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Determining the external costs of road freight activity in London

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Contents

Executive Summary

Nearly 90 per cent of goods moved around London are carried on London's roads. Goods vehicles account for 17 per cent of traffic in London – rising to 27 per cent in Central London. The use of goods vehicles, especially light goods vehicles (LGVs), has been growing at a faster rate than other vehicle types in London, and their activity coincides with busy peak traffic periods. This, among other things, causes goods vehicles to impose external costs on the urban environment. This report examines the costs of congestion, airborne emissions and noise.

Goods vehicles are used for many things, including the movement of goods, delivering services and commuting. This means that the external costs of freight – the movement of goods – is different from the costs created by goods vehicle activity. Heavy goods vehicles (HGVs) tend to do most of the heavy lifting, carrying the greatest proportion of goods, but are far outnumbered by light goods vehicles (LGVs), which perform many functions.

No sectors dominate the use of goods vehicles in London, but retail and construction are the largest. Retailers are increasingly targeting cost reductions in supply chains and are making them more efficient alongside just-in-time business models. A shift towards smaller vehicles is occurring, but because there is limited survey data and the use of LGVs is so varied, it is not possible to tell exactly what is causing this.

A review of available literature has found very little research into the external cost of freight activity. One study found looked at the cost of goods vehicle activity in London and two others looked at the cost of HGVs and the cost of urban road transport. These studies found that congestion is the largest contributor to external costs and serve as useful indicators of the contribution of each external cost relative to the others.

Congestion has knock-on impacts that make it even more costly in that it increases vehicle emissions. Congestion is a cost that is shared broadly across society while emissions and noise can have great local impacts in neighbourhoods. Particulate matter and nitrogen oxides are significant problems in London, but fortunately vehicle standards will do much to reduce this problem over time, especially with the Low Emission Zone bringing forward vehicle fleet renewal. At the same time technology and reform of working practices are bringing down the amount of noise generated by freight activity, which should keep the cost of noise at or below its current very low level.

The nature of external costs makes estimating their costs and indeed tackling their causes quite difficult. The cost of externalities generally rises at an exponential rate once a certain threshold has been reached. The implication of this is that the cost of externalities will be greatest where the background level of congestion, airborne pollution and noise is greatest – where the tipping point has already been, or is about to be, reached. To complicate this further, attempting to mitigate one cost can give rise to another. For instance, restrictions that encourage freight activity to travel during peak hours to eliminate noise at other hours add to congestion.

Freight activity in London is enormously valuable, as it supports almost all economic activity conducted, but it does generate costs. Understanding how it does so is important to begin a discussion on how to minimise these costs. This review seeks to prompt debate on whether and how policy should tackle these problems and highlights the complex nature of freight operations and the externalities they cause in London.

Introduction

Freight touches on every part of our lives and plays a fundamental role in London's economy. Each day tens of thousands of tonnes of goods are collected from and delivered to businesses and households in London and engineers respond to thousands of calls for services at homes and business sites.

It is easy to see freight as simply the distribution of retail goods but this is far too simplistic. Freight involves all activity carrying goods, from, to give only a few examples, the delivery of products to shops, home shopping deliveries, the collection of express parcels, the servicing and repair of plant or machinery, phone line installation, waste collection, and the movement of construction material. As a result, freight plays an important and beneficial part in every organisation in London and affects how all businesses and households operate.

Just short of 90 per cent of goods in London are carried on the road[1]. Even goods entering the region by other modes – rail and water – use roads for the final stage of delivery. And so the 10 per cent average annual growth in light goods vehicle travel since 1993 and the 140 per cent increase in the number of light goods vehicles crossing the Greater London boundary in the last three decades are of concern to many transport planners.

Previous work by GLA Economics has defined the logistics sector and its importance to London's economy[2]. This work profiled the location of and types of jobs in the sector and found that, in 2007, logistics operations accounted for 3.4 per cent of London's output and 5.2 per cent of jobs. But this, to some extent, underestimates the importance of freight activity, since the movement of goods through the economy is essential to nearly all economic activity in London.

Road freight activity plays a very important role in society but it does have some negative side effects. Freight activity makes noise, it generates airborne emissions – not just CO_2 but also nitrogen oxides, particulate matter and other harmful gasses – and finally, it adds to congestion on London's roads. This report seeks to understand how freight activity causes these costs and how substantial they are in London. While safety is an obvious point of conflict between freight and people, it is not a consequential by-product of freight activity and so is not taken up in this report.

Purpose and structure of report

The purpose of this report is to construct a broad picture of road freight activity in London to understand how the industry's operations create external costs and what specific activities are their sources. It does not seek to determine an exact value of these costs, but instead to understand the order of magnitude of each cost relative to the others. To do this, it explores how the freight industry operates, its position in the urban economy, and its effect on other businesses and individuals. Goods vehicles are not the only users of the roads, and so of course are not the only sources of external costs. But the cost of freight activity is one that is

[1] Transport for London, London Freight Data Report, 2009
[2] GLA Economics, Working Paper 37: London's logistics sector, 2009

not well documented, and so this review is needed to understand how freight fits in with other road users. This report does not prescribe policy or evaluate proposals. Instead, it seeks to prompt discussion of this very complex topic.

The report begins with a review of the available literature and statistics on freight and goods vehicle use in London to construct a view of how the industry works and ongoing trends within it. There is much data available about the movement of goods (usually by weight) in lorries, which is sufficient at the national level because large vehicles carry the vast majority of goods. But in urban areas, freight – and the use of goods vehicles – is much more complicated, as this report will show. Increasingly, goods are becoming more valuable and lighter in weight and are transported in smaller vehicles while many goods vehicles – especially vans – are also being used for other activities, principally the delivery of services and commuting.

Next, it explores how the industry's working practices create the externalities identified above – congestion, emissions and noise. This is based on an analysis of available data and a review of the limited available literature on this topic. Goods vehicles are used for far more than the transport of goods, as this report will show, so this review includes other activities, such as the delivery of services and commuting. While these activities are outside the definition of freight, they cannot be separated from data on freight activity. Because this review seeks to match actions with costs it is organised around the primary activities conducted using goods vehicles: goods delivery, services and commuting, mixing data on HGVs and LGVs when possible to illustrate how behaviours within the industry create external costs.

Finally, the interplay of trends in freight activity and external costs is discussed and talking points on the future direction of policy are presented.

Data sources

The data used in this report is primarily from two sources: The London Freight Data Report and a literature review of urban freight transport and light goods vehicles, both of which are largely based on DfT surveys. There is a plethora of goods data contained in these reports, but there is somewhat less data available on the other uses of vans. Furthermore, different recording methods are used for each vehicle type, reflecting the historic differentiation in use; most HGV data focuses on the weight of goods carried and van activity focuses on distance travelled and journey purpose. The review that follows demonstrates the need for much more data on LGV use, for more comparable statistics between HGV and LGV use, and for a need to consider volumes carried rather than just weight. Unless otherwise stated, all data presented in this report is from the London Freight Data Report.

Review of goods vehicle useage

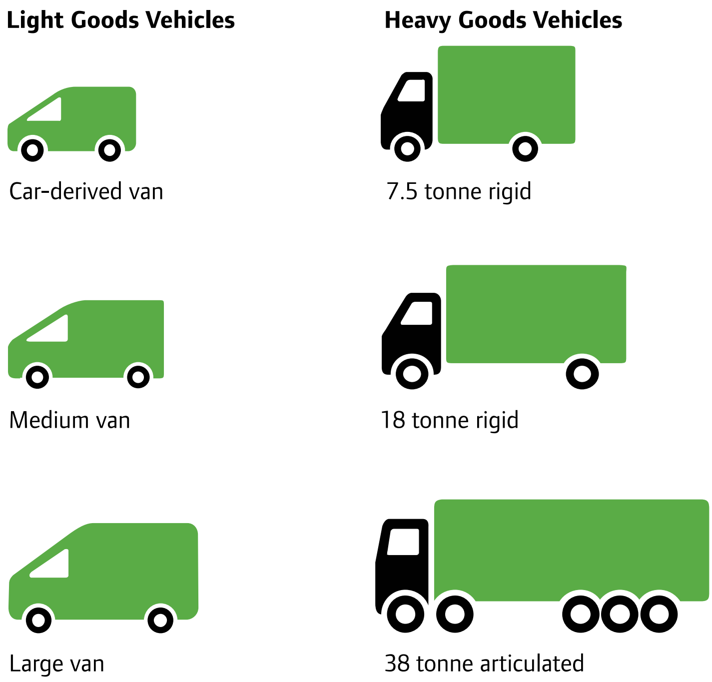
Modern transport research has focussed very heavily on the movement of passengers and has paid little attention to freight until recently. As a result, the literature base is much less robust for freight operations than for understanding personal travel. This section will review the available data and discuss trends in the freight industry that affect external costs.

Goods vehicles

The vehicles used in freight activity vary, ranging from bikes, cars and light goods vehicles (LGVs) – of the 'white van' variety – to much larger heavy goods vehicles (HGVs) – lorries. Lights goods vehicles are commercial vehicles with carrying capacity up to and including 3.5 tonnes and HGVs are commercial vehicles above 3.5 tonnes. Figure 1 shows the primary vehicles used in freight by size.

The largest HGVs are heavily regulated compared to LGVs. HGV owners must obtain an Operators special licence that requires fleet owners to conduct regular maintenance reports, detail where vehicles will be stored, demonstrate financial fitness and obtain permission from the local authority. LGV owners need not obtain any special license. In addition, vehicles over 18 tonnes must comply with the London Lorry Control Scheme, which curtails freight movements and access to minor roads. While both vehicle types are subject to delivery time restrictions and other rules, it is acknowledged that LGVs are much easier to own and operate.

