INTERNALISING THE EXTERNAL COSTS OF LIGHT AND HEAVY GOODS VEHICLES IN LONDON

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ABSTRACT

This paper discusses freight transport activity levels in London. It also presents the results of an analysis of the extent to which the taxes paid by light and heavy goods vehicles (LGVs and HGVs) operating in London cover their environmental, congestion and infrastructure costs through taxes and charges. This analysis was based on vehicle activity levels and costs in 2008. It is estimated that LGV and HGV activity in London in 2008 generated approximately £0.6 billion in nationally-levied fuel duties and road taxes (this comprised fuel duty, VAT on fuel and Vehicle Excise Duty). In addition to these nationally imposed duties and taxes, several other London-specific taxes and charges are also imposed on LGV and HGV operations. These include taxes and charges arising from the London Congestion Charging Scheme, the London Low Emission Zone, the London Lorry Control Scheme penalty charges, parking and loading penalty charges, moving traffic penalty charges, and bus lane penalty charges. It is estimated that in 2008 these London-specific taxes and charges totalled £0.2 billion for LGVs and HGVs. The two most important elements of these charges were parking and loading penalty charges and the London Congestion Charging Scheme (which accounted for 56% and 38% of the total London-specific taxes and charges paid by all goods vehicles).

By comparison, it is estimated that the total external costs of all LGV and HGV operations in London in 2008 are estimated at £0.4 billion when congestion costs are excluded, and £1.8 billion when congestion costs are included. Nationally-imposed taxes and duties are estimated to be equivalent to 155% of these total external costs in London when congestion costs are excluded and 33% when congestion costs are included. When London-specific taxes and charges are also taken into account in addition to nationally-imposed duties and

taxes, these total taxes and charges paid by LGVs and HGVs are estimated to equal 216% of total external costs in London (excluding congestion costs), and 46% of total external costs when congestion costs are included.

Keywords: Urban freight transport, light goods vehicles, heavy goods vehicles, external costs, London.

1. INTRODUCTION

London is the UK's capital city and covers an area of 1579 km² (609 square miles). The economic success of London is dependent on the efficient movement of goods and services as well as people. The London Plan forecasts that by 2025 in London there will be an increase in population of 900,000 to 8.3 million people, together with the creation of more than 847,000 additional jobs (Greater London Authority, 2004). This growth of London will lead to an increase in goods and service vehicle activity in London.

1.1. Goods vehicle and logistics activity in London

London had 16 million square metres of warehousing in 2008. This represents about 10% of the total warehousing space in England and Wales. The south east of England had an additional 19 million square metres of warehousing space, much of which is also used to handle goods to and from London (Department of Local Government and Communities, 2009). In 2007, 179,000 people (4.9% of the London workforce) were directly employed in organisations whose main activity involves freight transport and logistics. An additional 55,000 people (1.5% of the London workforce) was employed in freight and logistics activities in other sectors in 2007. Therefore a total of 6.4% of London's workforce was employed in freight and logistics activities (234,000 people) (Allen et al., 2009).

Road is by far the dominant mode for goods transport in London in terms of the weight of goods lifted. It has been estimated that road was responsible for 89% of freight lifted to, from and within London in 2007 (Allen et al., 2009). London is a net importer, meaning that far more freight is unloaded in London, than loaded.

All goods vehicles (i.e. light goods vehicles – up to 3.5 tonnes gross weight, and heavy goods vehicles – over 3.5 tonnes gross weight) travelled a total of 5.3 billion vehicle kilometres on roads in London in 2008. Eighty per cent of these kilometres were performed by light goods vehicles, 15% by rigid goods vehicles over 3.5 tonnes, and 5% by articulated goods vehicles over 3.5 tonnes. Between 1998 and 2008 vehicle kilometres performed on London's roads by light goods vehicles increased by 25%, while heavy goods vehicle kilometres decreased by 4% (TfL, 2010a).

Vehicle kilometres performed by light goods vehicles (LGVs) and heavy goods vehicles (HGVs) on London's roads accounted for 6% and 4% respectively of all vehicle kilometres performed by these vehicles on British roads in 2008; and 17% and 24% of all vehicle kilometres performed by these vehicles on urban roads in Britain in 2008 (TfL, 2010a; DfT, 2009a).

LGVs and HGVs were responsible for 14% and 3% respectively of the vehicle kilometres travelled by all motorised road vehicles in London in 2008 (TfL, 2010a).

Approximately 142 million tonnes of road freight, carried on journeys by UK-registered vehicles with gross weights of over 3.5 tonnes, had its origin and/or destination in London in 2008. The road freight carried on journeys to, from and within London represented approximately 8% of the total freight lifted in Britain by weight in 2008 (TfL, 2010a; DfT, 2009b). For all journeys within, into and out of London in 2007, 28% of vehicle kilometres were run empty. This compares with an empty running percentage of 27% for all goods vehicle kilometres performed in Britain in 2007 (Allen et al., 2009; DfT, 2008).

There were approximately 250,000 goods vehicles licensed with keeper's addresses in London in 2008. The vast majority of these are LGVs (i.e. up to 3.5 tonnes gross vehicle weight).

1.2. Background to the externalisation of internal costs of goods vehicle activity

Internal costs, sometimes referred to as market or private costs, are the costs borne directly by road freight transport operators. These costs consist of operating costs and capital investments in facilities and vehicles which eventually need to be replaced.

The adverse impacts of LGVs and HGVs impose external costs which are not borne by those who generate this freight traffic but by society as a whole. Hence, externalities are not normally taken into account in the decisions made by transport users. Internalisation measures aim to correct this anomaly by increasing the price of transport services in proportion to all the relevant social and environmental costs generated (Beuthe et al., 2002, Baublys et al., 2005). Placing an appropriate value on external costs of LGV and HGV activity is, therefore, fundamental to their internalisation.

