A call to action on green freight in cities

EcoMobility Dialogues / Technical Paper

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By Sudhir Gota

In brief:

Freights travel across the globe, but it is the first and the last mile that is often most costly and emission intense. Improving the efficiency of the 'first and last mile' of deliveries is of prime importance for economic growth, environmental sustainability and livability of cities. Sudhir Gota has analyzed the drivers, strategies and instruments for greener urban freight systems.

The EcoMobility World Festival 2015

The EcoMobility World Festival 2015 will take place in the CBD of Sandton, Johannesburg – the vibrant heart of South Africa – in October. The Festival will offer a view of the cities in the future, with active street life and social inclusivity, served by a sustainable transport system.

As part of the EcoMobility World Festival, the EcoMobility Dialogues aim to encourage local and international dialogue and informed conversations about the future of urban mobility and the need for innovation to meet the needs in developing cities.

The Technical Papers: Contributions to the EcoMobility Dialogues 2015

In the course of preparing the EcoMobility Dialogues 2015 in Johannesburg, South Africa, experts have been asked to prepare and present technical papers on topics that challenge urban mobility today.

Five such technical papers have been compiled:

- Transferring sustainable transport and EcoMobility solutions
- Transport and climate change
- Sustainable development synergies and co-benefits of low-carbon transport measures
- A call to action on green freight in cities
- Soot-free urban bus fleets

The findings and messages of this paper are part of informing local leaders for their debates and provide input to the "Johannesburg Declaration on Climate Smart Cities". They will be further shared within ICLEI's EcoMobility Alliance (www.ecomobility.org) and are made available to a wider audience.

We cordially thank the author of **a call to action on green freights in cities** for their enormous work and input and for enriching technical and political debates around how we can generate more livable cities while contributing to a low carbon development.

Further information

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A call to action on green freight in cities

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Executive Summary

Within the logistics chain, it is the first and/or the last mile that is often the most costly and emission intense of the entire supply chain. High demand of freight within a small geographical area does not translate into high efficiency due to several barriers. Improving the efficiency of the 'first and last mile' of deliveries is of prime importance for economic growth, environmental sustainability and livability of cities.

The urbanization megatrend goes hand in hand with increased urban freight intensity, but also with corresponding negative externalities such as congestion, air pollution, greenhouse gases and traffic fatalities. These trends together with the increasing availability of green urban freight solutions make an ideal business case for green urban freight systems. But current urban freight systems often lack vision, clear targets, are based on poor infrastructure and low technology awareness. Avoid-Shift-Improve Strategies are frequently applied in passenger transport, but rarely in freight transport. Even though the author does not identify “magic bullets” for solving urban freight problems, lessons from experimentations are presented in detail, taking into consideration policy aspects, the institutional setting, stakeholder capacity and technology. The paper closes with a systematic list of 50 green urban freight solutions.

Acknowledgements

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The paper represents the view of the authors.

Introduction

Cities are seeking ways to facilitate better goods movement which have “no borders” in the global economy. Freight travels through multiple jurisdictions, generating disproportionate share of traffic related externalities such as congestion, air pollution, greenhouse gases, traffic fatalities etc. Within the logistics chain, urban freight which is often the first or last mile comprises one of the most costly and emission intensive segments of the supply chain. High demand of freight within a small geographical area does not really translate into high efficiency due to several barriers. Improving the efficiency of the 'first and last mile' of deliveries is of prime importance for economic growth, environmental sustainability and livability of cities.

However, urban freight is not well integrated into transport and economic development strategies of cities especially in developing countries. In addition, some developed cities in EU have set ambitious targets to achieve CO2 free city logistics by 2030[1]. Clearly, policymakers are now beginning to shift their view about urban freight transport. There is an urgent need to change current public discourse on urban freight and prioritize green freight in cities especially in developing countries. This paper is a call to action on urban green freight.

In this paper, some of the key issues, challenges and solutions connected with urban freight are discussed by summarizing lessons from demonstration, experimentation and implementation of urban freight solutions in cities. This paper is divided into three sections. First, it provides reasons to prioritize green freight in cities. Second, it provides a snapshot of green freight solutions and third, it examines lessons from experimentation and implementation of green freight solutions over last two decades.

Why prioritize green freights in cities cities

“Cities are where the battle for sustainable development will be won or lost”- **UN High Level Panel of Eminent Persons on the Post 2015 Development Agenda[2]**

Efficient freight movement is indispensible for livable cities and is fundamentally linked with economic vitality and poverty alleviation. Trillion dollars worth of commodities are absorbed annually on urban streets. However, urban freight movement is now at a cross roads. Old challenges remain but new have emerged.

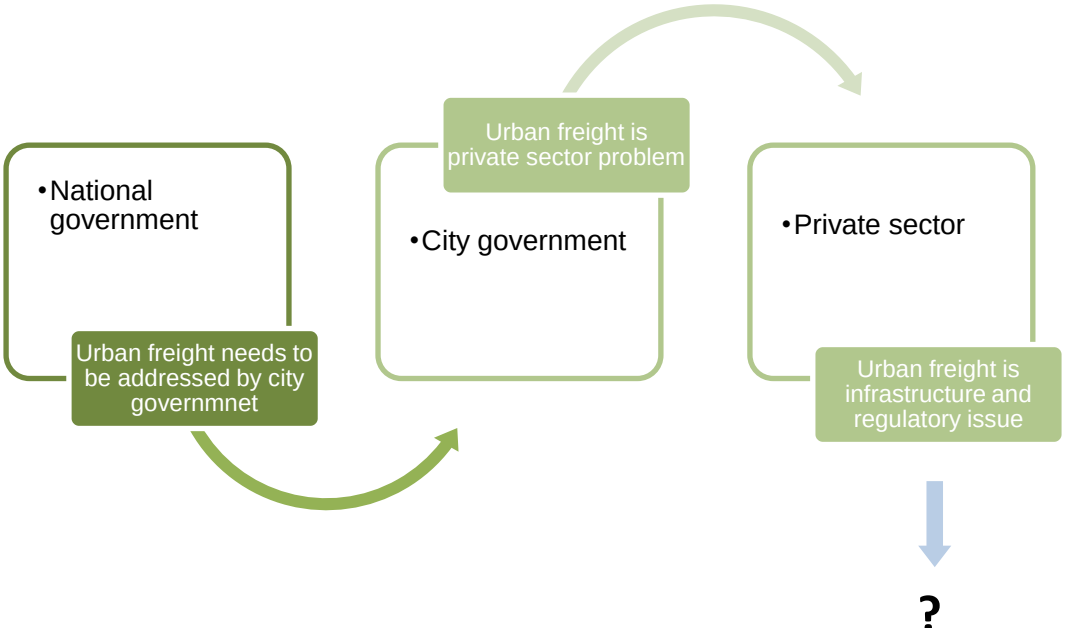
Freight movement generates a variety of negative externalities including traffic congestion, greenhouse gas emissions, air pollution, noise pollution, traffic accidents and land-use disruption. Growing urbanization and globalization has ensured that the majority of world's population is directly exposed to these positive and negative impacts. Urban freight is a critical link in economic growth and environmental sustainability.