Figure 1: Sample of typical vehicles used in freight



Different vehicles tend to be used for different activities. Heavy goods vehicles are almost exclusively used to move goods, ranging from construction materials to food. LGVs are used for many things: for delivering goods, performing services and even commuting. The

Department for Transport's company van survey shows that around a quarter of LGV travel is engaged in servicing, with about three-quarters of this being made wholly within London. Servicing activities include anything from repairing a piece of machinery or replacing car or building windows, to laying new water pipes and delivering and installing home appliances.

Table 1: Total travel performed by company-owned LGVs by journey purpose, 2003-2005 average

	Million vehicle kilometres	
Commercial: servicing	858	24%
Commuting	1,330	38%
Delivery/Collection	1,172	33%
Personal freight	7	0%
Personal non-freight	97	3%
Other/Unknown	43	1%
Total	**3,506**	

Table 1 shows the number of kilometres travelled in company-owned vans by journey type, showing that as little as 33 per cent of LGV travel is engaged in freight, though it is probably more. Nearly 40 per cent of company-owned LGV travel is commuting, and a very small proportion is personal travel. This data does not include privately-owned and leased vans, which account for about 40 per cent of LGV travel in London. Privately-owned vehicles, recorded in a separate survey, are more involved in commuting and personal trips and fewer delivery trips.

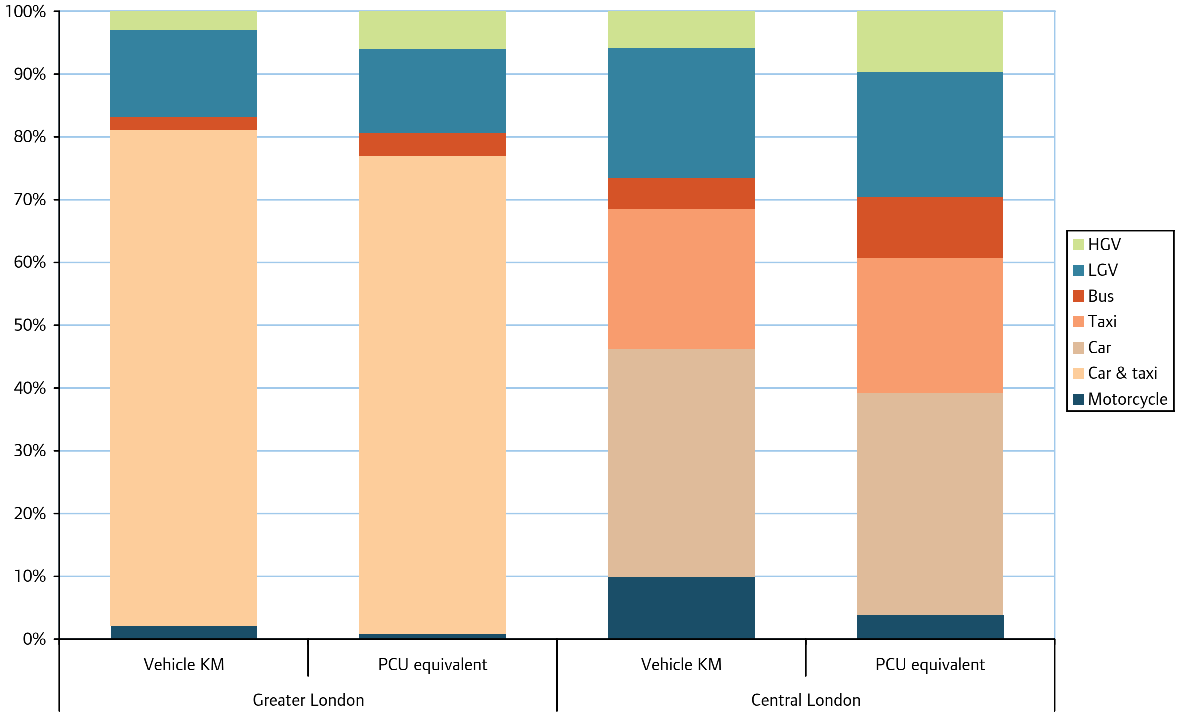
There are severe limitations in the data available for LGV use in London, which have significant implications for the findings of this review. The surveys are self-completed and many journeys could well fit into different categories. For instance, a builder travelling from home to work with spare parts in his van is both commuting and servicing. It is impossible to determine how much 'commuting' behaviour is of this sort, or the pure commuting type.

Freight activity in context

Transport for London estimates that HGVs account for 3 per cent of the distance travelled on London's roads and LGVs 14 per cent. The bulk of travel is done by cars and taxis, which account for 80 per cent of the total[3]. The only data available for a detailed geographic area is within the Central London congestion charging zone. Here HGVs and LGVs account for 6 and 21 per cent of travel, respectively[4]. This demonstrates the significant concentration of freight activity in Central London. Taking into account the amount of road space occupied by different vehicle types, goods vehicles account for 20 per cent of road space use in Greater London and 30 per cent of road space in Central London, as shown in Figure 2[5].

[3] Transport for London, London Freight Data Report, 2009
[4] Transport for London, Central London Congestion Charging: impacts monitoring, 5th annual report, 2008
[5] Passenger car units (PCUs) are used in freight transport models. The draft TfL Traffic Modelling Guidelines lists the following factors: Motorcycles 0.4, cars, taxis and LGVs 1.0, buses 2.0, MGVs 1.5, and HGVs 2.3. MGVs are goods vehicles of 3.5t to 7.5t and are included in this report as part of the HGV category of vehicles. For the calculations here, an average based on cordon counts was used to mix HGVs and MGVs. This yielded an average HGV factor of 2.1 in Greater London and 1.7 in Central London.

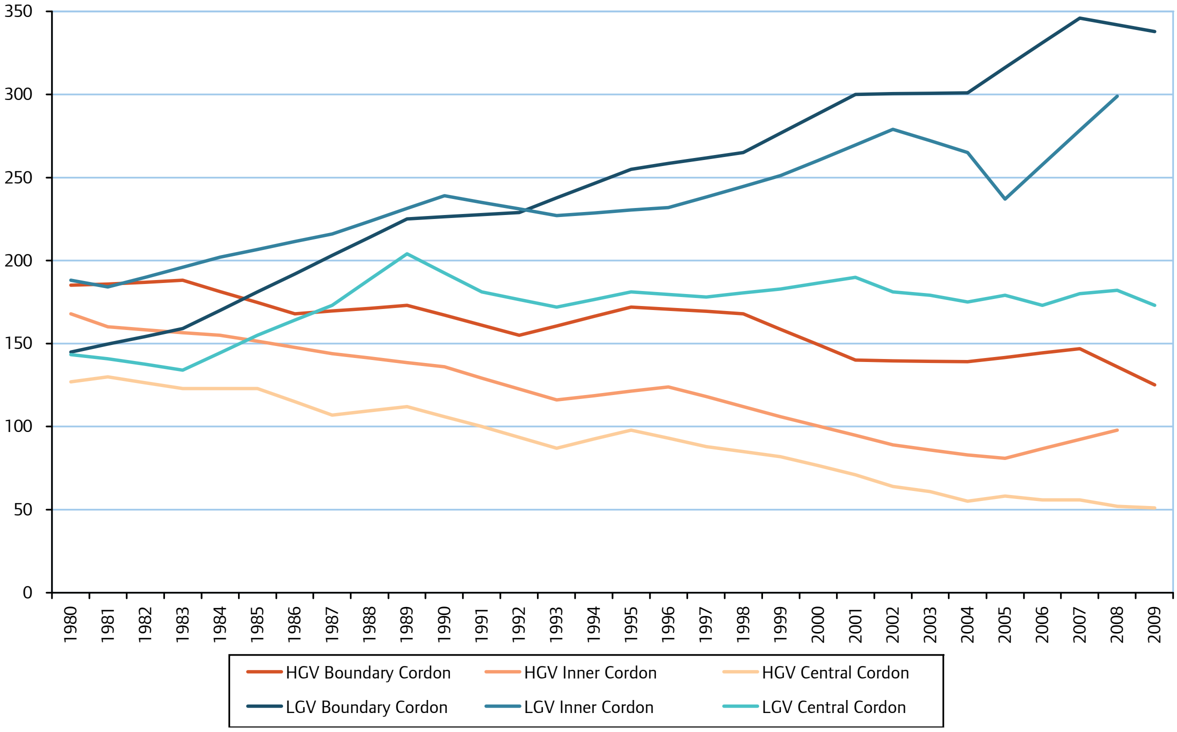
Figure 2: Proportion of vehicle travel and road space use by vehicle type in Greater London and the Central London congestion charging zone, 2007



Source: GLA Economics calculations based on data from Transport for London, London Freight Data Report and Central London Congestion Charging Zone impacts monitoring, 2008

In recent years, traffic counts across strategic cordons and screenlines have been largely unchanged or falling and this is also the case for HGVs. Since 1980, the number of HGVs crossing the Greater London boundary has dropped by 21 per cent and by 56 per cent at the Central London cordon. The smallest HGVs have been experiencing the greatest drop in use. In contrast, the number of LGVs on London's roads has increased in recent decades, particularly the number crossing the Greater London boundary. Since 1980, the number of LGVs crossing the boundary has risen by 139 per cent and the number crossing the Central London cordon has grown by 25 per cent. Figure 3 shows the number of vehicles crossing key London traffic cordons (in both directions).

