SMART FREIGHT CENTRE

Developing a Sustainable Urban Freight Plan – a review of good practices

A review of worldwide policy good practice, with 5 supporting case studies

Disclaimer

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About Smart Freight Centre

Smart Freight Centre (SFC) is a global non-profit organization leading the way to a more efficient and environmentally sustainable global freight sector. SFC works with partners and existing initiatives to help businesses gain competitive advance from smarter freight and catalyze sector-wide action.

SFC focuses on three approaches:

- Define and drive business leadership and collaboration between the private sector, government and civil society (Smart Freight Leadership)
- Create and implement a universal and transparent way of calculating logistics emissions across the global supply chain through the Global Logistics Emissions Council (GLEC)
- Catalyze the sector-wide adoption of proven and cost-effective technologies and solutions starting with road freight through SFC's Smart Trucks Platform.

Contact

Smart Freight Centre
Vijzelstraat 68-78, 1017 HL, Amsterdam, Netherlands
P.O. Box 11772, 1001 GT, Amsterdam, Netherlands
Tel office: +31 6 4695 4405
www.smartfreightcentre.org
info@smartfreightcentre.org

Smart Freight Centre Beijing Office
Room 817, ULO Park
Wang Jing, Chaoyang district
Beijing, China
Tel office: +86 10 8476 6376

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1. Introduction

Cities are seeking ways to facilitate the better movement of freight, which has no borders in the global economy. Freight travels through multiple jurisdictions, generating a disproportionate share of traffic related externalities including congestion, air pollution, greenhouse gas emissions, traffic fatalities etc.
Within logistics supply chains, urban freight comprises one of the costliest and most emission-intensive segments of the supply chain; the high demand of freight within a small geographical area translates into low levels of vehicle and energy efficiency due to a variety of barriers.

Improving the efficiency of the 'last mile' of deliveries is of prime importance for the economic growth, environmental sustainability and livability of cities. However, urban freight is not yet well integrated into the transport, land use and economic development strategies of cities, especially in developing countries.

Some developed cities in the EU have recently set ambitious targets to achieve CO_2 free city logistics by 2030.[1]
As a result, policymakers are now beginning to take more interest in the impacts of urban freight transport.
In all countries, there is a need to ensure that all transport is more sustainable, for both people and goods movement. In an urban context, there is a need to address the social, environmental and climate impacts of freight movement, and given the economic impacts, we need to achieve this without increasing the costs of goods and services.

This results in an urgent need to change the current public discourse on urban freight and prioritize sustainable freight movement in cities, especially in developing countries. To do this, cities need credible urban freight policies. This requires understanding the experiences of cities who have established urban freight policies, and quickly learning the lessons from those that have carried out large-scale experiments.

To assist this process, Smart Freight Centre has carried out a comprehensive review of urban freight plans and policies from around the globe. In this report, we discuss some of the key issues, challenges and solutions that are connected with urban freight, and summarize the emerging themes, based on the demonstration and implementation of urban freight solutions in cities.

This paper is divided into four sections. It first explores the reasons to prioritize sustainable freight in cities. It then provides a snapshot of sustainable freight solutions and moves on to examine the lessons from experimentation and implementation of sustainable freight solutions over the last two decades. Finally, it provides a summary of the experiences and initiatives from five regions that have perhaps the most experience in the area of sustainable urban freight: London, New York, Tokyo, Paris and California.

[1] European Commission (2011) **Roadmap to a Single European Transport Area.**

2. Why prioritize sustainable freight in 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 indispensable for livable cities and, in both developed and developing countries, is fundamentally linked with increasing economic vitality and reducing poverty. Trillion of dollars' worth of commodities are consumed annually on urban streets. However, urban freight movement is now at a crossroads. Old challenges remain but new ones have emerged.

Freight movement generates negative externalities; including traffic congestion, greenhouse gas emissions, air pollution, noise pollution, traffic incidents and associated safety concerns, and land-use severance. And globalization and a growing urbanization have ensured that most of the world's population is directly exposed to these negative impacts.

Increasing the safe, clean and efficient movement of urban freight is critical to economic growth and environmental sustainability. However, despite large economic benefits to the city, the current operating costs associated with urban freight movement rest entirely with the private sector, and it is often not accorded due policy recognition in most cities. One of the most comprehensive reviews of urban policies across developing countries identified that, while around half of all policies addressed passenger transport, in contrast only 5 percent were focused solely on freight transport.[3]

There are very few developing cities and countries that have established sustainable freight policies or have dedicated programs or partnerships to address these issues.[4] In many cases there is a problem of perceived ownership of these issues: most national governments consider urban freight to be a local problem, which should be addressed by local authorities; many local authorities consider urban freight to be a private sector problem, as it is generated by private commercial operations; and the private sector often considers urban freight to be an infrastructure and regulatory problem, which needs to be addressed by national and local governments

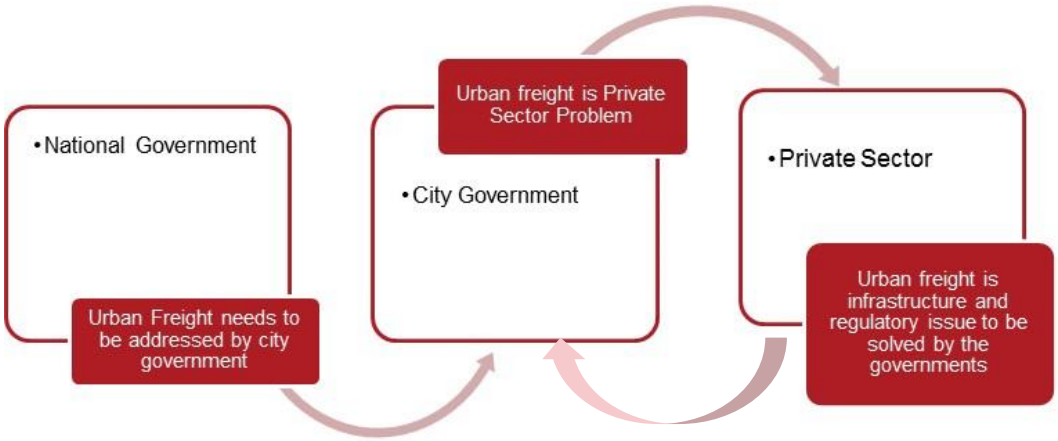


Figure 1. Urban freight paradigm in developing countries (source author)

[2] UN High Level Panel of Eminent Persons on the Post 2015 Development Agenda (2013). (page 17), http://www.un.org/sg/management/pdf/HLP_P2015_Report.pdf
[3] TRL et al. " T-MAPPER: Transport Measures And Policies to Promote Emission Reductions", European Commission - DG Climate Action
[4] Smart Freight Centre (SFC, 2015). **Green Freight Programs Worldwide**

There are three critical factors which are now the need for the prioritization of sustainable freight in cities. These are described next.

2.1 Growing urbanization

Today, about 3.9 billion or 55 per cent of world's population reside in urban areas (Figure 2). Latest projections show that increasing 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 per cent of the future increase concentrated in developing countries in Asia and Africa".**[5]

There are approximately 500 cities with over 1 million inhabitants and some 1,700 cities with populations greater than 300,000 across the globe today. And 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; the link between a growing economy and growing urbanization is increasing in strength (Figure 3). Several studies have indicated that rapid urbanization has profound implications on the increase of pollution and emissions. Infrastructure planned, designed and built for the movement of goods and people has a significant capacity to lock-in future emission trajectories for several decades.

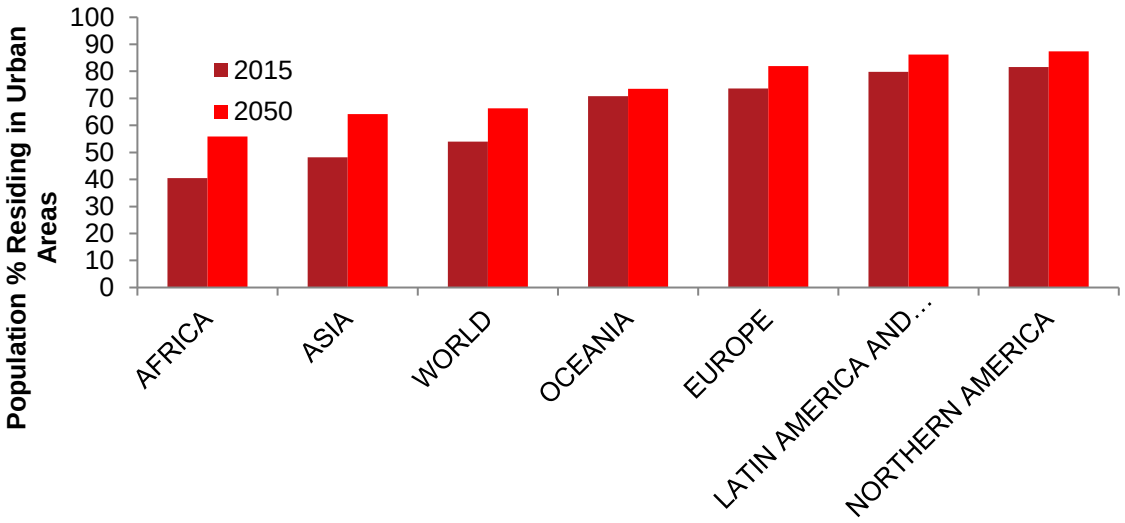


Figure 2 Share of urban population

Source: United Nations, Department of Economic and Social Affairs, Population Division (2014). **World Urbanization Prospects: The 2014 Revision**

[5] United Nations, Department of Economic and Social Affairs, Population Division (2014). **World Urbanization Prospects: The 2014 Revision**, CD-ROM Edition

[6] Seto K.C.et al. Climate Change (2014). **Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change** [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

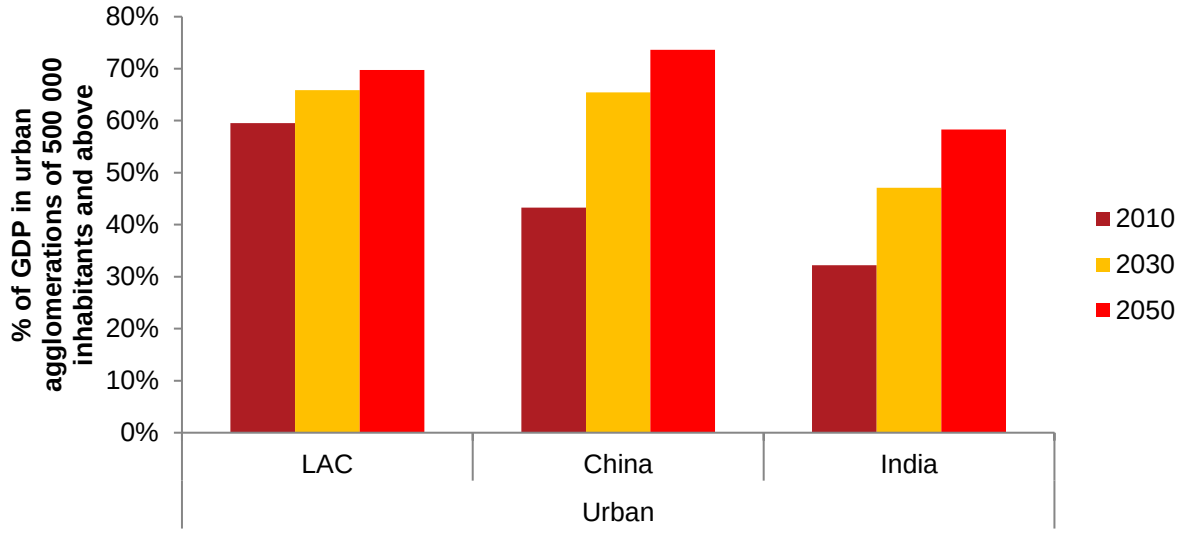


Figure 3 Share of GDP in urban areas

Source: ITF Transport Outlook 2014

2.2 Freight and economy

Economic activities in urban areas now account for as much as 55 percent of the GDP in low-income countries, 73 percent in middle-income countries, and 85 percent in high-income countries[7]. However, urban areas also account for between 67 and 76 percent of global energy use.[8]

Globalization and world trade would not have been possible without the freight and logistics industry, and both the tonnage and value of trade is growing in the global economy. In 2010, the import and export of goods and services represented 29 percent and 31 percent of global gross domestic product (GDP). In the past decade, global GDP grew by 96 percent, and the import and export of all goods and services grew by 130 percent and 135 percent[9]. It is projected that the growth in trade would outpace the GDP growth over the next 50 years, with value of international trade growing by a factor of four by 2050.[10]

The link between GDP and freight is highlighted by the level of 'freight intensity', i.e. the 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 result of the dematerialization of production due to growing service share in the GDP. Over the last two decades, there has been a shift of economic mass to emerging economies. And the economic boom, changes in economic structure and growing trade demands in developing regions has attracted infrastructure investments to developing cities.

Growing globalization with varied economic growth is leading to changes in production and consumption patterns across different regions. There are also large changes in the commodity mix, and more freight is being transported over longer distances. Since 2000, the global roadway network has increased by approximately 12 million lane-km to facilitate the movement of goods and people, and China and India accounted for more than 50 percent of paved lane km additions during that period. Over the next four decades, Non-OECD regions are predicted to account for nearly 90 percent of the global travel increase[11] and the majority of this infrastructure it expected to be developed in and around cities.

[7] Opening statement by Dr. Joan Clos Executive Director of UN-Habitat and Habitat III Secretary-General, 5th Session of AMCHUD: High-Level Segment, N'Djamena, Chad, 28 February, 2014
[8] Statement by Renate Christ Secretary of the Intergovernmental Panel on Climate Change, ADP Technical Expert Meeting: Urban Environment, Bonn 10 June 2014
[9] SSCCAP and Clean Air Asia (2012). **Macroeconomic indicators for freight for Green Freight Asia Network**
[10] L. Martinez, J. Kauppila, M.Castaing (2014). **International Freight and Related CO2 Emissions by 2050: A New Modelling Tool**. International Transport Forum
[11] International Energy Agency (IEA, 2013). **Global Land Transport Infrastructure Requirements Estimating road and railway infrastructure capacity and costs to 2050**.

Recent estimates by the International Transport Forum (ITF) have suggested that freight volumes could grow enormously in the future. For example, freight demand in ton-km could increase by 350 percent, meaning road international freight share would increase about 40 percent and freight average hauling distance would increase by 17 percent between 2010 and 2050 in the absence of any policies to mitigate the impact.[12] The expected growth in road freight movement has direct consequences for congestion, air pollution and greenhouse gas emissions. Estimates reveal that every year €100 billion, or 1 percent of the European Union's Gross Domestic Product, are lost to the European economy as a result of delays and pollution related to urban traffic.[13]

2.3 Growing Externalities from Urban Freight

"The diesel engine exhaust causes lung cancer in humans" - International Agency for Research on Cancer, World Health Organization (2012)

Overall logistics activity accounts for approximately 7 percent of total global GHG emissions, and within the logistics sector, freight transport accounts for around 90 percent of total GHG emissions and 35 to 60 percent of logistics cost.[14 ,15, 16] Within logistics, urban freight (usually the first or last mile of the trip) comprises one of the costliest and emission-intensive segments of the supply chain. But this the critical purpose of the trip - delivering to, or collecting goods from, the end customer.

Last mile emissions have been estimated to be about 25 percent of logistics supply chain emissions and account for 28 percent of total transport costs.[17] Typically, in most urban areas, goods get delivered in low volumes and at high frequencies in much more congested traffic conditions. In response, this generates high numbers of trips, with low levels of vehicle fill and low fuel efficiency, generating high levels of pollution. Average congestion costs in cities like Rio de Janeiro and São Paulo amount to roughly 43 billion USD in 2013 or about 2 percent of Brazil's entire GDP.[18] In many large cities, congestion costs are estimated to be between 1 and 5 percent of national GDP.

Urban freight constitutes only a small share of total vehicle ownership, often less than 10 percent in many developing cities. However, urban freight constitutes a significant share of urban transport externalities, and is usually the most polluting link of the entire supply chain.

The movement of goods represents a high portion of urban traffic volume. In most cities on average, only 15 to 25 percent of the urban vehicle kilometers travelled (four-wheel or more) can be attributed to commercial vehicles, it is estimated that they occupy approximately 20 to 40 percent of motorized road-space, and cause 20 to 40 percent of urban transport CO_2 emissions. Commercial vehicles are also responsible for approximately 30 to 50 percent of air pollutants (such as particulate matter (PM) and nitrogen oxides (NOx)), in cities in developed economies, and higher than 50 percent for cities in developing countries.[19]

[12] International Transport Forum (ITF,2014). **ITF Transport Outlook: Scenarios to 2050**
[13] ERTRAC, the European Road Transport Advisory Council, and ALICE, the Alliance for Logistics Innovation through Collaboration in Europe. **Urban Freight Research Roadmap**
[14] World Economic Forum / Accenture (2009). **Supply Chain Decarbonisation**. Geneva
[15] International Energy Agency (IEA, 2013). **IEA Global Outlook 2013**.
[16] Alan McKinnon (2012). **Mapping a Decarbonization Path for Logistics, Dialogue on future trends**
[17] Parrcel2Go (2013). **The 'last mile' problem.** Supply Chain Digital
[18] Custo de congestionamentos no Rio e em São Paulo atinge R$ 98 bilhões, Industry Federation of the State of Rio de Janeiro
[19] Bernhard O. Herzog, Sudhir Gota and Rajnish Ahuja (2013). **Sustainable urban freight in Asian cities**. GIZ

3. Sustainable urban freight planning and solutions

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

Over the past twenty years, cities in Europe, North America and Japan have begun to experiment with innovative urban freight solutions. While this is now becoming more common, in low income countries there is little awareness or demand for sustainable urban logistics. The range of urban freight understanding and innovation across different cities is highlighted in Table 1.

Table 1. Current typology of urban freight development

	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 on 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	Highly optimized and high share of third party logistics providers (3PL)	Inefficient and low share of 3PL	Highly inefficient
Technology	Technology use being piloted in demonstration studies	limited initiatives on promoting technology	Low awareness of technologies
Freight Partnerships	Being established	No active partnerships	No active partnerships
Data	Limited but priority data becoming available	limited	Very limited or absent
Finance	Not a critical barrier	Challenging, but new mechanisms developing	Is a major barrier
Recognition Schemes for 'good' operations	Sustainable freight recognition schemes being implemented	Sustainable transport recognition schemes (mainly passenger oriented)	Not yet implemented

Source: Author

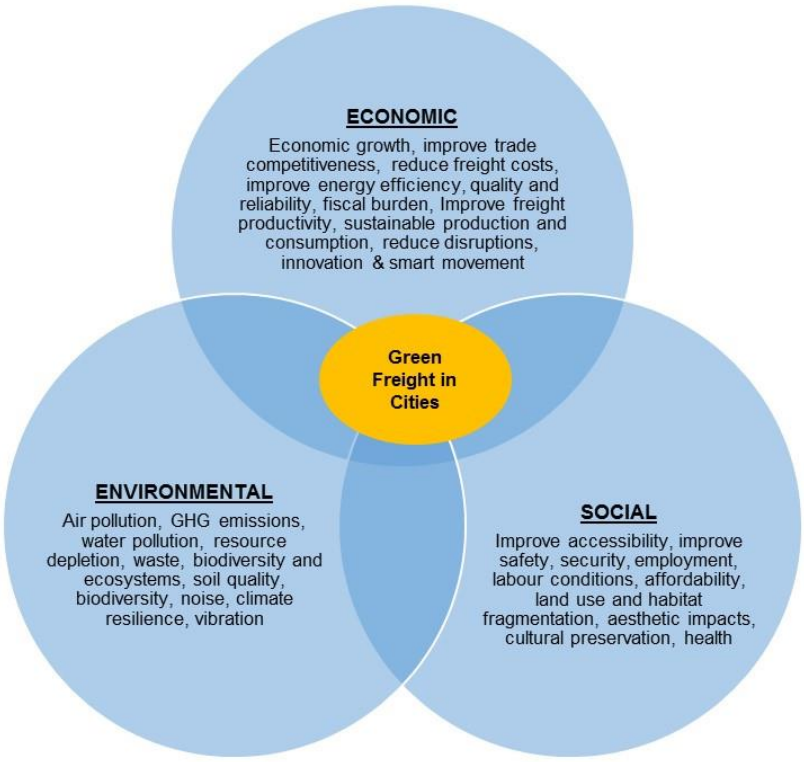


Figure 4. Sustainable freight in cities

Source: Based on UNCTAD (2016)

Sustainable urban freight systems need to facilitate freight movement that is safe, socially inclusive, accessible, reliable, affordable, fuel-efficient, environmentally friendly, low-carbon, and resilient to shocks and disruptions, including those caused by climate change and natural disasters.

SFC conducted a detailed literature review and expert survey of global approaches to sustainable urban freight to identify and draw lessons and practices from cities who are already wrestling with these issues. While any review of this nature will be generic in nature, it does provide an overview and a clear set of approaches to sustainable urban freight.

Based on this SFC review, approximately 50 sustainable urban freight instruments, strategies and policies have been identified. Urban sustainable freight solutions are often measures and instruments which influence volume, distance, efficiency, infrastructure, modes, supply chain structure and operations. And as such, the approaches adopted differ based on the geographic scope, source, nature and duration of the problem, and the solution and type of implementation actor and intended impact.

Obviously, these measures can be categorized and identified using a number of different typologies. However, there is no standard approach for any such categorization. The 'Avoid, Shift and Improve' framework (A-S-I) is well established in the consideration of energy efficiency in passenger transport, and while it is relatively unknown in the freight sector, SFC has used this approach to enable the solutions to be considered within urban areas. A-S-I refers to:

- 'Avoid' policy/strategies reduce the need to travel or to reduce the travel distance for road freight vehicles. 'Avoid' reduces either tons or kilometers travelled or both tons and kilometers
- 'Shift' policy/strategies refer to those which transfer freight activities to more energy-efficient and/or environmental-friendly modes. 'Shift' reduces emissions per unit freight activity
- '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-off 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 the efficiency of logistics chains. By integrating A-S-I strategies, freight can be decoupled from economic growth, ensuring more sustainable growth. Table 2 summarizes proven and effective A-S-I strategies for urban freight, i.e. strategies applicable for cities.

Table 2. Avoid-Shift-Improve strategies applicable for urban freight

Avoid	Shift	Improve	Crosscutting
▪ Enhanced building codes ▪ Freight clusters (freight villages) ▪ Increase storage capacity at, or near delivery points – to permit delivery of larger loads ▪ Integrating freight into land use planning ▪ Introduction of fuel taxes ▪ Loading and parking restrictions ▪ Low emission zones ▪ 'Just-in-time' replenishment schedules relaxed to permit greater load consolidation ▪ Restriction on truck idling ▪ Road pricing/ incentives ▪ Urban consolidation centers ▪ Vehicle size and weight restrictions ▪	▪ Cargo Tram ▪ Use of non-motorized transport for freight distribution ▪ Using public transport capacity ▪ Pick-up or deliver-to alternate locations ▪ Relocation of large traffic generators ▪ Ring roads for through traffic ▪ Use alternative delivery vehicles	▪ Appointments and pricing strategies at receiving sites (ports, depots, customers) ▪ Developing network of e-commerce pickup points ▪ Energy Efficient warehouses ▪ Extend opening hours of premises for collections and deliveries ▪ Exclusive truck lanes ▪ Eco-driving ▪ Freight exchange networks ▪ Freight Parking and loading zones ▪ Implement scrappage schemes for older freight vehicles ▪ Real-time information systems ▪ Reschedule deliveries to inter-peak periods and evening / night ▪ Retrofitting aerodynamic technologies to improve fuel efficiency ▪ Retrofitting rolling resistance technologies to improve fuel efficiency ▪ Subsidies for low emission delivery vehicles ▪ Subsidizing use of low sulphur fuel ▪ Telematics ▪ Time access restrictions ▪ Training truck drivers in the techniques of fuel efficient driving ('eco-driving') ▪	▪ Create a Freight Advisory Committee ▪ Create a Freight Quality Partnership or Forum ▪ Designate a trained freight person at key agencies ▪ Developing Urban Logistics Plans ▪ Environmental justice schemes ▪ Encouraging industry-led best practice dissemination programs ▪ Collaboration between freight companies ▪ Freight Operator Recognition Schemes ▪ Labelling and certification ▪ Mandatory greenhouse gas/energy reporting and monitoring ▪ Noise reduction programs/ regulations ▪ Urban freight information and maps ▪ Urban freight policy ▪

Source: Author

4. Lessons from cities

There are a large range of options and significant opportunities to address the freight sector at a local level. It is also clear that individual city needs vary greatly, due to their location, land use, density and traffic flows. However, from the review of existing urban freight plans and policies that are seeking to address sustainable urban freight, several key themes emerge. This section presents lessons from sustainable freight policy development, experimentation and implementation in cities.

4.1 Vision, strategy and targets

There is clear need for a **freight vision,** accompanied by appropriate land use and transport **strategy and** clear **targets**, to drive and focus activity

Vision

There is a need to develop a long term sustainable urban freight policy to guide the development of appropriate activity, investments and regulations. To develop this policy, visioning of urban freight is essential.

For example, the London Freight Plan (2007) was based 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". While the approach in London has moved on, the clear vision provided a focus for the initial activity and is still effectively the vision that is in place today, 10 years later.

Land use and transport strategy

The pattern of the urban logistics system, and the impacts of economic growth and infrastructure development are different in every city. However, across cities on different continents, the setting of land use policy by local government to develop, modify and implement planning and building guidelines is clearly established[20]. And this is common across developed and developing cities.