However, in spite of large economic benefits and costs associated with urban freight movement, it is often not accorded due recognition in most cities. In one of the most comprehensive reviews of policies across developing countries established that while, around half of all policies addressed passenger transport, in contrast only 5% were focused solely on freight transport[3]. There are not many developing cities and countries which have established green freight policies or dedicated

programs or partnerships[4]. To this issue, national governments consider urban freight to be a local problem which is to be addressed by local authorities. Local authorities consider urban freight to be a private sector problem as it is linked with their commercial operations. Private sector often considers urban freight to be an infrastructure and regulatory problem which needs to be addressed by the government (Figure 1).

Figure 1: Urban freight paradigm in developing countries

Source: Sudhir Gota



Some of the critical factors which calls for prioritization of green freight in cities are

- **Growing urbanization**

Today, about 3.9 billion (equivalent to 54%) of world's population reside in urban areas (Figure 2). Latest projections show that urbanization combined with the overall growth of the world's population could add another 2.5 billion to urban populations by 2050, with ***"close to 90 % of the future increase concentrated in developing countries of Asia and Africa"***[5]. Now, with more than half of world's population residing in cities, there are about 500 cities with population greater than 1 million and about 1,700 cities with population greater than 300,000 across the globe. Although the urban share of global land cover is negligible, urban land use at the local scale shows trends of declining densities and outward expansion[6].

Most urbanization is underpinned by an economic logic. With growing urbanization, the link between economy and urban areas is increasingly getting strengthened (Figure 3). Several studies have indicated that rapid urbanization has profound implications on the increase in emissions. Infrastructure planned, designed and built for movement of goods and people has a significant capacity to lock-in future emission trajectories for several decades.

Figure 2: Share of urban population
Source: United Nations, Department of Economic and Social Affairs, Population Division (2014). World Urbanization Prospects: The 2014 Revision.

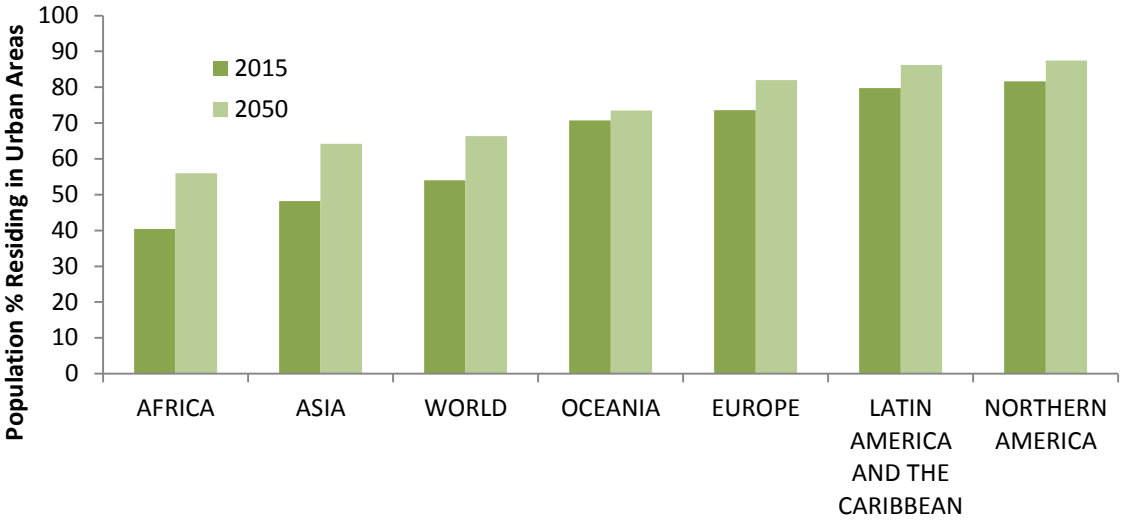
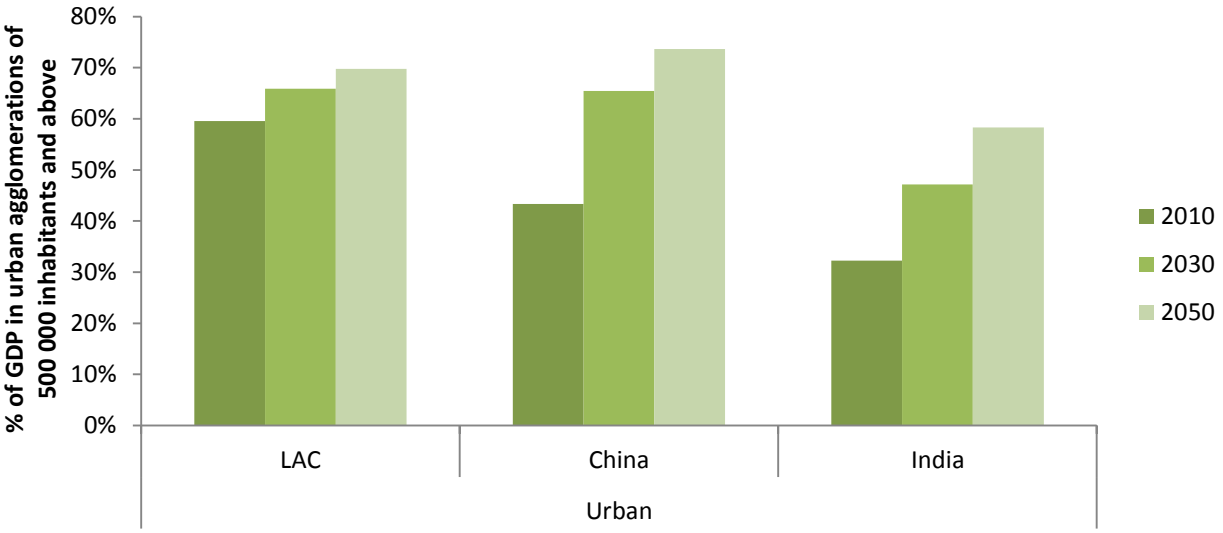


Figure 3 Share of GDP in urban area
Source : ITF Transport Outlook - © OECD 2014



- **Freight and economy**

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[7]. However, urban areas also account for between 67–76% of global energy use[8].

Globalization and facilitation of trade could not have been possible without the freight and logistics industry. Trade both in terms of value and tonnage is growing in the global economy. In 2010, the import and export of goods and services represented 29% and 31% of global gross domestic product (GDP). In the past decade, global GDP grew by 96%, the import and export of goods and services by

130% & 135%[9]. It is projected that the growth in trade would outpace the GDP growth over the next 50 years, with value of international trade to grow by a factor of four by 2050[10].