Figure 3: Number of goods vehicles crossing strategic cordons, thousands in 1980-2009

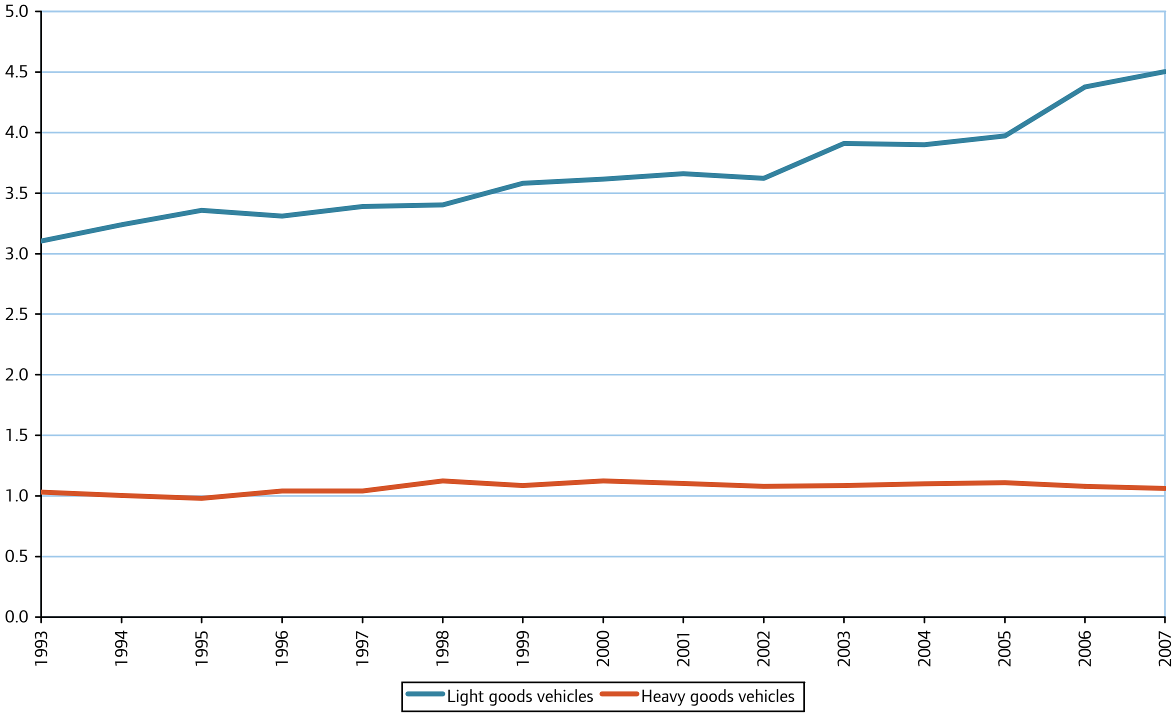


Source: Transport for London. Each cordon is surveyed at least once every three years. The Inner London cordon's last data point is 2008

LGV traffic has grown faster than other vehicle types, rising 50 per cent since 1993 against 7 per cent of background growth, and now accounts for 14 per cent of traffic in London. LGVs travelled 4.5 billion kilometres in 2007, and occupied 14 per cent of road space. Growth in LGV travel on minor roads has been faster than for all roads. LGVs travel 42 per cent of distance on minor roads compared to only 18 per cent for HGVs[6]. HGV travel has remained relatively flat for a long time and in 2007 accounted for about 3 per cent of traffic, travelling 1.1 billion kilometres, and around 6 per cent of road space use.

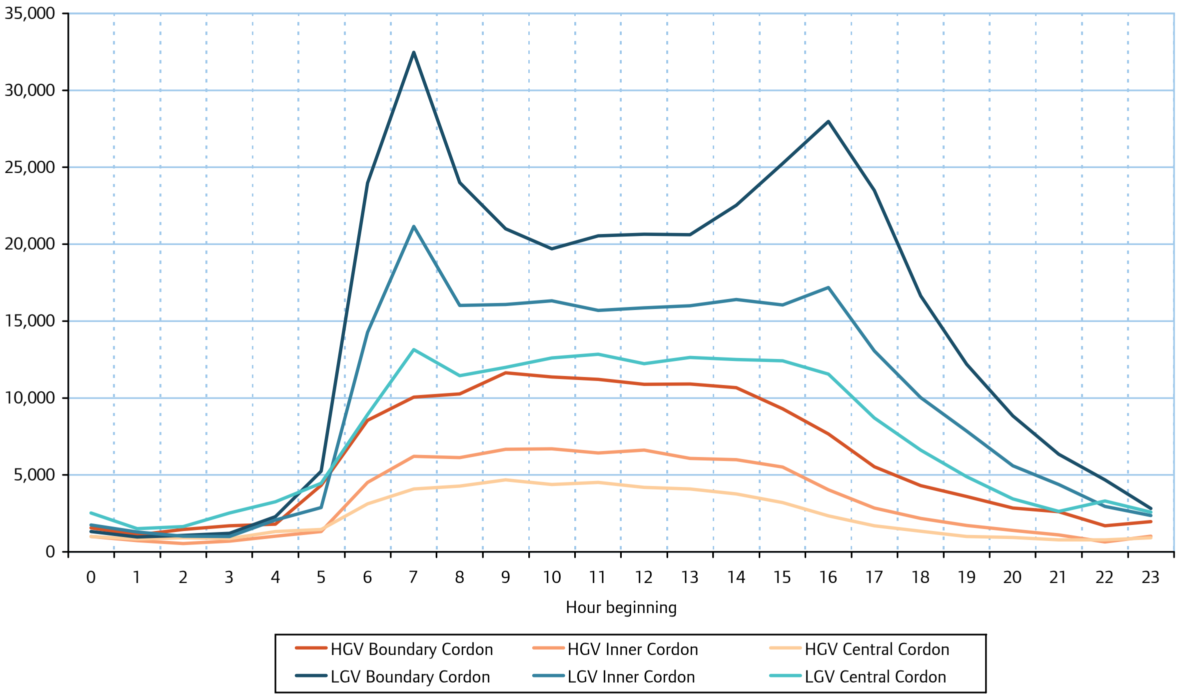
[6] Transport for London, London Freight Data Report, 2008

Figure 4: Vehicle kilometres performed by goods vehicles on all roads in London in billions, 1993 – 2007



Light goods vehicles are active for more hours than HGVs and are particularly active during peak traffic hours. The cordon counts in Figure 5 show two daily peaks at the Greater London border, one at 7am and another at 4pm. Moving closer to the centre, a less pronounced morning peak occurs at 7am at the Inner London cordon but there is no afternoon peak here and counts are steady from 7am to 4pm. And finally, at the Central London cordon LGV traffic is high and steady from 7am to 4pm.

Figure 5: Goods vehicles crossing strategic cordons by time of day, 2007



Review of activities conducted by goods vehicles

The following section explores the available data on freight activity in London, looking at the carriage of goods, delivery of services and commuting. This is to build an understanding of the specific activities undertaken by goods vehicles and to connect actions with the external costs described above. It examines trends within each of these activities to look forward to what the future may hold.

Carriage of goods

Most goods are carried by HGVs. It is estimated that only 5 to 10 per cent of goods by weight are carried in LGVs[7]. As a result, most available data relates only to goods carried by HGV and those carried in LGVs are not represented in freight data. This may not be problematic when dealing with volumes of goods since the contribution of LGVs in this respect is small, but because LGVs are numerous their impact on the urban environment is disproportionate to the amount they carry. LGV survey data suggests that at least a quarter of LGV travel in London is involved in carrying goods.

London is a net importer of goods. Data of goods moved by HGV show that in 2007, 47 million tonnes of goods were brought into London and only 36 million were taken out, mostly to and from the surrounding east and south east regions. But this is not the case for all types of goods[8]. On balance, nearly half of London's net imports are of food and drink, followed by bulk products (mostly construction material) and chemical products (mostly petrol), as shown in Table 2. Nearly all of the imports and exports are carried on the largest vehicles available – the articulated HGVs weighing over 33 tonnes and the rigid HGVs over 25 tonnes.

Table 2: Goods carried to and from London, million tonnes, 2007

	To London		From London		Net Imported
Food, drink and tobacco products	13	28%	8	21%	5
Bulk products	13	28%	10	33%	3
Chemicals and petrol	4	8%	1	4%	3
Miscellaneous products	17	35%	17	42%	0
Total	47		36		11

Another 56 million tonnes of goods were carried entirely within London in 2007. The vehicles used to move goods within London tend to be smaller than those used to import and export goods. Goods moved within London tend to be mostly bulk products (41 per cent) and miscellaneous products (44 per cent), but also some food, drink and tobacco products, as shown in Table 3. This break-down of goods types suggests that construction, retailing and possibly waste are dominant sectors for goods movement wholly within London.

[7] Browne *et al*, Literature Review Part 2: Light goods vehicles in urban areas, 2007 and Department for Transport, Road Freight Statistics, 2008

[8] The available data classifies all goods in the following four categories: food, drink and tobacco; bulk products; chemicals and petrol; and miscellaneous products. Bulk products include building products and raw materials. Miscellaneous products include machinery and other equipment, manufactured goods and all other articles not classified, including consumer goods and waste.

Table 3: Goods carried within London, million tonnes, 2007

Food, drink and tobacco products	8	14%
Bulk products	23	41%
Chemicals and petrol	1	1%
Miscellaneous products	25	44%
Total	56	

There is much attention given to the number of goods vehicles that are running empty or not fully loaded. Since London is a net importer, there will always be some degree of empty running. Available data shows that on trips that are carrying any goods, HGVs are carrying 56 per cent of capacity, by weight. But this is measured only by weight, but many vehicles carry goods that are less dense than others, which can cause a vehicle to be full by volume, but not by weight. More data is needed to determine load factors by volume, which is of much importance in understanding the utilisation rates of goods vehicles in Central London.