Cities are currently undergoing two contrasting trends; increasing urban sprawl (including logistics facilities moving outside the cities) and consolidation of freight facilities (where smaller local freight facilities are being replaced by large distribution centers). To address this, there is an immediate need to strengthen land use and transport strategies in considering the impacts of urban form, density and land use diversity on urban freight. For example, approximately 6,800 restaurants and drinking establishments in Manhattan produce more truck traffic than the Port Authority of New York and New Jersey combined. Similarly, 81 large buildings in New York City could generate about the same number of truck trips as the ports.[21]

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 the city center.[22]

Targets

The setting of targets is a fundamental part of the strategy development process. The goals and targets provide a clear future direction of action and a benchmark against which the success of the strategy can be evaluated and adjustments made if required. The targets established can be clearly defined based on local assessments and diagnosis, or could just be an aspirational measure of progress toward sustainability for the stakeholders to meet or attempt to exceed.

[20] METRANS Transportation Center & University of Southern California. **Synthesis of Freight Research on Urban Transportation Planning**
[21] Miguel Jaller, J. Holguín-Veras, and S. Hodge (2013). **Parking in the City: Challenges for Freight Traffic**. Transportation Research Record (TRR), Journal of the Transportation Research Board. (2379)
[22] Laetitia Dablanc et al (2010). **Urban freight consultations in the Paris region,** accessed 25-05-2015

For example, Tokyo has established the following targets in its environmental master plan: “Reduce GHG emissions by approximately 40 percent in the transportation sector by 2020 from the 2000 level. Enhance the loading ratio, (especially improve this ratio for commercial vehicles), improve the average travel speeds (improve the average traveling speeds of 23 ward areas in peak traffic hours to 25km/hr), and solve the chronic traffic congestion problem (reduce the through traffic in the central district of Tokyo) by 2016.”

4.2 Coordination of approaches

The **coordination of approaches** – especially regulation and institutional coordination – is critical to success

Differentiation and Harmonization

Urban freight movement is only one part of the whole global logistics supply chain. Initiating and implementing measures to increase the sustainability of urban freight will have interrelated effects in other areas of freight transport and storage. Regulations for urban freight need to be harmonized across appropriate geographic levels to achieve the greatest results, but allow a differentiation to reflect the different issues or levels of development that occur in differing urban areas.

For example, the European Union standards on vehicle emissions provide an agreed standard that allows cities a degree of differentiation in regulations to address their specific needs. This reward private sector companies for taking a proactive approach and investing in emission reduction, without generating a plethora of nuanced and costly individual regulations for accessing each city – operators are effectively rewarded for purchasing the cleanest vehicle.

Carrot and stick

The implementation of any smart freight strategy may lead to mixed reactions from diverse stakeholders. This is because not all benefits accrue directly to either the private sector or government, as cost and carbon emission reductions are not always aligned in the same direction. For example, private sector freight companies may be burdened with additional operational costs due to time, lane or parking restrictions imposed by the government, or due to any other regulatory changes.

Financial uses are a concern for all logistics operators, but particularly in developing countries (see Figure 5). Governments can balance this by providing additional incentives or subsidies which provide a tangible reduction in costs; offering the same advantage to all private sector operators. Further, subsidies and/or support from the public sector appear to have a critical role in the evolution and transformation of technologies in the freight sector. Many pilots and trials have demonstrated that it is challenging to establish profitable operations for the operator in the first instance.[23] Market-based mechanisms that provides both "carrot and stick" provide an incentive to shippers, logistics and trucking companies to adopt fuel-saving strategies that increase profits and reduce emissions.

[23] Strategies and measures for smarter urban freight solutions, Final Report,

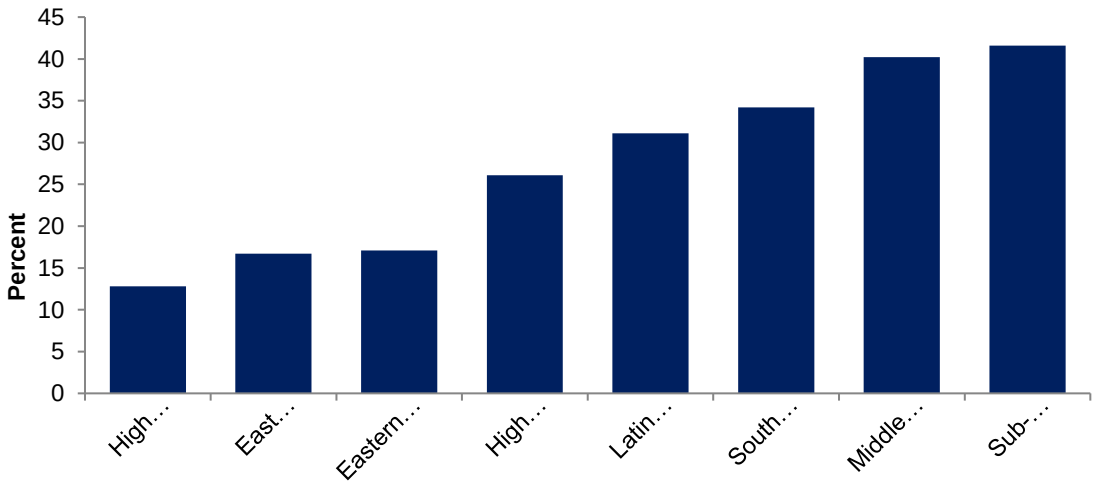


Figure 5 Share of Firms Identifying Access to Finance as a Major Constraint

Source: World Bank Enterprise Survey (2015)

Institutional Barriers

While developing a smart 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 single point of reference to provide the information that the freight industry requires to operate in that urban area or region and to ensure industry engagement on policy and regulation consultations.

An Office of Urban Freight could be established for developing and disseminating public outreach materials.[24] This could provide the focus for the enforcement of truck routes, local freight expertise, developing and facilitating transparent partnerships with stakeholders with access and exchange of information, periodic sustainable freight training, documenting and sharing good and bad practice examples etc.

4.3 Working with stakeholders

Working with stakeholders is not optional – the freight area is complex and stakeholders have competing needs. Success depends on these being clearly understood and incorporated into any approach to urban freight.

Awareness and Capacity building

Integral to the successful implementation of smart freight strategies is the critical role of awareness, training and capacity building, which helps to scale-up freight interventions. It is important to incorporate such mechanisms into institutionalized structures as most barriers related to urban freight involve information, cooperation, investments and decision-making[25].

Best Practice Transfer

There is a significant lack of knowledge transfer among different developing cities and between the developed and developing cities, which makes it hard for cities to follow good experiences and avoid failures. The European Union has implemented several knowledge transfer projects on urban freight over the last decade. For example, the "Best Practice Factory for Freight Transport" project (BESTFACT 2012-2016), examined best practice in urban freight transport, sustainable logistics, co-modality, and e-freight. Another good example is 'Sustainable Urban Goods Logistics Achieved by Regional and local policies' (SUGAR 2008-2010) which was

[24] Daniel Miodonski, The Need for a Federal Urban Freight Policy in the US
[25] Jacques Leonardia , Michael Browne , Julian Allen , Simon Bohne, Martin Ruesch. **Best Practice Factory for Freight Transport in Europe:** *Demonstrating How 'Good' Urban Freight Cases are Improving Business Profit and Public Sectors Benefits*

an EU co-funded initiative which aimed to promote the exchange, discussion and transfer of policy experience, knowledge and good practices in the field of urban freight management, especially about policy and planning levers between and among advanced and less experienced cities.[26]

Recognition Programs

There are several regional sustainable freight related recognition programs currently in existence around the world which are applicable to the urban freight sector. However, there are only few dedicated urban freight recognition programs which provide annual recognition applicable for cities in developing countries. Examples of such programs include the CIVITAS Awards[27] and the fleet operator recognition scheme[28] which award innovative projects and programs in cities.

Partnerships

Many local decision makers often consider freight transport issues as a private sector issue, and that optimization of transport is a business-driven interest which does not need government intervention, unless it causes serious problems[29]. However, most freight interventions cannot be implemented in isolation by a single stakeholder.

No single decision maker can transform urban freight without adequate support from a range of stakeholders. This has led to the formation of many urban freight partnerships between the private and public sectors. For example, In California, a Freight Advisory Committee (CFAC) has been established. This committee provides a dedicated forum for the discussion of freight-related topics, to help coordinate regional freight priorities with other organizations and to advise on freight issues priorities, projects, and funding needs. CFAC consists of 62 freight stakeholder representatives and is chaired by Caltrans.

4.4 Data, tools and modelling

There is a need to improve **data, tools and modelling**, but not at the expense of doing nothing. No city will ever have a perfect set of freight data, so there is a need to start with what is available.

Good data

Good data is the key to any successful implementation. However, the availability of urban freight data in cities is extremely poor. There is also little consistency or standardization in terms of the data collected about urban goods and vehicle flows. Cities need freight data to understand local needs and anticipate future planning requirements, evaluate multiple solutions to existing problems, and to understand the current performance of freight investments. Some cities in developed countries like France and Japan have attempted to address this by carrying out extensive surveys to develop a common data collection methodology and roll out urban freight indicators.[30]

Options to improve the current quality and quantity of urban freight data in many cities, and especially in developing countries, appear expensive and is unlikely to occur quickly. However, while this currently restricts effective planning and implementation of sustainable freight measures, it should not stop all efforts to address sustainable urban freight. For example, Beijing have begun a dialogue with local stakeholders, and as more stakeholders become aware of the cities interest in freight and get involved in the discussion, the amount of data is beginning to grow.

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 reveals that nearly 61 per cent of

[26] City Logistics Best Practices a Handbook for Authorities
[27] CIVITAS Awards
[28] Fleet Operator Recognition Scheme
[29] Maria Lindholm (2012). How local authority decision makers address freight transport in the urban area, Procedia - Social and Behavioral Sciences 39, 134 – 145
[30] Quantification of Urban Freight Transport Effects I

methodologies are applicable to the freight sector, which could quantify CO_2 emissions and air pollutants across different boundaries - national, city, project and supply chain[31]. However, there is a need for the harmonization of methodologies and emissions reporting for private sector companies such as shippers and logistic service providers, as supply chains extends across 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 methodologies would enable a scaling-up of efforts to reduce freight sector emissions, by ensuring a standard system for collecting, analyzing and monitoring CO_2 emissions from private sector freight operations.

Performance Benchmarking

There is a significant lack of performance benchmarking between cities. The development of an international benchmarking tool (for example a Sustainable Urban Freight Index) could assist cities in comparing their sustainable logistics performance, enabling the identification of suitable solutions and investment opportunities for local implementation. This Index could be developed through consultation with policy makers in cities, logistics experts, shippers, carriers, third party logistics providers and industry associations. It could also help identify local market failures relating to policy, institutional, financial and technical factors that currently prevent stakeholders from scaling-up sustainable freight solutions.

4.5 Issues to be aware of: tradeoffs, experimentation and technology

There are some issues to be aware of that will not have an easy resolution. These include the options around tradeoffs, the need for experimentation and consideration of the uptake of technology.

Value Proposition

Sustainable urban freight is often associated with the "triple bottom line" concept of advancing economic and social quality of life while limiting impacts on the environment. For sustainable freight efforts to succeed, a tradeoff of economic costs and/or social costs against environmental benefits may be needed, along with a strong convergence between the low-carbon, environmental, economic and cost-efficiency agendas.

Different stakeholders have different expectations from sustainable freight and, as a result, cities implement sustainable freight initiatives for a range of reasons, not only to address climate change or air pollution. While nearly 80 per cent of the urban freight solutions identified in this study indirectly reduce emissions, the main motivation behind their implementation included congestion reduction, stakeholder engagement, fuel consumption reduction, safety concerns, logistics supply chain decisions, and reducing freight costs.

Experimentation

Cities in developed countries have carried out several urban freight trials, pilots and demonstration studies to understand the investment potential, economic and social impacts and the strengths and barriers for wider implementation. Though these experiments concern only a minor fraction of urban freight flows within a city, they are very effective in convincing political leaders and policy makers of possible options, in increasing the understanding of any changes in behavior of consumers and the private sector[32] and in generating a 'snowball' effect. For example, the trials promoted by the city of Paris have been widely advertised in both the specialized and local press. However, cities in developing countries have not yet initiated large scale experimentation and demonstration activities to field-test innovative ideas in the urban freight sector. **Until and unless cities in developing countries utilize a trial and error approach and test innovative solutions, radical improvement is unlikely**.

[31] SLoCaT Transport GHG Emissions Methodologies Database
[32] Laetitia Dablanc et al. Urban freight consultations in the Paris region, 2010, accessed 25-05-2015

Market Failure in Technology

To break the market failure in the use of new freight-related technologies in urban areas, there is a need to provide incentives, especially to increase the pace of uptake. Many technologies, especially those related to the fuel efficiency of trucks, have higher payback periods due to the lower annual mileage and fuel use of urban, as opposed to long-haul trucks.

It has been estimated that for long-haul trucks, due to the very large volumes of fuel they use, a reduction of up to 50 percent in energy intensity is possible by 2030 at a negative societal cost per ton-CO_2 equivalent. However, trucks used in urban areas have a wider range of potential issues and costs (above $100 per ton-$CO_2$ equivalent[33] in 2010). To ensure the uptake of new technologies, bring down the age-profile of fleets and ensure an increase in the capacity of the urban delivery fleet, access to affordable finance is especially important.

A wide range of new technologies is also influencing the behavior of the freight industry (e.g. 'smart' phones, connected and autonomous vehicles, the use of drones), and is moving faster than local or national government can respond or regulate. No city appears to have been able to currently address this issue but technological innovation is likely to play an increasing role in the volume and type of transport moving on urban streets.

[33] Sims R., R. Schaeffer, F. Creutzig, X. Cruz-Núñez, M. D'Agosto, D. Dimitriu, M.J. Figueroa Meza, L. Fulton, S. Kobayashi, O. Lah, A. McKinnon, P. Newman, M. Ouyang, J.J. Schauer, D. Sperling, and G. Tiwari, 2014: Transport. In: Climate Change 2014: **Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change** [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

5 A. Case Study - London

***"…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…"* – London Freight Plan[34]**

1. Background

London constitutes less than 1 percent of total area of the UK but it accommodates 13 percent of the population and generates a quarter of the UK's total economic output. It is one of the largest city economies in the world with a GDP of over £565 billion.[35] Over the past three decades, the city has transformed from a strong manufacturing economy to a service oriented economy. In 1984, approximately half a million jobs in London were manufacturing oriented, but by 2011 only 129,000 jobs were manufacturing based.[36] Estimates suggest that the total value of London exports at around £92 billion a year – representing 24 percent of the total value of all UK exports. London is the base of operations for two out of every three Fortune 500 companies. In 2007, the London logistics sector's output was £8 billion (3.4 per cent of London's output).[37] The freight sector is a major employer in London with more than 6,400 freight companies with an ownership of nearly 225,000 vehicles. The Mayor's 2016 London Plan foresees a significant increase in economic growth, population and employment over the next 20 years. This growth in population and employment will increase the demand for freight and services.

[34] Photo credit - Luis Llerena, Unsplash.com
[35] London's Economic Plan
[36] The Spatial Development Strategy for London Consolidated with Alterations Since 2011
[37] FTA - Supporting economic growth in London

2. Freight in Numbers

The Mayor's London Plan forecasts that population could increase from 8.3 million in 2013 to 9.8 million people by 2031, with an increase of 750,000 jobs by 2031. This will result in an increase of freight transport demand. About 90 percent of goods in London are carried on the road by a combination of light commercial vehicles and heavy good vehicles.[38] While the total freight vehicle ownership in London has remained similar to 1995 levels, the number of heavy good vehicles has reduced and the light commercial vehicle share has increased.

Freight movement necessitated approximately 4.8 billion vehicle road kilometers in London in 2012. This is about 17 percent of total traffic, but the percentage increases up to 27 percent in Central London, thereby causing higher traffic externalities. About 80 percent of inbound freight movements take place between 6am and 6pm[39]. Freight vehicles are second only in scale to car traffic in London.[40] Approximately 80 percent of these freight kilometres were performed by LGVs (up to 3.5 tonnes gross weight), and 20 per cent by HGVs (15 percent by rigid goods vehicles over 3.5 tonnes, and 5 percent by articulated goods vehicles over 3.5 tonnes). However, the majority of goods are carried on HGVs (approximately 90 – 95 per cent) while the light commercial goods vehicle carries only 5 to 10 percent of goods by weight. The volume of goods moved by HGV is evenly split between articulated and rigid vehicles – 51 and 49 per cent respectively.[41]

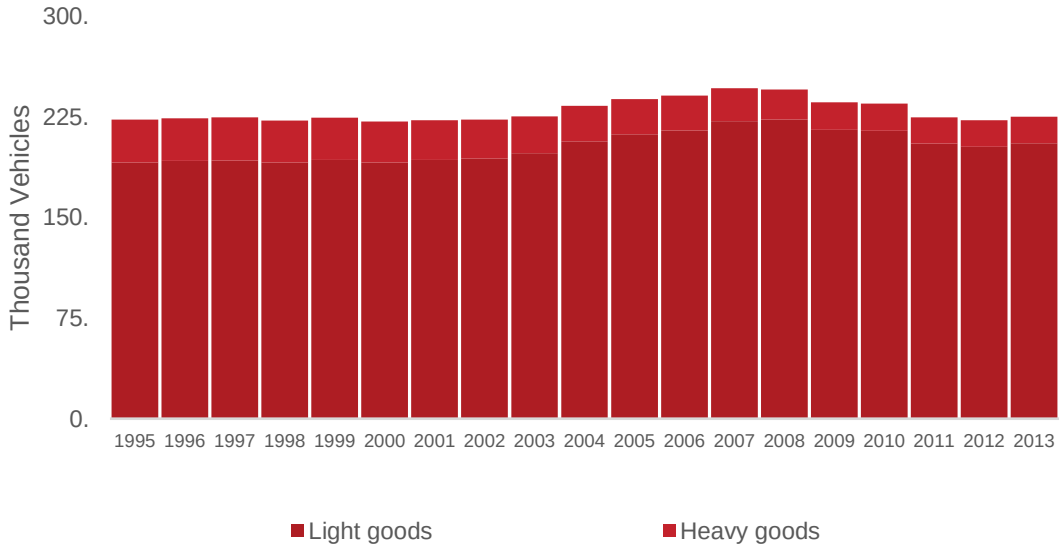


Figure A1. Freight Vehicle Ownership in London

London is a net importer of goods. In 2010, about 132 million tonnes of road freight carried by UK-registered HGVs had an origin and/or destination in London. About 53 million tonnes were lifted elsewhere in the country and had a destination in London, while 35 million tonnes were lifted in London and had a destination elsewhere in the country[42]. The Port of London handles 48 million tonnes of cargo every year[43] and the main London airports handled 1.8 million tonnes of freight, with Heathrow accounting for 1.4 million tonnes.[44]

[38] Determining the external costs of road freight activity in London
[39] URBAN FREIGHT FOR LIVABLE CITIES
[40] London Freight Data Report: 2014
[41] Freight, servicing and logistics in London – what are the key industry trends?
[42] Freight, servicing and logistics in London – what are the key industry trends?
[43] London's Economic Plan
[44] Implications for the Air Freight Sector of Different Airport Capacity Options

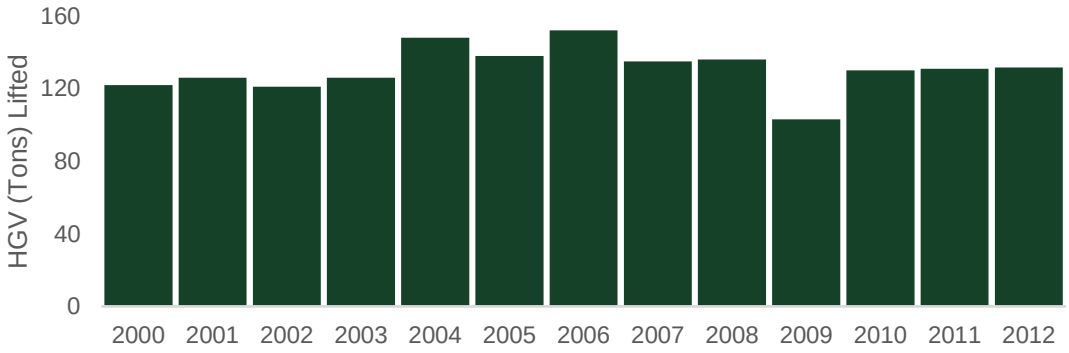


Figure A2. Freight lifted by HGVs on journeys to, from and within London

A rapid increase in all vehicle traffic has resulted in higher traffic congestion. On London's A-roads, average speed reduced from 16.3mph in July 2013 to 14.8mph in July 2015. High traffic congestion in London is estimated to cost the freight industry £800 million to £1.5 billion[45] per year[46]. The external costs (congestion, air pollution, noise, accidents and infrastructure costs) generated by freight sector in London is shown below[47].

In 2010, Transport for London estimated that road freight transport was responsible for 23 percent of road transport CO_2 emissions, with 13 percent contribution by HGVs and 10 percent by LGVs.[48] In the Climate Change Mitigation and Energy Strategy, the Mayor committed London to reducing CO_2 emissions economy-wide by 60 percent below 1990 levels by 2025. This translates into a projection for reducing London's transport CO_2 emissions by between 4.6 and 5.3 Mt CO_2 by 2025.[49] The transport sector is also a major contributor to NOx and PM10 emissions, accounting for 63 percent and 52 percent of emissions of these pollutants respectively in 2010. The road freight share of NOX and PM 10 is 27 percent and 25 percent of the overall transport sector.[50] However, the freight sector has significantly reduced PM emissions by 67 percent and NOx by 75 percent over the last 20 years.[51]

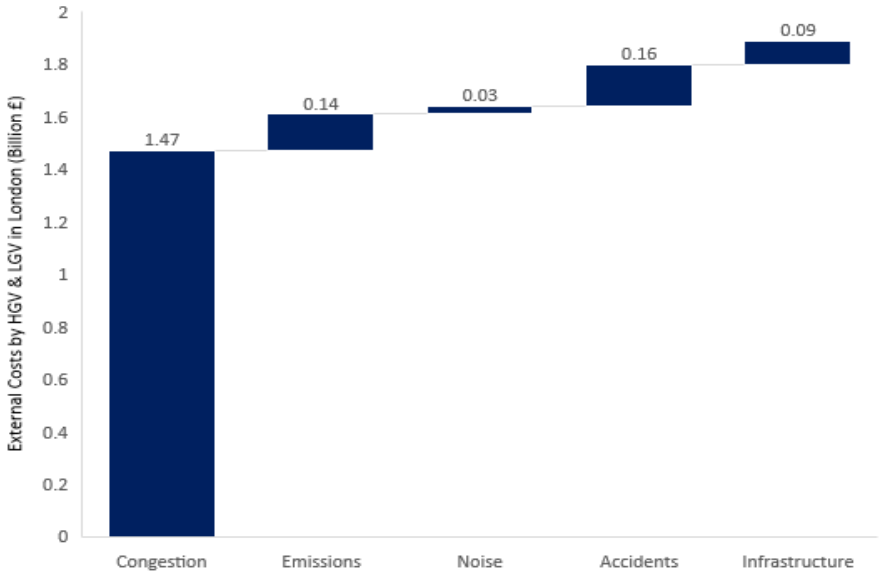


Figure A3. External Costs by HGV and LGV in London

[45] Determining the external costs of road freight activity in London
[46] The London Freight Plan and the Transport for London Freight Unit
[47] Internalising the external costs of LGV and HGV transport in London
[48] The London Freight Plan and the Transport for London Freight Unit
[49] Transport Emissions Roadmap
[50] Transport Emissions Road Map 2
[51] FTA - Supporting economic growth in London

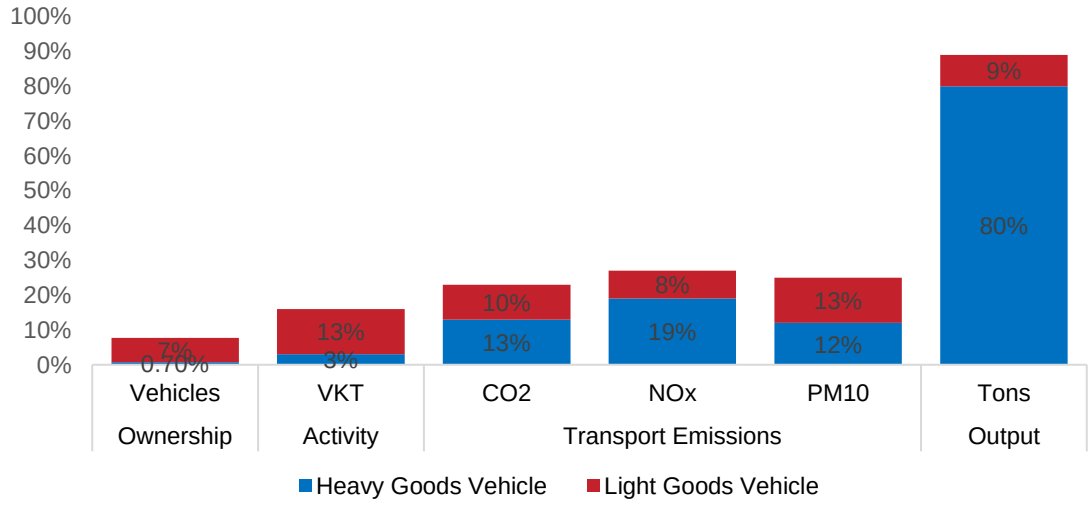


Figure A4. Road Freight Share in Ownership, Activity, Emissions and Tons Lifted

The demand for logistics land in London is growing, due to increasing population and employment. The planned growth of London will lead to a 15 percent growth in demand for freight and servicing by 2025.[52] However, increased freight demand could lead to logistics sprawl, with high land values forcing new warehouses and consolidation centers to be built on the outer peripheries. This would result in longer trip lengths and increased CO_2 emissions and other externalities such as congestion.[53] There is increased centralization of logistics facilities at two locations - West London, near Heathrow and the London Gateway development, a new port and logistics site to the east of London. Currently, the average size of warehouses is 683 sqm with a total warehousing floorspace of 15648 (000) sqm[54]. The average freight trip length is 26km[55] for trips within the London area. For intercity trips, the length of haul is far greater with an average trip length of 110k m. Approximately 31 percent of freight kilometers travelled in London are empty.[56] The average 'Loading factor' (average percentage load) for HGV journeys in London is 59 percent.[57]

Freight vehicle movement has resulted in 22 percent of total road traffic fatalities, with freight vehicles involved in 57 percent of cyclist fatalities and 25 percent of pedestrian fatalities between 2009 and 2014.[58]

Over the past decade, the total tons lifted by rail freight has ranged from 6 to 7 Million tonnes with a mode share of 5 percent within London and about 7 percent by weight of the total rail freight lifted in Britain[59] Freight movement by rail and water transport is now increasingly used for development of major infrastructure projects in London.