The link between GDP and freight is highlighted by freight intensity i.e. actual freight activity required to produce a unit of goods and services in the nation's GDP. This ratio is very high for developing countries when compared to developed countries. This reduction in freight intensity with GDP is a direct contribution of dematerialization of production due to growing service share in the GDP. Over the last decade, there has been a shift of economic mass to emerging economies. Economic boom, changes in economic structure and growing trade demands in developing regions has attracted infrastructure investments in developing cities.

Growing globalization with varied economic growth is leading to changes in production and consumption patterns among different regions. Changes in the commodity mix, thus more freight is being transported over longer distances. Since 2000, the global roadway network length increased by approximately 12 million lane km to facilitate movement of goods and people. China and India accounted for more than 50% of paved lane-km additions during that period. Over the next four decades, Non-OECD regions will account for nearly 90% of global travel increase[11] and majority of this infrastructure would be expanded in cities.

Recent estimations by International Transport Forum (ITF) suggest that freight may grow in enormous proportions in the future. For example, freight demand in ton-km could increase by 350%, road international freight share would increase about 40% and freight average hauling distance would increase by 17%[12] between 2010 and 2050 in absence of better policies. The expected growth in road freight movement has direct consequences to congestion, air pollution and GHG emissions. Estimates reveal that every year €100 billion, or 1% of the EU's Gross Domestic Product (GDP), are lost to the European economy as a result of delays and pollution related to urban traffic[13].

- **Growing externalities from urban freight**

"The diesel engine exhaust causes lung cancer in humans"- International Agency for Research on Cancer (IARC), World Health Organization (WHO)

Logistical activity accounts for roughly 5.5% of total global greenhouse gas (GHG) emissions[14]. Within the logistics sector, freight transport accounts for around 90% of total GHG emissions[15] and 35% to 60% of logistics cost. Within the logistics chain, urban freight, which is often the first or last mile, comprises one of the most costly and emission intensive segments of the supply chain in which companies deliver goods to end customers. Last mile emissions could be about 25% of logistics supply chain emissions and accounting for 28% of total transport costs[16].

The urban freight link is the most polluting in the entire supply chain. As final products get delivered in low volumes and at high frequencies in congested traffic conditions, this generates high number of trips at low volumes with high pollution and low fuel efficiency. Average congestion costs in cities like Rio de Janeiro and São Paulo amounted to roughly about 43 billion USD in 2013 or about 2% of Brazil's entire GDP[17]. In many large cities, congestion costs are estimated to be 1-5% of national GDP.

Urban freight constitutes only a small share in total vehicle ownership with less than 10% in many developing cities. However, urban freight constitutes a significant share of urban transport

externalities. Movement of goods represents a considerable portion of urban traffic volume. Although in most cities on average only 15 to 25 % of the urban vehicle kilometers (four-wheel and more) travelled can be attributed to commercial vehicles, it is estimated that they make up roughly 20 to 40 % of motorized road-space occupation and cause 20 to 40 % of urban transport CO2 emissions.

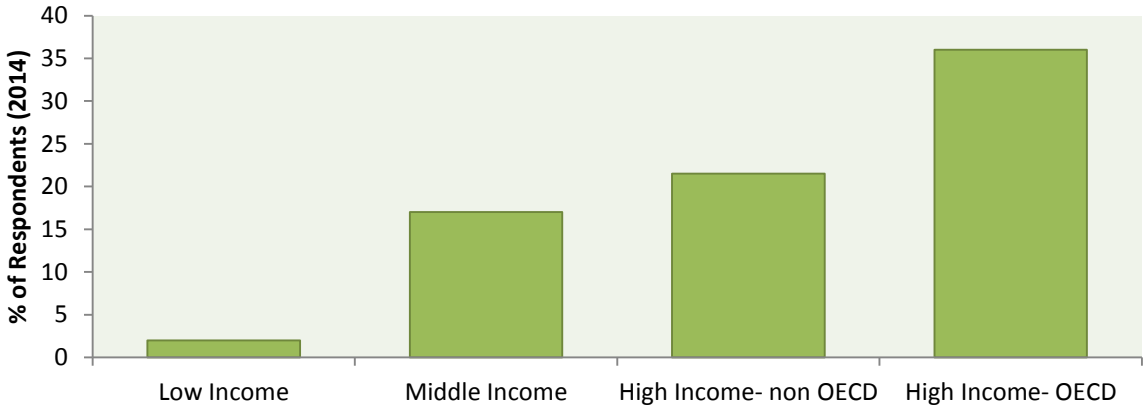
For air pollutants such as particle matter (PM) and nitrogen oxides (NOx), the commercial vehicle is responsible for about 30-50% in cities of developed economies and higher than 50% for cities in developing countries[18].

- ## Green urban freight solutions

"Freight is often neglected in design & planning of urban transport systems"

In the past two decades, several cities, mostly in Europe and Japan experimented innovative solutions on urban green freight. But these measures are restricted to few metropolitan cities. In low income countries, there is low awareness and little demand for green logistics and green products. LPI 2014 survey[19] indicates that demand for green freight among shippers could vary from 2% in low income countries to 36% in high income countries (Figure 4).

Figure 4: Shippers demand for green logistics and green products
Source: LPI-2014



The typology of urban freight development across different cities is highlighted in Table 1.

Table 1 Current typology of urban freight development
Source : Sudhir Gota

	Metropolitan cities in high income economy	Metropolitan cities in middle income economy	Growing cities in low income economy
Vision	Freight Planning often starts with a vision	No vision	No vision
Emission targets	Established both by public authorities and private companies	No target established	No target established

Infrastructure	High quality for all modes where possible	Lot of infrastructure deficit but high priority	Infrastructure development for roads currently beginning to be prioritized. Infrastructure available is of poor quality
Restrictions of freight mobility	High	High	Medium
Trucks	Trucks with better technologies available	High share of old trucks and few better technology models. Fuel quality being improved.	High share of old trucks with high sulphur fuel
Operations	High optimized & high share of third party logistics provider (3PL)	Inefficient and low share of 3PL	Highly inefficient
Technology	Technology use being piloted as demonstration studies	Few initiatives on promoting technology	Low awareness on technologies
Freight partnerships	Being established	No active partnerships	No active partnerships
Data	Only Priority data available	limited	Very limited/to absent
Finance	Not a critical barrier	Challenge but new innovative mechanisms proposed.	Is a major barrier
Recognition scheme	Green Freight recognition schemes being implemented	Sustainable transport recognition schemes (mainly passenger oriented)	Not yet implemented

Based on detailed literature review and expert survey, nearly 50 urban green freight instruments, strategies and policies are identified in this paper (

Table 4). These measures can be categorized & identified using different typologies. There is no standard approach for such a categorization. These typologies differ based on the geographic scope, source, nature & duration of the problem and the solution and type of implementation actor and impact. Urban green freight solutions are often measures and instruments which influence volume, distance, efficiency, infrastructure, modes, supply chain structure and operations.