Two other measures of goods delivery are important to keep in mind: the distance travelled and the time of day in which the activity occurs. The previous section showed that HGV activity tends to occur during daytime hours, more specifically during standard working hours and a similar trend exists in LGV use.

Carrying goods in LGVs

Department for Transport survey data suggests that about one-third of LGV journeys are carrying goods. The type of goods carried by LGV appears to differ somewhat from that carried in HGVs, with consumer goods accounting for more than one-third, food, drink and tobacco around one fifth and parcels and mail and bulk products each around one-sixth. Within these categories, it is the materials with highest value density[9] and most time-sensitive that are transported in LGVs[10].

But this data must be viewed as only indicative because of the quality of the survey behind them. Every van journey has been classified by type of good or equipment carried, even if it is not in fact carrying goods or equipment at the time. This is because no differentiation is made between those commuting to work or those en route to conduct a service, for example. As the survey is self-completed, it is not possible to determine how respondents have classified their journey.

A detailed study commissioned by TfL on goods delivery in Regent Street provides some insight into specific goods deliveries in Central London[11]. This found that 75 per cent of deliveries were made by vans and that the peak time of activity was between 7am and midday. Nearly 40 per cent of deliveries were made to restaurants and hotels, 28 per cent to

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[9] Value density refers to the value of a product relative to its size and weight. Copper has an extremely high value density while aggregates do not.
[10] Browne *et al*, Literature Review Part 2: Light goods vehicles in urban areas, 2007
[11] Arup, Regent Street – Delivery and Servicing, 2009

offices and 19 per cent were to retailers. After mail and parcels, milk and newspapers were the most common products delivered.

One sector with some promising information available is the parcel and express delivery sector[12]. This sector is very active in Central London and is one of the larger users of LGVs, accounting for about 3 per cent of travel across London by this vehicle type. A recent review commissioned by TfL has found that 61 per cent of parcel and courier vehicles are light vans and that the average vehicle in this industry travels nearly 80km per day. Central London is the largest market amongst these businesses, and when depots are located outside the central zone the average distance travelled is higher.

In summary, it appears that LGVs are an integral part of supply chains for many businesses. LGVs are used at the beginning or end of global supply chains to transport goods of high value or time-sensitive and are more frequently used to transport consumer goods, including food, than are HGVs. But there is simply not enough information available on the use of LGVs within supply chains.

Trends in the organisation of goods delivery supply chains

The data presented above reflects the operation of complex supply chains. Every tonne of goods described forms a stage in a bigger supply chain. The data points to two key industries that dominate goods delivery in London: retail (high street and supermarkets) and construction. The organisation of supply chains in these industries is a significant driver of freight activity in London.

High street retail and supermarkets

The retail sector is responsible for moving a very high proportion of goods to, from and within London. The sector is probably responsible for most of the 'miscellaneous products' and a large portion of the 'food, drink and tobacco' that is moved around London each year (shown in Tables 2 and 3). Together, these commodities account for almost two-thirds of all goods moved, so retailers may be responsible for anywhere from 35 to 50 per cent of all goods moved.

The retail industry is composed of many players: wholesalers, small independent shops, global retail chains and department stores, to name a few. Each of these businesses has a different distribution network, which could be organised in a number of different ways. The choice of distribution network is made to maximise service levels at a minimised cost, including labour and capital costs.

The largest volume of goods is likely to flow through larger retailers, which, because of their size, are more likely to use their own distribution networks. These may be operated by contracted third-parties, but are often operating exclusively for the retailer. Supermarkets operate similarly to other retailers, except with the added dimension of multi-temperature foods, which are often handled by a parallel supply chain, and home shopping deliveries,

[12] Triangle, Parcel and courier: central activities zone activity report, 2010

which may be handled by a dedicated fleet, usually of small HGVs similar in appearance to a van[13].

A typical large retailer has a number of regional distribution centres that are used to supply goods to shops. The number and location of these centres is based on a number of factors, especially the location of shops and suppliers. Suppliers that deliver direct to retailers will operate in much the same way but will be heavily influenced by the location of their customers. The distribution network will be organised to minimise transport costs – factoring in time and up-front cost – but will also be influenced by availability and price of sites. For many retailers this will mean a site close to London on a motorway or other major road.

The rise of online shopping has led to a shift in the distribution strategy of retailers and supermarkets. Traditional retailers rely heavily on couriers and the parcel delivery services to deliver goods to customers. While there have been fears that this would lead to a dramatic change in the organisation of supply chains, there is limited evidence to show this as parcel delivery accounts for only 3 per cent of LGV activity. In recent years there has been some movement by retailers to allow for goods to be delivered to local stores instead of direct to consumers' homes to reduce the number of failed deliveries.

In contrast, supermarkets deliver goods directly to customers' homes with their own fleet of vehicles. This occurs in one of two ways: some retailers have dedicated distribution centres for home shopping where effectively all goods are delivered direct from the distribution centres to the customer. Others source goods directly from stores. In both cases, though, the home delivery occurs in either a van or a small HGV, and the general timing of the delivery is decided by the customer. In 2003, it was estimated that Sainsbury's and Tesco had together 700 LGVs in Britain, though this number will undoubtedly be higher today.

Modern manufacturing and retailing trends have led to more flexible supply chains[14]. Retailers are increasingly optimising supply chains to minimise the cost of bringing goods to market. This was led first by setting up and controlling distribution centres and more recently by retailers developing alternatives including own cross-docking operations. The most efficient retailers do not retain large inventories anywhere in the supply chain, including in the shop itself. Eliminating storage space saves occupancy cost and reduces the risk of having unsold goods. This just-in-time supply chain has led to many more, smaller deliveries being made and retail supply chains continually evolve in response to this.

Increasing efficiency in supply chains is affecting all forms of retail, including supermarkets. As a result, the movement of goods – at least by the most efficient firms – is handled with high degrees of supply chain efficiency already[15]. The issue is whether this business efficiency is reflected in efficient distribution activity for London. There is no doubt that more frequent and smaller deliveries affect the size of vehicle used, but it is not clear how much retailers use LGVs and whether this is a growing trend. LGV survey data show that 3 per cent of LGV

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[13] Behrenbeck *et al*, Supply chain excellence in retail, McKinsey & Company, 2005
[14] Department for Transport, Review of freight modelling, Report A1 – Issues in logistics and the freight industry
[15] Behrenbeck *et al*, Supply chain excellence in retail, McKinsey & Company, 2005

travel is delivering furniture or leather, textiles and clothing and 5.4 per cent are delivering food, drink and tobacco, though it is not possible to tell whether these goods are moving to customers, to restaurants, or to supermarkets.

Construction

The construction industry is responsible for around 40 per cent of both HGV and LGV travel in London. Building sites consume an enormous amount of material, and in London many building sites require the removal of much waste. Some construction deliveries are very specialised, using enormous vehicles to deliver a very large, pre-constructed part. There is much less information available on the structure of the construction goods supply chain, though by all accounts it is less efficiently organised than the retailing supply chain[16].

Survey data show that construction accounts for nearly 40 per cent of LGV travel, but only around 15 per cent of LGV goods journeys (the remaining journeys would be servicing or commuting). This is often for final building fit-out and carries high value density material, such as copper wiring and other highly engineered products. There is not sufficient data to analyse how many LGVs are engaged in the different types of construction work. An LGV delivering wiring to a construction site must be differentiated from one used by a plumber commuting to work with his tools and supplies, and from one used by a handyman. More research into this area is needed.

The delivery of services, trade activity and commuting

Servicing has traditionally not been included in 'freight' activities, which focuses on logistics, but it is an integral part of the freight industry as it too includes the movement of many goods. True, some servicing does not require parts, only equipment, and goods vehicles are also used for commuting, but nevertheless this review will include these activities because it is impossible to differentiate between them. There are many overlaps between the delivery of services, the construction industry, and commuting and when this is combined with significant limitations in the data on LGV use it makes sense to evaluate all three activities together.

The best source of information on LGV use is DfT's Company Van Survey, which it conducted on a continual basis from 2003 to 2005 and the Private Van Survey, which was completed once in 2003. A very brief updated summary of van use in England was published in 2009. The data show that company-owned vans account for 67 per cent of distance travelled by LGVs in England and privately-owned vans account for 17 per cent. The remaining 16 per cent are leased vans. The largest single use of vans in England is to carry equipment, accounting for 53 per cent of all LGV travel, and delivering or collecting goods account for around one-fourth.

Transport for London commissioned a separate cut of the data looking at only London's company owned vehicles, which showed that around half of LGV trips made to or from London are commuting trips, which account for more than a third of all LGV travel.

[16] Vrijhoef R and Koskela L, Roles of supply chain management in construction, Proceedings of the International Group for Lean Construction Conference, Berkeley USA, July 1999 and Transport for London, London construction consolidation centre: final report, 2008

Commuting represents a smaller proportion of LGV use within London than for trips to and from London. The rest of LGV journeys within London are for commercial servicing (24 per cent) and delivery or collection (29 per cent).

The LGV fleet is largely made up of small owners. Royal Mail owns the largest fleet and other delivery companies own substantial numbers. Utility and telecommunications companies also own large fleets. Other notable owners include courier firms, local authorities, security firms and auto-repair and response companies. Groups that use LGVs heavily include the construction industry, office supply companies, wholesalers, medical/pharmaceutical suppliers, and newsagents[17].

There is an obvious need for more information detailing the use of LGVs in London to understand both the delivery of services and goods. The data available suggests that only around one quarter of LGV travel is carrying out servicing, around 30 per cent is delivering goods and services, and a large portion of LGV travel is commuting. But understanding how all of these trips come together in travel patterns is not possible. Much more research is needed on this topic.