Table A1. Freight Key Performance Indicators

No	Performance Indicator	London
1	GDP/Capita (PPP)	65800
2	City Size (km2)	1600
3	Population Density (People/Sqkm)	5200
4	Average Loading Factor (per cent)	59 %
5	Freight Lifted (Tons/Capita)	18
6	Freight Motorization Index (V/1000 Pop)	27
7	Urban Freight share of VKT (per cent)	17 %

[52] Towards a City Freight Strategy – Interim Report
[53] How to transfer best practice initiatives between cities
[54] Freight Transport Report
[55] Sustainable freight distribution plan for London
[56] London is a net 'importer' of goods and thus resulting in an imbalance between the movement and volume of goods into the city and out of the city. Thus empty trips does not necessarily mean the freight trips are necessarily inefficient.
[57] Freight, servicing and logistics in London – what are the key industry trends?
[58] London Freight Data Report: 2014
[59] London Freight Data Report: 2014

No	Performance Indicator	London
8	Mode Share (Tons)	
	a) Road	89 %
	b) Rail	5 %
	c) Water	6 %
9	Freight Accident Fatality Share (national)	22 %
10	Freight Employment (transport and postal services)	5 %
11	Freight Emission Intensity (g/tonne km)	200
12	Urban Freight Emission share CO2 (per cent)	22 %
13	Retail establishments Density (No of establishments/sqkm)	27

3. Government plans and stakeholders

Transport for London (TfL) is the integrated body responsible for the London's transport system and it is accountable for both the planning and delivery of transport facilities. It launched the London Freight Plan in 2007 to support London's freight industry efforts towards sustainability.

The London Freight Plan promoted 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, London's environment and Londoner's quality of life[60]. Four key projects were identified in the Freight Plan:

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

Three work-streams would support delivery of these projects

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

The plan was developed through several rounds of engagement with regulatory bodies, campaign groups and industry partners. This range of stakeholders continue to work with TfL, through a 6-monthly Freight Forum and direct engagement. They include:

- Key freight industry operators from a variety of sectors (retail, waste, construction, courier and parcel; oil and chemical, utilities)
- Strategic freight quality partnerships (sub-regional partnerships for London and local borough council initiatives)
- Modal knowledge specialists (road, rail, water, air)
- Special knowledge groups representing land use planning, businesses, and vehicle manufacturers
- Trade Associations representing the freight industry and business groups
- The Department of Transport, London Councils, Greater London Authority, Transport Commissioners, Vehicle and Operator Services Agency

TfL has also committed funds for key infrastructure projects (Three Mills Lock), and developed guidance documentation to assist borough Local Implementation Plans, Development Plan Documents (DPDs) and the implementation of traffic authorities' Network Management Duty.

To deliver the London Freight Plan, Transport for London set up a dedicated Freight Team. This team has varied in size over the years but now works with colleagues across TfL and in partnership with the freight industry, freight users, investors and regulators. TfL's Freight team aims to encourage best practice and serve as a center of freight excellence.

[60] The London Freight Plan and the Transport for London Freight Unit

Activity is coordinated through 6-montly Freight Forum, and direct engagement with freight stakeholders has proved invaluable in ensuring the development of practical and economic solutions to managing freight issues. The freight team manage this engagement and provide the technical freight input into broader TfL transport policy development. The team are also responsible the development and implementation of the range of TfL freight projects and programs covering safety, environmental issues and freight efficiency, which includes consolidation and re-timing deliveries.[61]

4. Freight surveys and monitoring

Data on freight movement is important for the development of an urban freight modelling capability and to demonstrate the benefits of best practice case studies and build business cases for change. The following prominent initiatives are relevant to urban freight data and modelling in London:

- **The London Freight Data Report**[62] is a digest of freight statistics for London and presents a summary of key facts and trends on freight sector. Considering the commercial nature of freight data and its confidentiality concerns, it is essential to promote and secure the sharing of information by operators and businesses. The annual report has been produced by the University of Westminster which established a Freight Transport Data Centre for London with TfL. The foundation of TfL's freight data work was provided by a UK Department for Transport commissioned report "The Review of Freight Modelling Projects" in early 2000. This study provided insights on the availability of data for freight modelling. The University of Westminster reviewed freight data sources for London for TfL in 2001 to 2003 under this initiative. The University of Westminster and TfL coordinate with several stakeholders to generate the data report. These include; the Department for Transport Road Freight Statistics Team, Department for Transport Road Vehicle Licensing Statistics Team, Greater London Authority, London Councils, MDS Transmodal, Network Rail, Port of London Authority (PLA), The Traffic Commissioners, and the Driver and Vehicle Services Agency (DVSA).
- **Continuing Survey of Road Goods Transport (CSRGT**)[63] - The CSRGT is run by the Department for Transport (DfT) to obtain details of domestic activity of nationally registered HGVs. The owners of certain HGVs are asked to record the details of the trips within the UK within a specified survey week. The vehicle samples are chosen from groups which depend on vehicle type, vehicle weight, and the traffic area in which the vehicle is registered.
- **International Road Haulage Survey (IRHS)**[64] - The International Road Haulage Survey (IRHS) is carried out by the Department for Transport (DfT) to obtain details of domestic and international activity of HGVs

[61] The London Freight Plan and the Transport for London Freight Unit
[62] Freight, servicing and logistics in London – what are the key industry trends?
[63] Continuing Survey of Road Goods Transport (GB): Respondents section
[64] International Road Haulage Survey: Respondents section

registered in the UK. The information and data collected are used by the government to inform decisions and policies about the road freight industry. The survey results are also utilized under European legislation by the European Commission.

- **The Freight in London Model**[65] – this multi-modal integrated model of economic demand and logistics structures, generated projected freight flows and tonnages by origin and destination, commodity type, logistic stage and transport mode. The model had about 700 zones, six type of road freight vehicle categories in addition to rail and shipping, and uses 16 commodities split into 3 distribution stages. The model had a spatial input-output structure to determine the pattern of demand for freight travel based on the economic structure of the regions of the UK. It also included the stages of freight generation, distribution, mode choice and assignment to the detailed road and rail networks. While the model was designed to examine the impact on freight and logistics services of policy measures within London[66], it has proved more practical to consider freight within the existing traffic models to better understand overall traffic patterns.

5. Main urban freight initiatives

Fleet Operator Recognition Scheme (FORS)[67]

FORS is a voluntary recognition scheme for freight operators. It uses a tiered set of membership levels to address fleet and freight vehicle operational efficiency standards i.e. FORS Bronze, Silver or Gold accredited. All FORS accredited companies join FORS at the entry-level of 'bronze' and can progress to the higher 'silver' and 'gold' levels, subject to achieving the criteria or FORS standard requirements. FORS provides fleet operators with practical advice and guidance to help reduce fuel consumption and emissions, which are delivered through company training, workshops and electronic guides and tools. The scheme's main partners include the Metropolitan Police Service (MPS), Health and Safety Executive (HSE), Driver and Vehicle Services Agency (DVSA), and the Learning and Skills Council (LSC). Support is also provided by the Department for Transport, and Road Haulage Association (RHA).

London Congestion Charge Scheme (CCZ)[68]

London introduced a congestion charge at £5 a day in February 2003, with the ambition of reducing traffic congestion in and around the charging zone, the central 8 square miles which is the most heavily congested (figure A5). It was increased to £8 a day in July 2005 and to £10 in January 2011. Currently, the charge is £11.50 for driving any vehicle within the charging zone between 07:00 and 18:00, Monday to Friday.

The primary aim of the Congestion Charge is to cut traffic levels and congestion in central London. It contributes directly to the achievement of the four transport priorities in the Mayor's Transport Strategy:

- to reduce congestion
- to make radical improvements to bus services
- to improve journey time reliability for car users
- to make the distribution of goods and services more efficient

[65] FiLM - a model of freight and LGV movements in London
[66] NB: The model has been superseded by a range of different TfL modelling options as part of the development of the new Mayor's Transport Strategy.
[67] Fleet Operators Recognition Scheme STANDARD (version 4.0)
[68] Impacts Monitoring – Sixth Annual Report

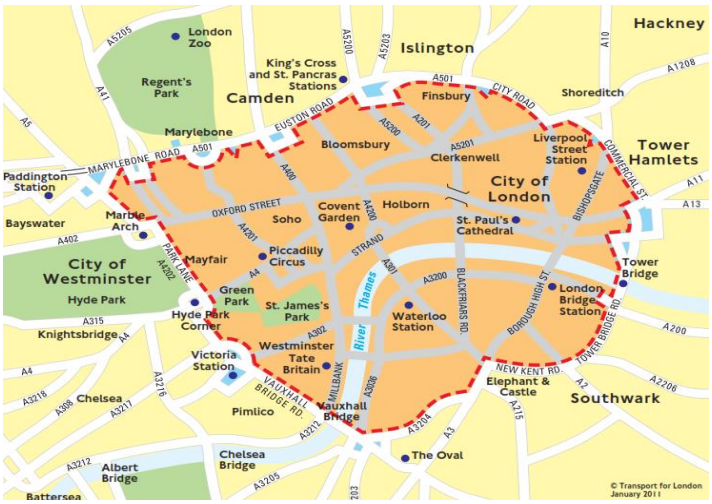


Figure A5. London Congestion Charge

Traffic entering the original charging zone has remained stable at 27 percent lower than pre-charging conditions in 2002. Cycling levels in the Congestion Charging zone are also up by 66 percent since the introduction of the scheme. Freight curbside delivery zones were protected during these changes. A recent evaluation indicated that freight traffic increased throughout London during CCZ implementation, but declined in the central business district within the congestion charge zone. Analysis indicated that the congestion charge may have time-shifted some light goods trips, but little evidence was found of freight traffic re-routing or avoiding the charged zone altogether.[69]

Delivery and Servicing Plans (DSPs) and Construction Logistics Plans (CLPs)[70]

TfL developed Delivery and Servicing Plans (DSPs) and Construction Logistics Plans (CLPs) to ensure building operators and developers maximized the use of logistics best practice, benefiting operators, customers and residents.

- CLPs are appropriate for the design and construction phases of premises, and are designed specifically to improve construction freight efficiency and reduce externalities. CLPs are now required through the land use planning system for all major construction activity in London. TfL provides guidance in the development and content of CLPs.
- DSPs aim to reduce delivery trips (particularly during peak periods) and increase the availability and use of safe and legal loading facilities, using a range of approaches including more efficient freight vehicles, better drivers, consolidation and out-of-hours deliveries. DSPs have also proven to be useful (see Table A2) in increasing building operational efficiency, by reducing freight delivery impacts to premises including, CO_2 emissions and air pollutants, congestion and collisions. However, DSPs have not yet been successfully adopted through land use planning.

[69] Sustainable Freight: Impacts of the London Congestion Charge and Low Emissions Zone
[70] DSPs (Delivery Service Plans) and CLPs (Construction Logistics Plans)

Table A2. Examples - benefits of DSP

Element	Who	How?	Outcome
First trial	TfL (Palestra)	trial and error!	Deliveries reduced by 20% (from 250/week)
Promoting responsible operations	KPMG	Specified sustainable freight in procurement conditions in new contracts, includes quarterly review	CSR benefit Increase in FORS operators
Reduce the number of suppliers	Emirates Stadium	consolidated food deliveries, incl. Milk	Deliveries reduced by 20%
Move deliveries away from peak hours	Single occupancy offices	moved £40,000 worth of orders to one suppliers who deliver outside peak	reduced on site and local congestion
Inform suppliers of the delivery location	Network Rail	Promotion of legal loading, and out of hours delivery	
Reduce frequency of activity	London Borough	coordinating cash collection from low value offices	6% reduction in security contract
Promote the use of legal loading locations	Restaurant chain	Review of open book contract and changes to delivery routes	£40k reduction in PCN costs
Promote use of low emission vehicles/modes	Freight operator	replaced diesel van with electric	saving £5k per annum in fuel costs and 14 t of CO2
Establish a centralised ordering system	University	Reviewed finance function. Average invoice value £28, cost to process £20	Stationery deliveries reduced by 80%

The London Borough Consolidation Centre[71]

Consolidation is the process of rearranging and combining shipments to reduce the number of deliveries, reducing the number of vehicles entering the city and using the vehicle carrying capacity to the maximum extent possible. The London Boroughs of Camden, Enfield, Islington and Waltham Forest require a wide range of goods and services for their several hundred separate addresses including municipal buildings, libraries, schools, care homes, offices, hostels, day and sports centers, commercial premises and households. Their individual supply chains consisted of suppliers delivering goods directly to addresses in the area using their own transport or through parcel delivery and courier companies, thereby resulting in poor loading efficiencies. In 2012, the London Borough of Camden with its borough partners started carrying out consolidation trials with initial funding from the European Union and the Mayor's Air Quality Fund. The consolidation center was opened in 2014 and is operated by a FORS operator. It collates and consolidates the goods received and then carries out onward delivery to the council's sites using optimized routes with higher loading factors and utilizes two low emission (Euro V) trucks.

The project has resulted in:

- 46 percent reduction in the number of vehicle trips delivering to council sites
- 45 percent reduction in the total distance travelled by delivery vehicles
- 41 percent reduction in CO_2 emissions
- 51 percent reduction in NOX emissions
- 61 percent reduction in PM
- Over 70 percent vehicle capacity utilization achieved

London Lorry Control Scheme[72]

The London Lorry Control Scheme controls the movement of the heavy goods vehicles over 18 tonnes maximum gross weight and is designed to minimize the noise pollution in residential areas at night time and at weekends. This initiative is implemented using the Greater London (Restriction of Goods Vehicles 1985) Traffic Order and is applied in all 32 London boroughs and the City of London. The scheme is managed by London Councils, the body that coordinates activities between London's boroughs.

[71] The London Boroughs Consolidation Centre
[72] London Lorry Route Approver service

Several roads, referred to as the excluded route network (ERN), are excluded from this restriction. To be compliant goods vehicles with permission must, during the proscribed hours, travel along the ERN to the closest point to their destination before traveling the shortest possible distance along non-ERN roads. Failure to observe the restriction ensures high penalty charges of £550 for operators and £130 for drivers. These charges are reduced by 50 percent if paid within 14 days. TfL and London Councils provide truck operators with information on routing.

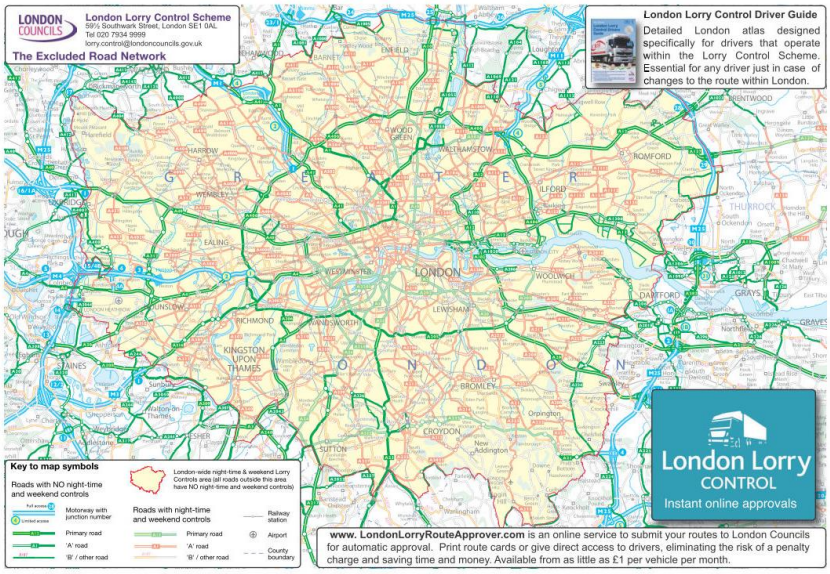


Figure A6. London Lorry Control Scheme

Quiet Deliveries Demonstration Scheme[73]

This scheme refers to the delivery of goods outside normal delivery hours, using equipment and techniques to reduce noise and disturbance to residents. In 2009, the Department for Transport (DfT) jointly, with the Freight Transport Association (FTA) and the Noise Abatement Society (NAS), launched the quiet deliveries demonstration scheme. This scheme established that by using quiet deliveries, shippers and carriers could use the existing infrastructure more effectively, reducing peak hour congestion and emissions, and improving road safety. Trials of out-of-hours deliveries were held by local authorities in 2010 and a temporary code of practice issued in 2012 by TfL for the Olympic Games, when retiming deliveries was a major success[74].

London Low Emission Zone (LEZ)[75]

A LEZ is a zone where access by the most polluting vehicles is restricted, based on the vehicle age and type as specified in the vehicle pollution criteria laid down in national or international standards. In London, it was estimated that the equivalent of 9,400 premature deaths occurs each year due to long-term exposure to air pollution[76]. The initial plan for the London LEZ, supported by TfL, the Greater London Authority and London's boroughs, was proposed in 2001 with implementation over 6 years. In 2008, a LEZ was implemented in a phased manner. The Phase 1 emissions standard was Euro III for HGVs over 12 tonnes. In July 2008, Phase 2 extended this standard to 3.5-tonne vehicles, buses, and coaches. In 2012, Phase 3 extended the Euro III standard for particulate matter to all diesel-powered vehicles in London, including light goods vehicles (LGVs).

[73] Quiet Deliveries Good Practice Guidance
[74] Retiming deliveries
[75] Sustainable Freight: Impacts of the London Congestion Charge and Low Emissions Zone
[76] Sadiq Khan proposes early delivery of Ultra-Low Emission Zone

Figure A7. London Low Emission Zone signage[77]

To monitor the compliance of LEZ implementation, a system of automatic cameras was installed to photograph vehicle number plates and check them against the national database of registered vehicles. This system is automatic and managed by Tf. With coverage of 2650 km2, the London LEZ is one of the largest environmental zones in the world. Ambient air quality measurements show that concentrations of particulate matter within the LEZ have dropped by 2.46–3.07 percent compared to just over 1 percent for areas just outside the zone[78]. Currently, consultations with stakeholders are being carried out to understand the feasibility of implementation a Central London Ultra-Low Emission Zone (ULEZ) in 2019, which would apply to vehicles that do not meet the Euro 4/IV emissions standard for NOx and PM emissions.

London Freight Quality Partnerships (FQP)[79]

FQP partnership forums help government, businesses, freight operators, environmental groups, private sector associations, the local community and other interested stakeholders work together to address common freight issues. They also allow better coordination between TfL and boroughs. There is no 'standard' type of FQP; they can take different forms and address many different issues. The main objectives of developing a FQP are:[80]

- To identify problems perceived by each interest group relating to the movement and delivery of goods in their city/area
- To identify measures within the group's competence to resolve or alleviate such problems,
- To identify best practice measures and principles for action by local government and industry to promote environmentally sensitive, economic and efficient delivery of goods in towns and cities.

In the UK, Freight Quality Partnerships have grown in number. The first partnerships emerged in the mid-90's and by 2003 there were over 110 of all types. In London, there are two Freight Quality Partnerships, one at Heathrow and one for Central London (covering the City of London and the London Boroughs of Camden, Islington, Southwark, Lambeth; Royal Borough of Kensington and Chelsea; and the City of Westminster). In West London, the wider borough partnership (Westrans) has a specific focus on freight issues and have developed their own Freight Strategy.[81]

[77] Leo Reynolds (Flickr)
[78] Five years of London's low emission zone: Effects on vehicle fleet composition and air quality
[79] Central London Freight Quality Partnership
[80] Freight Quality Partnerships in the UK – an analysis of their work and achievements
[81] Westtrans: Planning transport together

5 B. Case Study – New York

"Transportation is paramount to the quality of life and economic wellbeing of New York and the (New York Transportation Master) Plan focuses on the ability of New York's transportation system to safely and efficiently meet the current and future mobility needs of residents, visitors, and businesses" **New York State Transportation Master Plan for 2030**[82]

1. Background

New York City is the most populous city in the United States of America and a global financial hub, headquartering the highest number of fortune 500 companies (18) compared to other cities in the USA.[83] The city ranks as the 13th largest economy in the world, surpassing a number of countries such as Spain, Mexico and South Africa in the trillion-dollar economies. In 2014, its Gross Metropolitan Product (GMP) was $1.4 trillion, almost 60 percent above the 2nd largest city economy in the USA, Los Angles[84], which is ranked 20th in the world. New York City (NYC) topped the national retail index in 2015 with iconic streets such as Fifth Avenue, Arthur Avenue, and Orchard Street identified as some of the most expensive shopping areas in the world.[85] 20 percent of the country's advertising employment and 14 percent of the revenues are generated in NYC.[86]

[82] New York State's Transportation Master Plan for 2030 and photograph source: unsplash.com
[83] http://fortune.com/2015/06/15/states-most-fortune-500-companies/
[84] US Metro Economies, 2013
[85] Industry Trends & Insights, 2015
[86] http://www.nycedc.com/resource/industry-trends-insights

The New York Metropolitan Transportation Council (NYMTC) is a regional council of governments that is the metropolitan planning organization for New York City consisting of five boroughs (Manhattan, Brooklyn, Bronx, Queens and Staten Island), Long Island and the lower Hudson Valley. NYMTC covers approximately 64 percent of the New York State's population (in 2010) and an area of 2440 square miles.

Figure B1. The NYMTC Region[87]

New York is a leading trade gateway, with its air terminal (John F Kennedy Airport), water terminal (Port Authority of New York and New Jersey - PANYNJ) and road modes (Port of Buffalo - Niagara Falls land border gateway) ranked 1, 7 and 9 respectively in terms of shipment value[88]. New York is now considered as one of the most congested cities in America with annual traffic congestion cost of more than $13 billion.[89]

According to the U.S. Bureau of Labor Statistics, from 2010 to 2011, each of the 9.1 million households in the New York Metropolitan Statistical Area spent an average $7,371 on food, $2,596 on clothing and $2,006 on gasoline. Freight transportation carries these and many other everyday items, as well as the raw materials to build homes and supply businesses. As the cost and complexity of transporting freight increases, the cost consumers pay for these items also increases. Additionally, the amounts of products and materials coming into and out of the region is expected to increase by 48 percent in the next 25 years.[90]

2. Freight in numbers

Key freight numbers for New York are: [91]

- The NYMTC region is home to more than 12.4 million people, whose gross regional product, estimated at nearly $1.3 trillion annually, is the highest in the USA
- The region is home to more than 600,000 business establishments, including 30,000 retail stores
- Retail sales generated about $31 billion or 30 percent of the taxable sales in 2010
- Hoe to more than 1.3 million registered trucks and 1,622 trucking companies[92]
- Trucks carried 91 percent of all freight (405 million tons) by weight within the NYMTC region in 2007
- Freight tonnage is expected to increase by 46 percent by 2040

[87] The Basics of Freight Transportation in NYMTC Region
[88] http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/state_transportation_statistics/new_york/html/table_03_26.html
[89] Partnership for New York City
[90] The Basics of Freight Transportation, NYMTC
[91] Holguin-Veras, J., Paaswell, E. R., New York Regional Intermodal Freight Transportation Planning: Institutional Challenges
[92] Employment in New York's Transportation Sector

- Of the 5.5 million private-sector jobs in the NYMTC region, 1.3 million, or 24 percent, are in freight-intensive industries, such as construction, manufacturing, agriculture, the wholesale or retail trade, transportation and warehousing
- Every year more than 67 million truck cross the toll bridges in the region
- Truck and rail freight together are responsible for 40 percent of nitrogen oxides (NO_x), 31 percent of particulate matter (PM), and 20 percent of carbon dioxide (CO_2) emissions from all transportation sources
- In New York's borough of Manhattan, the demand for parking delivery trucks exceeds the linear capacity of the streets in 10 out of 43 zip codes [93].
- Traffic congestion costs the NYMTC more than $13 billion per year in delay and lost revenue

Table B1. New York Urban Freight Indicators94

Indicators	New York
GDP/Capita (New York, Northern New Jersey and Long Island)	$113571
City Size (km2)	6320
Population Density (People/sqkm)	1994
Per capita Road Space (Road length per 1000 population)	1.2
Empty running (percent)	20 %
Freight Lifted (Tons/Capita)	32
Freight Motorization Index (V/1000 Pop)	103
Freight Intensity (ton-miles/GDP in millions)	0.01
Mode Share (Tons)	
a) Trucks	91 %
b) Water	5 %
c) Rail	3 %
Freight Accident Fatality Share	32 %
Freight Employment[95]	2 %
Freight Emission Intensity (g/tonne km)	
Urban Freight Emission share	40 % (NOx), 31 % (PM) and 20 % (CO2)
Retail establishments Density (No of establishments/sqkm)	5

Freight Trips

Urban freight and local delivery trips generated 8.3 million truck trips in 2007, or 27 percent of all commodity truck trips in the NYMTC region.[96] In 2015 about 75,000 commercial vehicles and 11,000 trailers were registered with the New York Department of Motor Vehicles (NYDMV) accounting for 4 percent of all vehicle registrations.