External costs included in this calculation relate to the negative effects of environmental impacts including air pollution, greenhouse gas emissions, noise and accidents. Goods vehicles' contribution to the cost of providing, operating and maintaining road infrastructure is not an externality as such, but has to be calculated to determine its share of road taxation. It is out of the remaining taxes that the environmental should be recovered. For this reason, the calculations in this paper also include LGVs' and HGVs' allocated share of infrastructure costs. Some economists also consider congestion to be an external cost and include it in calculations of total external costs. It is commonly agreed that congestion costs are far

greater than any other category of external cost imposed by road users (House of Commons Transport Committee, 2009 – paragraph 48). However, congestion costs are unlike the costs of environmental damage (such as air pollution) which are imposed on the wider society, and often on future generations. Instead, the cost of congestion is both caused and borne by road users themselves. Therefore, other economists exclude it from calculations of total external costs (House of Commons Transport Committee, 2009 – paragraph 48). Therefore, in this paper we have calculated total external costs both excluding and including congestion costs. See section 2 of the report by Piecyk and McKinnon (2007) for further discussion of these external costs. The results presented in this paper have been derived using the same methodology that was developed as part of the Green Logistics project (Piecyk and McKinnon, 2007).

The 'fair and efficient pricing' policy promoted by the European Commission (EC, 2001 and 2006) aims to ensure that the external costs imposed by road traffic are fully internalised in the price of transport. It argues that pricing should be fair, meaning that those imposing the costs are obliged to pay the marginal social cost of their activities, giving them an economic incentive to reduce the negative effects of these activities (EEA, 2006). At an EU level, freight movement by all modes is responsible for a third of the total external costs of transport, with the movement of people accounting for the rest (INFRAS, 2004).

The purpose of the remainder of this paper is to estimate the total external costs imposed by LGV and HGV traffic in London and to measure the degree to which these externalities are currently internalised by duties, taxes and charges paid by these goods vehicle users. An estimate of the total cost of externalities imposed by foreign-registered HGVs operating in London has also been made.

In order to produce this analysis, LGVs were segmented into several categories based on three key attributes that affects the vehicle usage, fuel consumption, and emissions rates of the vehicles:

- Ownership (company- and privately-owned)
- Propulsion (petrol and diesel powered)
- Weight (up to 1.8 tonnes gross weight, and 1.8 – 3.5 tonnes gross weight)

This LGV segmentation is further discussed in Allen and Browne (2008).

In the analysis presented in this paper, HGVs have been segmented into six categories of rigid and articulated vehicles based on gross vehicle weights:

- Rigid vehicles
  - Over 3.5 tonnes to 7.5 tonnes
  - Over 7.5 tonnes to 17 tonnes
  - Over 17 tonnes to 25 tonnes
  - Over 25 tonnes
- Articulated vehicles
  - Over 3.5 tonnes to 33 tonnes
  - Over 33 tonnes

A report produced as part of the Green Logistics project has calculated the external costs of LGV operations in Britain, and compared these with the external costs of HGV operations at a national level (Allen, Piecyk and McKinnon, 2008).

2. INTERNALISATION OF THE EXTERNAL COSTS IMPOSED BY BRITISH-REGISTERED FREIGHT VEHICLES IN LONDON

2.1. National taxes and charges borne by vehicle operations in London

A small proportion of LGVs run on petrol (approximately 6% of the British LGV fleet) while the vast majority run on diesel. HGVs are powered by diesel. In the UK ultra-low sulphur diesel and petrol are liable for fuel duty and for Value Added Tax (VAT) at a rate of 17.5% of the full retail price. Additionally, vehicle ownership incurs Vehicle Excise Duty (VED). Apart from one motorway link and a few tolled bridges and tunnels, there are no direct infrastructure charges in Britain.

The following calculations were based on the average retail fuel prices at 1st July 2008 – 132.98 pence per litre (ppl) and 119.62 ppl, respectively for diesel and petrol (BERR, 2008). Bulk prices as at 1st July 2008 are estimated to be 125.81 ppl and 117.22 ppl respectively for diesel and petrol, based on information about differences in bulk and retail prices for both fuels in 2006 (FTA, 2006). An assumption that 80% of fuel used will be purchased in bulk by drivers of HGVs and company-owned LGVs, and 50% purchased in bulk by drivers of privately-registered LGVs. A duty rate of 56.94 ppl for diesel and 53.65 ppl for petrol at the 2008 level has been used to ensure the same base year for all calculations (BERR, 2009).

Although most LGV and HGV operators are VAT-registered and can recover this tax through VAT transactions, VAT passes along the supply chains and it is finally borne by one of the direct or indirect transport users. Hence, VAT is included in the estimate of the income generated by duties and taxes from LGVs and HGVs.

Estimates of the annual distance travelled by LGVs and HGVs in London obtained from TfL are based on road traffic counts (TfL, 2010a), and have been used to calculate the amount of these taxes related to road freight activity in London. The vehicle kilometres travelled affects estimates of the total fuel duty and VAT on fuel collected from road freight operators. However, in reality these taxes are collected by the national government and do not accrue to London's government.

VED is paid nationally per vehicle per annum, and is therefore unaffected by distance travelled. In order to calculate VED for road freight in London, we have calculated the VED paid by road freight vehicles with keepers addresses in London (although this revenue accrues to the national government rather than London's government). Obviously, far more road freight vehicles visit London to perform work than are kept in London. Therefore an

alternative method for calculating London's VED is to calculate the proportion of all national road freight activity that takes place in London and allocate this same proportion of national road freight VED to London. This method produced similar results to the first method.

It is estimated that LGV activity in London in 2008 resulted in £349 million of government revenue in fuel duty, VAT and VED. Fuel duty, VAT and VED were responsible for 74%, 29% and 11% of this revenue respectively (Table 1).