Avoid, Shift and Improve framework (A-S-I) is well established in passenger transport but in freight sector, it is still an unknown commodity. A-S-I refers to

a) Avoid policy/strategies reduce the need to travel or to reduce the travel distance for road freight vehicles. Avoid reduces either tons or kilometres travelled or both ton-km.
b) Shift policy/strategies refer to those which transfer freight activity to more energy-efficient and/or environmental-friendly modes. Shift reduces emissions per unit freight activity.

c) Improve policy/strategies are the ones which improve the energy efficiency of the current road freight transport modes, their operations and technologies. Improve reduces emissions per unit freight activity.

"It is important to note that improving efficiency in urban freight will not necessarily make it more sustainable"

Efficiency of freight transport means reducing the costs or fuel consumption per unit freight demand without reducing the demand i.e. ton-km. Improving efficiency can cause a significant rebound effect where companies start sourcing products from greater distance at higher frequency. This can also cause a trade-offs that companies make between transport, warehousing and inventory causing them to trade off more freight movement for lower warehousing and / or inventory costs and could have adverse implications on efficiency of logistics chain. By integrating avoid, shift and improve strategies, freight can be decoupled with economy ensuring holistic growth. The Table 2 summarizes demonstrated and effective avoid-shift and improve strategies for urban freight i.e. strategies applicable for cities.

Table 2: Avoid-Shift-Improve Strategies applicable for urban freight
Source : Sudhir Gota

Avoid	Shift	Improve	Crosscutting
• Enhanced Building Codes • Freight clusters (freight villages) • Increase storage capacity at delivery points – to permit delivery of larger loads • Integrating freight into land use planning • Introduce Fuel tax • Loading and Parking restrictions • Low emission zones • Relax just-in-time replenishment schedules to permit greater load consolidation • Restriction on	• CargoTram • NMT freight distribution • Using Capacity of Public Transport	• Appointments and pricing strategies at ports • Developing network of ecommerce pickup points • Energy Efficient warehouses • Exclusive truck lanes • Eco-driving • Extend opening hours of premises for collections and deliveries • Freight Exchange • Freight Parking and loading zones • Implement Truck Scrappage Scheme • Pick-up/delivery to alternate locations • Real-Time Information Systems • Relocation of large traffic generators • Reschedule deliveries to inter-peak periods and evening / night • Retrofitting aerodynamic technologies to improve fuel efficiency	• Create a Freight Advisory Committee (FAC) • Create a Freight Quality Partnership (FQP) • Designate a freight person at key agencies • Developing Urban Logistics Plans (ULPs) • Environmental justice • Foster an Industry-Led Best Practices Dissemination Program • Freight Company Consortium • Freight Operators Recognition Scheme • Labelling and Certification • Mandatory GhG reporting

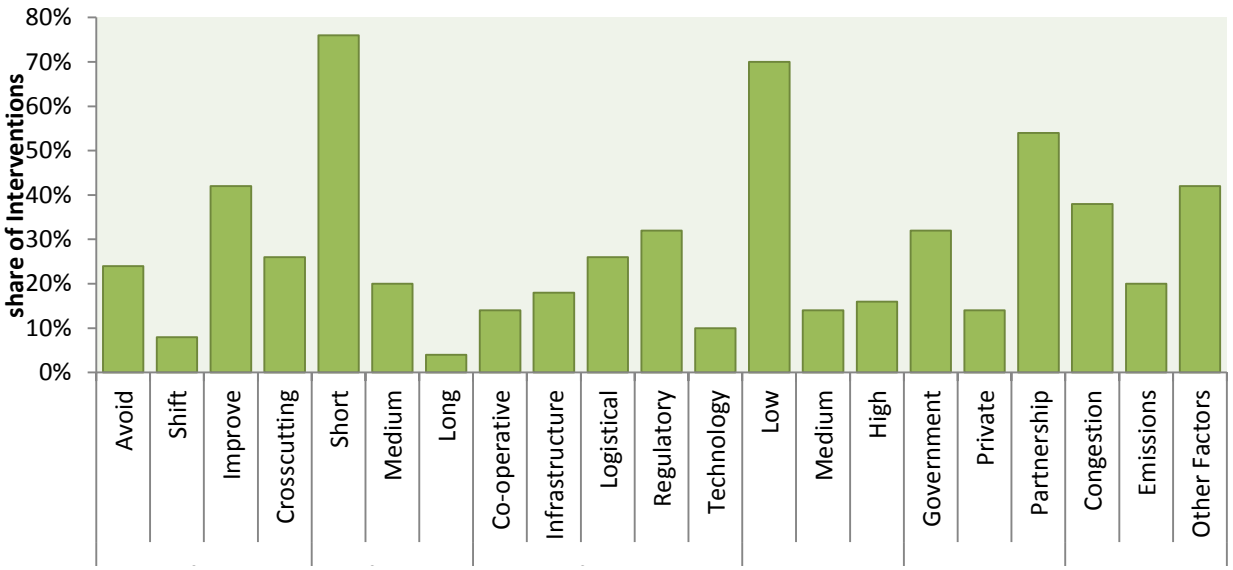
truck idling • Road pricing/ incentives • Urban consolidation centers • Vehicle size and weight restrictions	• Retrofitting rolling resistance technologies to improve fuel efficiency • Ring roads for through traffic • Subsidies for low emission deliver vehicles • Subsidizing use of low sulpher fuel • Telematics • Time access restrictions • Train drivers in the techniques of fuel efficient driving (eco-driving) • Use small delivery vehicles	• Noise programs/ regulations • Urban freight information and maps • Urban freight policy

The entire array of 50 measures could be further segregated by different instruments such as co-operative, infrastructure, regulatory and technology solutions. Table 3 provides typology a of 50 popular urban freight solutions.

Table 3 Typology of urban green freight measures
Source : Author

	Avoid	Shift	Improve	Crosscutting	Total
Cooperative				14%	14%
Infrastructure	2%	8%	8%		18%
Logistical	6%		14%	6%	26%
Regulatory	16%		10%	6%	**32%**
Technology			10%		10%
Total	24%	8%	**42%**	26%	

Figure 5 Urban green freight categorization
Source : Author



There is a dominance of improve and regulatory measures in urban freight strategies. Technological interventions improve the energy efficiency of the current road freight transport modes. Some of the measures often cited like fuel economy standards for trucks can be implemented at national level, but many technologies to improve fuel efficiency of trucks can even be implemented at city level by working with freight operators.

There is severe lack of *significant* mode shift opportunities in urban freight due to number of reasons such as high number of destination points, quality of existing rail and water transport infrastructure within cities, impact of non-freight policies on modes, land use and transport, customer tastes and required service and safety levels.