Summary of trends in freight activity

The statistics and literature available identify a number of key trends that are driving change within the freight sector and are of importance to the creation of external costs.

Goods vehicles account for 17 per cent of traffic in London but 20 per cent of road-space usage and this activity is coinciding with busy peak traffic periods. This causes freight to add significantly to demand for road space and so congestion and pushes up emissions. In Central London goods vehicles account for nearly one-third of road space usage.

LGVs are an integral part to many supply chains, but there is not enough evidence to understand how so. The food and beverage sector makes more use of LGVs than others, but the data suggests that LGVs are used by nearly every part of the economy. The growth in LGV use is a response to changes in many industries to just-in-time business models and the proliferation of services, such as telecommunications and building services. More information is needed to understand how this change is taking place.

Over several decades, the number of HGVs travelling in London has been declining while the use of LGVs has been growing strongly. More information is needed to understand what sectors are driving this change, if any.

No sectors dominate the use of freight vehicles. The retail sector, including supermarkets, may be the largest sector, but this depends on the proportion of food and beverages going to supermarkets compared to the proportion going to restaurants and other hospitality services.

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[17] Browne *et al*, Literature Review Part 2: Light goods vehicles in urban areas, 2007

Construction accounts for 40 per cent of goods vehicle traffic and is the largest single user of such vehicles. Little is known about the use of LGVs by the industry, though, particularly the degree to which they are used for commuting.

The range of users of goods vehicles varies considerably across space and time, as the study of Regent Street has shown. There, the hospitality industry is the largest receiver of deliveries and the most common goods delivered are mail, milk and newspapers, but this will vary from street to street.

Supply chains are becoming increasingly efficient as retailers and other businesses concentrate on reducing costs in bringing goods to market, but this may not be the most socially efficient option, as some external costs are not priced. Retailers are often in the position of power with suppliers in terms of the timing and nature of deliveries and this has implications for delivery schedules. Supply chain research suggests that goods movement is already relatively efficient and confirms that businesses have financial incentives to minimise costs, and lading levels (the proportion of weight capacity that is used) appear to support this.

The impact of freight activity on the urban environment

Freight activity generates a number of external costs and benefits. Most commonly identified amongst the costs are congestion, emissions (including CO_2), noise and safety. This section will examine how different freight activities contribute to these costs. Each cost is examined in detail to identify its cause.

A review of the available literature has found one study by Allen *et al* that attempts to quantify and monetise the external cost of freight activity in London. Two other relevant pieces of research were found; a specific study by Piecyk and McKinnon on the external costs of HGVs in Britain and a literature review by the Cabinet Office exploring the external costs of road transport in England[18].

The Allen *et al* study applies the methodology used by Piecyk and McKinnon to LGV and HGV activity in London. It finds that goods vehicles create external costs in London in the order of £2 billion, led mostly by congestion costs, which account for 77 per cent of the total. LGVs contribute more to congestion than to other costs, and in total make up around 55 per cent of all costs.

The methodology used to calculate these costs is based on a review of national goods vehicle movements. It relies heavily on average costs per kilometre, which generalises costs incurred in very specific geographies across all travel and so does not take into account many of the causes of external costs specific to urban environments, especially the higher background concentration of emissions. As a result, it possibly underplays the cost of emissions and does not deal sufficiently with congestion caused by lane blockages. It does, though, make much effort to determine the cost of specific vehicle types and contributes much to the understanding of the scale of costs generated by LGVs compared to HGVs.

Piecyk and McKinnon estimate that HGVs create external costs in Britain in the order of £7.2 and £8.3 billion annually. They estimate that 40 per cent of this can be attributed to congestion, 15 per cent from airborne emissions and 2 per cent from noise. The remaining 43 per cent are split between accidents and infrastructure, which this paper will not examine. But the study looked at HGVs across Britain, where much of the travel occurs between cities on motorways. Many of these costs will have been incurred in urban areas and it is not possible to apply these findings to only one urban area to know how the relative balance of these costs would shift between urban and rural areas. As will be shown in the examination of specific external costs, the findings from this report cannot be easily applied to London and it appears that the best the results can be used for is to determine the relative scale of each cost.

The Cabinet Office literature review came to a similar conclusion with regard to the scale of costs, given that HGVs account for a small portion of all vehicles but contribute disproportionately to costs. The review found that across Britain, road transport creates

[18] Allen, Piecyk & McKinnon, Internalising the external costs of LGV and HGV transport in London, 2008; Piecyk & McKinnon, Internalising the external costs of road freight transport in the UK, 2007; and Cabinet Office, The wider costs of transport in English urban areas in 2009, 2009

external costs in the order of £40 to £50 billion, with congestion responsible for 25 per cent, emissions 22 per cent and noise 9 per cent. The remaining 44 per cent are put down to accidents and physical inactivity (the health effects of using motor transport rather than walking or cycling). Where specific figures have been found for London they account for a substantial portion of costs. For example, 40 per cent of congestion costs arise in London. The review acknowledges that it gives only an indicative assessment of the costs, but it confirms that the costs of congestion, emissions and noise are substantial.

Table 4: Findings of external costs, 2009 prices (billions)

	Allen, Piecyk & McKinnon (London HGV and LGV)		Piecyk and McKinnon (HGV in Britain)		Cabinet Office (England urban roads)	
Congestion	£1.47	77%	£2.9-3.3	40%	£10.9	22-29%
Emissions	£0.14	7%	£1.1-1.2	15%	£5.7-14.3	15-29%
Noise	£0.03	1%	£0.1-0.2	2%	£3-5	8-10%
Accidents	£0.16	8%	£1.4-1.6	19%	£8.7	18-23%
Infrastructure	£0.09	5%	£1.7-1.9	23%		
Physical inactivity					£9.8	20-26%
Total	**£1.92**		**£7.2-8.3**		**£38.1-48.7**	

The findings of the three papers are compared in Table 4. They are useful benchmarks for understanding the costs of freight and confirm that the freight sector contributes disproportionately to the costs of urban road traffic. The following section examines these three external costs in depth, with specific attention paid to the activities that give rise to costs.

Congestion

By all accounts, the largest external cost of freight to be examined here is congestion, the delay created when too many vehicles try to use a limited amount of road space. The surplus of demand causes traffic to grind to a halt. Goods vehicles account for a large proportion of road space use in London, particularly in Central London, and so contribute significantly to the demand for road space. Some argue that because congestion creates a direct cause – longer journeys and the operating cost this involves – it is not really an externality. But this is erroneous since the congestion cost incurred by an individual is in fact the cumulative impact of other users on that person, not the cost that person is creating for others. In other words, congestion is caused by only the small proportion of vehicles using the road that bring demand above capacity and so only a small number of vehicles are actually responsible for generating the full cost of congestion.

Freight adds to congestion primarily in three ways; the activity adds volume to traffic levels and contributes to surplus demand, goods vehicles can sometimes block traffic lanes while loading/unloading or navigating narrow streets, and large vehicles can slow traffic in urban areas where traffic lights require stopping, effectively reducing road capacity. Each of these impacts has significant knock-on costs to other road users.

Congestion costs are difficult to estimate because of the extreme volatility over space and time, which affects both the scale of impact as well as the size of costs. Estimates of the cost of congestion vary, but all are fairly large. Allen *et al* put congestion costs at more than three quarters of the external cost of goods vehicles in London, reflecting the fact that London's roads are operating at or above capacity frequently, with LGVs contributing much more to this than HGVs. The Cabinet Office estimates congestion accounts for 22 to 29 per cent of external costs of road transport in England's urban areas, but nearly 40 per cent of the national cost is in London alone. Looking at only HGVs, Peicyk and McKinnon estimated that congestion accounts for 40 per cent of the external costs of freight activity. All the studies are based on valuing excess journey time based on transport model runs.

Valuing the cost of congestion delays is complicated by the varied composition of traffic within the urban environment. The traditional method for valuing congestion costs is by measuring the time delays caused. The mix and quantity of other vehicles (buses, cars, etc) on the road at any given time and place means different types of people are affected and so the valuation of delays is different for each incidence of congestion. For example, a fully loaded bus will tend to have a much higher cost of delay than a passenger car with only one occupant, and a vehicle blocking a lane to unload will cause less delay at 5am than it will in the same place at 9am when the roads are very busy.

On top of these delays are the effects of delays to goods vehicles themselves. Transport research has advanced the value of time concept greatly for individuals and valuing delays incurred by people is very much routine. But the valuation of delays to other road users – particularly commercial vehicles – is poor. Time is not appropriate here. For example, heavy delays for the movement of goods leads to missed sales in shops, but also can delay the production process for manufacturers. The value of freight traffic is certainly more than the wages paid to the driver – the current method – and is rarely even so low as the value of the contents of the vehicle.

No paper attempted to value the effect of lane blockages during delivery or service activity. Initial findings from research commissioned by Transport for London found that obstructions can reduce road capacity very significantly and that the effect of disruptions varies across space and time. In one scenario, a long stoppage reduced capacity by 70 per cent at one location, but the same length stoppage in another location only reduced capacity by 5 per cent[19].

London is a growing city, with three-quarters of a million more jobs and nearly one million more residents expected by 2031. This will only mean more demand for road space and more congestion. Many of London's roads are already heavily congested. The review of evidence suggests that congestion from freight can be minimised by ensuring that sufficient loading and unloading space is provided to prevent lane blockages, that appropriate vehicles are used in narrow streets, that freight vehicles are highly utilised (to reduce numbers), and that more freight activity is conducted outside peak hours.