Table 1. Nationally-imposed duties and taxes generated by LGV operations in London in 2008 (£ million)

	LGVs (up to 1.8 t gvw)	LGVs (1.8 – 3.5 t gvw)	All LGVs
Fuel duty	50.5	176.5	**227.0**
VAT (17.5%)	19.8	69.2	**89.1**
VED	7.7	25.3	**33.1**
Total	**78.0**	**271.1**	**349.1**

It is estimated that HGV activity in London in 2008 resulted in £262 million of government revenue in fuel duty, VAT and VED in London. Fuel duty, VAT and VED were responsible for 69%, 27% and 4% of this revenue respectively (Table 2).

Table 2. Nationally-imposed duties and taxes generated by HGV operations in London in 2008 (£ million)

	Rigid HGVs				Articulated HGVs		All HGVs
	Over 3.5-7.5 t	Over 7.5-17 t	Over 17–25 t	Over 25 t	Over 3.5-33 t	Over 33 t	
Fuel duty	48.5	16.8	20.0	41.5	6.5	46.7	**180.0**
VAT (17.5%)	19.0	6.6	7.8	16.2	2.5	18.3	**70.4**
VED	1.7	0.7	2.0	3.7	0.3	3.2	**11.6**
Total	**69.1**	**24.1**	**29.8**	**61.4**	**9.3**	**68.2**	**261.9**

Table 3 shows the comparison of the estimates of fuel duty, VAT and VED generated by LGV and HGV operations in London in 2008.

Table 3. Nationally-imposed duties and taxes generated by goods vehicle operations in London in 2008 (£ million)

	LGVs	HGVs	All goods vehicles
Fuel duty	227.0	180.0	**407.0**
VAT (17.5%)	89.1	70.4	**159.5**
VED	33.1	11.6	**566.5**
Total	**349.1**	**261.9**	**726.0**

2.2. London-specific taxes and charges borne by goods vehicle operations

There are several additional transport schemes and measures that can result in charges and taxes being applied to light and heavy goods vehicles in London. These are:

- London Congestion Charging Scheme
- London Low Emission Zone
- London Lorry Control Scheme penalty charges
- Parking and loading penalty charges
- Moving traffic penalty charges
- Bus lane penalty charges

London Congestion Charging Scheme

The London Congestion Charing Scheme was introduced in 2003 and extended to western London in 2007. The charge is intended to deter a proportion of less-essential traffic from entering the charging zone and thereby encourage public transport, walking and cycling. A charge of £8 per day is made for cars, vans and lorries entering the charging zone from Monday to Friday between 07:00 and 18:00 (£7 per day for pre-registered fleet vehicles). The Congestion Charging Scheme has a penalty charge of £120 per vehicle that has not paid the Congestion Charge (reduced by 50% if paid within 14 days) (TfL, 2009a). The scheme is run by Transport for London (TfL).

In the financial year 2007/2008 the London Congestion Charging Scheme had a total revenue of £268 million (this included charges paid and enforcement penalties imposed on vehicles) (House of Commons Transport Committee, 2009 - chapter 4). Buses, taxis, and motorbikes are exempt from the Congestion Charge. However, cars, LGVs and HGVs are subject to the Congestion Charge. Of these three vehicle types, LGVs accounted for approximately 26% and HGVs for 8% of vehicles entering the charging zone in 2007/8 (TfL, 2010b). It can therefore be estimated that in 2007/8 the amount paid by LGVs and HGVs in congestion charges and penalty charge notices was equivalent to approximately £70.4 million and £20.6 million per year respectively.

London Low Emission Zone

A Low Emission Zone (LEZ) was introduced in London in February 2008. The London LEZ scheme seeks to improve air quality in London by requiring vehicle operators to meet minimum emission standards – based on the 'Euro' emissions classification. It covers virtually the whole of Greater London. It currently only applies to HGVs (over 3.5 tonnes), and buses and coaches over 5 tonnes. Vehicles that do not comply with the stipulated emissions standards must pay a daily charge of £200. The Low Emission Zone has penalty charges of £500-£1000 per non-compliant vehicle that has not paid the daily charge depending on vehicle type and weight (reduced by 50% if paid within 14 days) (TfL, 2009b). The scheme is run by TfL.

The set-up costs for the London LEZ scheme were estimated at £50 million. Operating costs were estimated at £80 million (present value to 2015-16) while the scheme was estimated to generate revenues of £5 million to £7 million per annum. The LEZ is, according to the Office of National Statistics, a tax rather than a charge, as no benefit accrues to the payer (House of Commons Transport Committee, 2009 - chapter 4)

The number of compliant vehicles entering the zone each day is approximately 180,000 unique HGVs over 12 tonnes and 130,000 unique HGVs (3.5 -12 tonnes), buses and coaches (TfL, 2010b). Data for September 2009 shows that 98% of HGVs over 12 tonnes with the LEZ scheme 96% of HGVs from 3.5 -12 tonnes and buses and coaches over 3.5 tonnes were compliant (TfL, 2010b). Non-compliant vehicles include some exempted categories as well as those who pay the daily charge or PCN. This suggests that HGV operators provide annual revenue of approximately £4.7 million in charges.

London Lorry Control Scheme penalty charges

The London Lorry Control Scheme is an environmental control on the use of HGVs with a maximum gross weight over 18 tonnes. The aim of the scheme is to reduce noise pollution on residential roads overnight and at the weekends. The penalty charge for vehicles operating without permits or operating in locations not allowed by their routeing agreements is currently £550 for hauliers and £120 for drivers. These charges are reduced by 50% if paid within 14 days (London Councils, 2010a).

In 2008/9 London Councils issued a total of 2918 penalty charge notices (PCNs) to HGV operators and 526 penalty charge notices to HGV drivers as part of the London Lorry Control Scheme (London Councils, 2010b). This was equivalent to a total charge on HGVs of approximately £1.0 million in 2008 (assuming that half of the PCNs were paid within 14 days and were therefore charged at the discounted rate).

