Private sector could also design proper templates or could get customised software to collect data about their freight movements and hence alleviating the problem of data collection. The development of an Urban Consolidation Centre (UCC) via PPP mode could be considered to be an infrastructure measure where it involves the development of a new distribution centre and it could also be seen as a land use planning measure, if land required for a UCC is safeguarded from other uses; it could also be characterised as a technology measure where low or zero emission vehicles operate from the UCC. Fiscal and regulatory measures can stimulate the use of UCCs, where, for example, a congestion charge increases the cost for each delivery in an urban area or only zero/low emission vehicles operating from a UCC are allowed to access a city centre at certain times of the day.

8.1 Issues faced by the private sector

This section describes some of the issues faced by the private sector and possible solutions.

A survey carried across Lao PDR, Thailand and Viet Nam reveals some of the issues faced by the private sector operators, especially truck operators[^22]:

Sustainable Urban Freight in Asian Cities

i. The road freight industry Lao PDR, Thailand and Viet Nam is fragmented. Over 90% of the interviewed companies in Lao PDR and Viet Nam use second hand trucks, mostly between 7 and 25 years old from the date of manufacturing.

ii. More than 70% of the surveyed companies in Thailand replace their vehicles every 6–15 years, and every 6–20 years in Lao PDR and Viet Nam.

iii. The logistics companies in Lao PDR and Viet Nam face a lack of access to funds coupled with high bank interest rates — for example, the interest rate in Hue is reported to be as high as 27% per annum.

iv. Fuel cost make up 40–60% of the operating cost for companies surveyed in all three countries.

v. Trucks having to travel empty one way (empty back haul) is another important factor affecting the overall operating cost for logistics businesses. Empty back haul is seen to make up almost 25–50% of total trips.

vi. With relation to the usage of the East West Economic Corridor, the most significant problems faced by companies surveyed were poor road infrastructures, delay at border crossing/custom points, different load capacities of roads across countries, absence of a standard weight system, and partial implementation of the Cross Border Transport Agreement (CBTA).

vii. Logistics companies in Lao PDR are supported by the Government in terms of tax reduction for imported vehicles with a nominal tax of only 1% for trucks (for freight forwarding/transporting businesses). The normal import tax for other vehicles for a commercial or personal purpose is 100%.

viii. Government support for freight businesses in Thailand includes: the provision of soft loans for freight businesses through the SME Bank and Small Business Credit Guarantee Corporation; training for companies to help reduce operational costs; and the development of cargo hubs at Nongkhai, Mukdahan, Maesot and Chiengrai to facilitate easier logistics movements.

ix. The priorities for companies surveyed in terms of fuel efficiency include: low-cost access to financing (first priority), provision of capacity building in logistics management, as well as retrofitting vehicles with innovative technologies.

Over and above, it has to be acknowledged that private sector trucking companies all find themselves under severe economic pressure, everywhere in the world. So it will be difficult to expect their buy-in and cooperation, if this would endanger their competitive situation or be an economic threat to their operations. However, in reality efficient city logistics are good for both, the general public and the individual operator. Table 8 shows that the pursuit of the private operator business and optimisation objectives will at the same time contribute to the objectives set by a professional urban transport planning body.

Unlike in other sectors of transport, as for instance in passenger transport, a market driven optimisation of private company operations does not necessarily counteract the traffic optimisation efforts by the municipal authorities. On the contrary, it can be said that low efficiency in many developing country cities is the cause of high transport rates. It can be expected that a successful shift to higher efficiency and sustainability logistics will alleviate this situation.

Table 8: Coincidence of logistics operator- and socio-economic objectives

<table>
<thead>
<tr>
<th>Logistics operator optimisation objectives</th>
<th>Effect on socio-economic parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deploy appropriate vehicle size</td>
<td>Reduced road space usage</td>
</tr>
<tr>
<td>Minimise kilometres</td>
<td>Reduced GHG and noise-emissions</td>
</tr>
<tr>
<td>Minimise time consumption</td>
<td>Reduced road space usage</td>
</tr>
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<td></td>
<td>Reduced congestion</td>
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</table>

8.2 Green Freight Asia Initiative[23]

In the process of designing the China Green Freight Initiative, the Clean Air Initiative for Asian Cities (CAI-Asia) and the Sustainable Supply Chain Centre – Asia Pacific (SSCCAP) brought together shippers, carriers and logistic service providers in Singapore (April 2011), Beijing (May 2011) and Singapore (November 2011) to discuss the role of the private sector in emission reductions from freight and logistics. During the 2nd Green Freight Asia Workshop held in Singapore it was agreed to establish a “Green Freight Asia Network” of private sector

companies, including shippers, carriers, 3PLs and industry associations.

The Green Freight Asia Network was launched on 6 December 2011 at the Environmentally Sustainable Transport (EST) Forum attended by transport and environment government officials from 22 countries. The founding members of this network signed the “Private Sector Declaration on Green Freight in Asia toward a Green Economy”. The purpose of this declaration is to call on governments to establish green freight programs across Asia that are aligned and whereby the private sector can play a leading role.

The goal of the Green Freight Asia Network is to:

i. Ensure the active participation of the private sector in the development of green freight policies and programs in Asia that are consistent with each other and with other global Green Freight programs. These efforts should cover road, rail, water and aviation, but an initial focus could be on road freight.

ii. Develop streamlined and consistent methods for fuel and CO₂ measurement and reporting and a central database for data from freight carriers, national statistics, and other studies.

Enhance collaboration among shippers, carriers and logistics service providers to share best practice and jointly scale up Green Freight efforts.
9 Conclusion

The urban goods transport sector, which is growing fast, remains under-optimised, inefficient and polluting. The relevance of urban freight traffic is increasingly recognised in Asian cities. Climate change and pollution risks will further push governments, the private sector and the general public to reduce freight movement’s emissions. The recent classification of Diesel as carcinogenic by WHO underlines the need for action to limit risks for the urban population.

The actions proposed in this document are structured along the principles of Avoid–Shift–Improve. Only a combination of planning and technological measures will be effective in the long run. In addition, the need for co-operation between public and private actors to improve the efficiency of urban freight operations has been highlighted. 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 in Asia will have to choose actions suitable to solve most urgent problems and may have to adapt these solutions to the specific local context based on co-benefits.