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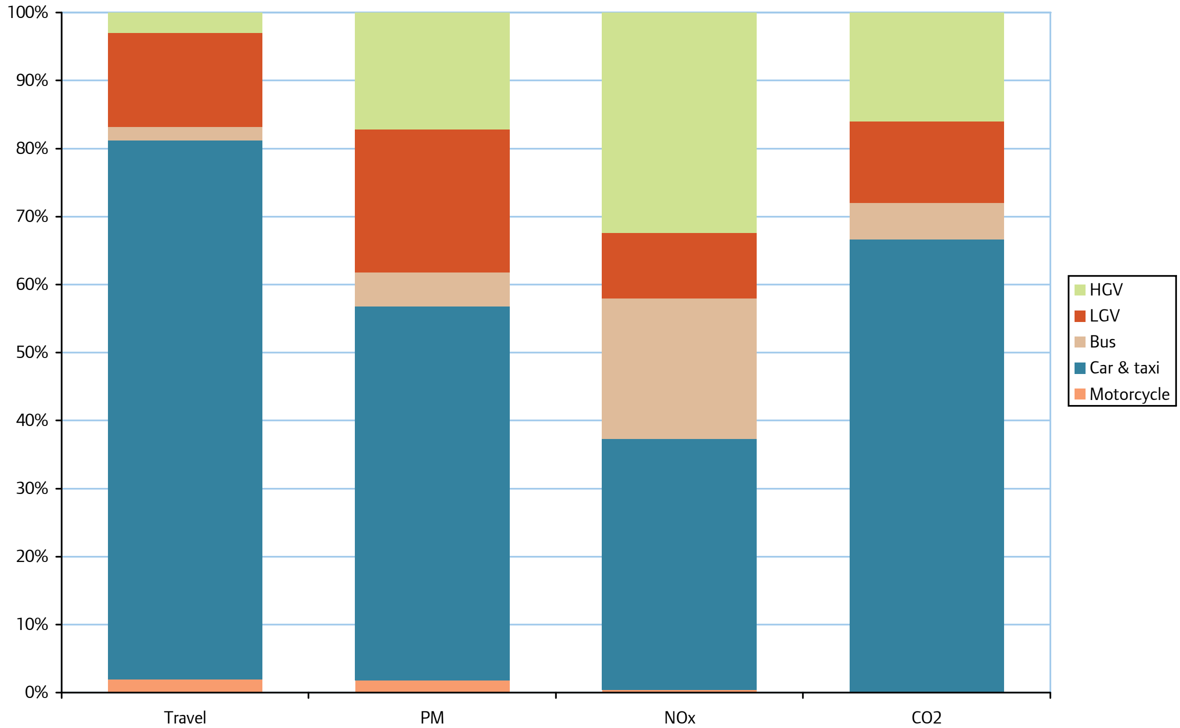
[19] Massachusetts Institute of Technology for Transport for London, Evaluating the impacts of interventions on network capacity, 2010

Emissions and air quality

Like most vehicles, goods vehicles emit pollutants into the air. Many of these pollutants, such as particulate matter, have direct health impacts and some, such as greenhouse gases, have longer-term consequences. In total, goods vehicles emit proportionally more pollutants per kilometre travelled than passenger vehicles. In 2008, HGVs emitted 17 per cent of the particulate matter (PM) from road traffic in London, 32 per cent of nitrogen oxides (NO_x), and 16 per cent of carbon dioxide (CO_2) but accounted for only 3 per cent of vehicle travel. At the same time, LGVs accounted for 21 per cent of PM emissions, 10 per cent of NO_x and 12 per cent of CO_2 but 14 per cent of vehicle travel[20]. This is shown in Figure 6. While much public discourse concentrates on the climate-changing effect of carbon emissions, much less attention is given to the human health impacts of other vehicle emissions. Each of these emissions are detailed below.

Figure 6: Comparison of airborne emissions by vehicle type relative to distance travelled, 2008



Source: Greater London Authority, Air Quality Strategy, 2010

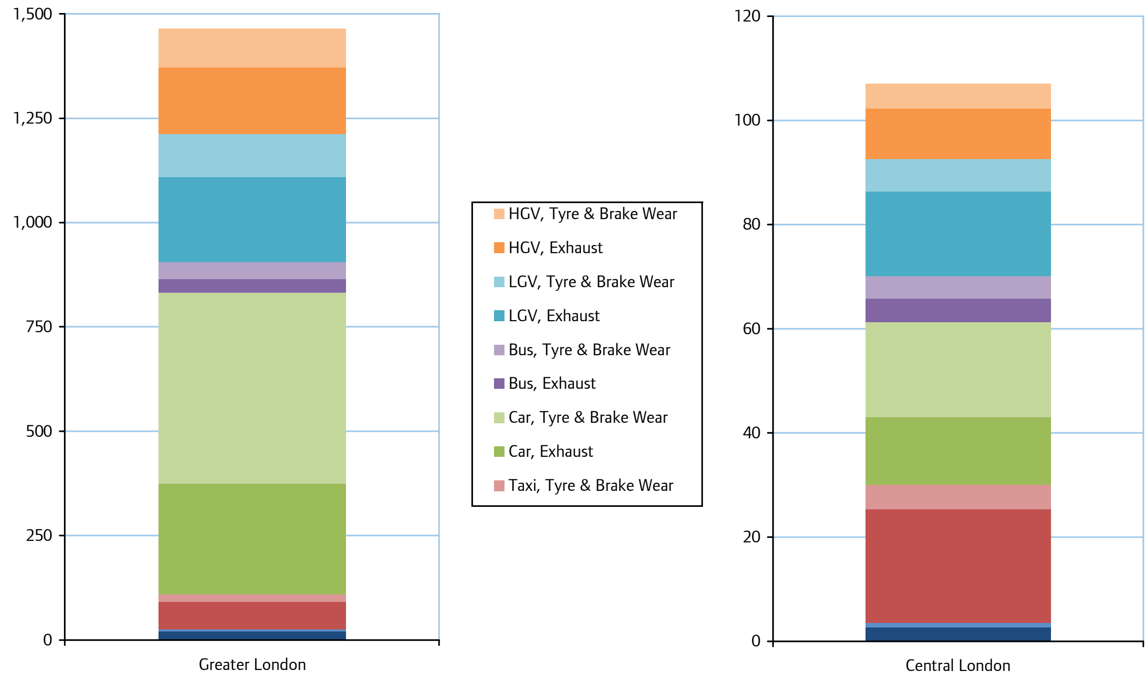
Particulate matter

Particulate matter (PM) and nitrogen oxides are of especially great importance in this respect. Particulate matter is very fine non-gaseous particles suspended in the air that can be breathed deep into the lungs. It has significant human health impacts, including asthma, lung cancer, cardiovascular issues, and premature death. It is contained in vehicle exhaust but also created by the wear of tyres and brakes.

[20] Greater London Authority, Air Quality Strategy, 2010

Goods vehicles generate 38 per cent of PM from road traffic in London, as shown in Figure 6. The amount of PM generated by road transport has been in decline for some time as vehicle standards have lowered the concentration in engine exhaust. But while particulate matter in exhaust is decreasing, the amount from tyres and brakes is growing. No technological solutions currently exist to reduce the amount of PM generated in this manner and only abatement methods are currently available.

Figure 7: Particulate Matter emissions in Greater London and Central London, annual tonnes in 2008

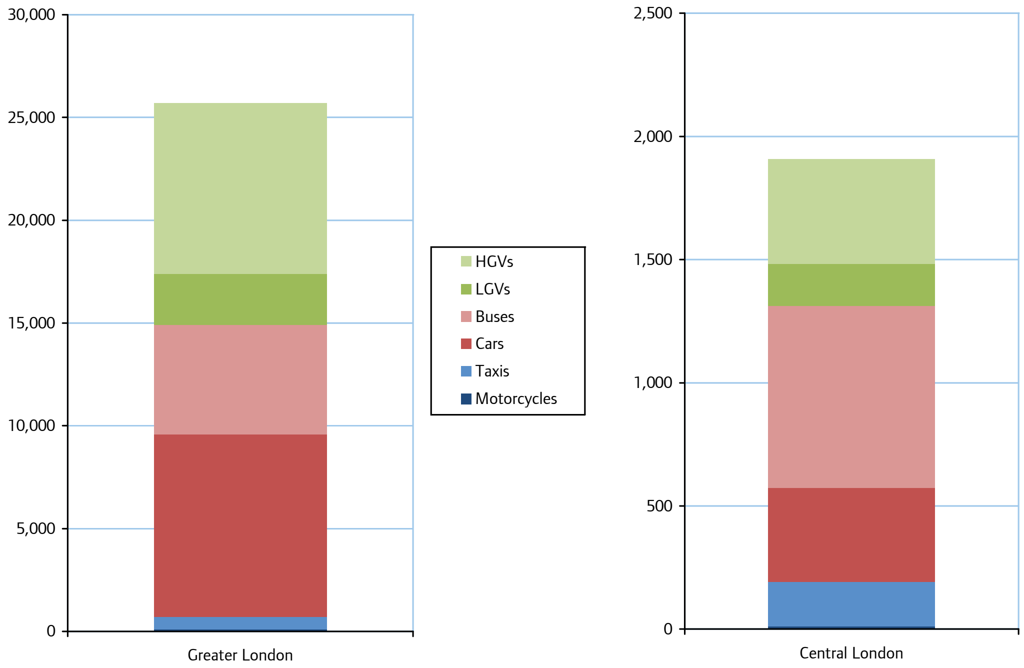


Source: Greater London Authority, Mayor's Air Quality Strategy

Nitrogen oxides

Goods vehicles produce 42 per cent of NO_x from road transport, as shown in Figure 6. Nitrogen dioxide has significant harmful respiratory impacts and is a direct by-product of combustion engines. It is also created when nitrogen monoxide (also a by-product of combustion) combines with oxygen in the air. Like PM, NO_x is declining as new vehicle standards take hold.