Parking and loading penalty charges in London

Parking and loading enforcement in London is carried out to: i) keep London moving, ii) maintain the safety of all road users (including pedestrians), and iii) ensure the limited amount of space available for parking is available for those who need it (London Councils, 2010c).

PCNs are issued by enforcement officers and by camera. Since 2007, parking and loading fines in London are based on a two tier system scheme which reflects the seriousness of the contravention. Serious contraventions include parking/loading at bus stops, on pedestrian crossings, or in the safety zones outside schools. Serious contraventions receive a higher penalty of £120 in central London and £100 in outer London. Lesser contraventions receive a penalty charge of £80 in central London, and £60 in outer London. These penalties are reduced by 50% if paid within 14 days.

Using data made available by London Councils on parking and loading PCNs it is possible to estimate the total level of these charges levied on LGVs and HGVs in 2008/9 (London Councils, 2010b). The London Councils data does not disaggregate PCNs by type of vehicle. However, of all the parking and loading PCNs issued by TfL (via wardens and cameras) on the Transport for London Road Network (TLRN) in 2008, LGVs received 25% and HGVs 13% (Allen et al., 2009). Assuming that the same proportion of parking and loading PCNs are issued to LGVs and HGVs in all London boroughs, it can be estimated that the amount paid by LGVs and HGVs in parking and loading fines in 2008/9 was equivalent to approximately £89.5 million and £44.7 million per year respectively.

Moving traffic and bus lane penalty charges in London

Penalty charge notices are also issued for moving traffic and bus lane offences by LGVs and HGVs in London. All penalty charge notices are issued by camera and are all issued at the serious contravention rate of £120 in central London and £100 in outer London. These penalties are reduced by 50% if paid within 14 days.

Using data made available by London Councils on moving traffic and bus lane PCNs it is possible to estimate the total level of these charges levied on LGVs and HGVs in 2008 (London Councils, 2010b). The London Councils data does not disaggregate PCNs by type of vehicle. If it is assumed that these fines are issued in proportion to the level of vehicle activity by different types of vehicle and that half of all PCNs are paid within 14 days (and therefore attract the discounted rate) then it is possible to estimate the total cost of moving traffic and bus lane fines issued to LGVs and HGVs. It is estimated that in 2008/9 LGVs and HGVs paid moving traffic fines in London of approximately £6.3 million and £1.5 million respectively. It is estimated that in 2008/9 LGVs and HGVs paid bus lane fines in London of approximately £2.6 million and £0.6 million respectively.

Table 4 shows a summary of these estimates of the London-specific taxes and charges imposed on LGVs and HGVs in 2008. It is estimated that in 2008 these totalled £169 million for LGVs and £73 million for HGVs. The two most important elements of these charges were parking and loading penalty charges and the London Congestion Charging Scheme (which accounted for 56% and 38% of the total London-specific taxes and charges paid by all goods vehicles).

Table 4. Estimate of London-specific taxes and charges borne by goods vehicle operations in 2008 (£ million)

Scheme	LGVs	HGVs	All goods vehicles
London Congestion Charging Scheme	70.4	20.6	**91.0**
London Low Emission Zone	0.0	4.7	**4.7**
London Lorry Control Scheme penalty charges	0.0	1.0	**1.0**
Parking and loading penalty charges	89.5	44.7	**134.2**
Moving traffic penalty charges	6.3	1.5	**7.8**
Bus lane penalty charges	2.6	0.6	**3.2**
Total	**168.8**	**73.1**	**241.9**

Table 5 shows the estimated taxes and charges paid by LGVs and HGVs operations in London in 2008, taking into account both nationally-imposed and London-specific duties, taxes and charges.

Table 5. All taxes and charges generated from goods vehicle operations in London in 2008 (£ million)

	LGVs	HGVs	All goods vehicles
National duties and taxes	349.1	261.9	**611.0**
London-specific taxes and charges	168.8	73.1	**241.9**
Total duties and taxes	**517.9**	**335.0**	**852.9**

2.3. External cost of LGV and HGV operations in London

A spreadsheet has been constructed based on freight and traffic data from the government's Company Van Survey (DfT, 2004a), Survey of Privately-Owned Vans (DfT, 2004b), the National Road Traffic Survey (NRTS) (DfT, 2007a), traffic data from TfL (TfL, 2010a) and Vehicle Licensing Statistics data (DfT, 2009c; DfT 2008). It models the relationship between UK-registered LGV and HGV activity in London and a series of freight transport-related externalities, including climate change, air pollution, noise and accidents. The costs of congestion associated with this level of vehicle activity have also calculated.

The estimates of noise, accident, infrastructure and congestion costs are based on valuations provided by the DfT and used in a government report on the external costs of food distribution in the UK (DEFRA, 2007) (Table 6). These cost values were originally expressed in 2005 prices and have been rebased to 2008 values using Gross Domestic Product (GDP) data.

Table 6. Infrastructure, noise, congestion and accident costs on urban roads (pence per km - 2008 prices)

	External costs on urban roads (pence per km)
INFRASTRUCTURE	
LGV	0.10
Rigid HGV: over 3.5 tonnes to 7.5 tonnes	2.50
Rigid HGV: over 7.5 tonnes to 17 tonnes	5.39
Rigid HGV: over 17 tonnes to 25 tonnes	7.70
Rigid HGV: over 25 tonnes	13.37
Articulated HGV: over 3.5 tonnes to 33 tonnes	9.67
Articulated HGV: over 33 tonnes	17.30
NOISE	
LGV	0.33
Rigid HGV	1.28
Articulated HGV	2.43
CONGESTION	
LGV	20.26
Rigid HGV	44.55
Articulated HGV	74.52
ACCIDENTS	
LGV	2.05
Rigid HGV	7.01
Articulated HGV	5.63

The estimates of air pollution emissions and carbon release were derived from the National Atmospheric Emissions Inventory (NAEI). The cost of carbon emissions was calculated using the values quoted by DEFRA (2007). The 'Air Quality Damage Cost Guidance' report (DEFRA, 2006) was used to calculate the cost of PM10, NOx and SO2 emissions. The 'Mode Shift Benefit Values' report (DfT, 2009d) was the source of cost data on VOCs emissions. All these costs were updated to 2008 in accordance with changes in GDP (see Table 7).