Green freight interventions are not expensive to the society. However, research demonstrates that there exist several barriers for optimization. The implementation of green freight measures may impose additional costs on some stakeholders, especially private sector. It needs to be recognized that benefits and trade-off are both significant factors at play and it is important to acknowledge the difference in the value propositions of different stakeholders.

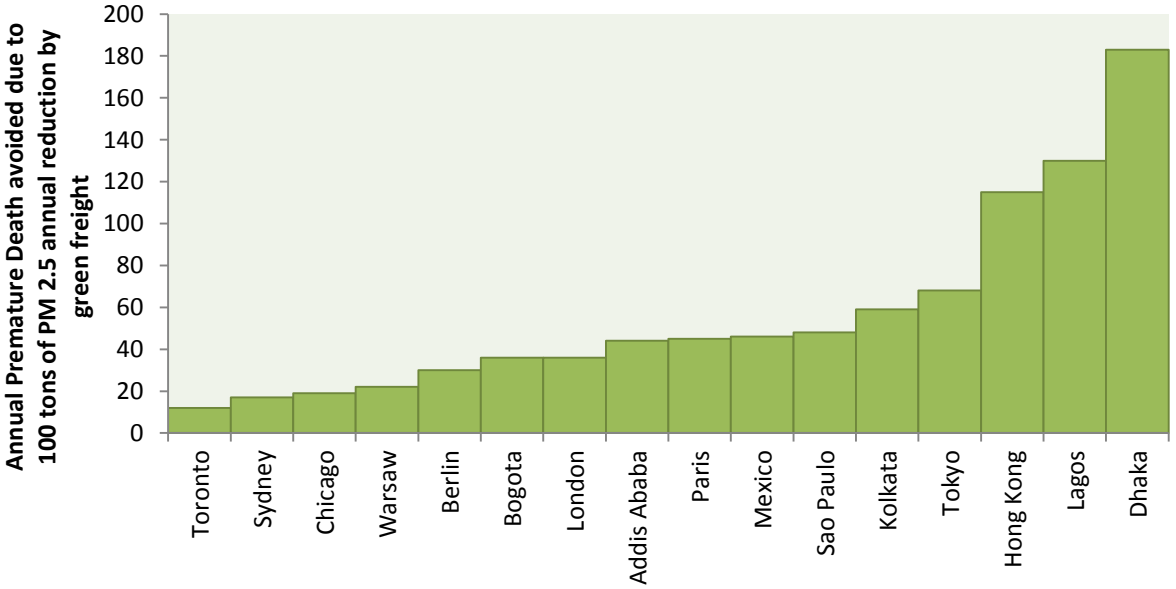
Many initiatives are regulatory, cooperative, logistical and behavioral which are easy to implement fairly quickly and which yield significant impact within 5 years of decision making. Many urban freight measures generate high co-benefits i.e. cost effective improvements at the local level and at the same time make significant contributions to longer term national transport, economic, health and environmental objectives.

For example, Figure 6 shows annual premature death avoided by a simple ground level reduction of 100 tons of PM2.5 annually due to green freight activities in cities. In Sao Paulo, a green freight retrofit program to reduce fuel consumption in 10,000 heavy-duty vehicles generate cumulative

benefits greater than 1 billion US$ due to health impact by reduction of nearly 3000 tons of Black Carbon[20].

Figure 6 Annual premature death avoided in cities

Source : Sudhir Gota, own calculations using Aircounts calculator (www.aircounts.com)



Regulatory approach is dominated by restrictions (time, space, engine) and improve strategies such as truck scrappage schemes. It is interesting to note that infrastructure plays a vital role in the mode shift strategies. Many of the logistical measures implemented by private sector is to ensure reduction in transport costs with fuel efficiency improvements. Annex-I provides best practices for urban freight solutions. The next section captures lessons from research, demonstration, experimentation and implementation of green freight strategies in cities.

Lessons from green freight experimentation and implementation in cities

Based on the discussions until now, it is clear that there is no “magic bullet” in solving the freight problems in cities. There are significant opportunities to address freight sector at local level (

Table 4), however, city needs vary greatly, as location, land use, density, and traffic vary from city to city. While identifying and implementing urban green freight measures, it is important to consider following lessons.

Figure 7 High density and scarcity of space leads to freight conflicts in urban area
Photo source : https://unsplash.com/

1. Importance of policy, strategy, regulation and institutional strengthening

- **Vision and policy** - There is a need to develop a long term urban green freight policy to guide the regulatory development and infrastructure investments. In order to develop this policy, visioning of urban freight is essential. For example, the London Freight Plan is founded on the following vision - *"The safe, reliable and efficient movement of freight and servicing trips to, from, within and, where appropriate, through London to support London's economy, in balance with the needs of other transport users, the environment and Londoners' quality of life"*.

  Based on the vision, London Freight Plan supports sustainable development of London by giving clear guidance and direction on freight investments. Further, investments prioritized by urban freight policy can be successful and sustained over a long term if an integrated policy is in place nationally in support of green freight. In UK, London Freight Plan is in sync with UK freight policy[21].

- **Land-use strategy** - The starting point and the development pattern of urban logistics systems, economic growth and infrastructure development are different in each city. However, across cities in different continents, land use policy authority of local governments to develop, modify and implement planning and building guidelines is clearly established[22]. This is a common universal denominator across developed and developing cities.

  Currently cities across the globe are undergoing two contrasting trends simultaneously i.e. undergoing urban sprawl (logistics facilities moving outside the cities) and consolidation of freight facilities (small freight facilities like warehouses are being replaced by large distribution centers). Based on evaluation of impact of land-use strategies on urban freight,

there is an immediate need to strengthen land use strategies considering high impact of urban form, density and diversity of land-use on urban freight. For example, roughly about 6,800 restaurant and drinking establishments in Manhattan produce more truck traffic than the Port Authority of New York and New Jersey. Similarly 81 large buildings in New York city could generate about the same number of truck trips as the ports[23].

Clearly, land use strategies could play a significant role in managing freight operations. For example: restaurants in Barcelona are obliged to have a storage area within their premises to store bottles. This small modification in land-use strategy has decreased the number of daily deliveries of beer trucks to cafes and restaurants in city center[24].

- **Carrot and stick** - Implementation of green freight strategy may lead to heterogeneous reaction among diverse stakeholders. It is important to note that not all benefits would be directly accrued to private sector or government as cost and carbon emission reductions are not always aligned in the same direction. For example, private sector companies may be burdened with additional costs to freight operations due to time, lane or parking restrictions imposed by the government or due to any other regulatory changes. Government can balance this by providing additional incentives or subsidies which provide tangible reduction in costs while offering the same advantage to all private sector operators.