Figure 8: Nitrogen Oxides emissions in Greater London and Central London, annual tonnes in 2008



Source: Greater London Authority, Mayor's Air Quality Strategy

Carbon dioxide

Carbon dioxide emissions contribute to climate change and are produced when vehicles burn petrochemicals. Goods vehicles produce 28 per cent of London's CO_2 from road transport. CO_2 emissions are not regulated by vehicle standards. Instead, the industry voluntarily reduces CO_2 from vehicles and when vehicles are sold an estimate of carbon output is provided to buyers. Unlike PM and NO_x, the amount of carbon produced by goods vehicles is not declining significantly.

Airborne emissions are directly related to the distance travelled and the efficiency of freight vehicle engines, which is heavily affected by driving conditions. As a result, the amount emitted by freight movements differs by time, location and vehicle type. Freight activity during peak traffic periods in heavily congested areas will produce the greatest levels of harmful emissions.

The cost of vehicle emissions

Vehicle emissions are regulated by European regulations. These vehicle standards (the Euro standards) are updated regularly and cause the vehicle fleet to gradually become less polluting as new vehicles replace old. Limits for carbon dioxide are implemented voluntarily by manufacturers. Vehicle emissions are regulated locally by London's low emission zone (LEZ), implemented in 2008, which currently affects only HGVs.

The literature reviewed found the effect of transport on air quality to be about 15 per cent of external costs. Allen et al put emissions at only 7 per cent of costs in London, though this is probably too low since it is based on a national average cost per kilometre. The Cabinet

Office review found an enormous range in estimates of the cost of airborne emissions, mostly because of uncertainty of the link between poor air quality and life expectancy[21]. The Piecyk and McKinnon study, which looked only at HGVs and is based on DEFRA guidance, found particulate matter to be more costly in urban areas than other airborne emissions, despite PM being lower than many other pollutants in terms of weight. Both LGVs and HGVs emit large amounts of particulate matter, with LGVs in fact producing more in London than HGVs.

The cost of these emissions depends on the volume emitted and the concentration of these chemicals in the air. The cost of PM and NO_x rise exponentially with concentration, while CO_2 costs are uniform across space. Existing valuation methods for air quality are based primarily on willingness to pay surveys and are very difficult to apply to real-world situations. For instance, the effect of NO_x and PM is greatest when certain concentrations are reached, so to estimate the cost of freight emissions it is necessary to know how many kilometres are travelled in areas where heavy concentrations exist and how much more output is emitted in these periods. Since this last stage is affected by driving conditions, it is near to impossible to accurately value this cost.

Improving the efficiency of motor engines can reduce airborne emissions, as can replacing petrol-powered engines with electric ones. This can be done through technological improvement, replacing older vehicles, or by reducing the amount of travel conducted in highly congested environments. Particulate matter, though, is likely to be a long-term problem as the amount created by the degeneration of brakes and tyres is significant. For these impacts mitigation will be needed.

Since many health impacts are based on concentration of pollutants in the air, hotspots will form where costs are higher. Air quality is already most poor in Central London, town centres, along major road traffic corridors and around logistics facilities, as shown in Figures 9 and 10.

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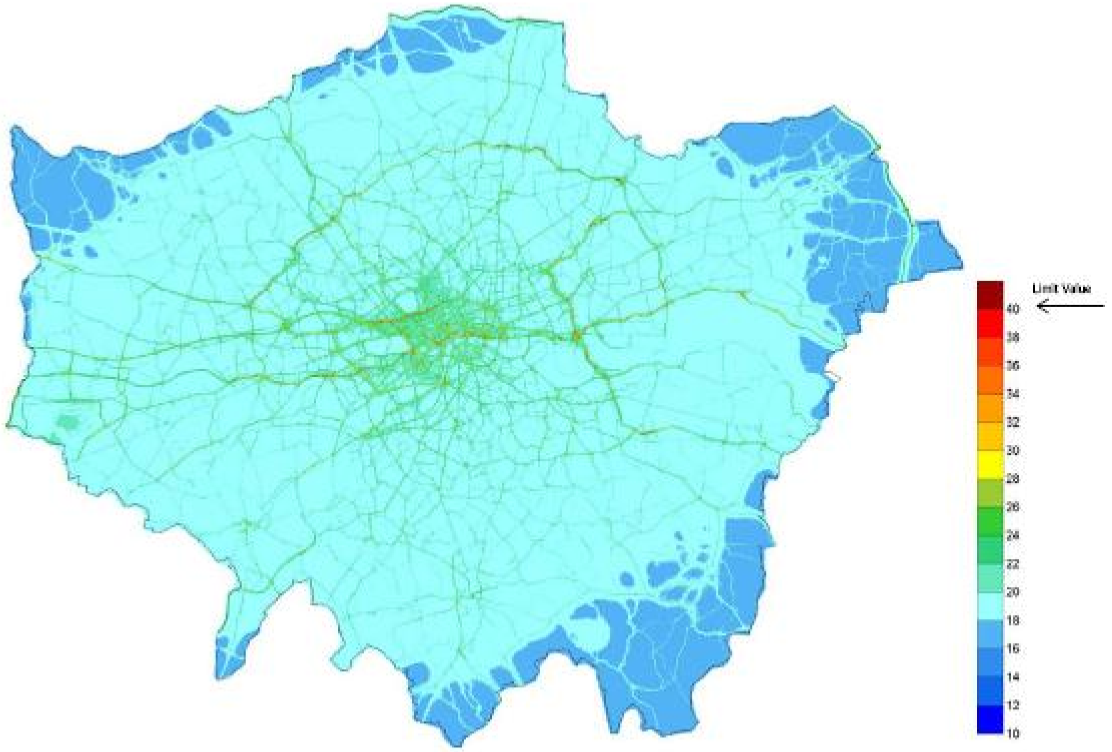
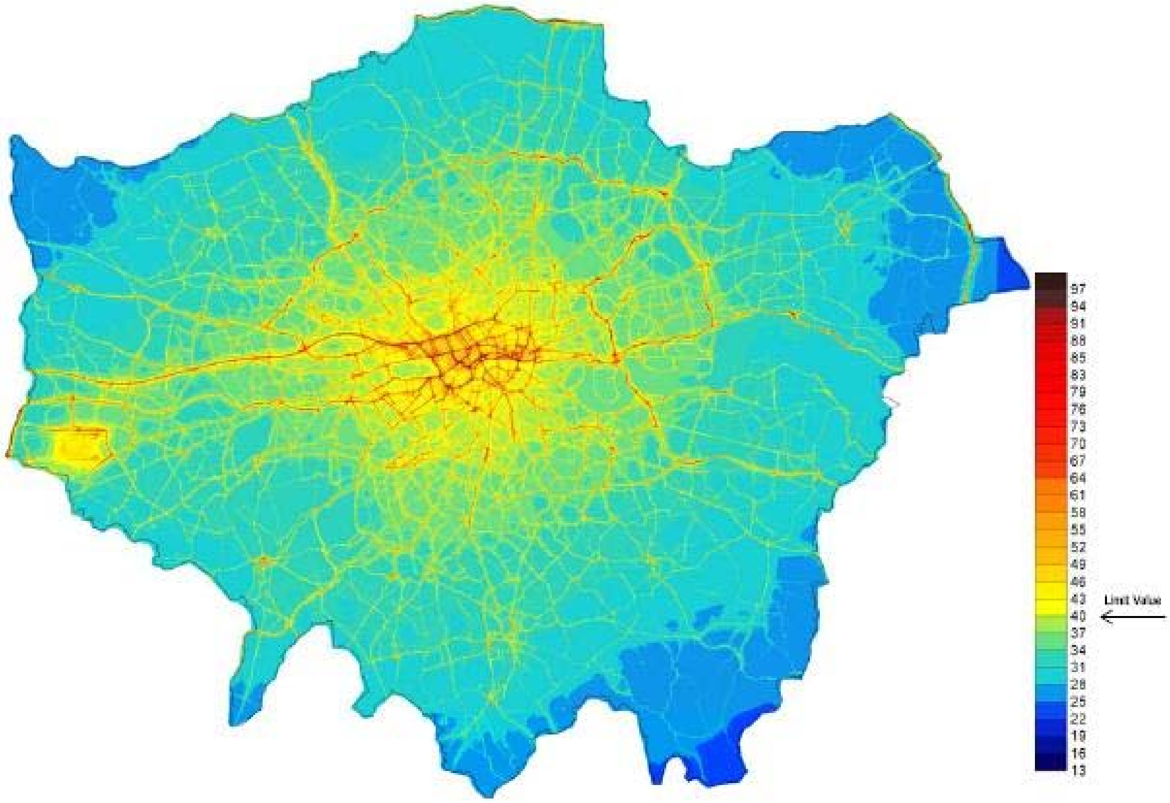
[21] The range of estimates was £4.5 to £10.6 billion for this element of costs

Figure 9: Particulate matter (PM_{10}) average annual concentration ($\mu g/m3$), 2008



Source: Greater London Authority, Mayor's Air Quality Strategy, EU limit values indicated

Figure 10: NO_2 average annual concentration ($\mu g/m3$), 2008



Source: Greater London Authority, Mayor's Air Quality Strategy, EU limit values indicated

Noise

Put simply, vehicles make noise. Engines, aerodynamics and surface treatment create noise while vehicles move and loading and unloading goods also creates noise: opening and closing doors, raising and lowering truck platforms and verbal communication. These disruptions have quality of life impacts, particularly when they occur at night in residential neighbourhoods where sleep can be disturbed.