Table 7. Air pollution costs (£ per tonne - 2008 prices)

	Low	Medium	High
Carbon	23	26	31
PM urban	76,994	94,370	111,746
VOCs	29	37	42
NOx	724	930	1056
SO2	1,284	1,590	1,805

The total external costs of LGV activity in London in 2008 (both including and excluding congestion costs) are shown in Table 8. The total external costs excluding congestion (i.e. only including environmental and infrastructural costs) were estimated to be £159 million,

while the total external costs including congestion were estimated to be £1022 million. The results indicate that when congestion costs are omitted, accidents were the most important cost category accounting 54% of total costs, followed by emissions (33%), noise (9%), and infrastructure (3%). However, when congestion costs are included they accounted for 84% of total external costs, far exceeding any other cost category. LGVs with a gross weight of 1.8 - 3.5 tonnes can be seen to be responsible for a far higher proportion of total external costs than LGVs with a gross weight of up to 1.8 tonnes. This is due to the fact that these heavier LGVs are responsible for the majority of vehicle kilometres performed by LGVs in London.

Table 8. Total external costs of LGV operations in London in 2008 (£ million)

	LGVs (up to 1.8 t gvw)	LGVs (1.8 – 3.5 t gvw)	All LGVs
Total external costs (excluding congestion)	39	120	**159**
Total external costs (including congestion)	290	733	**1022**

The total external costs of HGV activity in London in 2008 (both including and excluding congestion costs) are shown in Table 9. The total external costs excluding congestion (i.e. only including environmental and infrastructural costs) were estimated to be £235 million, while the total external costs including congestion were estimated to be £822 million. The results indicate that when congestion costs are omitted, infrastructure was the most important cost category accounting 42% of total costs, followed by accidents (31%), emissions (19%), and noise (8%). However, when congestion costs are included they accounted for 71% of total external costs, far exceeding any other cost category. The two types of HGV that are responsible for the greatest proportion of HGV external costs are rigid vehicles with a gross weight of 3.5 – 7.5 tonnes, and articulated vehicles with a grow weight of over 33 tonnes. This is due to the high proportion of all HGV vehicle kilometres accounted for by these vehicle types. However, these articulated vehicles over 33 tonnes gross weight carry have lower external costs per tonne-km, when the quantity of freight they lift and their loading factor and empty running rates are taken into account.

Table 9. Total external costs of HGV operations in London in 2008 (£ million)

	Rigid HGVs				Articulated HGVs		All HGVs
	Over 3.5-7.5 t	Over 7.5-17 t	Over 17–25 t	Over 25 t	Over 3.5-33 t	Over 33 t	
Total external costs (exc. congestion)	59	20	23	47	8	77	**235**
Total external costs (inc. congestion)	243	68	75	128	37	270	**822**

The total external costs of all LGV and HGV operations in London have been estimated at £0.4 billion excluding congestion costs, and at £1.8 billion when congestion costs are included (Table 10).

Table 10. Total external costs of LGV and HGV operations in London in 2008 (£ million)

	LGVs	HGVs	Total
Total external costs (excluding congestion)	159	235	**394**
Total external costs (including congestion)	1022	822	**1844**

Table 11 shows the proportion of total external cost accounted for by emissions, infrastructure, noise, congestion, and traffic accidents for LGV and HGV operations in London based on the medium emissions cost values. Congestion comprises a greater proportion of total external costs for LGVs than for HGVs (but it is also by far the greatest cost category for HGVs). Infrastructure costs are the second most important cost category for HGVs, but the least important for LGVs. When congestion costs are not included, costs associated with greenhouse gases represent 7% and 5% of the total external costs of LGV and HGV operations in London respectively.

Table 11. Importance of external cost categories for LGV and HGV operations in London (using medium emission cost values) in 2008 (proportion of total external cost)

	Excluding congestion costs		Including congestion costs	
	LGVs	**HGVs**	**LGVs**	**HGVs**
Emissions	34%	19%	5%	6%
Infrastructure	3%	42%	0%	12%
Noise	9%	8%	1%	2%
Congestion	-	-	84%	71%
Accidents	55%	31%	9%	9%
Total	**100%**	**100%**	**100%**	**100%**

2.4. External cost of road freight operations in London

However, whereas HGVs are used almost entirely for the collection and delivery of goods, LGVs perform a wide range of other activities in addition (this includes providing a wide range of commercial services to establishments, for commuting to and from work, and for personal trips). LGV trips can therefore be subdivided into categories based on the trip type (i.e. whether the trip is primarily carried out for to collect or deliver goods or not – “goods” or “non-goods”) and the trip purpose (i.e. whether the trip is for commercial or personal reasons). This classification is more fully described in another report (see Allen and Browne, 2008). Using this LGV trip type/purpose approach LGV trips can be divided into four options: i) Commercial goods trips, ii) Commercial non-goods trips (i.e. service-related trips), iii) Personal goods and non-goods trips (i.e. shopping trips, leisure trips and trips to friends and relatives). Commercial non-goods trips can be further disaggregated into commuting trips

(i.e. journeys to and from work) and all other commercial non-goods trips ((including service-related trips, and the carrying of personnel), giving a total of five types/purposes for LGV trips. Table 12 provides an estimate of the proportion of total LGV vehicle kilometres associated with each of these LGV trip types/purposes for company- and privately-owned LGVs in Britain.