[93] Jaller, M., Holguin-Veras, J., & Hodge, S. (2013). **Parking in the City:Challenges for Freight Traffic.**
[94] Computed from various sources by author
[95] Arrived at considering the 117600 jobs in transport and warehousing out of the approximately 8 million jobs
[96] NYMTC Regional Freight Plan Update 2015-2040 Interim Plan: Truck Trip Analysis Summary

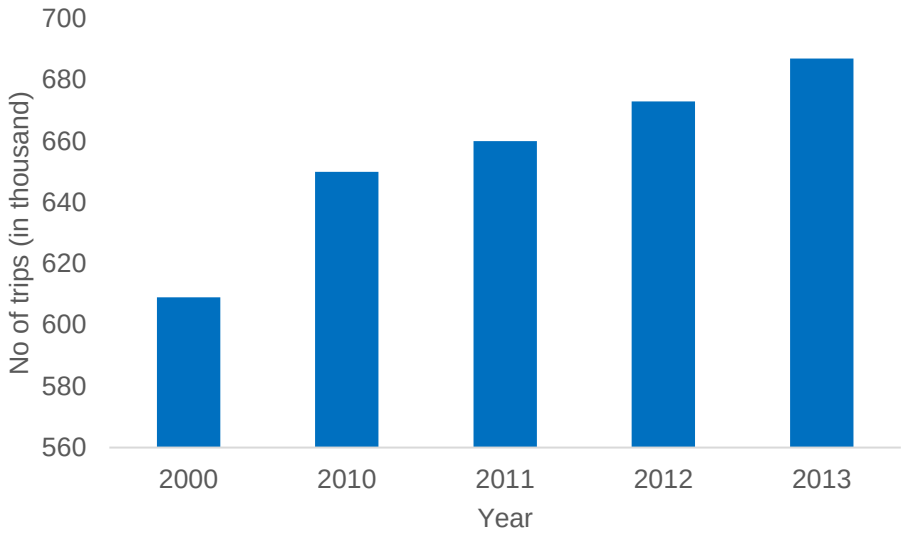


Figure B2. No of daily freight trips in New York City[97]

New York City freight trips:

- In 2013 an estimated 687,100 trips were carried out a day (figure B2)
- 6,500 restaurants receive 6 to 8 truck deliveries each day, accounting for 40,000 truck trips[98]
- Approximately 180,000 truck trips are generated daily by Manhattan's 37,000 freight-related business establishments[99]
- The 180 establishments in the Grand Central Terminal generate up to 200 trips a day
- In the NYMTC area, the Port of New York and New Jersey generate approximately 9,000 truck trips per day[100]

Being a multi-modal hub and a strategic gateway, only about 60 percent of the trips are within the NYMTC region, with 34 percent being either inbound or outbound trips, (figure B3). The Borough of Manhattan, with an area of 23 square miles (8 percent of the city), accounts for nearly half of the freight trips generated in the city, with about 182,427 daily inbound freight truck trips and 161,144 outbound (figure 4). Manhattan is also home to the majority of businesses and employment within the city.

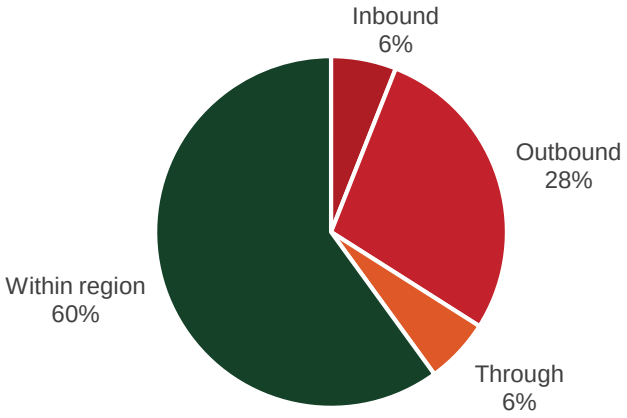


Figure B3. Freight Movement in NYMTC[101]

[97] New York Department of Transport (2016). New York City Mobility Report
[98] Employment in New York City's Transportation Sector, 2008
[99] https://coe-sufs.org/wordpress/ncfrp33/case-studies/nyc/intro/
[100] Jaller,M. (2013), Large Urban Freight Traffic Generators: Opportunities for City Logistics Initiatives
[101] NYMTC Regional Plan Update 2015-2040 Interim Plan, Truck Trip Analysis Summary

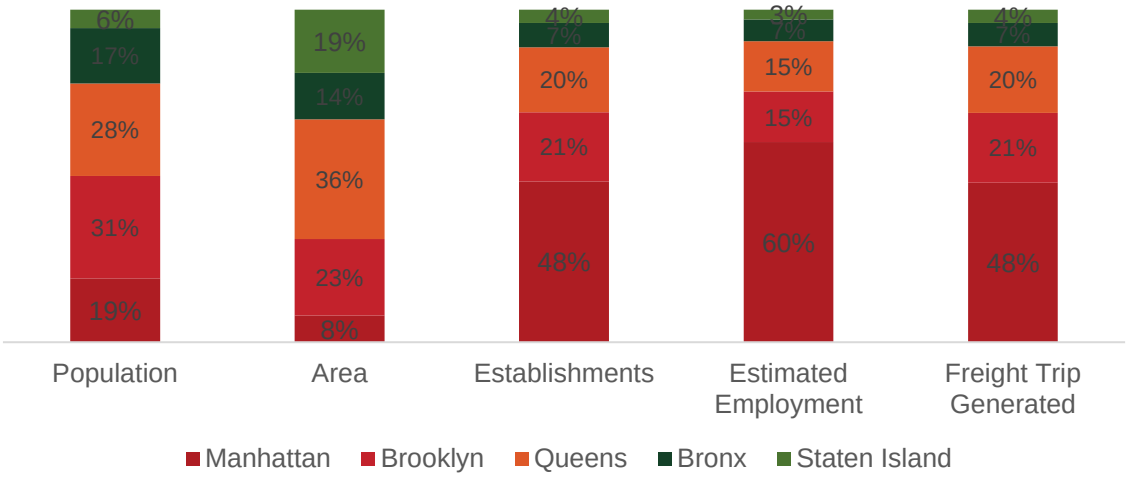


Figure B4. Characteristics of the boroughs of New York City[102]

Mode Share

Within the NYMTC, trucks carry more than 90 percent of the freight by weight (Figure B5) and 60 percent by ton miles.[103] Approximately 4.3 million truck trips travel into the NYMTC region, destined for terminals or warehousing and distribution facilities. This represents about 17 percent of all commodity truck trips in the region. About 25 percent of the inbound trucks are carrying secondary traffic; i.e. freight moving from a warehouse, distribution center, or terminal rather than direct from supplier.[104]

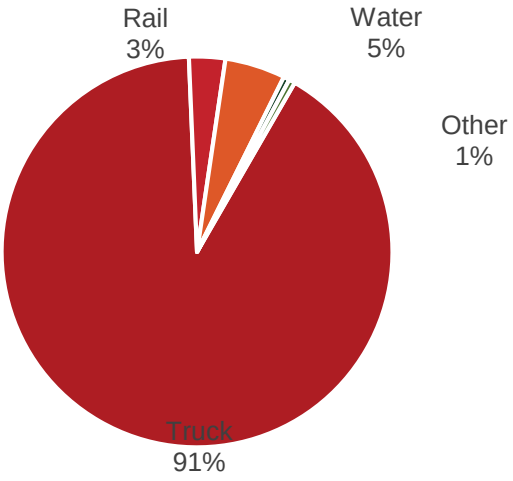


Figure B5. Urban freight mode share

Waterborne freight transportation has a long history in the region, accounting for the movement of about 5 percent of all freight by tonnage. It is facilitated by marine cargo ports, inland waterways and hundreds of wharves and docks scattered throughout the region. Regional ports work closely with other modes such as truck and rail to link local markets to global locations such as Western Europe and Asia.

The volume of freight moved by **rail** is relatively small in the NYMTC region, due to the limited rail freight infrastructure and the challenge of operating rail freight within the high-density commuter rail network east of the Hudson River. Rail accounts for about 3 percent of freight movement by tonnage, which is forecast to remain fairly consistent to 2040. But rail is a critical transportation mode for some sectors, e.g. building

[102] Jaller,M., (2013). Large Urban Freight Traffic Generators: Opportunities for City Logistics Initiatives
[103] USDOT (2007) Shipment Characteristics by Mode of Transportation for Metropolitan Area of Origin
[104] NYMTC Regional Plan Update 2015-2040 Interim Plan, Truck Trip Analysis Summary

products, lumber, food, stone and fuel. It is also vital for intermodal containers carrying higher-value exports and imports.[105]

Employment

Goods movement into and out of the New York and New Jersey region is a major economic activity. The transport and delivery of goods represents about 8 percent of total employment growth in recent years and 1 in 13 jobs in New York State is supported by the trucking industry.[106]

The New York – New Jersey Metropolitan Areas has one of the highest number of truck trailer drivers, as well as the highest hourly wage in the country[107].In 2007, the trucking sector was estimated at about 18,000 jobs within the private sector[108]. These jobs tend to be clustered near the airports and marine terminals in Jamaica, Queens; Red Hook, Brooklyn; and Howland Hook, Staten Island.

Between 2015 and 2040, total employment levels are expected to increase by a total of 23 percent, or 1.7 million jobs, while the population will increase by about 1.7 million people. Queens has the highest percentage of New York City's truck transportation workforce (38 percent), followed by Brooklyn (27 percent).

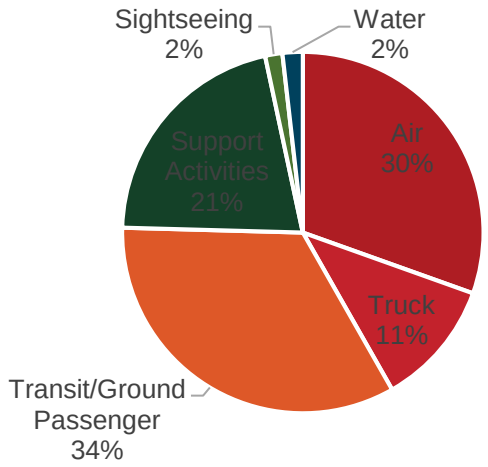


Figure B6: Private sector transport employment[109]

Table B2 New York State employment in freight[110]

Occupation	percent share of sector
Heavy and Tractor Trailer truck drivers	55.0
Laborers and Freight, Stock and Material movers	12.1
Bus and Truck mechanics and Diesel Engine	3.4
Dispatchers	2.8
Secretaries and Admin assistants	2.7
First - line supervisors of transport	2.5
Light truck or delivery services drivers	2.5
Book keeping, accounting and auditing	2.0
Office clerks, general	1.8
Packers and packagers	1.3

[105] The Basics of Freight Transportation, NYMTC
[106] King,D., Gordon, C., Peters, J. (2014). Does road pricing affect port freight activity: Recent evidence from the port of New York and New Jersey
[107] http://www.bls.gov/oes/current/oes533032.htm
[108] http://www.nyc.gov/html/ohcd/downloads/pdf/lmis%20transportation%20report%20sept08.pdf The total number of transportation jobs is likely to be more than double the official estimate of 9,000
[109] , NYCLMIS (2008) Employment in New York City's Transit and Ground Passenger Transportation Subsector
[110] Campion,S. (2014), A Profile of New York City's Workforce

2. Government plans and stakeholders

The efficient, safe and sustainable movement of the large quantity of goods is managed by various stakeholders through a variety of plans and policies. The local government provides the crucial role of policy, planning and infrastructure supply and maintenance, while the private sector, of shippers and carriers, carries out the freight operations.

New York City Department of Transport (NYCDOT)

The department manages an annual operating budget of $900 million and a five-year, $6.3 billion capital program covering; 6,000 miles of streets and highways; over 12,000 miles of sidewalk; 789 bridges and tunnels; installation and maintenance of over one million street signs, 12,700 signalized intersections, and over 315,000 street lights; and 69 million linear feet of road markings. The DOT also specify the dimensions and load restrictions that a truck can carry in the city limits.

The NYC DOT Office of Freight Mobility

This office has an overall mission to support the City's economic competitiveness. It does this by advancing policies and programs to mitigate the adverse impacts of trucks on infrastructure and communities, while also improving truck delivery efficiency. A recent increase in personal numbers has enabled the Office of Freight Mobility to create four new programs that include Planning, Outreach, and Research, Signage and Field Operations, Efficient Deliveries (Off-Hour Deliveries), and Commercial Vehicle Compliance.

Figure B7. Urban Freight Stakeholders in New York[111]

The Port Authority of New York and New Jersey (PANYNJ)

The PANYNJ designs, builds, operates and maintains a wide range of infrastructure including; America's busiest airport system, marine terminals and ports, the PATH rail transit system, six tunnels and bridges between New York and New Jersey, the Port Authority Bus Terminal in Manhattan, and the World Trade Center. The port is ranked 3rd in the US and is the busiest on the east coast, handling 3,342,286 cargo containers in 2014.

[111] Compiled by authors

New York Metropolitan Transportation Council

Federal transportation legislation requires that all urbanized areas with a population over 50,000 must have a designated Metropolitan Planning Organization (MPO) in order to qualify for federal transportation funding. The NYMTC brings together diverse stakeholders and provides a partnership planning forum to address transportation-related issues from a regional perspective. It undertakes complex urban freight studies for transportation improvements; forecasts future conditions and needs; pools the resources and expertise of its member agencies to plan for transportation and development in the region; and makes decisions on the use of Federal transportation funds. The NYMTC planning area covers 2,440 square miles and a population of 12.4 million as of 2010, which is about 64 percent of New York State's population[112].

Various advisory working groups[113] have been formed by the NYMTC to allow stakeholders and the public to get involved with NYMTC in specific areas of interest. These groups have been established by the Program, Finance, and Administration Committee (PFAC) and support NYMTC's planning efforts and data collection activities. Working groups can be theme or area focused, and members are drawn from a variety of sectors. They provide input to the development of policies, projects and programs for NYMTC and hold meetings that are open and accessible to the public.

Freight associations such as the American Trucking Associations[114] (ATA) and the Trucking Association of New York[115] (TANY) also play a key role in engaging with policy makers and the general public, to create a better awareness within the community.

4. Freight surveys and monitoring

The departments and institutions involved directly or indirectly in freight movement collect data of various types at various intervals. NYCDOT is the leading agency related to freight (and passenger) transport, and collects data on vehicles, goods, and freight safety impacts. Information is collected by manual survey and electronic means, and is analyzed to develop relevant initiatives and policies, such as the truck route network.

The NYMTC carries out inter-regional travel studies and surveys that are relevant for the larger region. These government agencies are assisted by academia, such as the Rensselaer Polytechnic Institute (RPI) which assists in carrying out and monitoring pilots, such as the off-hour deliveries project.
The table below summarizes the data points used this report.

Table B3: List of indicators and the relevant agencies that collect them

Sl No	Indicator	Relevant Agency	Website
1	Vehicle registration	New York State Department of Motor Vehicles	https://dmv.ny.gov/
2	Vehicle miles and related activity	USDOT Department of Transport, Office of the Assistant Secretary for Research and Technology	http://www.rita.dot.gov/
3	Regional Transport Planning Agency	New York Metropolitan Transportation Council (NYMTC)	https://www.nymtc.org/
4	Local agency for Freight specific policies	NYCDOT, Office of Freight Mobility	http://www.nyc.gov/html/dot/html/motorist/trucks.shtml
5	Modes	Respective air, port websites	http://www.panynj.gov/
6	Commodity movement	USDOT Department of Transport, Office of the Assistant Secretary for Research and Technology	http://www.rita.dot.gov/

[112] NYCDOT (2015) Urban Freight Initiatives
[113] https://www.nymtc.org/ABOUT-US/who-we-are/working-groups
[114] http://www.trucking.org/
[115] http://www.nytrucks.org/

Sl No	Indicator	Relevant Agency	Website
7	Accidents	New York State Department of Motor Vehicles	https://dmv.ny.gov/
8	Economic data - including Establishment, employment	New York City Economic Development Corporation	http://www.nycedc.com/
9	Infrastructure	New York City Department of Transport (NYCDOT) and NYSDOT and USDOT	http://www.nyc.gov/html/dot/html/infrastructure/infrastructure.shtml
10	Employment	New York City Labor Market Information Service (LMIS)	http://www.nyc.gov/html/ohcd/html/publications/labor-market.shtml
11	Stakeholder engagement	Working Groups of NYMTC	https://www.nymtc.org/ABOUT-US/who-we-are/working-groups
12	Academic Research	Rensselaer Polytechnic Institute (RPI)	http://rpi.edu/

5. Main urban freight initiatives

The New York City Strategic Plan highlights the current range of freight initiatives[116]

- Reducing air pollution and congestion by expanding the off-hour delivery program, especially in areas of high NMT volumes
- Develop a comprehensive strategy for each of the five boroughs.
- Increased enforcement through technology and stakeholder engagement, especially on trucks that are frequently off route or overweight
- Expand capacity of the office freight mobility at the NYCDOT

NYMTC's current Regional Transportation Plan, Plan 2040, identifies a series of goals that guide regional freight planning activities. [117] These include:

- Improve the transportation of freight by removing burdensome government regulations and restrictions and by rationalizing and coordinating regulations and restrictions
- Improve the physical infrastructure of the transportation system for freight related transport among shipping and receiving points, and major terminals and ports
- Improve the reliability and overall movement of freight in the region by encouraging expedient and cooperative multimodal shipment of freight
- Improve the reliability and overall movement of freight in the region by expanding alternatives for trucks and other commercial vehicles
- Improve the performance, reliability, and local accessibility of the region's strategic [or major] roadway [or highway] corridors for freight movement
- Maximize existing land use patterns in ways that make maximum use of freight transportation investments and improve the cost-effectiveness of expenditure
- Improve the freight system's strategic redundancy

Some of the prominent urban freight initiatives are described next.

Off-hours delivery pilot

To combat congestion, help businesses control costs and improve air quality, DOT worked with Rensselaer Polytechnic Institute (RPI), and a group of stakeholders and research partners to implement an Off-Hour Truck Delivery Pilot program, funded by USDOT, which ran from late 2009 through 2010. It was focused on 25 establishments to voluntarily shift delivery timings from 7pm to 6am.

The success of the initiative was highlighted by the media and the participants honored by the NYCDOT, acting as a stimulus for greater implementation and dissemination. With the range of stakeholders involved, and the

[116] NYCDOT Strategic Plan 2016
[117] https://www.nymtc.org/Regional-Planning-Activities/Freight-Planning

need for long-term acceptance, the key element of the program was that it was voluntary, and delivered win-wins.

The receivers of goods had an increased reliability of delivery time, carriers had improved travel times, and for local residents and commuters the advantage was reduced noise, air pollution and potential truck–bike conflict. The biggest winner obvious winner appears to be the carrier: travel speeds improved as much as 75per cent and they experienced a sharp reduction in parking fines, which had exceeded $1,000 a month for each truck.[118]

The pilot found that travel speeds from the depot to the truck drivers' first stop in Manhattan improved by up to 75 percent compared to travel speeds during the evening rush hours, while subsequent trips averaged travel speeds up to 50 percent faster. With less competition for parking spaces near the delivery location, trucks spent only 30 minutes stopped at the curbside making deliveries, whereas before the pilot they had spent up to 100 minutes as they had to park further away and compete with pedestrians for curb space. From beginning to end, delivery routes were, on average, 48 minutes faster during the pilot.

Truck Route Network

The DOT publishes a full color, double-sided map featuring the City's comprehensive **Truck Route network** overlaid on top of the entire arterial street network, making it easier for drivers to locate specific streets and intersections. The truck routes are designed to protect residential neighborhoods (by effectively segregating trucks) and improve the safety of pedestrians and cyclists[119]. The map also contains helpful information on; truck route signage, weight limits and dimensions, parking areas, potential truck related violations, and City, regional and state related truck resources. Each year 800,000 copies are distributed to truckers.

Freight Villages

A recent study by Rutgers University reports that high land prices have been driving **trucking and warehousing firms** further away from central New York, particularly across the Delaware River to Pennsylvania. However, due to a combination of rising fuel prices and the efficiencies of locating operations nearer to population centers, carriers are now considering 'brownfield lots' (i.e., former manufacturing sites requiring environmental remediation). While these may be smaller they are cost-effective as they are closer to where the demand is and enable a quicker response time. NYMTC is undertaking a feasibility study about locating 'freight villages' in or around New York City.[120]

Curbside Management Initiative

This initiative is designed to replace single-space parking meters with ticket dispensing "Muni-meters". These meters are located along each block of restricted curb space, allowing commercial vehicle operators to purchase prepaid parking tickets for up to three hours. Traditionally, curb spaces were reserved for commercial vehicles from 7 a.m. to 6 p.m. to provide access to businesses during the busiest hours of the day but this has resulted in demand exceeding supply.[121]

This initiative is designed to increase the flexible use of the curb. It uses a tailored pricing strategy to ensures curb-space turnover and increase parking availability to a larger number of users. An escalating rate structure of $2.00 for one hour, $5.00 for two hours and $9.00 for three hours ensures shorter dwell times. A significant reduction in dwell times for curbside loading spaces has been observed as a result of implementation.

Truck replacement program[122]

A 2015 Regional Truck Replacement Program (2015 RTRP) was funded by a $2 million federal Congestion Mitigation and Air Quality Improvement (CMAQ) Program grant. It was designed to mitigate the impact of the

[118] http://www.nyc.gov/html/dot//html/pr2010/pr10_028.shtml
[119] http://www.nyc.gov/html/dot/html/motorist/trucks.shtml#routes
[120] Employment in New York City's Transportation Sector, LMIS, 2008
[121] Urban Freight Case Studies: New York, USDOT, 2009
[122] http://www.panynj.gov/truckers-resources/truck-replacement.html

Port Authority banning access for pre-2007 trucks. The RTRP covered up to 50 percent of the cost of a replacement truck or a maximum of $25,000, whichever was less.

The New York Alternative Fuels Program

This program has been developed to support NYC environmental laws and Mayoral Executive Order, specifically in the Hunts Point/Port Morris area in south Bronx.[123].The program develops freight incentives, policies, funding mechanisms, education, and outreach to increase the adoption of cleaner vehicles and fuels. The NYC DOT is expanding the use of alternative fuels such as biodiesel, compressed natural gas and hybrid electric vehicle technology in its municipal fleet. Nearly 700 of 3,000 municipal vehicles already use alternative fuels.

Clean Truck Program

The NYC DOT **Clean Truck Program** is also focused on trucks that are based in or travel through the Hunts Point/Port Morris area. This initiative involves replacement, retrofit, and retirement of about 500 older polluting diesel trucks, with 2010 and newer EPA emission compliant diesel-hybrid, compressed natural gas, and diesel Class 3 to Class 8 trucks. This initiative has improved local air quality, reducing particulate matter (PM 2.5) emissions by 97 percent (13.34 tons per year) and Nitrogen Oxides (NOx) by 89.2per cent (241.20 tons per year). With more efficient trucks using less fuel, Greenhouse Gas Emissions (GHGs) have also reduced by 4,477 tons per year.[124]

Research, Implementation and Safety Team

The NYC DOT maintains a comprehensive accident database, recording incidents, accidents, and fatalities that are transportation and freight movement related. The NYC DOT's **Research, Implementation and Safety Team** (RIS) separate out those involving pedestrians, cyclists, buses, and freight traffic to assist the development of relevant road-safety related policies.[125] This has enabled the New York City 'Vision Zero Action Plan' to outline 63 separate targeted initiatives to reduce fatalities and serious injury.

Weight in Motion

Three **'Weigh in Motion'** sensors have been installed in locations decided by a multi-agency Technical Advisory Committee. These provide real-time information on vehicle overloading and the $1.8 Million project will use the information collected to decide future policies and regulations impacting the City's truck route management.

Office of Freight Mobility

NYCDOT created a dedicated freight office to plan, strategize and engage with freight stakeholders in 2008. The Office of Freight Mobility **increases the coordination and effectiveness** of the New York City government departments and other agencies. As identified above, the Office is responsible for developing policies and programs to mitigate the adverse impacts of trucks on infrastructure and communities, while also improving truck delivery efficiency.[126]

Goods Movement Plan

The Port Authority is currently developing a Comprehensive Long-Term Regional **Goods Movement Plan (GMAP)**, which will result in a 30-year action plan for improving freight movement in the New York/New Jersey metropolitan area. The City will continue to participate in this effort and take the appropriate actions that emerge within their jurisdiction.[127]

[123] http://www.nyc.gov/html/dot/downloads/pdf/2015-09-14-urban-freight-initiatives.pdf
[124] Urban Freight Initiatives, NYCDOT, 2015
[125] Urban Freight Initiatives, NYCDOT, 2015
[126] https://coe-sufs.org/wordpress/ncfrp33/case-studies/nyc/intro/
[127] PLANYC

5 C. Case Study – Tokyo

*"Reduce GHG emissions by approximately 40 percent in the transportation sector by 2020 from the 2000 level. **En**hance the loading ratio … improve the average travel speeds … and solve the chronic traffic congestion problem by 2016"* – **Environmental Master Plan, 2008**[128]

1. Background

The Tokyo Metropolitan Area consists of 23 wards (**Ku** in Japanese), the Tama area and a few small islands spread over an area of 2,100 square kilometers, housing approximately 13.3 million people. Along with prefectures of Saitama, Kanagawa and Chiba, it forms the Tokyo Megalopolis Region, or Greater Tokyo Area. The national capital region consists of Tokyo Megalopolis Region and four other prefectures, Yamanashi, Gunma, Tochigi and Ibaraki[129]. The total area-wide population is about 37 million of some 8,500 square kilometers, making it the largest city-region in the world. Tokyo is also the most densely populated city in Japan.