Resident complaints about noise are nothing new and so local authorities have restricted much freight activity in mornings and evenings and large goods vehicles face strict regulations on their use of minor roads through residential areas. Regulations also limit the amount of noise produced by all vehicles. Local authorities have made much effort to minimise the noise created by freight activity, especially in residential areas. In London, boroughs operate the London Lorry Control Scheme, which restricts the routing of HGVs over 18 tonnes during nights and weekends and local authorities also create noise abatement zones or assign delivery windows when granting planning permission. These controls have the effect of significantly limiting the timing of freight activities.

It is estimated that freight noise has a relatively small cost under current operating practices. Some of this can be put down to technological advances having reduced the noise created from vehicles as well as the delivery and collection of goods. But most freight activity occurs in the daytime when the disruptive effect of noise will often be less than background noise levels and so have limited costs. Modern vehicle technology continues to bring down operating noises, and electric vehicles can be very quiet. Other advances have been made in advancing quiet loading and unloading practices. However, the noise of moving vehicles caused by surface quality and wind dynamics remains to be tackled.

The literature has found noise to be a minor cost of road activity. Piecyk and McKinnon cite a DEFRA report on the cost of supermarkets and find 2 per cent of costs of HGV activity arise from noise and in London Allen *et al* put this at only 1 per cent. The Cabinet Office review is based on a more traditional method based on hedonic modelling, which shows noise to be more costly.

Noise is typically valued on the loss of amenity it causes and this is rooted heavily in perception. Valuation is based on hedonic price modelling that reveals a relationship between house prices and background noise levels. This is the most well researched method of valuing noise, though work on stated preference and willingness-to-pay has also been conducted. Generally, people place a value on reducing noise only once a threshold has been reached and so it is only in particularly noisy periods that this methodology suggests noise creates a cost on society. But the methodology is based on sustained noise levels and is not appropriate for some types of freight noise, which is irregular, so it is difficult to apply the metrics of traffic noise to noise from freight.

Noise problems will be most problematic along main traffic corridors and where certain land uses are heavily mixed – primarily housing and those retail or leisure uses that receive a great number of deliveries. The shift in planning to the ‘compact city’ model will likely increase the number of such conflicts, especially since people increasingly expect less noise. Quiet residential areas will be more heavily affected than busy ones since the ambient noise level is lower. To combat noise, efforts should be concentrated on reducing the noise from loading and unloading in urban areas and to limit the auditory intrusion of HGVs into quiet residential areas. Attempts to mediate the noise created from road surfaces may be worthwhile.

Summary of costs and discussion of valuation

This section has reviewed three broad categories of external costs. It is clear that congestion is the greatest cost arising from freight activity in London. Though goods vehicles account for 17 per cent of travel on London's roads, they account for 20 per cent of road space usage. In Central London the effect is even greater, with goods vehicles accounting for 30 per cent of road space usage, and this doesn't even consider the effect of lane blockages, which would increase the road space usage figures.

Congestion has knock-on impacts that make it even more costly in that it increases the scale of emissions generated by goods vehicles. While congestion is probably the single largest cost to society, it is one that is shared broadly. Nearly everyone suffers as a result of congestion. But noise and emissions can have a very great local impact on neighbourhoods and individuals that are heavily affected by goods vehicle activity.

Airborne emissions and noise have a direct impact on London's quality of life. Particulate matter and nitrogen oxides are significant problems in London, but fortunately vehicle standards are reducing the amount of these pollutants emitted by vehicles, though certainly not eliminating this problem. On the other hand, the cost of noise is very small at present, which probably says more about the number of regulations in place to prevent noise than anything else, though improvements in vehicle design and operating practices have significantly reduced the noise of freight activity compared to the time in which these restrictions were put in place.

No studies were found that provide a robust method for estimating the external cost of freight activity in London. The Allen *et al* study is the best available but relies too heavily on generalised multipliers and probably underestimates the contribution of airborne emissions to costs. The other two pieces of literature found are indicative at best. The nature of external costs makes estimating their costs and indeed tackling their causes quite difficult. The cost of externalities generally rises at an exponential rate once a certain threshold has been reached. That is, the cost of each additional bit of impact is greater than the last. The implication of this is that the cost of externalities will be greatest where the background level of congestion, airborne pollution and noise is greatest – where the tipping point has already been, or is about to be, reached.

To complicate this further, attempts to mitigate one cost can give rise to another. For instance, prohibiting early morning deliveries in residential areas requires freight operators to work during peak traffic hours, increasing congestion and consequently emissions. This suggests that balancing the mix of costs may be difficult, especially without a good way of valuing impacts and that solutions may need to be very targeted both in time and space.

Conclusion

London is a growing city. As a result, demand for goods and services will likely grow as the region's roads become more congested. Indeed, Transport for London expects LGV use to grow by 30 per cent by 2031[22]. The good news is that improvements in vehicle standards are likely to drive down some of the harmful airborne emissions emitted by goods vehicles and work towards a solution to the noise problems associated with freight. But technology will not eliminate all problems, particularly the harmful effects of particulate matter from tyres and brakes and carbon dioxide emissions.

The contribution of freight to congestion appears to be its greatest cost. This review has explained how goods vehicle activity is not the same as freight activity and shown that the external cost of freight is likely only a portion of the external cost of goods vehicle use in London. It is unclear how much freight activity is contributing to the growth in light goods vehicle use or if the growth use is actually to conduct other activities, for instance for commuting. More research is needed into this.

Goods vehicles take up a disproportionate amount of road space and can cause much delay if lanes are blocked during deliveries. They are also most active during peak hours when congestion – and therefore emissions – costs are highest. Substantial benefits could be gained by shifting some of this activity to other times. The industry often points to noise restrictions and the demands of customers for the timing of their activities, but what else might be preventing freight activity from taking place at less busy times? If deliveries must be made at peak times, are goods vehicles given sufficient kerbside access?

The evidence suggests that a strategy targeting freight activity will not necessarily result in a reduction in the use of goods vehicles. The review has highlighted the broad range of users of goods vehicles, but has also shown that there is insufficient information to separate the external costs of all of the varied uses of goods vehicles. How can better data be collected on the different uses of LGVs? It is important that LGV data shows not only the use of vehicles but also the industry for which the goods are being moved around rather than only the commodity type.

Large retailers, including supermarkets, tend to control their distribution networks and have been working to reduce costs in their supply chain. But what are small retailers and the hospitality industry doing? In parts of Central London the largest generator of deliveries is mail and parcels, followed by daily supplies of milk and newspapers. These deliveries are small and unlikely to fill a single vehicle and so are likely to be less efficient. The Regent Street study showed how significant the hospitality industry is to freight activity in Central London and the prominence of small deliveries.

The social and economic benefits of goods vehicles have not been examined here, but that value is likely to be extremely high. Even if freight activity generates external costs, do they

[22] Transport for London, Mayor's Transport Strategy, 2010

outweigh the benefits of this activity and how does the balance between the two compare to other road users?

Finally, policies aimed to counter external costs general abide by the 'polluter pays' principle, in which the agent that creates an external cost should pay a tax of the value of that cost. Goods vehicles are subject to much tax already, including excise duty and high petrol taxes. Is this sort of policy appropriate for the external costs identified here?

This review has raised a number of issues around freight activity in London, including many gaps in knowledge and many questions that need to be asked. These issues will need to be addressed to successfully develop policy.

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Vietnamese

Nếu bạn muốn có văn bản tài liệu này bằng ngôn ngữ của mình, hãy liên hệ theo số điện thoại hoặc địa chỉ dưới đây.

Greek

Αν θέλετε να αποκτήσετε αντίγραφο του παρόντος εγγράφου στη δική σας γλώσσα, παρακαλείστε να επικοινωνήσετε τηλεφωνικά στον αριθμό αυτό ή ταχυδρομικά στην παρακάτω διεύθυνση.

Turkish

Bu belgenin kendi dilinizde hazırlanmış bir nüshasını edinmek için, lütfen aşağıdaki telefon numarasını arayınız veya adrese başvurunuz.

Punjabi

ਜੇ ਤੁਹਾਨੂੰ ਇਸ ਦਸਤਾਵੇਜ਼ ਦੀ ਕਾਪੀ ਤੁਹਾਡੀ ਆਪਣੀ ਭਾਸ਼ਾ ਵਿਚ ਚਾਹੀਦੀ ਹੈ, ਤਾਂ ਹੇਠ ਲਿਖੇ ਨੰਬਰ 'ਤੇ ਫ਼ੋਨ ਕਰੋ ਜਾਂ ਹੇਠ ਲਿਖੇ ਪਤੇ 'ਤੇ ਰਾਬਤਾ ਕਰੋ:

Hindi

यदि आप इस दस्तावेज की प्रति अपनी भाषा में चाहते हैं, तो कृपया निम्नलिखित नंबर पर फोन करें अथवा नीचे दिये गये पते पर संपर्क करें

Bengali

আপনি যদি আপনার ভাষায় এই দলিলের প্রতিলিপি (কপি) চান, তা হলে নীচের ফোন্ নম্বরে বা ঠিকানায় অনুগ্রহ করে যোগাযোগ করুন।

Urdu

اگر آپ اِس دستاویز کی نقل اپنی زبان میں چاهتے هیں، تو براہ کرم نیچے دئے گئے نمبر پر فون کریں یا دیئے گئے پتے پر رابطہ کریں

Arabic

إذا أردت نسخة من هذه الوثيقة بلغتك، يرجى الاتصال برقم الهاتف أو مراسلة العنوان أدناه

Gujarati

જો તમને આ દસ્તાવેજની નકલ તમારી ભાષામાં જોઈતી હોય તો, કૃપા કરી આપેલ નંબર ઉપર ફોન કરો અથવા નીચેના સરનામે સંપર્ક સાધો.

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