Table 12. Estimate of the proportion of total LGV vehicle kilometres accounted for by trip type/purpose

Trip type/purpose	Company-owned LGVs	Privately-owned LGVs	All LGVs
Commercial: goods (i.e. delivery/collection)	34%	23%	30%
Commercial: non-goods (i.e. service)	30%	15%	25%
Commuting	32%	45%	36%
Personal: goods and non-goods	4%	17%	8%
Total	**100%**	**100%**	**100%**

Note: Company-owned LGV data is average for 2003-2005. Privately-owned LGV data is for October 2002-September 2003.

Table 12 shows that LGV commercial goods trips (i.e. those involved primarily with the collection and delivery of goods) only account for 34% and 23% of LGV vehicle kilometres for company- and privately-owned LGVs respectively. Commuting accounts for 36% of all LGV vehicle kilometres, while commercial non-goods trips (i.e. service-related trips) account for 25% of all LGV vehicle kilometres. Personal trips account for 8% of all LGV vehicle kilometres.

Analysis of trip types/purposes for company-owned LGV trips in London from the 2003-2005 Company Van Survey indicate that using this national data for producing the London external cost estimate is acceptable as, in the case of company-owned LGVs, the proportion of kilometres accounted for by different trip types/purposes is broadly comparable. This analysis shows that specifically for trips to, from and within London by company-owned LGVs, commuting trips accounted for 38% of vehicle kilometres (compared with 32% nationally), and commercial goods and commercial non-goods trips each accounted for 29% of vehicle kilometres (compared with 34% and 30% of vehicle kilometres nationally).

Table 13 shows the estimated LGV external cost estimates for London operations associated with these five LGV trip types/purposes when congestion costs are included and excluded. This estimate has made use of the national proportions of total LGV vehicle kilometres for each of the five trip types/purposes shown in Table 12.

Table 13. Total external costs of LGV operations in London by trip type/purpose in 2008 (£ million)

Trip type/purpose	Excluding congestion costs	Including congestion costs
Commercial: goods (i.e. delivery/collection)	48	307
Commercial: non-goods (i.e. service)	40	256
Commuting	57	368
Personal: freight and non-freight	13	82
Total	**159**	**1022**

Table 14 compares the external costs associated with LGV commercial goods trips (i.e. collection and delivery of goods) with HGV trips in order to provide an estimate of the external costs associated with goods transport activity by LGVs and HGVs.

Table 14. Total external costs of LGV and HGV commercial goods transport in London in 2008 (£ million)

	LGVs	HGVs	Total
Commercial goods trips inc. congestion costs	48	235	**283**
Commercial goods trips exc. congestion costs	307	822	**1129**

It is estimated that the total external costs of road goods transport activity in London in 2008 were £0.3 billion excluding congestion costs, and £1.1 billion when congestion costs are included. HGVs accounted for 83% of these external costs and LGVs for 17% when congestion cost are excluded. When congestion costs are included, HGVs accounted for 73% of these external costs and LGVs for 27%. This compares with the estimate of the total external costs of all LGV and HGV activity in London in 2008 of £0.4 billion excluding congestion costs (of which LGVs accounted for 40% and HGVs 60%), and £1.8 billion when congestion costs are included (of which LGVs accounted for 55% and HGVs 45%).

2.5. Degree of Internalisation of external costs by LGV and HGVs in London

When taking into account only environmental and infrastructure costs (i.e. excluding congestion costs) LGVs covered 219%, and HGVs 111% of the total external costs in nationally-imposed duties and taxes in London in 2008.

If congestion costs are included, the nationally-imposed duties and taxes contributed by LGV and HGV operators covered, on average, only 34% and 32% respectively of their total external costs in London in 2008 (Table 15).

When London-specific taxes and charges are also taken into account together with the London share of nationally-imposed duties and taxes, LGVs covered, on average, 326%, and HGVs 143% of their allocated infrastructural and environmental costs in total taxes and duties in London in 2008 (i.e. excluding congestion costs). If congestion costs are included, LGVs and HGVs covered, on average, 51% and 41% respectively of the total external costs they imposed in London in 2008. (Table 15).

Table 15. Proportion of external costs covered by duties and taxes for LGVs and HGVs in London in 2008

	LGVs	HGVs	Total (LGVs + HGVs)
Taking into account national duties and taxes only			
Total external costs exc. congestion costs	219%	111%	155%
Total external costs inc. congestion costs	34%	32%	33%
Taking into account national and London duties and taxes			
Total external costs exc. congestion costs	326%	143%	216%
Total external costs inc. congestion costs	51%	41%	46%

The extent to which the duties and taxes paid by LGVs and HGVs covered the total external costs (both including and excluding congestion costs) that they imposed in London are shown in Figure 1 (taking account of national duties and taxes as well as London-specific taxes and charges). The results reflect the importance of congestion costs in the total external costs that HGVs and LGVs impose in London. These congestion costs can be seen to be especially important in the case of LGVs.