  Further, subsidies from public sector have a critical role in evolution and transformation of technologies in freight sector. Much experimentation establishes that it is challenging to establish profitable operations for the operator[25]. A strong market-based mechanism that provides both "carrot and stick" is a basic necessity in urban freight i.e. to provide incentive to shippers, logistic and trucking companies to adopt fuel-saving strategies that increase profits and reduce emissions and share data while simultaneously raising the service standards, improving regulations and implementing a wide array of instruments. ***One-fourth of the identified interventions are infrastructure and technology related solutions which need support in the form of easy access to finance especially for private sector,*** i.e. shippers and carriers (Figure 8).

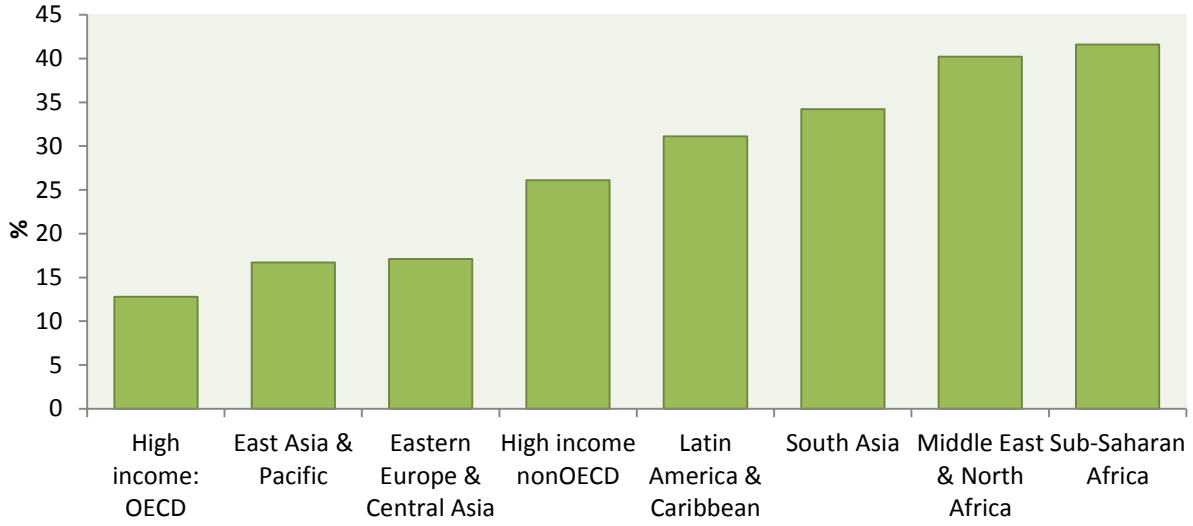


Figure 8: Share of firms identifying access to finance as a major constraint
Source: World Bank Enterprise Survey

- **Differentiation and harmonization** - Regulations for urban freight should increasingly be harmonised across appropriate geographic levels. Furthermore, cities need to introduce some degree of differentiation in regulations to reward private sector companies for taking proactive steps and investments towards reducing emissions. These differentiation in regulations can be implemented in various forms such as restricting movements in pre-Euro or Euro-I trucks while allowing special parking and loading facilities for cleaner trucks. This approach of differentiation and harmonization would allow private sector companies to make long term investments in reducing emissions (cleaner trucks).

- **Part of supply chain** - It is also important to remember that urban freight movement is only a part of the whole logistics chain. Initiating and implementing green urban freight measures would have interrelated effects in other areas of freight transport and storage. Furthermore, since freight is interconnected to trade, the implementation of policies and regulations need to accommodate trade related plans and investments. Finally, as freight movement would need to share the right of way with passenger transport in many cases, the overall vision of passenger transport needs to be cohesive with freight plans and investments.

- **Institutional barriers** - While developing a green freight program, institutional barriers need to be addressed along with encouragement and participation of all key stakeholder groups. For metropolitan cities with high intensity of freight production and attraction, there is a need for a kind of single window for freight that, in particular, provides a single point of reference for information that the freight industry requires to operate in a particular urban area or region and for policy and regulation consultation. An Office of Urban Freight[26] could be established for developing and disseminating public outreach materials. In addition, the enforcement of truck routes, developing and facilitating transparent partnerships with stakeholders with access and exchange of information, expertise, periodic green freight training, documenting and sharing good and bad practice examples.

2. Improve awareness and capacity of stakeholders

- **Awareness and capacity building -** Integral to the successful implementation of the green freight strategies involve the critical role of awareness and capacity building which could help scaling-up freight interventions. It is important to incorporate awareness raising, training and capacity building mechanisms into institutionalized structures as majority of barriers related to urban freight involve information, cooperation, investments and decision-making[27].

- **Best practice transfer** - There is a significant lack of knowledge transfer among the different developing cities and also between the developed and developing cities which makes it hard for cities to follow good experiences and avoid failures. European Union has implemented several knowledge transfer projects on urban freight over the last decade. For example, “Best Practice Factory for Freight Transport” (BESTFACT) which commenced in 2012 and would finish in 2016. The project is examining best practice in urban freight transport, green logistics, co-modality, and e-Freight. Other good example is Sustainable Urban Goods logistics Achieved by Regional and local policies (SUGAR) which is a EU co-funded initiative

launched in 2008 and which aims to promote the exchange, discussion and transfer of policy experience, knowledge and good practices in the field of urban freight management, with regards to policy and planning levers between and among advanced and less experienced sites[28].

- **Recognition programs -** There are a number of regional green freight related recognition programs currently in existence around the world which are equally applicable to urban freight sector. However, there are only few dedicated urban freight recognition programs which provide annual recognition in terms of awards for cities in developing countries. Good examples for green freight recognition program in cities in developed economies could be CIVITAS Awards[29], fleet operator recognition scheme[30] & SUGAR Awards[31] which reward innovative projects in cities.

3. Improve data, tools and modelling

- **Good data** is the key to any successful implementation. The availability of urban freight data in cities is extremely poor. Cities need urban freight data in order to understand local needs, evaluate multiple solutions to existing problems, and anticipate future planning requirements as well as to understand the current performance of freight investments. Some cities in developed countries like France and Japan have carried out extensive surveys to develop a common data collection methodology and roll out urban freight indicators[32]. However, the quality and quantity of urban freight data in cities of developing countries is extremely poor which restricts effective planning and implementation of green freight measures. Further, there little consistency or standardization in terms of the data collected about urban goods and vehicle flows

- **Harmonization of tools** - There are sufficient tools and models available for estimating carbon emissions and air pollutants from the freight sector. Global review of transport methodologies and models reveal that nearly 61% of methodologies are applicable to freight sector which could quantify CO2 emissions and air pollutants across different boundaries - national, city, project & supply chain[33]. However, there is a need for harmonization of methodologies and emissions reporting for private sector companies like shippers and logistic service providers as supply chain extends through continents.

  Many global shippers and logistic companies have established targets to improve efficiency and reduce carbon emissions. However, there is no standard process in place for the capture and calculation of emissions. Harmonization of emission calculation methodology will ensure scaling-up of efforts to reduce emissions from freight sector by ensuring uniform standard system for collecting, analyzing and monitoring CO2 emissions from private sector freight operations.