The Tokyo Metropolitan Area is home to almost 3,000 companies with a capital value of more than 1 billion Yen ($9mn). Tokyo's 10 percent of the country's population is responsible for nearly 20 percent of Japan's Gross Domestic Product ($4,920 billion). If it were a country, the Tokyo Metropolitan Area would be ranked 16th in terms of Gross Metropolitan Product (GMP) at $930 billion.[130] For the Greater Tokyo Region, the GMP rises to more than $2 trillion, making it the world's largest city economy.[131]

[128] Tokyo Metropolitan Environmental Master Plan
[129] Urban Logistics practices – Case study Joint delivery systems in Tokyo, 2011
[130] Tokyo Metropolitan Statistics
[131] Tokyo Metropolitan Statistics – City View

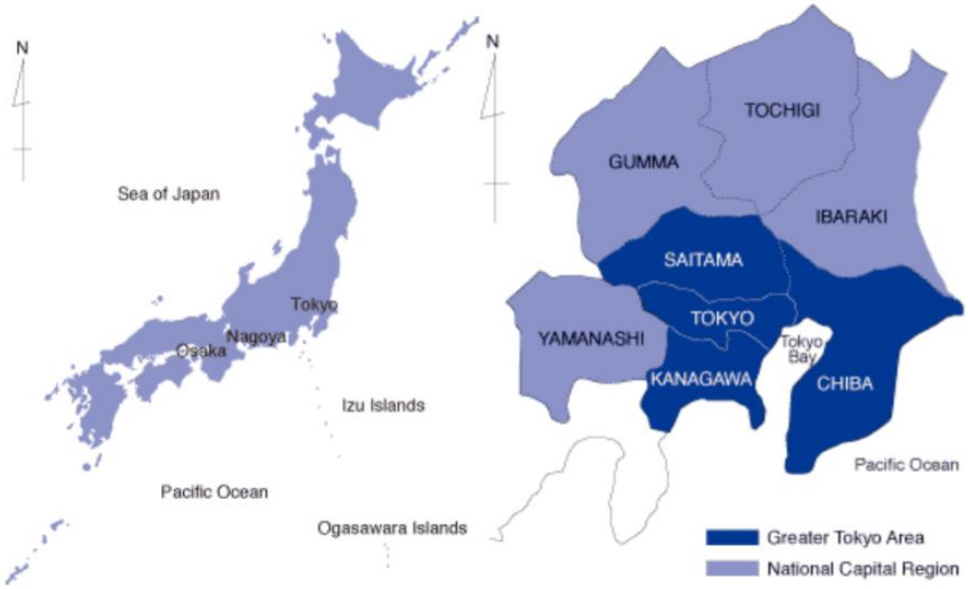


Figure C1. The Greater Tokyo Area and National Capital Region

2. Freight in numbers

The Tokyo metropolitan area is geographically small with low levels of freight vehicle ownership, but it generates high economic benefits. Tokyo's economy is based mainly on tertiary industry (services, wholesale and retail trade, transport and communication, financial institutions, etc.), which contribute approximately 84 percent of GMP, and these sectors account for about 80 percent of the total number of establishments and labor force in 2006. Tokyo is home to about 12 percent of the 4.9 million private businesses in the country, providing jobs to more than 6 million people. Furthermore, over 75 percent of foreign companies in Japan have headquarters in Tokyo.

Modes

Figure 3 gives the share of freight volume by mode within Tokyo and the surrounding regions, indicating the total dependence on road transport. In terms of the volume of goods moved, medium-sized trucks account for 73 percent of the total goods moved, with light trucks account for 11 percent.

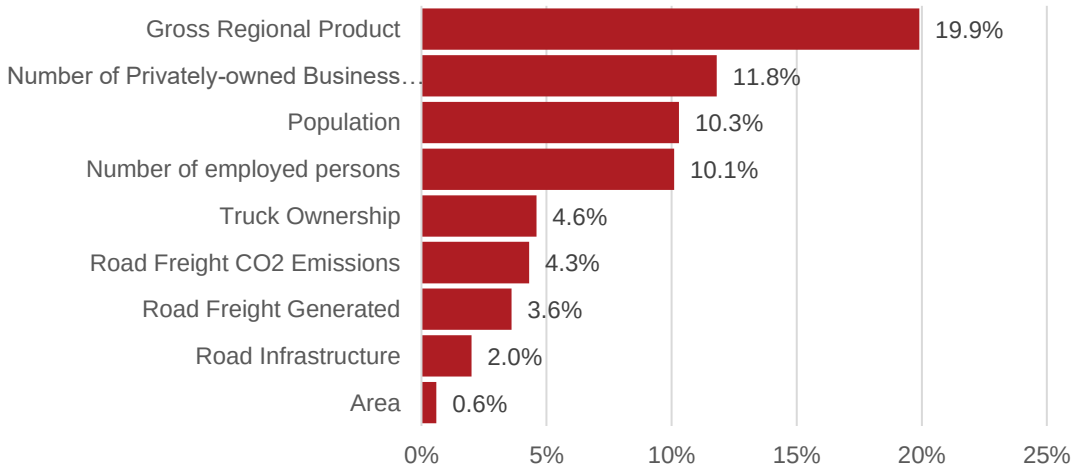


Figure C2. Tokyo's impact on Japan (Tokyo Metropolitan Statistics)

Table C1. Tokyo Key Performance Indicators of Urban Freight

Sl.No	Indicator	Tokyo
1	GDP/Capita (PPP)	$63,485
2	City Size (km2)	2188
3	Population Density (People/Sqkm)	6033
4	Average Loading Factor (per cent)	50 %
5	Freight Lifted (Tons/Capita)	33
6	Freight Motorization Index (V/1000 Pop)	30
7	Urban Freight share of VKT (per cent)	27 %
8	Mode Share (Tons)	
	a) Road	99 %
	b) Rail	0
	c) Water	1 %
9	Freight Accident Fatality Share (national)	5 %
10	Freight Employment (transport and postal services)	5 %
11	Freight Emission Intensity (g/tonne km)	389
12	Urban Freight Emission share CO2 (per cent)	33 %
13	Retail establishments Density (No of establishments/sqkm)	46

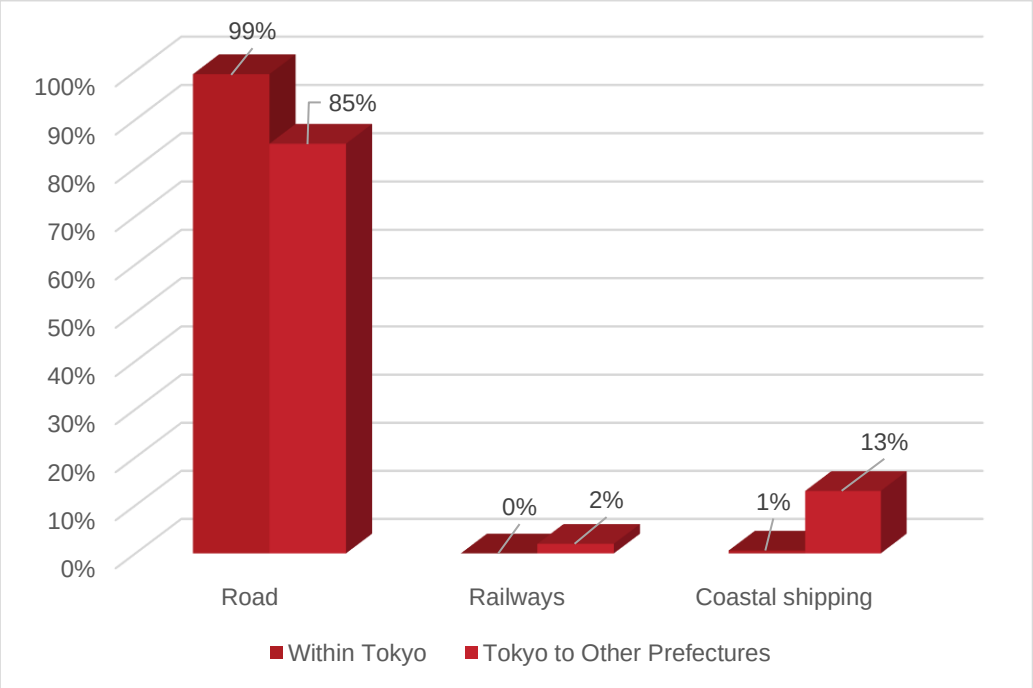


Figure C3. Freight mode share by volume[132]

Truck ownership

Over the past decade, the truck ownership levels and volume of freight generated within Tokyo has not increased. Despite a reduction in the volume of freight transported, the number of transactions have been increasing (totaling almost 25 million in 2010) especially for those less than 0.1 ton. There are three key reasons for this:

- Shopping and trading through the internet has been spreading for both individuals and businesses. More people have easy access to the internet than before, and access to a global market

[132] Urban Logistics practices – Case study Joint delivery systems in Tokyo, 2011

- There is a growing trend for businesses that support the aging society in Japan. As a result, door-to-door delivery services of goods and commodities for elderly people has been steadily growing
- There has been an increase of convenience stores and smaller supermarkets requiring frequent but smaller deliveries. People's lifestyles are also diversifying which increases the demand for a wider variety of products. This accelerates the rising number of freight transactions.[133]

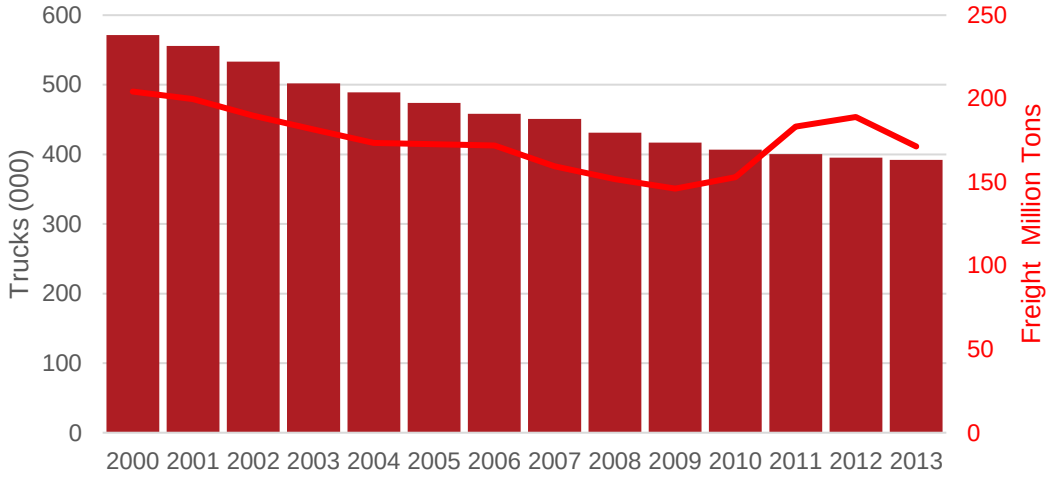


Figure C4. Freight volume and Truck Ownership (Tokyo)

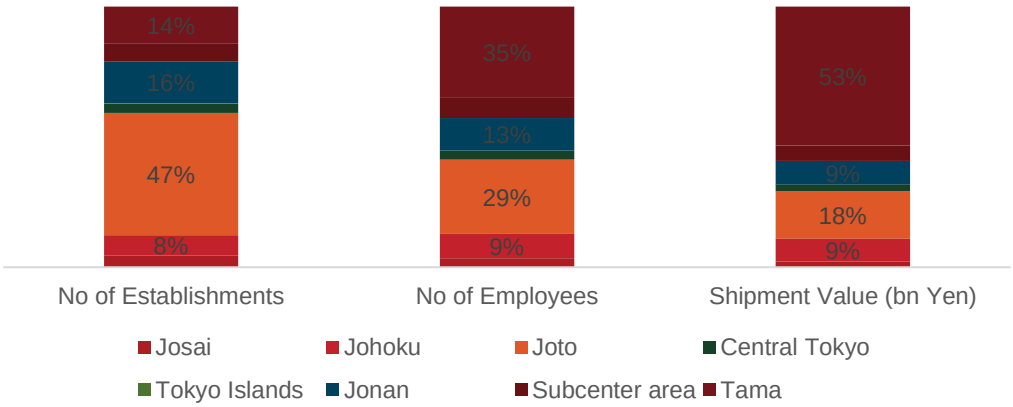


Figure C5. Distribution of establishments and jobs within Tokyo134

Figure C6. Trend in transaction consignment size (tons)

[133] A Study of Freight Facility Location in Tokyo Metropolitan and its Future
[134] Urban Logistics practices – Case study: Joint delivery systems, Tokyo, 2011

Truck operating costs

The average operational cost of a truck is shown in the figure below. Truck drivers are highly regarded in Japan because of the rigorous training and testing process the drivers go through. However, drivers are in short supply, resulting in personnel costs (mainly wages) being the single largest cost, unlike in developing countries where fuel costs are usually the highest. Recent reports suggest that due to the driver shortage and aging population, shippers are being forced to consolidate loads due to reduction in availability of freight drivers and vehicles[135].

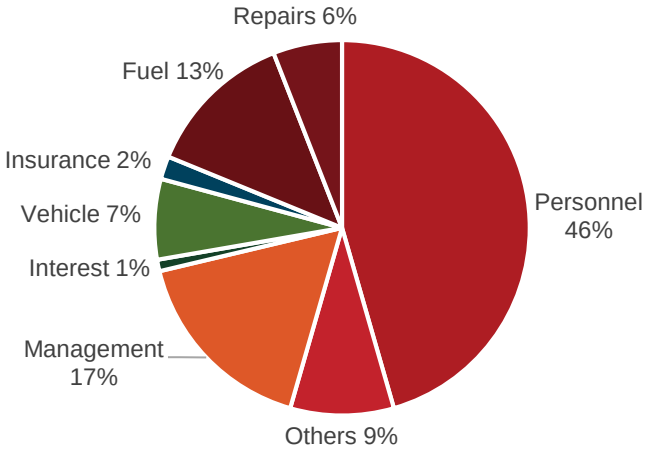


Figure C7. Typical Cost of Truck Operations136

Freight Facts and Figures

- The top 5 percent of shippers account for 86 percent of tons and 56 percent of truck trips
- Within Tokyo, roads carry 99 percent of the freight volume in the city
- Between 2000 and 2013 the total volume of freight moved decreased from 204 million tons to 171 million tons, the number of trucks decreased from 0.5 million vehicles to 0.4 million and the total freight vehicle kilometers travelled reduced by nearly 33 percent, to approximately 10 billion kilometers
- 65 percent of trucks are classified as small trucks
- It is estimated that in 2008, large scale retail stores received 46,000 truck trips every day, the majority made by small and medium trucks
- The average distance of warehouses to the center of Tokyo is about 30.7Km
- The average load factor of trucks is 50 percent, with smaller capacity trucks having load factors as low as 20 to 30 percent
- The transport sector accounts for 25 percent of total carbon emissions. Road CO_2 emissions amount to 90 percent of transport emissions (15 million tons) and freight accounts for 33 percent or 4.4 million tons. Private freight vehicles have an emission intensity of 1046 g-CO_2/ton-km, while commercial vehicles emit as little as 153 g-CO_2/ton-km
- About 20 percent of home deliveries fail the first time and redeliveries account for about 25 percent of total truck volumes in Tokyo and Fukuoka according to a survey in 2014. This results in 180 million man hours being wasted
- More than 80% of manufacturing businesses are concentrated in central Tokyo, also home to a high number of wholesale and retail businesses. This results in high levels of congestion, with average peak-hour vehicle speeds of 16.8 kilometers per hour

[135] Japan Inc. combats driver shortage with streamlined deliveries
[136] Urban Freight Transport Management for Sustainable and Liveable Cities: Presentation by Eiichi Taniguchi, 2013

Infrastructure

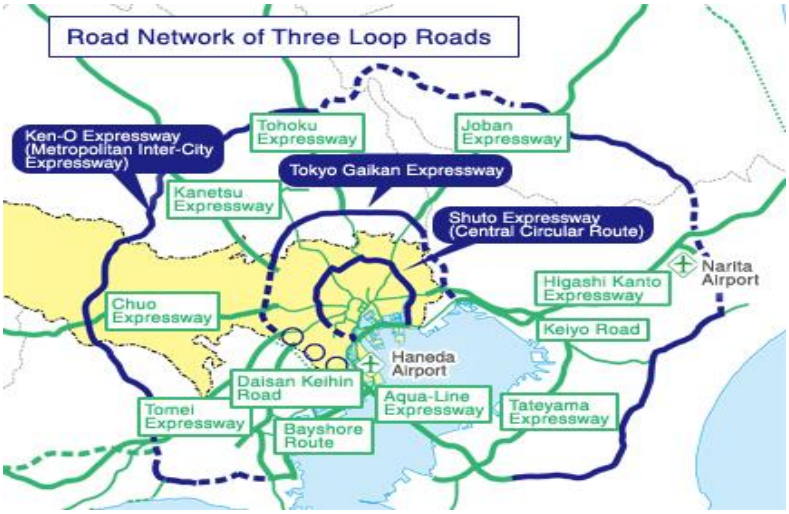


Figure C8. Major Infrastructure details in Tokyo137

Tokyo is Japan's main gateway, with two international airports and six ports. Haneda Airport, opened in 1931 as Japan's first airport for national and private airlines and is located only 15 kilometers from the city center. The port of Tokyo is the busiest in the country handling most of the container volume, although it is second to Nagoya in terms of the value of foreign trade. Together with the neighboring ports of Yokohama and Kawasaki, the Tokyo bay area is designated as an international strategic port for container traffic.[138]

The expressway network of three ring roads and nine radial roads was planned as early as 1963. However, the government aced difficulty with land acquisition for the ring roads and construction did not progress quickly; while the completion of radial roads was more successful, by 2003 only the northern and the eastern sections of Central Circular Route (ring road 1), the northern sections of Tokyo Gaikan Expressway (ring road 2) and the north-west sections of Ken-O Expressway (ring road 3) were completed. as of 2016, the Central Circular Route is fully open. The unfinished expressway network has put stress onto the existing urban roads.[139] The ring roads are expected to be 90 percent complete by 2020 in time for the Tokyo Olympics.[140]

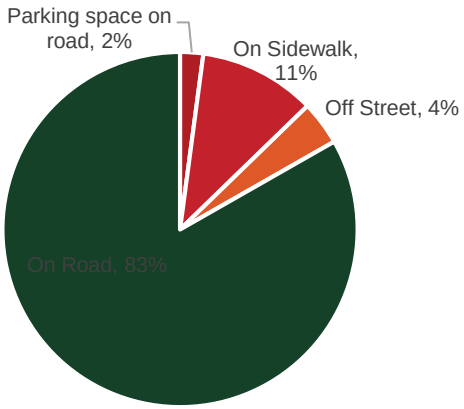


Figure C9. Loading/Unloading place for trucks141

The Tokyo Expressway Central Circular Route, approximately 47 km in length, runs closest to the center of Tokyo. It is designed to divert and disperse traffic and help ease the chronic traffic congestion that concentrates

[137] The Bureau of Construction
[138] Port of Tokyo
[139] Logistics facility distribution in Tokyo Metropolitan area: Experiences and policy lessons, Sakai, T., Kawamura, K.,Hyodo,T
[140] Road and Rail Network
[141] Concept and best practices of city logistics: Prof Eiichi Taniguchi, ITF, 2012

in central Tokyo[142]. The overall average annual cost of congestion in Tokyo is estimated at 435 million Yen/km, one of the highest costs in Japan.[143]

The on-street parking of vehicles, including delivery vehicles, is seen as one of the causes of high congestion levels. The Tokyo Metropolitan Environmental Master Plan (TMEMP) reports the average rush hour travel speed in Tokyo at 21.2 kmph but aimed to raise the average travel speed to 25 kmph by 2016.

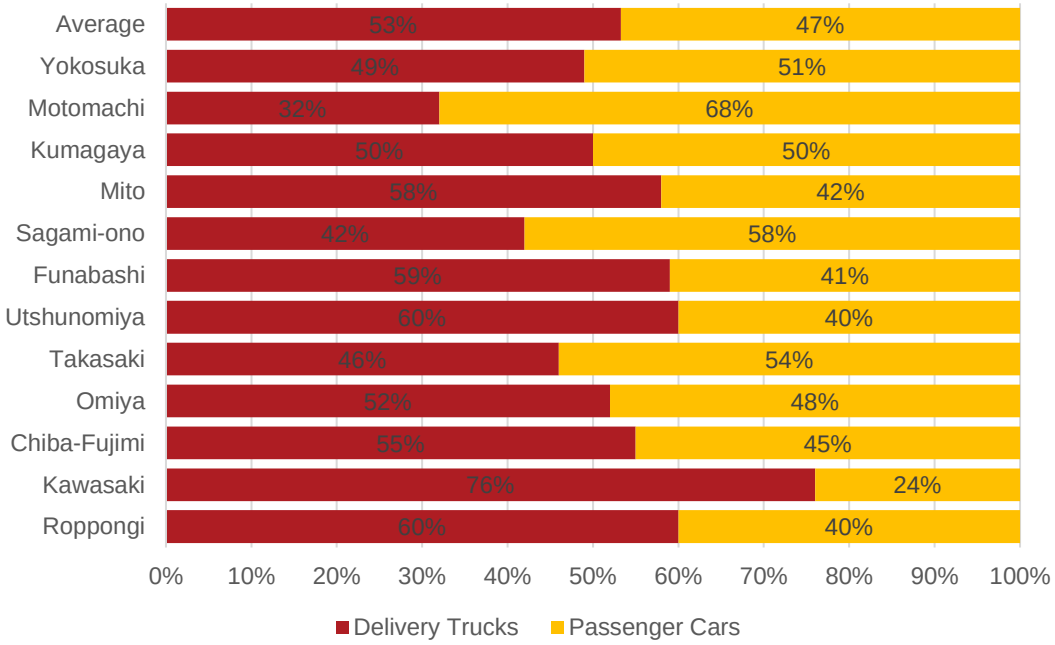


Figure C10. Share of parked vehicles on Tokyo streets in different wards

Source: 5th Tokyo Metropolitan Freight Survey

The Tokyo freight survey reports that highest proportion of on-street parked vehicles are delivery trucks, occupying 60 percent of the total space. But even in the district with the lowest proportion of delivery trucks, it still has a remarkably high share at 32 percent. It is estimated that only 8 percent of stores, including large-scale commercial facilities, have their own loading and unloading spaces. The average time for delivery trucks to park on the street is 10 minutes.

With a long history as the country's major domestic marine transport base, the Port of Tokyo handles cargo of foodstuffs, paper, steel, automobiles, and other products that satisfy domestic consumers. Regular sea routes move traffic between the Port of Tokyo and Hokkaido, Shikoku, Kyushu, and Okinawa. Recently, intermodal transport has increased, as have containers and roll-on/roll-off cargo. The Port of Tokyo plans to continue to develop modern terminals that can handle this domestic cargo quickly and efficiently. The Port is also the base for ferries that link the city with Shikoku and Kyushu, transporting both passengers and goods[144].

3. Government plans and stakeholders

The efficient, safe and sustainable movement of the large quantity of goods is managed by various stakeholders through a variety of plans and policies. The local government provides the crucial role of policy, planning and infrastructure supply and maintenance, while the private sector, of shippers and carriers, carries out the freight operations.

Tokyo Metropolitan Government[145]

[142] The Bureau of Construction
[143] Urban Logistics practices – Case study: Joint delivery systems, Tokyo, 2011
[144] Port of Tokyo
[145] Tokyo Metropolitan Government

The following departments oversee transport and environment activities:

- The **Bureau of Port and Harbor** is the authority for the Port of Tokyo. The Bureau is responsible for managing, administering, maintaining, and upgrading the Port, including developing reclaimed land, the waterfront sub-center and seaside parks. The Bureau is also responsible for implementing measures to mitigate high tides and for developing harbors and fishing ports in the outer islands.
- The **Bureau of Urban Development** is responsible for the construction of roads, railways and other transport infrastructure, and wider urban planning, housing policies, targets etc.
- The **Bureau of Environment** is responsible for environmental assessment, protection, climate change, and air quality, which includes monitoring motor vehicle pollution. It also develops targets and plans to reduce vehicle emissions and promotes eco-driving, vehicle replacement, alternate fuels etc[146].
- The **Central Wholesale Market** maintains and manages the facilities and ensures that food, marine products and flowers are delivered efficiently through its 11 wholesale markets.
- The **Bureau of General Affairs Statistics Division** publishes the Tokyo Statistical Yearbook which compiles all relevant official data of all transport modes

Other departments

Other relevant departments include:

- The **Transport Planning Commission** is a regional commission, consisting of representatives of Tokyo Metropolis, the surrounding 6 prefectures and 5 designated cities. It carries out numerous surveys and develops solutions to manage transport and traffic in the city.
- The **Ministry of Land, Infrastructure, Transport and Tourism**[147] is the main ministry for transport and logistics planning. It is responsible for the development and publication of official statistics and information on the condition of transportation and traffic services.
- The **Ministry of Economy, Trade and Industry**[148] is responsible for national level policies concerning industry and trade and provides relevant statistics. With a mission to develop Japan's economy, it focuses on promoting the economic vitality of private companies and advancing external economic relationships. It also aims to secure a stable and efficient supply of energy and mineral resources.
- The **Ministry of Environment** sets national policies regarding air quality and defines the acceptable emission standards for the transport sector.
- The **National Police Agency**[149] participates in traffic related planning and is responsible for issuing driver licenses, enforcement and safety. The NPA also collate accidents statistics.
- The **Japan Trucking Association** implements and promotes government directives and works towards increasing the standards of the trucking industry. It also works towards improvements in the environment and road safety[150].
- The **Tokyo Trucking Association**[151] carries out initiatives to increase the sustainability of local freight operators, including a Green-Eco project (see section VI, 10 below)

4. Freight surveys and monitoring

Tokyo Metropolitan Freight Survey

This is a survey on logistics that has been conducted by the Transport Planning Commission a total of five times (1972, 1982, 1994, 2003-2004 and 2013-2014). The survey helps to understand the current situation and logistics trends in the Tokyo area. It enables for the prefectures, cities and municipalities to address logistics problems through urban and transport planning policy measures.