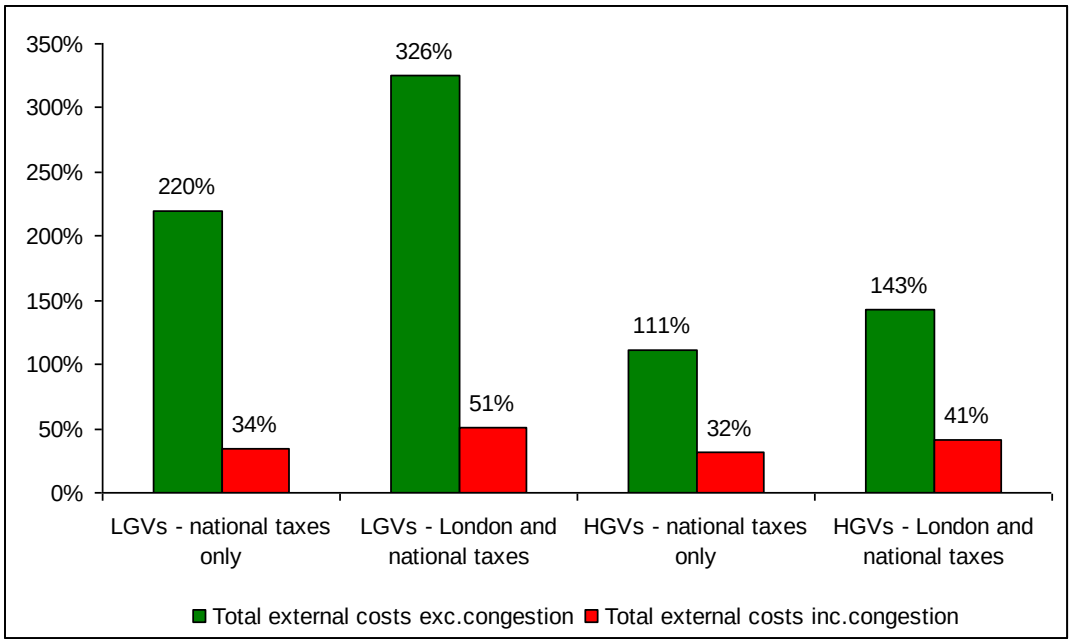

Figure 1. Internalisation of external costs by HGVs and LGVs in London in 2008

Also, in the light of recent re-assessments of the impact of climate change, these estimates of the degree of internalisation may turn out to be too optimistic. New research on the economics of climate change suggests that this element of external costs may have a significantly higher value than previously assumed. If so, the tax-to-cost ratio would be lower than calculated, reinforcing the case for sustainability measures to reduce the environmental damage done by road freight transport. The Stern report suggests that the cost of carbon should be around £265 per tonne in 2006 prices – roughly ten times higher than the medium value of the social cost of carbon factored into the above calculations.

3. EXTERNAL COSTS IMPOSED BY FOREIGN REGISTERED VEHICLES

The estimates of the external costs and their internalisation reported in Section 2 are based solely on the activities of UK-registered LGVs and HGVs. A significant proportion of HGV activity in the UK is undertaken by foreign-registered vehicles and this share has risen sharply over the past decade. According to recent estimates compiled by the DfT, the number of foreign-registered goods vehicles travelling each year between Britain and mainland Europe grew from 268,200 in 1985 to over 1.5 million in (DfT, 2007b). This foreign HGV activity imposes an additional burden on the UK environment and transport infrastructure. This negative impact needs to be evaluated and included in the estimates of the external costs associated with road freight transport in London. As foreign trucks pay no vehicle excise duty in the UK and very little fuel duty, the degree to which their external costs

are internalised in London is likely to be very much lower than that of UK-registered goods vehicles.

This section estimates the external costs imposed by foreign-registered HGVs (i.e. goods vehicles over 3.5 tonnes) travelling in London (both vehicles making collections and/or deliveries in London, and transit traffic. The methodology and cost estimates were the same as those used for the analysis of British-registered HGVs presented earlier in this paper. Foreign-registered LGVs have been omitted from the estimates as no data is available about the penetration of these vehicles. However, the proportion of foreign-registered LGVs operating in London is expected to be far smaller than is the case among HGVs.

A roadside vehicle number plate survey in December 2005 carried out on behalf of TfL, at 36 sites across the capital identified that, on average, 2% of HGVs were foreign-registered (results sites ranged from 0.1% to 4.7% - TfL, 2007). It has been assumed that 2% of foreign-registered goods vehicles carry out 2% of road freight vehicle kilometres in London. This represented 21.5 million vehicle kilometres of HGV activity by foreign-registered vehicles in London in 2008.

The Survey of Foreign Vehicle Activity in Great Britain (FVA) carried out by the DfT in 2003 (DfT, 2003) provided data about the kilometres travelled by different weight categories of foreign HGVs in Britain. This survey showed that the vast majority of the total kilometres travelled by foreign-registered HGVs were performed by vehicles over 38 tonnes gvw. The proportion of total distance travelled by foreign HGVs in Britain by the various weight categories used in the FVA survey was applied to the estimated foreign vehicle kilometres for London. It was then necessary to convert the HGV weight categories used in the FVA survey to the weight categories used in this study. This produced an estimate that foreign-registered rigid goods vehicles over 25 tonnes gvw performed 4.7 million kilometres, and foreign-registered articulated goods vehicles performed 16.8 million kilometres in London in 2008.

The estimates of the total external costs of foreign HGV activity in London in 2008 are presented in Table 16. These external costs range are estimated to be £5.7 million when congestion costs are excluded and £20.0 million when congestion costs are included.

Table 16. Total external costs of foreign-registered HGV operations in London in 2008 (£ million)

	Foreign-registered HGVs
Total external costs (excluding congestion)	5.7
Total external costs (including congestion)	20.0

When congestion is included in total external costs it constitutes 71% of their external costs, followed by infrastructure wear (17%), accidents (6%), pollutant emissions (3%) and noise (2%).

Eighty-three per cent of foreign HGVs spend less than two days in Britain per visit and 93% of visits last three or fewer days (DfT, 2003). Given the average distance travelled per visit (640 km), foreign-registered HGVs can undertake almost all their haulage work in the UK using fuel purchased outside the country. As the average price of diesel fuel in France, Belgium and the Netherlands was 28% lower in 2006 than in Britain (McKinnon, 2007), foreign carriers have a strong financial incentive to fill their tanks before entering Britain. As a consequence, hardly any of the external costs imposed by foreign trucks in Britain (and London) are currently internalised. It is not known what proportion of the fuel consumed by foreign HGVs in Britain is actually purchased here. As this is likely to be very low, however, it can be safely assumed that the level of internalisation is minimal. If the estimated 21.5 million vehicle kilometres run by foreign-registered lorries in London in 2008 had been run using diesel fuel purchased in Britain at an average level of fuel efficiency, an extra £4.5 million in fuel duty would have been raised for the UK Exchequer. Full internalisation of the external costs of foreign-HGV activity in London would have raised around £20 million in taxes.