- **Develop urban freight indicators** - There is lack of standardization in freight indicators for monitoring urban freight investments. Governments primarily monitor freight to understand implications on economy, energy consumption and environment. Further, freight indicators are also required to understand relative importance of different modes of urban transport

and to determine the infrastructure needs, while the private sector use indicators for evaluation of costs, performance and operational efficiencies of the logistics chain. Stakeholders have diverse needs and thus freight indicators should reflect this diversity while providing a standard approach to collect these indicators.

Few examples of urban freight indicators are - Freight transport mode share (tons and tonkm), details on urban freight infrastructure (km of roads & sqm of parking, loading and unloading facilities and storage space), freight motorization index, freight cost/tonkm for different modes, freight transport emissions per ton kilometre or energy consumption per tonne-km, fuel consumption/vehicle kilometer travel(MJ/Truckskm), freight transport intensity (ratio of total freight moved to GDP), traffic fatality related to freight transport, empty trips (%), average loading (tons) and ratio of truck kilometer travel to GDP.

- **Performance benchmarking**- There is a significant lack of performance benchmarking among cities. There is a need for development of a benchmarking tool (for example **Green Urban Freight Index)** which could assist cities to compare their green logistics performance, identify solutions and suitable investment opportunities for implementation. This Index could be developed based on consultations with policy makers in cities, logistics experts, shippers, carriers, third party logistics providers and industry associations. This tool could help identify local market failures relating to policy, institutional, financial and technical factors that prevent stakeholders from scaling-up green freight solutions.

- **Clean air action plan** - Many port cities have initiated green freight activities after carrying out detailed emission inventory to determine impact of ships and port activities on air quality of the city. For example, ports of Long Beach, Los Angeles and Hong Kong used comprehensive emission inventory to understand issues and identify best focus planning efforts and abatement strategies that exist within the city. These inventories facilitate development of clean air action plans which are instrumental in implementation of a slew of anti-air pollution strategies including the ports' Clean Trucks Programs, vessel pollution reduction programs etc. Many developed cities with intense port activities use emission inventories to track their progress in achieving emission reductions. Port cities in developing countries could develop a clean air action plan based on the emission inventory and consultations with key stakeholders and implement identified green freight measures.

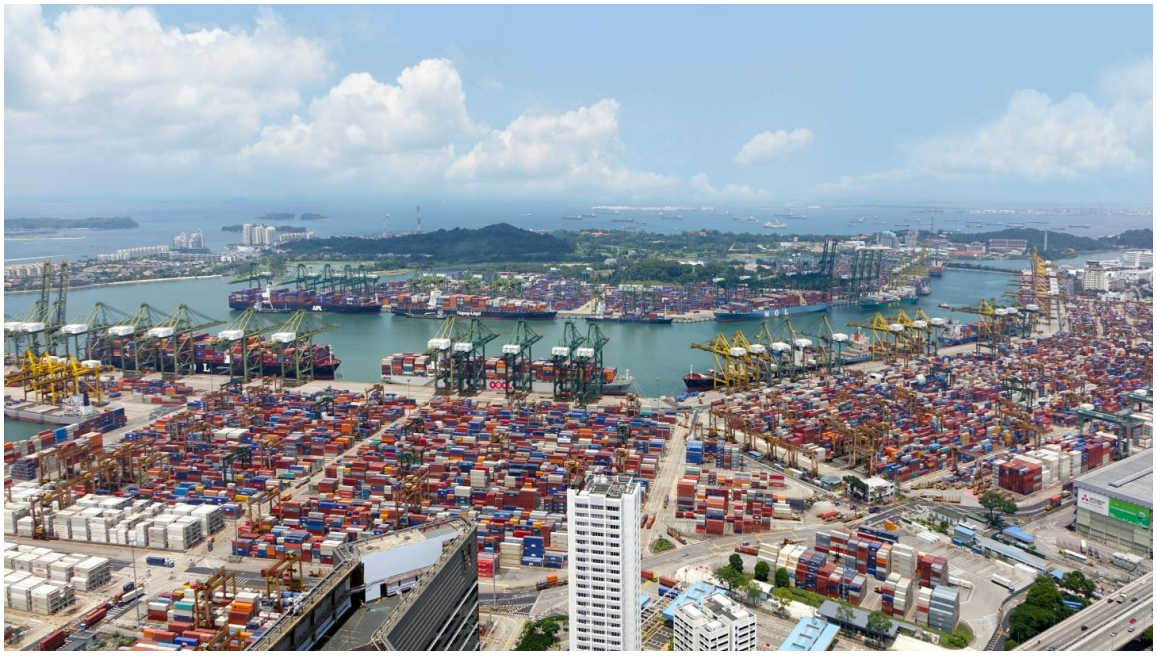


Figure 9: Ports generate high emissions
Photo Source: http://pixabay.com/

4. Partnerships, experiments and technologies

- **Value proposition** - Green urban freight is often associated with "triple bottom line" concept of advancing economic and social quality of life while limiting impacts on the environment. For green freight efforts to succeed, tradeoff of economic costs and/or social costs against environmental benefits should be managed and there needs to be a strong convergence between the low-carbon, environmental, economic and cost-efficiency agendas. Different stakeholders have different expectations from green freight. Cities do not implement green freight initiatives only to address climate change or air pollution. Nearly 80% of urban freight solutions identified in this study indirectly reduce emissions. The main motivation behind their implementation ranged from congestion reduction, stakeholder engagement, logistics supply chain decision, fuel consumption reduction, freight cost etc.

- **Partnerships** - Many local decision makers often consider freight transport issues as private rather than public and that optimization of transport is a business driven interest which does not need government intervention until when it is a serious problem[34]. However, based on analysis of freight interventions it is clear that they cannot be implemented in isolation by a single stakeholder. No single decision maker is able to transform the urban freight situation without adequate support from stakeholders. There is a need for urban freight partnerships between private and public sector. Public authorities in developing economies often do not have a good track record in involving diverse set of urban freight transport stakeholders in decision-making.

- **Experimentation**- Cities in developed countries have carried out several experimentation projects and demonstration studies to understand investment potential, economic and social impact, strengths and barriers for implementation. Though these experiments concern only a minor fraction of urban freight flows within a city, they are not only very effective in convincing political leaders and policy makers of possibilities but also understand changes in behaviour of consumers and private sector[35] and generating a snowball effect. For example, all the experiments promoted by the city of Paris have been widely advertised in the specialised as well as the local press. However, cities in developing countries have not yet initiated large scale experimentation and demonstration activities to field test innovative ideas in urban freight sector. **Until and unless cities in developing countries utilize trial and error approach and test innovative solutions, radical improvement is impossible**.