The survey of over 100,000 randomly selected businesses is voluntary, and consists of a main and supplementary survey. The main survey examines business characteristics, such as facility size, type of

[146] Realization of environmentally sustainable transport, Bureau of Environment, TMA, 2008
[147] Ministry of Land, Infrastructure, Transport and Tourism
[148] Ministry of Economy, Trade and Industry
[149] National Police Agency
[150] Japan Trucking Association
[151] Traffic Safety Initiatives

industry, distribution function and year of establishment (See Table 2). The Supplementary survey consists of a more detailed interview and questionnaire, to understand the reasons behind the freight facility location.[152]

In 2003, 120,000 businesses with a storage capacity were mailed the survey and 30,000 responses were collected. In 2013, the response rate increased 32 percent (43600 respondents out of 140,000 targeted businesses).

Table C2: Tokyo Metropolitan Freight Survey
(source: Transport Planning Council of Tokyo Metropolitan Area)

Survey subject	Aspect	Contents
Category 1: **Character of facility**	Location	▪ Address ▪ Year established ▪ Placed importance of location
	Scale	▪ No of Employees ▪ Site form and ownership of land ▪ Site area and total floor area ▪ Shipment value, sales
	Type	▪ Facility type - office, warehouse, truck terminal etc.
	Function	▪ Facility function - manufacture, collection and delivery etc.
	Distribution Character	▪ Volume of freight ▪ Major transaction items ▪ Origin and destination ▪ With/without international cargo
Category II: **Volume of generation / attraction**	Volumes	▪ Tonnage of freight carried (in and out by mode) ▪ Number of trucks
	Characteristics of freight and trucks	▪ Ratio of cargo volume with appointed arrival time ▪ Average loading ratio (weight/volume percent, size of trucks, etc)
Category III: **Generation and attraction volume**	Origin / destination etc.	▪ Address and number of origin / destination points, category of business, type of facility ▪ Volume of freight, transportation mode and number of trucks including international cargo

In addition to the establishment survey, data on parking, loading / unloading and nearby pedestrian flows was collected from selected trucking companies. 30 to 40 large companies were also interviewed to understand the current logistics practices, strategies adopted and investments.[153].

The analysis of survey data revealed three main challenges related to logistics facilities.[154]These were the need to address the demand for logistics facilities in coastal and suburban areas, the mixture of logistics facilities and residential land use, and the need to address ageing logistics facilities in coastal area.

Ministry of Land, Infrastructure, Transport and Tourism

The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) collects and reports freight data for all transport modes. Monthly reports are produced nationally and by region for each freight mode: trucks[155], rail[156], maritime[157] and aviation.[158] It also conducts several surveys to assist research, policy making, and the planning and development of transport facilities.

National Logistics Surveys, a survey of commodity flow, are carried out every five years and the report of the most recent survey is available online at the MLIT website. The survey is conducted using both postal questionnaires and onsite interviews to reduce costs, and only a sample of companies is involved (from mining,

[152] Iwakata, M., et al. A Study of Freight Facility Location in Tokyo Metropolitan and its Future
[153] Takeshi Kenmochi, Introduction and Application of Tokyo Metropolitan Freight Survey
[154] Urban Freight Survey and Policy Measures with Respect to Urban and Transport Planning in Tokyo Metropolitan Area
[155] http://www.mlit.go.jp/k-toukei/06/monthly/index.pdf
[156] http://www.mlit.go.jp/k-toukei/10/monthly/index.pdf
[157] http://www.mlit.go.jp/k-toukei/01/monthly/index.pdf
[158] http://www.mlit.go.jp/k-toukei/search/pdf/11/11201609ca0000.pdf

manufacturing, wholesale and warehousing businesses). For example, in the 8th national logistics survey, 1,873 companies were interviewed while another 61,544 companies were asked to fill out a postal questionnaire; with an overall response rate of 33.2 percent.

The MLIT also conducts a **National Survey of Net Freight Circulation,** to collect data on the origin and destination of freight. The survey includes questions on the nature of the businesses and number of employees, as wells as the type and weight of freight, and weight ratio of shipping freight.

The **Net Freight Flow Census** provides information on the movement of freight from the owners of the goods. This survey is of businesses in various industries with large shipments of freight, and gathers data on the types of goods, origin and destination, and mode for domestic transportation[159].

Monthly Automotive Transportation Statistics

The **Monthly Automotive Transportation Statistics** report gives details about the freight volume (tons) and freight intensity (ton-km). It also provides the freight transport distance in kilometers and the amount of fuel consumption in kiloliters. The National Logistics Survey report (2007) contains a variety of freight related data such as freight travel time (in hours) and cost (kg/unit cost in yen) for various transport modes.

Ministry of Internal Affairs and Communications

The **Ministry of Internal Affairs and Communications** (MIC) serves as the core statistical agency, creating and publishing national statistics, while individual ministries create and publish specialized statistics in their respective fields of jurisdiction.

The Statistics Bureau of the MIC works with other ministries to provide a one-stop service for the entire official statistical system, through the **Statistical Portal Site.** Measures are in place to ensure that unified statistical data is used across government departments that enables the 'e-Stat' system to work. With the e-Stat system, users can take advantage of this cross-sectoral access to statistics, to make a single comprehensive data set from the various domains such as transportation, demographic, and economic statistics.

5. Main urban freight initiatives

The national Japanese government implemented new freight transport policies in 2001, entitled 'The New Comprehensive Program of Logistics Policies[160]'. The policy considered following initiatives

- Promoting joint operations, and the standardization of logistics business improvement practices
- Regulatory reform, including simplified and more efficient administrative procedures
- Development and use of new technology
- Promotion of unit loading (palletization)
- Promoting the establishment of new logistics infrastructure, including for international logistics, and enhancement of their function
- Measures to cope with 24-hour full opening of harbors
- Encouraging electronic procedures, and the use of information technology and one-stop services
- Establishment of a logistics system to cope with social problems
- Measures to ensure logistics activities support national life

Urban freight transport is considered a priority in the national policy, with establishment of two quantitative targets for urban freight - 'the load factor of trucks' and 'peak-hour average travel speed' in three major metropolitan areas; from the current 45 percent to a target of 50 percent, and from the current 21 km per hour to a target of 25 km per hour, respectively.[161]

The Tokyo Metropolitan Government (TMG) has produced its logistics policy with five key initiatives:[162]

[159] Kawasaki.S (2015) The challenges of transportation/traffic statistics in Japan and directions for the future
[160] METI's Program for Efficient Distribution and Logistics
[161] Urban Freight Movements and Public and Private Partnerships
[162] Urban logistics practices – Case Study: Joint delivery systems in Tokyo

- Establishing an efficient logistics network
- Reinforcing logistics functions for international trade
- Promoting the development of logistics sites for the Tokyo Metropolitan area
- Focusing logistics projects on local revitalization
- Improving the environment and quality of life in urban areas through better logistics

Some of the prominent urban freight initiatives in Tokyo are:

Joint Delivery System

A system was set up by the Motomachi Shopping Street Association to improve road safety and the environment, especially for pedestrians. 1,300 stores and 500 individual homes were part of the program that started in 2004. The number of multiple trips made to individual stores in the area has been reduced by 85 percent (from 100 to 29) through the creation of a jointly owned collection and delivery center. The center carries out delivery and collection to designated loading and unloading areas using CNG powered trucks. Annually, the association funds the carrier about $30,000.[163]

Figure C11. Motomachi[164]

Urban Consolidation[165]

The Shinjuku area is one of the busiest in Tokyo with more than 130,000 workers and more than 20 high-rise buildings. In a private sector initiative supported by the city of Tokyo, a group of 35 office supply delivery companies collaborated to create an urban consolidation center. Instead of delivering to each of the high-rise buildings individually, a third-party logistics operator now consolidates goods at a new 330 m^2 warehouse. Goods are then sorted and distributed using specially designed trucks and equipment that can efficiently deliver in the high-rise building environment. The initiative is growing and it is estimated that it has removed over 50 trucks per day from the road, while delivering over half a million packages per year.

Controlling Diesel Emissions[166]

In 2000, the Tokyo Metropolitan Government (TMG) enacted the Tokyo Metropolitan Environmental Security Ordinance. This started a campaign to eliminate non-compliant diesel vehicles by September 2002, and introduced other measures, including reduction of engine idling and vehicle environmental management plans.[167] It also stimulated three neighboring prefectures to introduce and implement similar ordinances at the same time.

Tokyo's ban on driving diesel vehicles required noncompliant vehicle owners to install Diesel Particulate Filters (DPF). When no improvements were forthcoming, TMG banned noncompliant business owners from operating in the Tokyo area, with violations detected by monitoring cameras at certain points. Subsidies of $270 million

[163] Prof Eiichi Taniguchi, ITF (2012). Concept and best practices of city logistics
[164] Motomachi
[165] Multi–Donor Trust Fund for Sustainable Logistics: Position Note on Urban Logistics and Port - Cities
[166] Tokyo Metropolitan Government's Efforts to Control Diesel Vehicle Emissions
[167] Tokyo Retrofit Program

were provided to adopt DPF or to purchase low emission vehicles, such as those running on natural gas or hybrid vehicles.[168]

One of the highlights of was a promotion and public relations campaign, which included onsite guidance to nearly 3,800 businesses in the area that owned 20 or more vehicles. The Tokyo diesel policy led to the adoption of new truck PM standards, which forced the implementation of diesel after-treatment for the first time in the world.[169]

Freight Hub Development

Many of the logistics facilities in the Greater Tokyo Area are concentrated on the waterfront and along expressways. However, in response to changing freight traffic and to meet the demand of prompt delivery, the type of sites and number of freight facilities has been increasing consistently in the last few decades. In particular, distribution centers over 10,000 square meters (mega distribution centers) have been developed, that can handle a range of functions such as storage, sorting, etc. Larger centers require more land, which is easier to obtain in suburban areas of Tokyo where land cost is lower. Studies have also shown a reduction in facilities less than 1,000sqm over the decades. In addition, more than 70 percent of the facilities are now either rented or leased, a reversal compared to previous decades.[170]

Olympics 2020

Delivering the best-ever Olympics and Paralympics is one of the two goals of the Vision 2020.[171]. It is intended to use the opportunity as a launch pad for various sustainable and safety initiatives. For freight, this includes the use of next-generation technology and automatic driving technology, such as 'truck platooning' where a series of electronically controlled trucks follow a lead truck. If successful, this could help to address the driver shortage that the country faces. Another initiative is a trial, currently underway, of the transport of goods via urban rail during off peak hours when passenger volume is minimal.[172]

Road Pricing

Tokyo Metropolitan Government has been considering road pricing for more than a decade. While not yet implemented, surveys carried out indicate that the use of both small and large commercial trucks would reduce due to road pricing. This would be achieved through more efficient fleet management and cooperative delivery systems. It is also suggested that road pricing would affect private (own account) trucks with relatively low loading factors more significantly.[173]

Promoting Loading and Unloading Spaces

The Tokyo land use strategy requires loading and unloading facilities to be included in all new commercial developments over 2,000 square meters.[174] The main objective is to ensure sufficient parking space for freight operations in Tokyo, where parking space is usually scarce due to high density. Tokyo is also implementing a "smooth city 21" policy, where dedicated parking facilities could be created for freight vehicles. Other opportunities include the booking of parking spaces using ITS.

Promoting Rail

In Kawasaki city[175], waste material has been transported by rail since 1995. The waste disposal site is very near a railway station and specific containers were developed to enable freight trains to carry all residential waste, incinerated ashes, cans and bottles.

[168] Iwata. K, et al, (2014). The effectiveness of vehicle emission control policies: Evidence from Japanese experience
[169] Michael Walsh (2011) Tokyo's Diesel Policy: Tokyo's Diesel Policy: Impacts and Lessons Learned Impacts and Lessons Learned
[170] Efficient logistics
[171] Creating the Future: Long Term Vision for Tokyo,TMA
[172] Tokyo to test subway system for parcel delivery service
[173] Urban freight policies and distribution channels
[174] Best Practices in Urban Freight Management: Lessons from an International Survey
[175] Urban logistics by rail and waterways in France and Japan

The development of the Haneda Airport Access Line, includes the development of a new underground line from the Tokyo Freight Terminal to directly beneath Haneda Airport and other links to connects strategic freight locations with the airport. This project is expected to require an investment of more than ¥300 billion.[176]

Resilient freight network

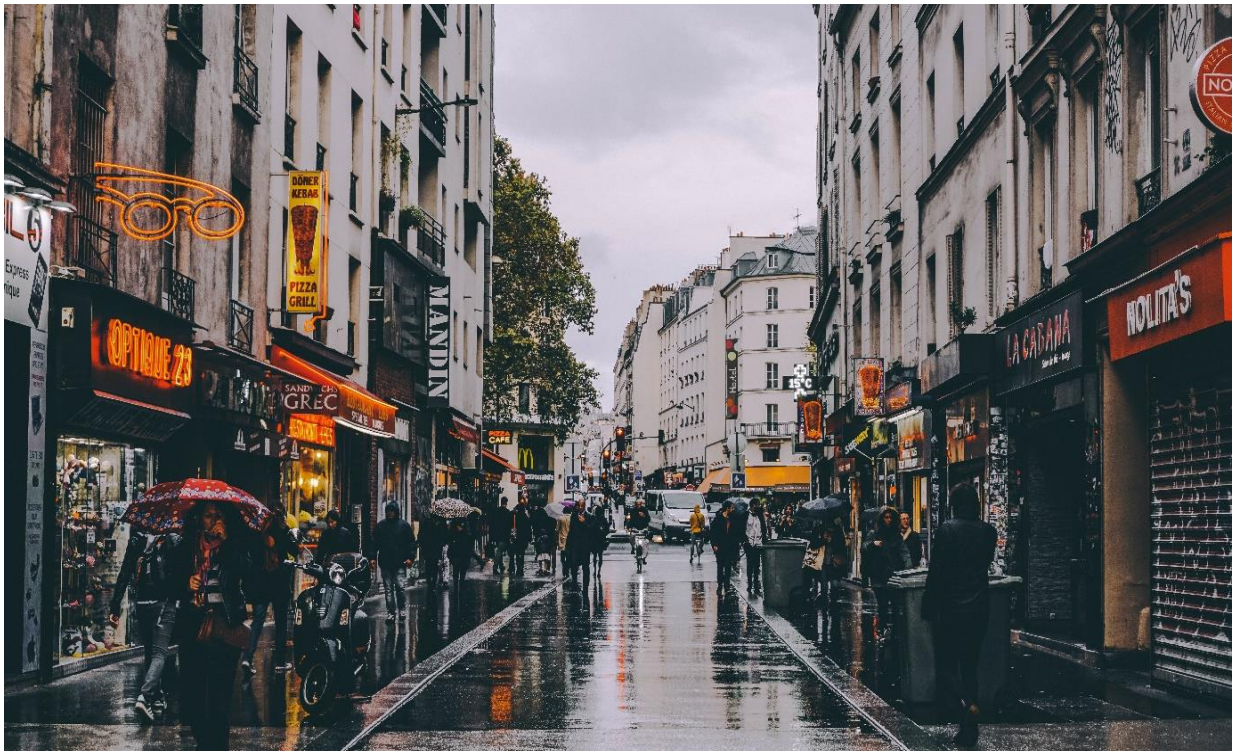
Official projections of the probability of an earthquake within next 30 years which would cause major damage within the Tokyo area is approximately 70 per cent. As expected, there is lot of emphasis on creating a resilient freight network to enable emergency response, so that relief goods can be supplied to disaster-hit areas speedily, and ensure company supply chains are not be completely severed when such a disaster occurs[177]. Additionally, over 30 percent of logistics facilities in TMA were constructed pre-1979. Older logistics facilities are more susceptible to damage during earthquakes and authorities are promoting the rebuilding of more robust logistics facilities.

The Green-Eco Project

This project includes initiatives to promote the eco-driving of trucks, reducing CO2 emissions and costs associated by improving fuel consumption and preventing accidents. The project collects and monitors fuel consumption data from every vehicle involved in the initiative, which is analyzed and shared on a monthly basis. The Tokyo Trucking Association, which is involved in the project, also carries out training to individual companies based on the analysis and findings. By 2010, about 11,171 trucks and 500 companies had participated in the project, which had reduced accidents by 40 percent and increased fuel efficiency (saving 20,000 tons of CO_2 and over 9.5 Million US Dollar cost).[178]

[176] Thriving with Communities, Growing Globally
[177] Urban Freight Survey and Policy Measures with Respect to Urban and Transport Planning in Tokyo Metropolitan Area
[178] Environmental approaches of Logistic companies in Japan

5 D. Case Study – Paris



"Decrease of overall carbon emissions by 75 percent in 2050 compared with 2004" **- Paris Climate Action Plan**[179]

1. Background

The Paris metropolitan region accounts for about 31 percent of France's GDP in 2014[180] and about 4.6 percent of the European Union's GDP.[181] It is one of the world's largest metropolitan areas, with 12 million inhabitants (18 percent of national population) within a geographic area of 12,012 km^2 (less than 2 percent of total land area). It is also one of the largest regions in Europe in terms of the inflow of foreign direct investment, and the world's number one tourist destination.[182]

The metropolitan region has more than six million jobs, about 23 percent of total employment in France.[183] All of France's businesses with over 1,500 employees have bases in the Paris region. About 59 percent of the regional workforce is in commerce, transportation, and market services, 27 percent in non-market services (public administration, education, health and social work activities), 8.6 percent in manufacturing, mining, and utilities, 5.3 percent in construction and 0.3 percent in agriculture.[184] The Paris Region's GDP is equivalent to that of the Netherlands and higher than that of Turkey and Switzerland. Average GDP per capita is about €53,617 and GDP per job is about €105,287.

[179] Paris Climate Action Plan, Cover Photograph is sourced from Brad Fickeisen, Unsplash.com
[180] Dynamics of the Paris Region economy
[181] Paris Region Key Figures 2016
[182] Paris Region by 2030
[183] Paris Region Key Figures 2016
[184] EMP2 - Emplois au lieu de travail par sexe, statut et secteur d'activité économique - Aire urbaine 2010 de Paris (001)"

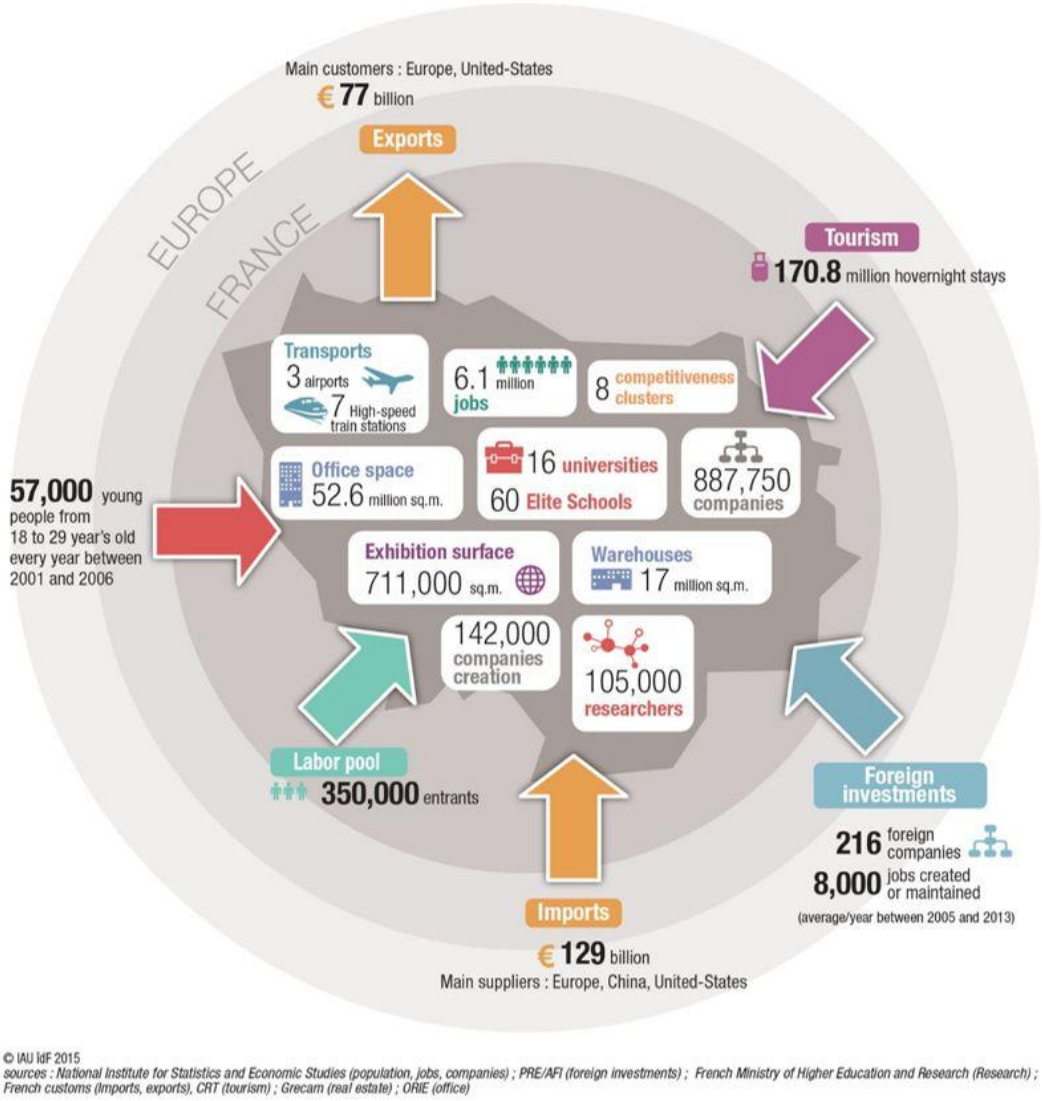
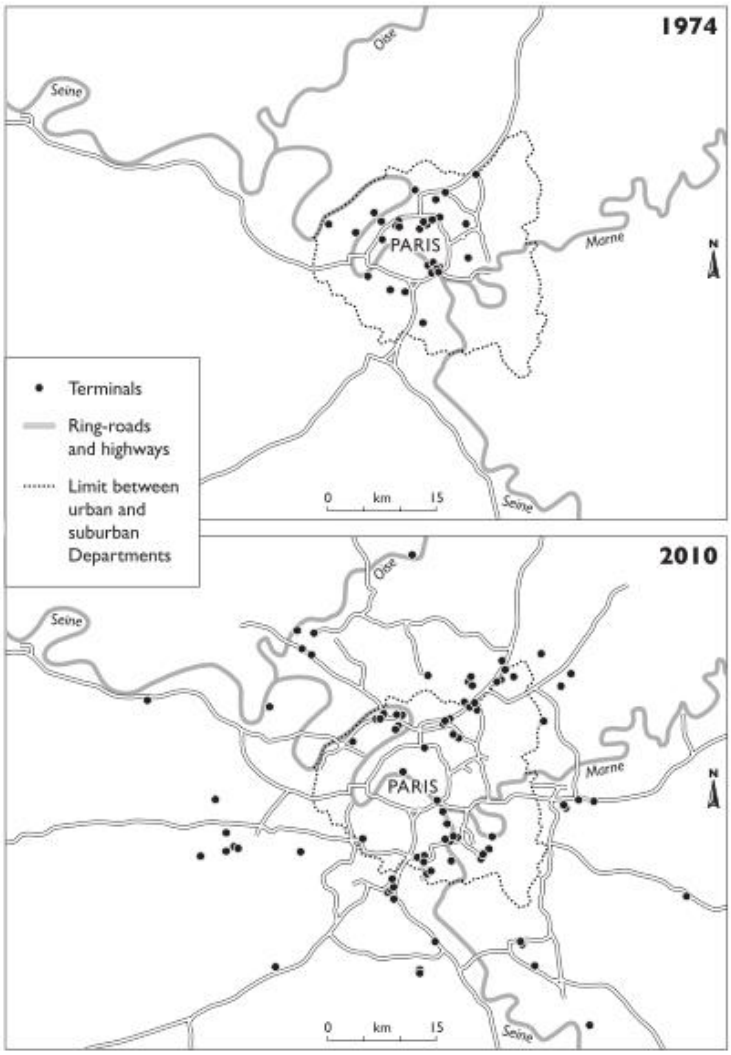


Figure D1. Paris Region Activity

In the Paris metropolitan area, the relocation of freight distribution centers and facilities to the suburbs has led to freight trip lengths gradually increasing, leading to a higher-intensity of congestion, CO2 emissions and air pollution. Research indicates that the average distance has increased by 10 km between 1974 and 2010, because of the spread of warehouses into the outskirts of Paris and surrounding towns.[185]

The main reasons for this freight sprawl are the scarcity and cost of land and a tax of 32 Euro/m^2 on new warehousing in Paris. In the early 1980's, the sprawl was induced by the construction of the first ring road which facilitated the development of warehouses close to the ring-road. Development of a second ring road further induced the development away from the Paris center. Between 2001 and 2009, 80 percent of the surface area of warehouses constructed in metropolitan region was in the outer ring region.[186]

[185] Urban freight for Livable cities
[186] What Role for the Seine in the Greater Paris Freight market?