4. CONCLUSIONS

It is estimated that in 2008, approximately £349 million was generated in nationally-imposed duties and taxes from LGV operations in London, and £262 million from HGV operations in London. This comprised fuel duty, VAT on fuel and Vehicle Excise Duty. Fuel duty accounted for the majority of these national duties and charges.

In addition to these nationally imposed duties and taxes, several other London-specific taxes and charges are also imposed on LGV and HGV operations. These include taxes and charges arising from the London Congestion Charging Scheme, the London Low Emission Zone, the London Lorry Control Scheme penalty charges, parking and loading penalty charges, moving traffic penalty charges, and bus lane penalty charges. It is estimated that in 2008 these totalled £169 million for LGVs and £73 million for HGVs. The two most important elements of these charges were parking and loading penalty charges and the London Congestion Charging Scheme (which accounted for 56% and 38% of the total London-specific taxes and charges paid by all goods vehicles).

This paper has provided estimates of the total external costs of LGV and HGV operations in London. In 2008, the total external costs of all LGV and HGV operations in London have been estimated to be £0.4 billion when congestion costs are excluded, and £1.8 billion when congestion costs are included. When LGV activity that does not involve the transport of goods is excluded, it is estimated that the total external costs of road goods transport activity in London in 2008 by LGVs and HGVs were £0.3 billion excluding congestion costs, and £1.1 billion when congestion costs are included.

LGVs covered 219%, and HGVs 111%, of their total external costs (excluding congestion costs) in nationally-imposed duties and taxes in London in 2008. If congestion costs are included, the nationally-imposed duties and taxes contributed by LGV and HGV operators covered, on average, only 34% and 32% respectively of their total external costs in London.

When London-specific taxes and charges are also taken into account together with the London share of nationally-imposed duties and taxes, LGVs covered, on average, 326%, and HGVs 143% of their total external costs (excluding congestion costs)in total taxes and duties in London in 2008. If congestion costs are included, LGVs and HGVs covered, on average, 51% and 41% respectively of the total external costs they imposed in London in 2008.

Fuel duties and taxes on LGV and HGV use in Britain are very high by international standards. LGVs and HGVs currently pay significantly more tax than required to cover their environmental costs and share of road infrastructure costs in London (especially when both national and London-specific taxes and charges are taken into account). However, LGV and HGV taxes and charges (national and London-specific) would still need to be increased substantially to fully internalise the congestion costs generated in London.

This paper has only considered LGVs and HGVs. However, information from the Department for Transport suggests that in the case of cars the situation is similar at a national level to that shown in this paper for LGVs and HGVs in London, with the national taxes and duties paid per kilometre covering the marginal external costs per kilometre, other than for congestion (DfT, 2009e). This Department for Transport information indicates that for cars, as for LGVs and HGVs, congestion costs are responsible for by far the greatest proportion of total external costs. The Department for Transport estimates that congestion costs are responsible for 85% of the average marginal external cost of driving a car an additional kilometre. The Department notes that the congestion costs for cars vary considerably with traffic conditions, “from 0p/km on quiet rural roads to £1.95/km on the most congested roads in conurbations”. By contrast, car drivers pay 3.6p per kilometre in fuel duty and VAT (DfT, 2009e).

Efforts to further internalise congestion costs in London (or nationally) would be likely to have different effects on LGVs and HGVs compared to cars, due to the elasticity of demand of these different types of vehicles. In the case of LGVs and HGVs, operators would attempt to improve vehicle efficiency in order to reduce total vehicle kilometres and to shift operations to off-peak where possible if faced with new forms of congestion charging. However, the vast majority of LGV and HGV activity would be likely to continue as it was prior to the introduction of the charges due to the fact that goods and services need to be delivered and collected to meet the needs of customers. Instead, LGV and HGV operators would look to pass these congestion costs onto their customers. By comparison, a much greater proportion of non-essential car travel would be expected to cease following the introduction of congestion charging. This predicted response by LGVs and HGVs to congestion charging compared with cars is broadly what was witnessed after the introduction of the London Congestion Charging Scheme, with car traffic falling by a far greater proportion. Therefore policymakers seeking to reduce congestion by internalising the costs it generates need to be mindful of these likely responses by LGV and HGV operators compared with car users, and to accept that attempting to reduce all types of road traffic by similar proportions is not necessarily a sensible or attainable goal.

The gradual upgrading of the LGV and HGV fleet to higher Euro emission standards and steady improvements in fuel efficiency will reduce the total value of emission-related externalities. Increases in official estimates of the social cost of carbon and in the level of traffic congestion in London, however, will tend to counteract this downward pressure on external costs. It is difficult to predict what the net effect of these conflicting cost pressures will be on the future degree of internalisation. The issue would be further complicated by the inclusion of road freight operations in the European Emissions Trading Scheme as has been recently discussed by Raux and Alligier (2007).

Awareness of the full costs of freight transport and service operations should help businesses to plan and manage their requirements in a way that achieves longer term sustainability. Nationally, this may involve greater use of alternative modes, more localised sourcing, improved vehicle utilisation and even some relaxation of current just-in-time scheduling. If the higher freight costs associated with greater internalisation are passed down the supply chain, the purchasing behaviour of final consumers should also become more sensitive to the environmental impact of the distribution operations that keep them supplied with goods and services. However, collection and delivery work as well as service provision in urban areas is dominated by road-based transport. This is likely to continue to be the case in future, with relatively little scope for a major increase in the use of non-road modes for these trips in towns and cities. There is though, substantial potential for the use of cleaner vehicles and greater out-of-hours working.

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