- **Market failure in technology** - In order to break the market failure in use of technologies, there is a need to provide incentives especially in the urban areas to increase the pace of diffusion of technical innovations. Many technologies especially related to fuel efficiency of trucks have higher payback periods due to low annual travel and fuel use when compared with long-haul trucks. It has been estimated that for long-haul trucks, up to a 50 % reduction in energy intensity by 2030 appears possible at negative societal cost per tCO2eq due to the very large volumes of fuel they use. However, for trucks used in urban areas have a wider range of potentials and costs, reaching above 100 USD / t CO2eq[36] in 2010. In order to ensure penetration of technologies and bringing down the age of the fleet and ensure increase in the capacity of the fleet, access to affordable finance is very important especially in urban areas.

Recommendations

Based on lessons from research, demonstration, experimentation and implementation of green freight strategies in cities, 10 top recommendations for bringing urban freight into agenda in developing cities are

1. Develop green freight vision, urban freight policy and link it with national transport and trade policy
2. Optimize land-use strategy for green freight movement
3. Incentives and subsidies are critical in implementation of urban freight policy and strategy
4. Address institutional barriers
5. Improve awareness & capacity with training, best practice transfer, performance benchmarking and recognition program
6. Improve data, indicators, modelling and tools
7. Overcome market failure of technologies
8. Develop partnership with private sector
9. Carry out large scale experiments
10. Improve low cost finance for shippers and carriers

Table 4: 50 Urban Green Freight Solutions
Source: Sudhir Gota

	Strategy	Type of strategy	Time	Type of instrument	Invest-ment	Implemen-tation by	Driver
1	Appointments and pricing strategies at ports	Improve	Short	Regulatory	Low	Government	Congestion
2	Cargo Tram	Shift	Medium	Infrastructure	High	Partnership	Congestion
3	Create a Freight Advisory Committee (FAC)	Awareness	Short	Co-operative	Low	Partnership	Stakeholder engagement
4	Create a Freight Quality Partnership (FQP)	Awareness	Short	Co-operative	Low	Partnership	Stakeholder engagement
5	Designate a freight person at key agencies	Awareness	Short	Co-operative	Low	Government	Stakeholder engagement
6	Developing network of ecommerce pickup points	Improve	Short	Logistical	Low	Private	Logistics
7	Developing Urban Logistics Plans (ULPs)	Awareness	Short	Logistical	Low	Partnership	Logistics
8	Energy Efficient warehouses	Improve	Medium	Infrastructure	High	Private	Fuel Efficiency
9	Enhanced Building Codes	Avoid	Long	Regulatory	Low	Government	Congestion
10	Environmental justice	Awareness	Short	Regulatory	Low	Government	Emissions
11	Exclusive truck lanes	Improve	Medium	Infrastructure	Moderate	Government	Congestion
12	Extend opening hours of premises for collections and deliveries	Improve	Short	Logistical	Low	Partnership	Congestion
13	Foster an Industry-Led Best Practices Dissemination Program	Awareness	Short	Co-operative	Low	Partnership	Stakeholder engagement

14	Freight clusters (freight villages)	Avoid	Medium	Infrastructure	High	Partnership	Logistics
15	Freight Company Consortium	Cross Cutting	Short	Co-operative	Low	Private	Logistics
16	Freight Exchange	Improve	Short	Logistical	Moderate	Private	Empty Trips
17	Freight Operators Recognition Scheme	Awareness	Short	Co-operative	Low	Partnership	Emissions
18	Freight Parking and loading zones	Improve	Short	Infrastructure	Low	Government	Logistics
19	Implement Truck Scrappage Scheme	Improve	Short	Regulatory	Moderate	Government	Emissions
20	Increase storage capacity at delivery points – to permit delivery of larger loads	Avoid	Short	Logistical	Moderate	Partnership	Congestion
21	Integrating freight into land use planning	Avoid	Long	Regulatory	Low	Partnership	Congestion
22	Introduce Fuel tax	Avoid	Short	Regulatory	Low	Government	Finance
23	Labelling and Certification	Awareness	Short	Co-operative	Low	Partnership	Emissions
24	Loading and Parking restrictions	Avoid	Short	Regulatory	Low	Government	Congestion
25	Low emission zones	Avoid	Medium	Regulatory	High	Government	Emissions
26	Mandatory GhG reporting	Awareness	Short	Regulatory	Low	Partnership	Emissions
27	Mode Shift Program	Shift	Medium	Infrastructure	Moderate	Partnership	Congestion
28	NMT freight distribution	Shift	Short	Infrastructure	Low	Partnership	Emissions
29	Noise programs/ regulations	Awareness	Short	Regulatory	Low	Partnership	Noise

30	Pick-up/delivery to alternate locations	Improve	Short	Logistical	Low	Private	Logistics
31	Real-Time Information Systems	Improve	Medium	Technology	High	Partnership	Congestion
32	Relax just-in-time replenishment schedules to permit greater load consolidation	Avoid	Short	Logistical	Low	Private	Empty Trips
33	Relocation of large traffic generators	Improve	Medium	Logistical	High	Partnership	Congestion
34	Reschedule deliveries to inter-peak periods and evening / night	Improve	Short	Logistical	Low	Partnership	Congestion
35	Restriction on truck idling	Avoid	Short	Regulatory	Low	Partnership	Emissions
36	Retrofitting aerodynamic technologies to improve fuel efficiency	Improve	Short	Technology	Low	Partnership	Fuel Efficiency
37	Retrofitting rolling resistence technologies to improve fuel efficiency	Improve	Short	Technology	Low	Partnership	Fuel Efficiency
38	Ring roads for through traffic	Improve	Medium	Infrastructure	High	Partnership	Congestion
39	Road pricing/ incentives	Avoid	Short	Regulatory	Moderate	Government	Congestion
40	subsidies for low emission deliver vehicles	Improve	Short	Regulatory	Moderate	Government	Emissions
41	Subsidizing use of low sulpher fuel	Improve	Short	Regulatory	Low	Government	Emissions
42	Telematics	Improve	Short	Technology	Low	Partnership	Fuel Efficiency
43	Time access restrictions	Improve	Short	Regulatory	Low	Government	Congestion

44	Train drivers in the techniques of fuel efficient driving (eco-driving)	Improve	Short	Technology	Low	Partnership	Fuel Efficiency
45	Urban consolidation centers	Avoid	Medium	Logistical	High	Partnership	Empty Trips
46	Urban freight information and maps	Awareness	Short	Logistical	Low	Government	Congestion
47	Urban freight policy	Awareness	Short	Logistical	Low	Partnership	Logistics
48	Use small delivery vehicles	Improve	Short	Logistical	Low	Private	Congestion
49	Using Capacity of Public Transport	Shift	Short	Infrastructure	Low	Partnership	Congestion
50	Vehicle size and weight restrictions	Avoid	Short	Regulatory	Low	Government	Congestion

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