Paris, 1974 and 2010. *Dablanc and Andriankaja, 2011*

Figure D2. Logistics Sprawl in Paris Region

2. Freight in numbers

Main freight numbers

- The Paris metropolitan region accounts for 18 percent of the population of France within less than 2 percent of total land area, contributing about 31 percent of France's GDP.
- Paris region contains:
  - 10,000 km of local roads and 1,100 km of main roads, including 497 km of national roads and 613 km of highways
  - 500 km of navigable waterways, 70 urban ports, and 6 container terminals[187]
- About 360 Million tonnes of goods annually[188], total freight lifted approximately 14.5 tons/capita[189]
- In 2006, 16 million tonnes were transported by waterway (6 percent) and 12 million tonnes by rail (4 percent), the rest by road
- Freight movement in tonne-kilometers is about 40 Billion tonne km annually[190]
- 4.3 Million deliveries/pick-ups a week, equating to approximately 0.74 per employee[191]

[187] Paris Region Key Figures 2016
[188] How can we Bring Logistics Back into Cities? The Case of Paris Metropolitan Area
[189] http://www.rungisinternational.com/documents/en/entretiens2009/session2/3.Levifve_EN.pdf
[190] http://ec.europa.eu/eurostat/statistics-explained/index.php/Transport_statistics_at_regional_levelhttp:/ec.europa.eu/eurostat/statistics-explained/index.php/Transport_statistics_at_regional_level
[191] Three Paris Master Plans, where does freight fit in?

- More than 80,000 trucks enter or leave one of the 17 highway toll plazas surrounding the Paris metropolitan area[192]
- Deliveries to building sites constitute about 30 percent of all tonnes carried[193]
- 17 million m^2 of warehouses, approximately 25 percent of national warehousing market[194]
- Share of commercial vehicles is about 14 percent of total traffic

Table D1. Paris Urban Freight Indicators

Sl.No	Indicator	Paris Region
1	GDP/Capita (PPP)	42700
2	City Size (km2)	12000
3	Population Density (People/Sqkm)	999
4	Average Trip Length (km) within urban area	66.5 (Parcel)
5	Freight Lifted (Tons/Capita)	32
6	Freight Mode Share	90% roads, 4% railway and 6% waterway
7	Freight Moterisation Index	80
8	Urban Freight share of VKT (per cent)	14%
9	Freight Employment	7%
10	Freight Emission Intensity (g/tonne km)	LCV - 1103, Trucks (6.1 to 10.9 t) - 435, Trucks (11 to 21 t) - 221, Trucks (21 to 32.6 t) - 196
11	Urban Freight Emission share (per cent PM, Nox, CO2)	26% CO_2, 59% PM 10 and 38% NOX
12	Retail establishments Density (No of establishments/sqkm)	5

Freight Emission Target in Paris

In October 2007, the Council of Paris unanimously approved the Paris Climate Action Plan, committing the City to decrease its overall emissions by 75 percent by 2050, compared with 2004. For 2020, the target is to reduce greenhouse gas emissions and energy consumption by 25 percent and ensure that more than 25 percent of total energy consumption is from renewable or recovered energy.[195]

Trucks constitute about 14 percent of the total vehicle kilometers traveled, but emit 26 percent of CO_2 emissions, 43 percent of SOx emissions, 38 percent of NOx and 59 percent of PM emissions from the transport sector within the Paris Metropolitan area.

The French Government has put in place measures to ensure a significant emission reduction in the freight sector, requiring transport service providers to inform service users of their carbon dioxide emissions[196]. Locally, Paris has also initiated a series of pollution abatement steps to cut the impact of diesel vehicles especially cars and trucks. Vehicles registered before 1997 have been banned from entering the city, with restrictions due to increase each year until 2020. The latest reports show that city government is planning to remove all diesel vehicles from the city by 2025.[197]

[192] Commercial Goods Transport, Paris, France
[193] Commercial Goods Transport, Paris, France
[194] Commercial Goods Transport, Paris, France
[195] Paris Climate Action Plan
[196] Article L1431-3 of the French Transport Code (formerly Article 228-II of Act no. 2010-788 of 12 July 2010 on the national commitment to the environment) requires transport service providers to inform service users of their carbon dioxide emissions (freight and passenger). http://www.ademe.fr/en/freight-transport
[197] Four major cities move to ban diesel vehicles by 2025

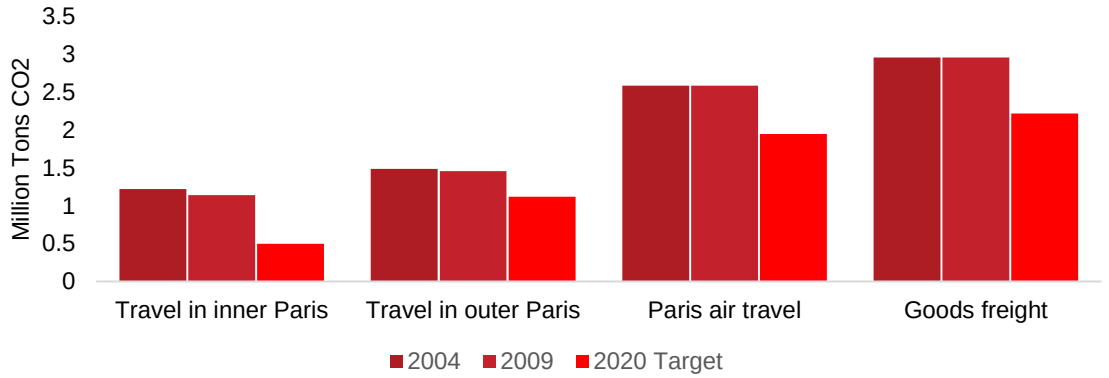


Figure D2. Transport Carbon Emissions in Paris

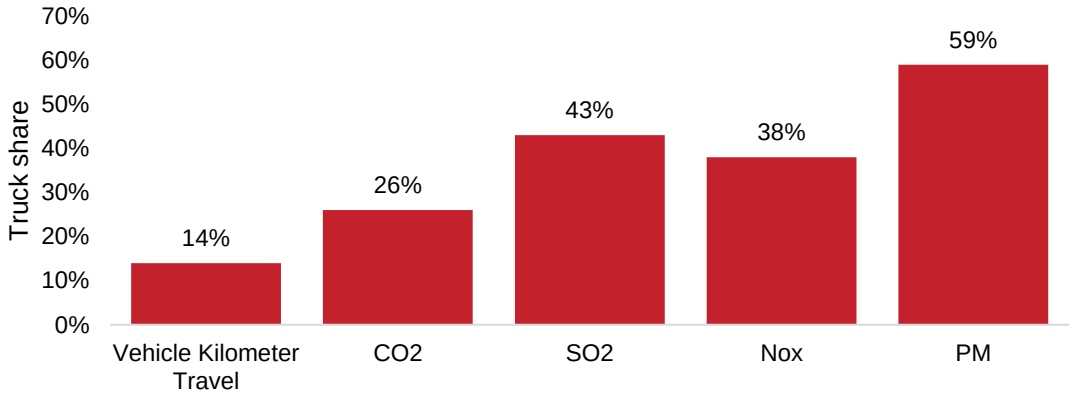


Figure D3. Truck Contribution to Emissions in Paris

Research estimates that annually, for less-than-truck-load and parcel transport services, more than 16,000 tons of CO^2 is directly generated by logistics sprawl[198]. Separate research indicates that achieving the freight elements of the Paris Climate Action Plan could require to.[199]

- stabilize freight demand at 2020 levels, or
- reduce emissions/tonne-km by 70 percent, or
- reach 50 percent of tonne-km by rail, waterways and clean road vehicles (LNG and electric)

3. Freight surveys and monitoring

In 1993, the "Programme national marchandises en ville"[200] was established, which prioritized urban freight for the first time in France. This program was financed by the French Ministry of Transport and the Agency for the Environment. Under this initiative, urban freight surveys were carried out in different cities to understand the importance of urban freight and to enable future management of their externalities. These Urban Goods Movement (UGM) surveys developed a common methodology, which was designed and implemented by the Laboratoire d'Economie des Transports in Lyon. The Indicators collected in this initiative are:

Table D2. Freight data collected

Impact Category	Indicator Category	Indicator
Freight Volumes and Commodities in Urban Area	Logistics	Number of urban establishments receiving goods
		Number of urban establishments sending goods
		Deliveries and pick-ups density
		Deliveries and pick-ups according to number of jobs

[198] Commercial Goods Transport, Paris, France
[199] Three Paris Master Plans, where does freight fit in?
[200] TURBLOG D3.1 - Urban Logistics practices – Case study Paris

Impact Category	Indicator Category	Indicator
	Population	Population Density
		Shopping trips made with private cars
Urban Freight transport fleet	Freight vehicles	Number of vehicles according to GVW
		Proportion of goods vehicles in total traffic (running)
		Proportion of goods vehicles in total traffic (parking)
	Urban traffic flow	Number of vehicles entering cities
		Distribution of freight vehicle movements over day
	Service visits and waste collections	Service visits
		Waste collection
	Performance	Freight vehicle kilometers
		use of load capacity
		average speed per round
Urban deliveries	General delivery characteristics (operators)	Loading/unloading density
		Number of loading/unloading
		Loading/unloading intensity per activity
		Average length of the first leg from terminal to delivery area
		Type of management (own account/for hire)
		Type of tour (delivery round/direct delivery)
		Combined shipments
		Delivery days and times
		Origin of delivery trip
		Number of stop per tour, per day
		Trip length
		Distance between stops
		Trip times
		Travel time to and within city center
	General delivery characteristics (receivers)	Supply of a delivery area at premises
		Dwelling time/loading and unloading times
		Number of deliveries per employee
		Number of deliveries per square meter
	Home deliveries	Number of home deliveries per 1000 households
		share of home deliveries in all deliveries
Contribution to economy	Employment in transport and logistics	Number of transport and related logistics jobs
		Number of transport related companies
		Share of own-account versus for-hire transport
Environment	Energy use	Typical fuel consumption by vehicle type
		Energy consumption in urban freight transport
		Share of urban freight in CO2 emissions
	Exhaust emissions	Typical emission factors by vehicle type
		Emissions per the zone/vehicle/activity
		Share of urban freight in emissions (PM, NOx)
Safety	Accidents/Casualties	Number of accidents involving trucks
		Number of fatal accidents involving trucks
		share of trucks in fatal accidents

The first UGM surveys were carried out in 1995–1997 in three cities, and the first in Paris in 2010. To minimize cost a sample number of establishments are surveyed. The collected freight data is then analyzed using a 'Freturb' simulation model. This model simulates urban freight movement using variables which are generally available in the statistical data of urban areas.[201]

The Paris UGM survey, examines logistics operations considering the businesses, the drivers serving these establishments and the transporters operating in the study area. The survey includes all possible types of freight trips (shop, offices, warehouse, etc.), and establishments of all sizes (from 0 to several hundred employees).

The methodology involves a comprehensive survey questionnaire completed by the establishment and a series of driver questionnaires covering one week.[202] The self-administered driver survey provides information about

[201] An alternative UGM Paradigm to O-D matrices: the FRETURB model
[202] How can Urban Goods Movements be Surveyed in a Megacity? The Case of the Paris Region

the mode of vehicle, travel activity pattern, and the loading and vehicle efficiency. The operator survey involves face to face interviews and includes the main transport companies active in the region.

The survey budget for the Paris region was about 1 million euro (including tax) and the cost of administering a single establishment survey was about €400.

To ensure statistical validity, a minimum of 30 establishments must correctly fill in the survey per activity and about 45 different activities are considered within the survey. The table below provides a snapshot of the sample size and results from the survey.

Table D3. Surveys

	No of Establishments		Movement/Job		Mode Share (Vehicle)				
Survey	Available	Surveyed	New Survey	Old Survey	cycle or motorbike	Cars	Vans	Rigid Truck	Articulated Truck
Agriculture	10,293	12	0.86	0.80	0%	0%	98%	1%	0%
Craft-services	234,487	194	0.69	1.20	4%	9%	59%	20%	8%
Industry	62,817	228	1.06	1.00	6%	6%	46%	37%	4%
Wholesale	48,909	123	2.79	4.20	2%	10%	33%	37%	17%
Hypermarket	1,624	54	0.52	0.80	0%	1%	36%	34%	29%
Small Retail	158,043	333	1.70	1.80	1%	15%	57%	25%	2%
Offices	341,167	199	0.25	0.17	12%	10%	55%	20%	3%
Warehouses-transport	3,394	45	4.99	6.50	0%	0%	12%	56%	32%

4. Government plans and stakeholders

Government plans

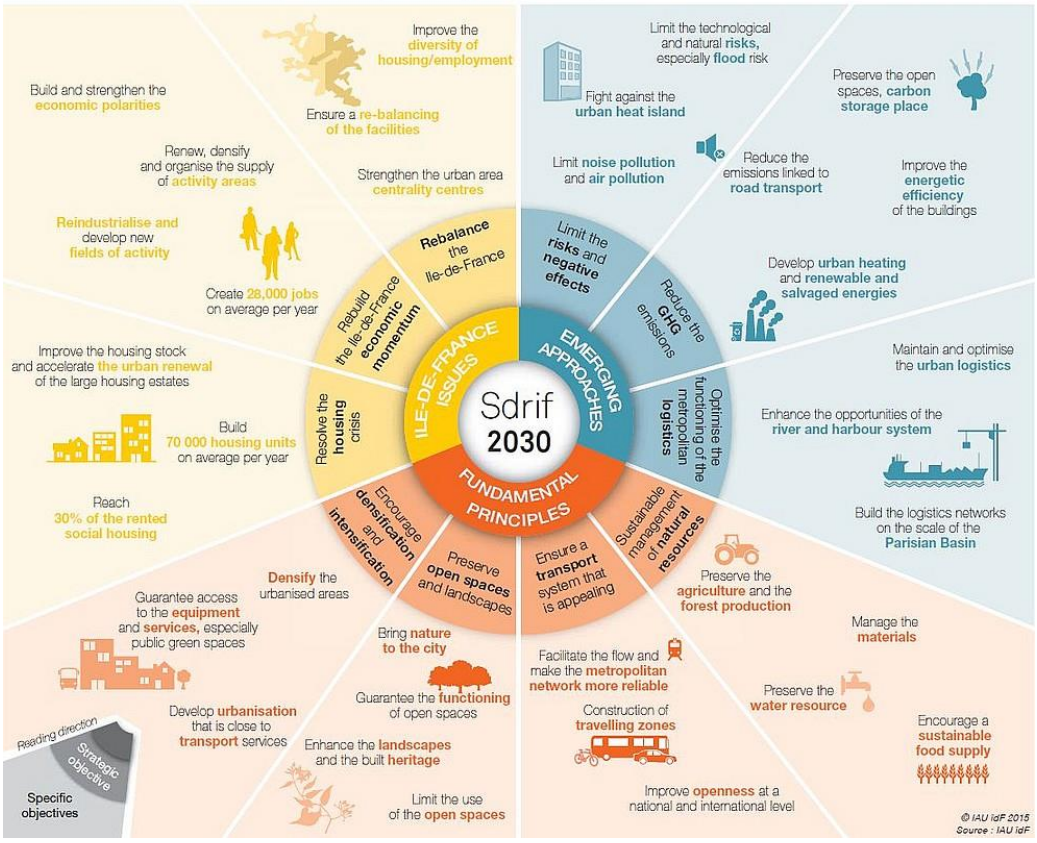
The Paris Region Development Master Plan for 2030 (SDRIF 2030) was approved on 27th December 2013 It was the first decentralized plan for the Paris region and was developed by the Region in conjunction with the French state and involved numerous stakeholders in the region. This master plan It sets out the conditions for creating a pleasant, attractive, socially integrated and robust region by 2030. The plan outlines sustainable freight priorities to increase the density of industrial and logistics activities in the region's core, encourage urban development close to transport links, maintain and optimize urban logistics, and enhance the opportunities of the river and harbor system.

The Regional Urban Mobility Plan (PDUIF)[203] also prioritizes the development of freight transport in the city. One of the major goals of the PDUIF is to optimize freight movement by encouraging modal shift to rail and waterway, preserve or develop logistics sites in dense areas, integrate urban logistics in to new urban development projects and improve the environmental performance of freight transport.

Two other strategy documents are of relevance for freight sector operations in the Paris region: the Regional Plan for Air Quality (PRQA) and the Plan for Atmospheric Protection (PPA).

[203] Dealing with Mobility Management (MM) within the Regional Masterplan (SDRIF) and the Regional Urban Mobility Plan (PDUIF) of Paris Ile-de-France Region

The logical tree of the objectives of the Great Paris Region master plan (SDRIF 2030)



Prior to 2002, urban freight planning in Paris Metropolitan area was only concerned with managing the negative traffic impacts. This resulted in the construction of the new ring roads, attempting to shift the traffic to the outer periphery.

The new infrastructure proved inadequate in accommodating freight or reducing the negative impacts. Changing approach, the city began consultations with in 2002, to engage all stakeholders in the planning process. This culminated in 2006, with the signing of a three-year, non-binding "Freight Charter" between the city and the private sector.

The Charter, while voluntary, outlined specific commitments from the 47 participating stakeholders to accommodate efficient freight activity in the city, while limiting the externalities from freight. In 2013, more than 80 institutions and associations in urban logistics signed a new Paris Charter for Sustainable Urban Logistics, committing themselves to further progress in the field of urban logistics[204]. The objectives of the 2013 Charter are to:

- assist economic development,
- reduce the environmental impacts of freight transport,
- encourage innovative freight initiatives, and
- prepare and plan for any changes in local, national or European regulations (e.g. new emissions standards), and develop with the industry the best ways and means of applying them.

The charter is a non-statutory initiative, and has facilitated the development of 16 permanent working groups. These groups cover the range of projects defined in the Charter, such as future freight regulations (truck and van access ban, low-emission zone, loading/unloading time windows), establishing a scheme to better inform freight companies, and promoting innovations in urban freight activities.

The charter was developed with input from a number of local consultation meetings. The meetings were initiated to bring together groups who do not normally meet, including a diverse set of stakeholders such as

[204] Forums, portals, certification schemes

local resident associations, elected representatives, technical staff from city government institutions and subject matter experts.

An evaluation[205] based on three years of cooperation under the Freight Charter indicates that the consultation among diverse stakeholders is extremely important, as it helps develop an understanding of each stakeholder's specific limits, needs, and difficulties and can defuse conflict before it occurs. The research also concluded that freight consultations are of little use if they only occur at the local and municipal level. To be effective the consultations need to be combined with metropolitan or region-wide consultation, because freight movement in urban areas is logistically connected to regional and national supply chains.

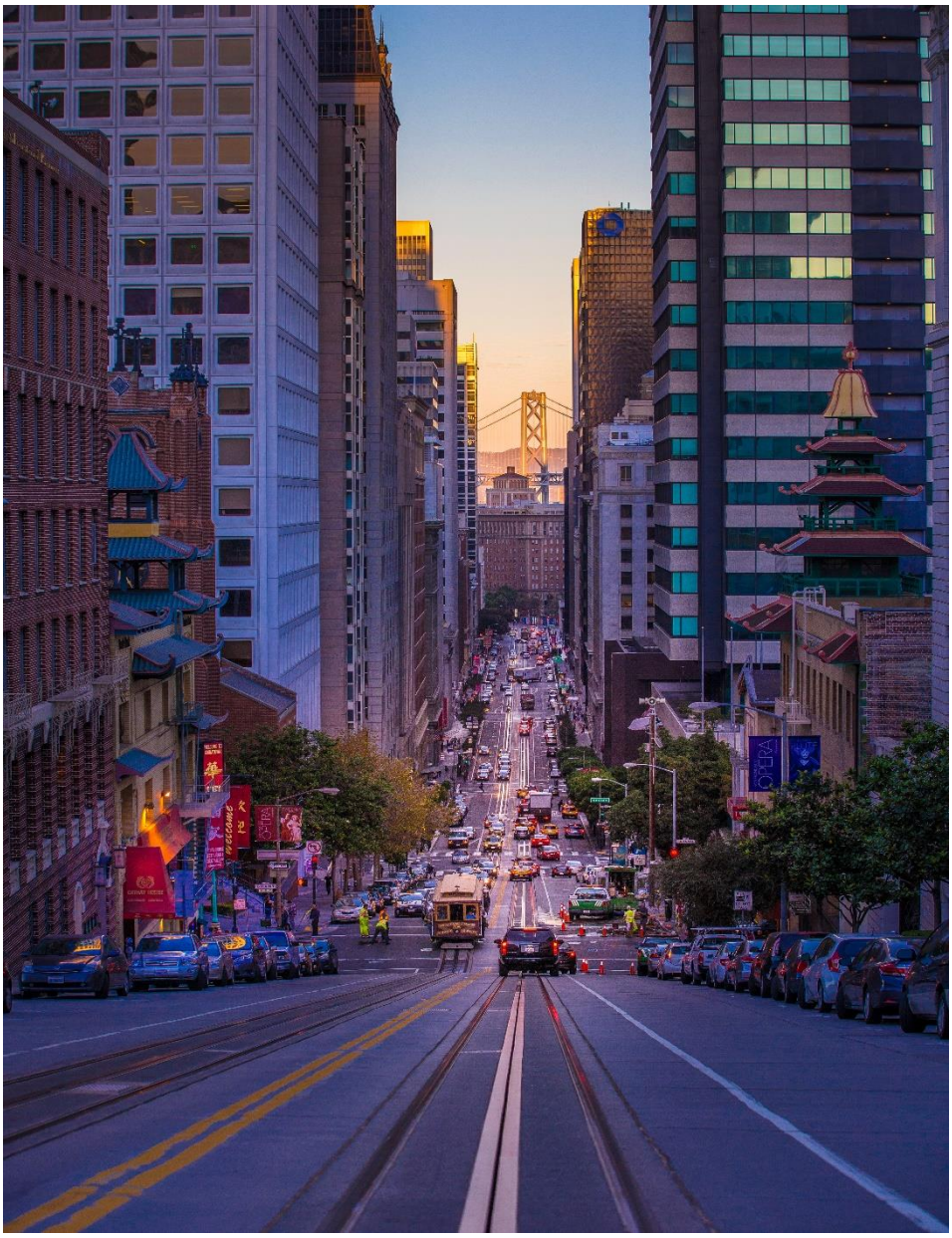
5. Main urban freight initiatives

Table D3. Overview of main urban freight strategies//initiatives

Strategy/Initiative	Type of Strategy	Time	Type of Instrument	Investment	Implementation by
Designate a freight person at key agencies	Awareness	Short	Co-operative	Low	Government
Freight Parking and loading zones	Improve	Short	Infrastructure	Low	Government
Integrating freight into land use planning	Avoid	Long	Regulatory	Low	Partnership
Low emission zones	Avoid	Medium	Regulatory	High	Government
Mode Shift Program	Shift	Medium	Infrastructure	Moderate	Partnership
Non-motorized freight distribution	Shift	Short	Infrastructure	Low	Partnership
Time access restrictions	Improve	Short	Regulatory	Low	Government
Urban consolidation centers	Avoid	Medium	Logistical	High	Partnership
Urban freight information and maps	Awareness	Short	Logistical	Low	Government
Urban freight policy	Awareness	Short	Logistical	Low	Partnership
Using Capacity of Public Transport	Shift	Short	Infrastructure	Low	Partnership
Vehicle size and weight restrictions	Avoid	Short	Regulatory	Low	Government
Reserved land for multimodal logistics	Avoid	Long	Infrastructure	Moderate	Government
Partnership	Awareness	Short	Co-operative	Low	Partnership
Cleaner goods vehicles	Improve	Medium	Logistical	Moderate	Partnership

[205] Urban freight consultations in the Paris region

5 E. Case Study – California



"California enhances economic competitiveness by collaboratively developing and operating an integrated, multimodal freight transportation system that provides safe, sustainable freight mobility. This system facilitates the reliable and efficient movement of freight and people while ensuring a prosperous economy, social equity, and human and environmental health"
- California Freight Mobility Plan Vision (2014) [206]

1. Background

California has the eighth largest economy in the world; the state's gross domestic product (GDP) at $2.2 trillion is about 13 percent of total USA GDP.[207] Exports from California were valued at $168 billion in 2013, and

[206] California Freight Mobility Plan and photograph source: unsplash.com, Rezaul Karim
[207] 2013 values, California Freight Mobility Plan

represented over 10 percent of total USA exports, while imports into California were valued at $380 billion and represented nearly 17 percent of total USA imports.

California's economy is facilitated by an efficient and multimodal freight infrastructure. The Freight Plan claims the freight system is responsible for one-third of California's economic product and jobs, with freight-dependent industries accounting for over $740 billion in gross domestic product and over 5 million jobs in 2014.[208]

California is also a global leader in environmental sustainability. Over the past few decades, freight modes have reduced air pollution emissions and other negative impacts. However, rapid growth in freight activity and high concentration of freight activity in certain locations have ensured that California has one of the most polluted air basins in the country (the South Coast and San Joaquin Valley), and freight-related emissions remain significant, especially PM and NOx emissions.

Freight activity and infrastructure within California is widely distributed, and while the benefits are shared by the state-wide level, the worst effects are often borne by residential communities near freight corridors and facilities. Housing and schools are often located near freight facilities, with the communities surrounding the freight network typically being minority-ethnic, low-income, and disproportionately affected by environmental pollution.[209]

California has recently established very aggressive targets for reducing greenhouse gas emissions to 40 percent below 1990 levels by 2030, to combat climate change. And one of the main targets included in the climate change strategy by Governor Brown includes "reducing petroleum use in cars and trucks by up to 50 percent".

However, the transport sector alone makes up more than one-third of California's total GHG emissions, and heavy duty trucks alone constitute about 7% of total GHG emissions. Reducing emissions in the freight sector is therefore critical to meeting the 2030 targets.

2. Freight in numbers

General

The truck traffic density in California is among the highest in the USA. There are about 32,800 trucking companies in California with about 5,645,836 commercial trucks and 2,380,417 commercial trailers registered in the state. Most of these companies are small and medium enterprises (SME).

The freight transportation system is the pillar of state's economy, supporting over 1.3 million freight-related jobs, and in 2011, nearly 900,000 people were employed directly in the freight industry, about 1-in-15 statewide.

Across California, about 1.8 billion tons of freight is generated, resulting in 872.5 billion ton-miles transporting about $3 trillion of freight.[210] Trucking is the most frequently used freight mode in California with 82 percent (by weight) of all goods movement. Over 78 percent of California communities depending exclusively on trucks to move their goods, and about 70 percent of freight shipments originating in California travel less than 50 miles, creating high demand for the trucking sector.

[208] California Sustainable Freight Action Plan
[209] Community and Environmental Context
[210] https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/california.pdf

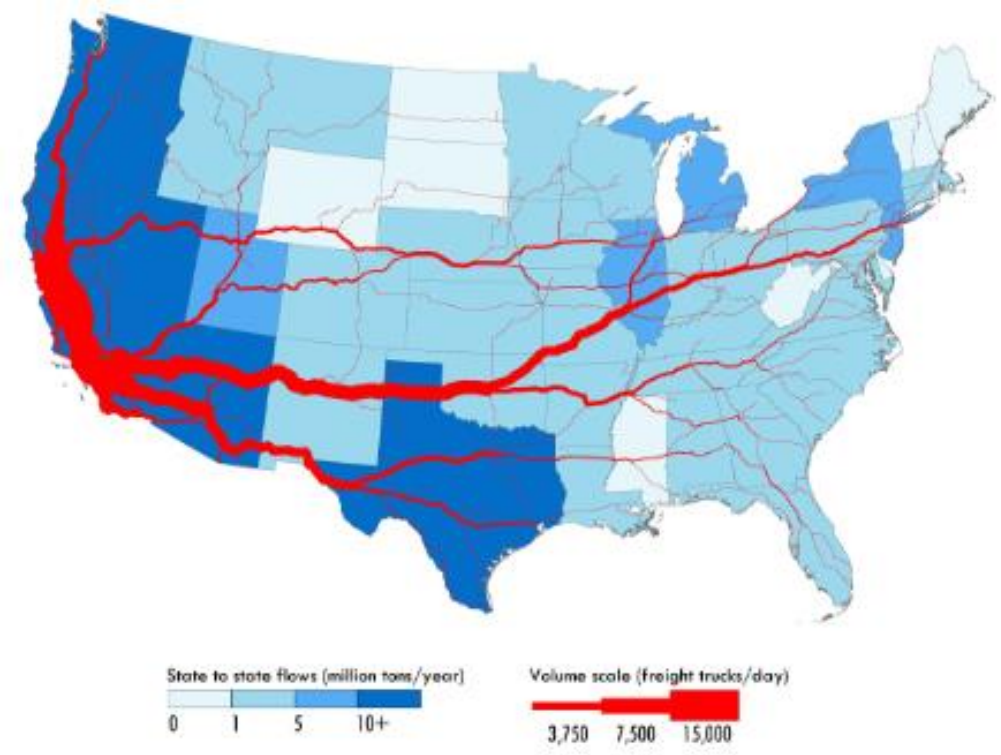


Figure E1. Major Truck Flows in and from California[211]

Infrastructure

State freight infrastructure consists of:

- Approximately 5,800 miles of high-traffic-volume interstate and state highways
- Two Class I railroads and twenty-six short-line railroads operating over approximately 6,000 miles of railroad track
- Twelve deep-water seaports (11 private and 1 public)
- Twelve airports with major cargo operations
- Three existing and one future commercial land border ports of entry with Mexico
- Approximately 19,370 miles of hazardous liquid and natural gas pipelines (including crude oil, refined petroleum products, and other highly volatile liquids)

Table E1. Mode of Freight for Shipments Originating in California (California Department of Transportation)

Mode	% of Value	% of Weight
Truck	66.0 - 70.4	78.5 - 86.1
Air (includes truck and air)	4.8 - 5.8	0.1 - 0.1
Rail	0.9 - 1.7	2.4 - 4.2
Water	0.4 - 2.2	0.6 - 4.2
Pipeline	2.5 - 5.5	6.1 - 12.3
Multiple modes	18.9 - 20.7	2.2 - 3.2
Parcel, U.S.P.S., or courier	17.5 - 19.3	0.6 - 0.6

Table E2. Distance Shipped for Shipments Originating in California (California Department of Transportation)

Miles Shipped	% of Value	Miles Shipped	% of Weight

[211] California transportation by the numbers

Miles Shipped	% of Value	Miles Shipped	% of Weight
Less than 50	38.8 - 44.0	Less than 50	66.2 - 71.0
50 to 99	8.7 - 10.1	50 to 99	8.2 - 9.6
100 to 249	6.4 - 8.6	100 to 249	6.0 - 9.2
250 to 499	7.7 - 9.1	250 to 499	4.4 - 5.4
500 to 749	3.7 - 4.7	500 to 749	1.5 - 2.3
750 to 999	3.1 - 3.9	750 to 999	1.1 - 1.5
1,000 to 1,499	5.5 - 6.5	1,000 to 1,499	1.2 - 2.0
1,500 to 1,999	8.0 - 9.4	1,500 to 1,999	2.2 - 3.2
2,000 or more	10.1 - 11.5	2,000 or more	2.1 - 3.1

High concentrations of freight movement results in high levels of congestion. Regions with the largest numbers of truck vehicle miles include, Southern California, the Central Valley, the Bay Area, and the Border Region. In these areas, average truck speeds are below 55 mph, and drop further near major urban areas, border crossings, and gateways due to high congestion. This resulted in total delays of 95.7 million hours in 2010, equating to an opportunity cost (lost value in terms of salaries and wages) of $1.4 billion, or $3.9 million per day.[212]

Trucks and trucking

Keys about trucks and trucking are[213]

- More than 32,800 trucking companies are located in California, most of which are locally owned small businesses
- There were 864,913 companies in California in 2012. Of these, a total of 75,012 (9 percent) exported goods from California, 71,921 (96 percent) were small and medium-sized companies with fewer than 500 employees[214]
- Trucking serves every community in California, and over 78 percent of all California communities depend exclusively on trucks to move their goods
- The California Department of Motor Vehicles registered 5,645,836 commercial trucks and 2,380,417 commercial trailers in 2011
- In 2010, trucks transported 88 percent of the total manufactured tonnage in the state, or about 3,822,566 tons per day
- California has 172,139 miles of public roads, over which all motorists travelled 327.8 billion miles (2011) and trucks travelled 24.8 billion miles (2008)
- The average annual daily truck miles for 4-axle-or-more trucks on California Interstate Routes in 2009 was 15,499,902. The three counties were most of these miles occurred were San Bernardino (2,755,616), Los Angeles (2,670,809), and Riverside (2,177,154)
- Trucking industry wages in California in 2010 exceeded $30.3 billion, with an average annual industry salary of $47,680. In 2011, there were 204,630 drivers of heavy trucks, tractor-trailer, light trucks, and delivery trucks, with a mean annual salary of $38,400
- The trucking industry in California paid approximately $4.3 billion in federal and state roadway taxes and fees in 2009. In 2008, the industry paid 36 percent of all taxes and fees owed by California motorists, even though trucks represented only about 8 percent of vehicle miles traveled in the state
- In California, heavy-duty trucks are responsible for 20 percent of the global warming pollution from the transportation sector
- Numbers of fatal and serious injury truck collisions declined between 2005 (343 fatalities; 7,810 injuries) and 2009 (236 fatalities; 4,874 injuries)
- More than 126,000 oversize/overweight permits were issued in 2010/11

[212] California Freight Mobility Plan
[213] Fast Freight Facts: Commercial Vehicles (Trucks)
[214] Fast Facts on California's International Economy

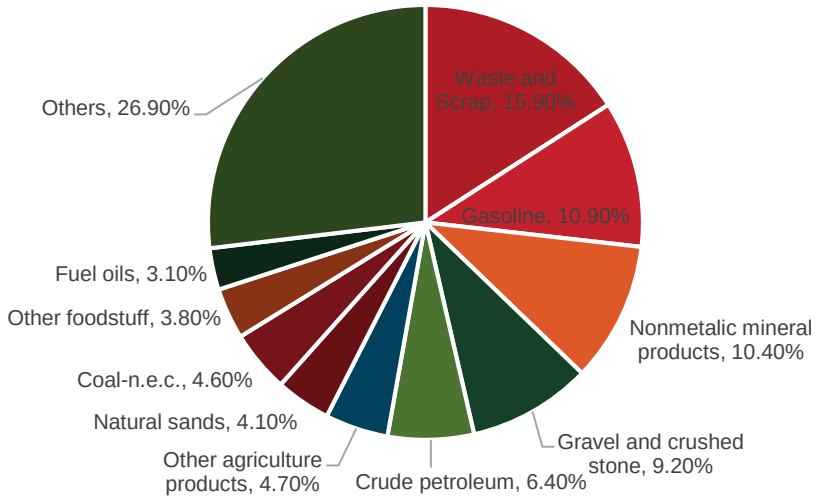


Figure E2. Commodity freight share from/to California

3. Government plans and stakeholders

In the USA, Metropolitan Planning Organizations and Regional Transportation Planning Agencies take the lead in developing Regional Transportation Plans (RTPs). These RTPs need to consider all transport modes, including freight, and their production involves intense consultations with all stakeholders including the private sector.

The main output of RTPs is a list of priority transportation projects, including freight, with potential funding and financing sources. The RTP considers a planning period extending about 25 years into the future. RTPs are further updated on a four- or five-year cycle depending on the specific regional agency. Project categories include: preserving and maintaining the transport system, making operational, safety, and system management improvements, enhancing communities and the environment, and expanding facility capacity.

California State-wide Goods Movement Strategy and Action Plan

In 1991, a new federal law, the "Intermodal Surface Transportation Efficiency Act (ISTEA)" was enforced[215]. This law prioritized economically efficient, environmentally sound, and socially responsive intermodal transport. This law, and the 1993 California Transportation Plan led to the development of **California State-wide Goods Movement Strategy**.

This strategy was a policy and action blueprint for improving the goods movement transportation system at the local level. Freight planning at the local level in California received a further boost with the initiation of a Goods Movement Cabinet working group in December 2004.

This group, with broader consultation with the wider freight stakeholder community, developed the administrations goods movement policy, "Goods Movement in California," in January 2005. The **Goods Movement Action Plan** was issued by the California Business, Transportation and Housing Agency and the California Environmental Protection Agency (Cal EPA). This action plan led to the identification of priority projects for the allocation of funds under the $2 billion national Trade Corridors Improvement Fund program, and was authorized by the voter-approved Highway Safety, Traffic Reduction, Air Quality and Port Security Bond Act of 2006 (Proposition 1B).

[215] Statewide Goods Movement Strategy

The Goods Movement Action Plan[216] main objectives are to:

- Generate jobs
- Increase mobility and relieve traffic congestion
- Improve air quality and protect public health
- Enhance public and port safety
- Improve California's quality of life

The plan identified about 200 actions and projects for further investigation, review and/or implementation, mindful that collectively, these strategies could cost around $15 billion.

Emission Reduction Plan for Ports and Goods Movement in California

Developing the plan also facilitated the development of "Emission Reduction Plan for Ports and Goods Movement in California" by the California Air Resources Board (ARB) in 2006. The main goal of this plan is to reduce community exposure to air pollution and to meet new federal air quality standards for ozone and fine particulate matter (PM2.5).[217] Under this plan, the five specific goals for addressing the air pollution associated with goods movement were:

- Reduce total state-wide international and domestic goods movement emissions to the greatest extent possible, and at least back to 2001 levels by 2010
- Reduce the state-wide diesel PM health risk from international and domestic goods movement 85 percent by 2020
- Reduce NOx emissions from international goods movement in the South Coast area by 30 percent from projected 2015 levels, and 50 percent from projected 2020 levels, based on preliminary targets for attaining federal air quality standards
- Apply the emission reduction strategies for ports and goods movement state-wide to aid all regions in attaining air quality standards
- Make every feasible effort to reduce localized risk in communities adjacent to goods movement facilities as expeditiously as possible

The total cost of goods movement related emission reduction strategies was estimated to be between $6 billion and $10 billion[218].

California Transportation Plan 2025

In 2006, California published the California Transportation Plan 2025 (CTP 2025). The CTP is a long-range transportation policy plan which examines the movement of both people and goods. It forecasts socio-economic and technology trends over the longer-term and provides recommendation for policies and projects over a 20-year planning horizon, describing their potential influence on travel behavior. The CTP was updated in 2016, with the publication of the California Transportation Plan 2040, where freight is actively considered using insights from a separate freight mobility plan.

Freight plans

In 2012, a new federal law was passed: "Moving Ahead for Progress in the 21st Century Act (MAP–21)". This act encourages states to develop a comprehensive Freight Plan to get access to dedicated financing. The freight plan needs to include:

- A Freight Investment Plan, including a financially constrained project list within the framework of the overall plan
- Designation of multimodal Critical Rural Freight Corridors and Critical Urban Freight Corridors
- Consideration of significant congestion or delay caused by freight movements, and strategies to mitigate the impact
- Targets to assess performance measures for the freight transportation system

[216] Goods Movement Action Plan
[217] Emission Reduction Plan for Ports and Goods Movement in California
[218] Goods Movement Action Plan

The freight plan needs to consider the existing conditions (i.e. a diagnosis of the assets, condition and performance, and likely changes); the context of freight issues and current regulations; the future vision, policies and strategies; and an implementation plan.

California Freight Mobility Plan

In 2015, the California Freight Mobility Plan (CFMP)[219] was developed in consultation with key stakeholders and partners. The CFMP highlights critical freight infrastructure for California's economic growth and the areas which are a high priority for investment to meet federal and state transportation and air quality goals. The CFMP builds on the work carried out under the Trade Corridors Improvement Fund program and identifies over 700 projects, with an estimated total cost of $138 billion.

Local law requires the California State Transportation Agency to update the State's freight plan every five years. Therefore, the CFMP is intended to be an active, "living" document that will be updated to keep pace with changes in the freight industry and international trade. The CFMP is fully consistent with MAP-21 freight plan guidance, and is now being updated with a revised version due to be released by December 2017.

As part of the development of the CFMP, an electronic stakeholder survey was sent to more than 180 stakeholders. The information received from the 72 completed surveys was combined with 27 participant telephone interviews, to identify the top stakeholder challenges, constraints and performance measures:
The top five goods movement problems:

1. Freight rail and freight intermodal terminal access
2. Community and environmental impacts
3. Seaport access
4. General state of highways
5. Need for highway-rail grade separations

The top four constraints identified:

1. Lack of project financing
2. Environmental issues or controversy
3. Regulatory and jurisdictional conflicts
4. Project approval processes

Performance measures for evaluating investment effectiveness:

1. Freight network efficiency
2. Freight network capacity improvements
3. Cost-effectiveness
4. Reliability
5. Environmental quality

The freight vision in CFMP is *"California enhances economic competitiveness by collaboratively developing* **and operating an integrated, multimodal freight transportation system that provides safe, sustainable freight mobility. This system facilitates the reliable and efficient movement of freight and people while ensuring a prosperous economy, social equity, and human and environmental health[220]**". The six CFMP goals are: economic competitiveness, safety and security, freight system infrastructure preservation, environmental stewardship, congestion relief and innovative technology and practices.

California Sustainable Freight Action Plan

In 2015, The California governor directed the California State Transportation Agency, California Environmental Protection Agency, Natural Resources Agency, California Air Resources Board, California Department of Transportation, California Energy Commission, and Governor's Office of Business and Economic Development, to develop a California Sustainable Freight Action Plan by July 2016, to enhance sustainability efforts within the freight sector.[221]

[219] California Freight Mobility Plan
[220] California Freight Mobility Plan
[221] California Sustainable Freight Action Plan

The proposed vision for a Sustainable Freight Transport System is *"Utilize a partnership of federal, State,* **regional, local, community, and industry stakeholders to move freight in California on a modern, safe,** *integrated, and resilient system that continues to support California's economy, jobs, and healthy, livable* **communities. Transporting freight reliably and efficiently by zero emission equipment everywhere that is feasible, and near-zero emission equipment powered by clean, low-***carbon renewable fuels everywhere else."*

The plan recommends a high-level vision and broad direction for the Governor and state agencies to consider when developing specific investments, policies, and programs related to the freight transport system. The Action Plan includes recommendations on:

- A long-term 2050 Vision for California's future freight transport system
- Targets for 2030 for meeting the vision
- Opportunities to leverage state freight transport system investments
- Actions to initiate over the next five years to make progress towards the targets
- Pilot projects to achieve on-the-ground progress in the near-term
- Additional concepts for further exploration and development, if viable

The following targets for 2030 are recommended:

- Improve freight system efficiency by 25 percent by 2030
- Deploy over 100,000 zero-emission vehicles/equipment and maximize near-zero by 2020
- Foster future economic growth within the freight and goods movement industry

Other plans by regional agencies

In addition to the above planning process, many regional and sub-regional agencies have also developed plans to prioritize freight movement.

Table E3. Plans by regional agencies

Regional Agency	Goods Movement Plan
Alameda County Transportation Commission (ACTC)	Countywide Goods Movement Collaborative and Plan
Association of Monterey Bay Area Governments (AMBAG)	Central Coast California Commercial Flows Study
Metropolitan Transportation Commission (MTC)	San Francisco Bay Area Goods Movement Plan
North State Super Region	North State Transportation for Economic Development Study (NSTEDS)
Sacramento Area Council of Governments (SACOG)	Regional Goods Movement Study
San Diego Association of Governments (SANDAG)	2050 Goods Movement Strategy
San Joaquin Valley Regional Transportation Planning Agencies (SJV RTPA)	San Joaquin Valley Interregional Goods Movement Plan
Southern California Association of Governments (SCAG)	Comprehensive Regional Goods Movement Plan and Implementation Strategy

The Institution responsible for carrying out planning activity and the implementation of priority actions is the California Department of Transportation (Caltrans). To facilitate better coordination with other official institutions, civil society and the private sector, the **Office of Freight Planning** (OFP) has been established within the Division of Transportation Planning. The mission of this office is to "provide a safe sustainable, integrated and efficient transportation system to enhance the State economy and livability".

The OFP consists of professionals working in three divisions; Freight Planning, Freight Analysis and Freight Research. The OFP carries out: comprehensive analysis of the performance and trends of freight transportation systems; develops freight mobility plans and modal studies; recommends improvements to goods movement systems and operations through system planning, regional planning and intergovernmental

review; and participates in multi-state goods movement advisory committees and other activities. The OFP provides information and analyses; works with advisory groups and modal operators; carries out consultation activities; gathers and provides freight content for inclusion in various regional and state-wide plans; manages cross-border studies and coordinates freight efforts; and identifies projects for potential funding.[222]

The key deliverables of the Office of Freight Planning are

- National Multimodal Freight Network
- Critical Urban and Rural Freight Corridors
- Freight Investment Plan
- National Performance Measures
- California Freight Mobility Plan
- California Sustainable Freight Action Plan
- Freight stakeholder engagement to support above activities

To ensure proper guidance during the planning process, a **California Freight Advisory Committee (CFAC)** has been established. The OFP coordinates the activities the Committee. The Committee discuss freight-related topics to help coordinate regional freight priorities across organizations, and advise the OFP on freight-related priorities, issues, projects, and funding needs. It consists of 62 stakeholder representatives and is chaired by Caltrans.

California Freight Advisory Committee (CFAC) Member Organizations

Alameda County Transportation Commission, Automobile Club of Southern California, Assembly Representatives, Association of Monterey Bay Area Governments, Bay Area Air Quality Management District, BNSF Railway, California Air Resources Board, California Airports Council, California Association of Port Authorities, California Chamber of Commerce, California Department of Housing and Community Development, California Department of Public Health, California Energy Commission, California Farm Bureau Federation, California Highway Patrol, California Marine and Intermodal Transportation System Advisory Council (CALMITSAC), California Natural Resources Agency, California Public Utilities Commission, California Retailers Association, California Short Line Railroad Association, California State Lands Commission, California Transportation Commission, California Trucking Association Center for Community Action and Environmental Justice, Coalition for Clean Air Communities for a Better Environment, Devine Intermodal, FedEx Corporation, Governor's Office of Business and Economic Development (GO-Biz), Greenlining Institute International Brotherhood of Teamsters, Joint Council No. 42 International Longshore and Warehouse Union, Los Angeles County Metropolitan Transportation Authority, Los Angeles World Airports, Metropolitan Transportation Commission, Mobility-21, National Association of Industrial Office Properties SoCal Chapter, Native American Advisory Committee, Natural Resources Defense Council, Pacific Merchant Shipping Association, Port of Long Beach, Port of Los Angeles, Port of Oakland, Rural Counties Task Force, Sacramento Area Council of Governments, San Bernardino Associated Governments, San Diego Association of Governments, San Francisco International Airport , San Joaquin Valley Air Pollution Control District, San Joaquin Valley Regional Planning Agencies, Senate Representative, Shasta County Regional Transportation Agency, Sierra Club ,California Silicon Valley Leadership Group, South Coast Air Quality Management, District Southern California Association of Governments, Transport Group Union Pacific Railroad, United Parcel Service, United States Customs and Border Protection & US Department of Transportation - Federal Highway Administration

A separate Freight Efficiency Group has also been established, consisting of freight experts from academia, industry and government. The aim of this group is to advance the discussion of freight related topics and identify promising strategies to increase efficiency of the freight system.

5. Main urban freight initiatives

[222] Office of Freight Planning

Table E4. Proposed actions in the California Freight Mobility Plan

Objective	Proposed Actions
Build on California's history of investments to seek sustainable and flexible funding solutions with federal, private, and green partners Invest in freight projects that enhance economic activity, freight mobility, reliability, and global competitiveness	1. Conduct a cost-benefit analysis for each freight project proposed for programming 2. Reduce transportation costs by eliminating bottlenecks and recurrent delay, making operational improvements, and accelerating rapid incident response on priority freight corridors 3. Seek creation of national, state, and regional dedicated freight funding programs 4. Expand capacity of freight corridors, or subsections through infrastructure or operational improvements 5. Eliminate unnecessary freight lifts or handling 6. Improve system condition and performance on priority freight corridors 7. Coordinate with other states and regions to improve multijurisdictional freight corridors to reduce delay, increase speed, improve reliability, and improve safety
Reduce rates of incidents, collisions, fatalities, and serious injuries associated with freight movements Utilize technology to increase the resilience and security of the freight transportation system	1. Reduce points of conflict on the freight system by constructing railroad grade crossings where there is a history of crashes and at crossings that have a high volume of vehicle and train traffic 2. Create truck-only lanes and facilities and encourage off-peak usage 3. Fully implement positive train control 4. Expand number and scope of cargo security screenings 5. Expand the system of truck parking facilities 6. Ensure consistent and effective safety and security requirements at all California ports 7. Identify alternate freight routes to maintain freight movement at times of disruption by disaster or other causes 8. Inventory and assess risks for freight facilities vulnerable to sea level rise and other natural disasters, and prioritize for abandoning, adapting, moving, or replacing
Apply sustainable preventive maintenance and rehabilitation strategies	1. Ensure adequate and sustainable funding for preservation of the freight system 2. Expand scope of freight system rehabilitation projects to include facility modernization, where possible and merited, to increase range of available funding sources 3. Make preservation projects multipurpose 4. Identify maintenance and preservation needs on priority freight corridors
1. Integrate environmental, health, and social equity considerations in all stages of freight planning and implementation, including considering impacts and mitigation relative to the context of the project location 2. Conserve and enhance natural and cultural resources 3. Avoid and reduce air and water pollution, greenhouse gas (GHG) emissions, and other negative impacts associated with freight transportation by transitioning to a lower-carbon and more efficient freight transportation system 4. Implement freight projects that demonstrate, enable, implement or incentivize use of advanced, clean technologies (including zero- and near-zero-emissions technologies) and efficiency measures needed to attain ambient	1. Establish corridor-specific impact reduction goals and projects 2. Incentivize and prioritize freight projects that maximize GHG, criteria pollutant, and air toxin emission reductions 3. Incentivize impact reduction 4. Implement projects in freight corridors that are specifically targeted to avoid, reduce, or mitigate freight impacts on the environment and community 5. Support and fund research focused on impact reductions and mitigation 6. Ensure coordination and alignment of the Plan with State GHG reduction goals and requirements and State and federal air quality standards 7. Develop an efficiency metric that captures the intensity of pollutants per unit of freight moved

Objective	Proposed Actions
air quality standards and achieve needed air toxics and GHG emission reductions	
1. Develop, manage, and operate an efficient, integrated freight system 2. Identify causes and solutions to freight bottlenecks 3. Invest strategically to optimize system performance	1. Create a multimodal freight bottleneck list for priority corridors and prioritize for correction 2. Identify most-congested freight corridors and facilities and prioritize for improvement through individual projects 3. Implement vehicle detection on priority corridors to identify problem areas across modes, particularly targeted to truck data 4. Construct railroad grade separations at high-volume roadway crossings 5. Add mainline track and sidings to accommodate demand for freight and passenger rail services 6. Implement system management and expand freight travel information availability with the focus on freight corridors 7. Expand freight travel information availability to entire truck fleet
1. Support research, demonstration, development, and deployment of innovative technologies 2. Promote the use of zero- and near-zero-emissions technologies within the freight industry to support the State Implementation Plan (SIP), attainment of California greenhouse gas reduction targets, and reduction of local air toxics 3. Support and incorporate the use of low-carbon renewable fuels 4. Promote innovative technologies and practices that utilize realtime information to move freight on all modes more efficiently	1. Prioritize Freight plan projects that implement state-of-the-art and demonstration technologies 2. Support deployment of new, non-fossil fuel distribution, recharging facilities, and shoreside power on the freight system, focusing on particular regions and corridors 3. Support implementation of cleaner, quieter engine technologies 4. Research opportunities for automation of certain freight movements

P.O. Box 11772 | 1001 GT Amsterdam | Netherlands
Tel office: +31 646 95 44 05 | Email: info@smartfreightcentre.org
www.smartfreightcentre.org