

Metropolitan Transport Research Unit

Heavy Lorries -
do they pay for the
damage they cause?

April 2008



Contents

Summary of Findings

- 1 Introduction
- 2 The two basic approaches to road use costs and charges
- 3 Calculating all the external costs of road use
- 4 Tax revenues – specific charges or general taxation?
- 5 Do HGVs meet their external costs?

Annex A

Example calculation of damage factors using 4th power law

Summary of Findings

Do HGVs pay their way?

The conclusions of this study are as follows:

- 1 There is a wide range of studies in the UK and Europe which have used different assumptions about costs and about which taxes and charges paid by HGVs should be set against them. The different approaches have produced significantly different levels of road damage, congestion and environmental costs for HGVs in the UK.
- 2 Despite this, even using the assumptions which are most favourable to HGVs and leaving out congestion, no study shows that tax revenues from HGVs cover their UK costs except on motorways.
- 3 Current cost estimates in the UK used for comparing rail and road freight (the Sensitive Lorry Mile – **SLM** values) appear to be in the low to middle range of the study results for environmental factors and thus may underestimate HGV costs in the UK.
- 4 Some environmental impacts caused by HGVs have not yet been costed in UK studies, although some European studies have done so. These include:
 - community severance
 - visual intrusion
 - damage to underground structures (including gas and water mains, electricity and telecommunications)
 - low frequency noise (vibration) associated with the largest vehicles
- 5 Disbenefits for other road users, especially cars, have not been fully included in UK studies (although this is included in Government Guidance on appraisal and DfT research has estimated their cost)
- 6 Using SLM values and counting fuel duty and annual licences as income, HGVs in the UK meet 36% of their costs – a shortfall of £6.7 billion (2006 prices). This includes congestion costs, as do the other estimates below (except 9).
- 7 If VAT on the fuel duty is also counted as income (not a consensus view) this revenue to cost ratio rises to 41% - a £6.1 billion shortfall.
- 8 Using the lowest HGV damage and track cost estimate found in any of the studies, this ratio would rise to 52% if fuel duty & VED only are counted, and 61% if VAT on fuel duty is added, a shortfall of £2.75 to £3.35 billion per annum.
- 9 Using the same lowest cost estimate, some HGVs' revenue can exceed their costs on motorways, but only if their congestion costs are ignored - even in this extreme case their costs will not be covered off motorways.
- 10 For HGVs to cover their costs, using the range of estimates from the UK and EU studies as above, a charge on all HGVs over 3.5 tonnes of 10-23p a

kilometre would be needed in addition to current fuel duty and tax, with the most damaging paying the highest charge.

11 To ensure efficient use of road space, any charge should be related to vehicle size, weight, axle loads and engine standard, and to type of road. For example, it should be significantly higher off motorways for the heaviest vehicles, and much lower for lighter vehicles on motorways.

12 Most other road vehicles (mainly cars) have a far higher ratio of revenue to costs. This means that, in economic terms, road space may be allocated inefficiently because cars subsidise lorry use. Consideration should be given to bringing the ratios of revenue from environmental and road charges to costs closer together across vehicle types.

13 The use of improved (Euro standard) engines has reduced some environmental damage in recent years and the overall impact is still reducing as newer vehicles are purchased. This explains some of the variation between studies.

14 Foreign vehicles do not pay UK damage costs if they use fuel purchased abroad. Their traffic has grown threefold in the last decade (though this is still less than 10%) and they should be included in any charging scheme at least at the same rate as UK HGVs.

Way forward

15 In order to address the economic and environmental problems caused by the high external costs of HGV use, some additional balancing charge is required.

16 This could be a charge per kilometre, for example levied according to gross weight. The income could be recycled to environmental mitigation and improved road maintenance. There are various options including possible variation by road type, and different levels of administrative and technological complexity.

17 Price is, however, not the only means of limiting the costs. In view of the extremely high external costs off the motorway network, a new national initiative is suggested for further development. This would seek to minimise the use of non-motorway roads (local or trunk) by the heaviest HGVs. Powers to do this already exist in the Road Traffic Regulation Act. Limiting use of unsuitable roads by HGVs could reduce their external costs overall and thus the amount of any nationally applied environmental charge.

18 The major DfT study showsⁱ that drivers value the removal of HGVs from non-motorway roads very highly, and that this is preferred to road widening. However, the driver benefits (including work journeys) of controlling HGV use off motorways are never counted in lorry control schemes. They are likely to be significant and this should be taken into account in the appraisal of proposals in the future.

1 Introduction

Background

There is considerable interest at the European and UK level in charging road vehicles in full for their external costs. These include environmental damage, the cost of building and maintaining roads, and the delay costs imposed on other users. In general terms, cars pay much more tax and charges relative to their costs than heavy vehicles. The latter are the focus of this report, which reviews a range of studies relevant to HGVs and analyses their differences.

Overall, it considers whether HGVs in the UK pay enough tax to meet their external costs and what might be done to balance the two. It does not rework the existing values placed on environmental damage for the simple reason that they are still subject to immense uncertainty. This extends to the price of carbon, currently insufficient to ensure that reduction targets are met. This report focuses on the question of which taxes and charges can be said to pay for HGVs' external costs, and what those costs may be, using existing values.

Since the 1960s there have been various attempts to count the real costs of using HGVs on Britain's roadsⁱⁱ. Until 1995 an annual statement of costs and income for different vehicle types was published, entitled the "Allocation of Road Track Costs"ⁱⁱⁱ. This covered elements such as road building and maintenance, lighting, policing and accidents.

Many different weights of HGV had their own ratio of income to cost, partly because damage to road surfaces rises extremely rapidly as axle weights increase. For example, the heaviest HGV axle does over 150,000 times more damage than a typical car axle (see Annex A). Other aspects of damage, also much higher than cars and vans, are related to gross weight, size or handling characteristics. In the original document, environmental impacts such as noise and air pollution, were not assessed in terms of money values, although they were acknowledged.

Since that time there has been considerable activity in terms of trying to put specific costs on environmental impacts such as noise, air pollution, and greenhouse gas emissions, and in measuring impacts on health and safety.

There has thus been a continuing interest in developing the idea of what HGV costs really are, and, combined with this, to what extent some or all of the tax income from HGV use would cover these costs. There is a great deal of discussion about which different elements of tax, such as fuel duty, VAT and annual Vehicle Excise Duty (**VED**) should be counted as "income". The various approaches in the UK and Europe are described in Section 3 of this report.

Thus the report explores the different approaches which have been used, for both cost and income, to work out whether HGVs "pay their way". It illustrates how the answer differs significantly according to what assumptions are made. It reviews the state of play in relation to the issue and what might be done in future.

2 The two basic approaches to road use costs and charges

Introduction

The original road track costs publications started with the total cost of providing the road network (building and maintenance) and then tried to estimate what proportion should be paid by HGVs of different weights and types. Such calculations *for any one year* add together the following costs:

- running the road network, including maintenance, lighting, policing
- allowance for the capital involved in the building of the road network (either related to annual expenditure, or a rate of return on the total historic cost)
- accidents
- environmental impact

This approach is generally known as the total cost coverage or fully allocated cost.

One problem with this is that annual expenditure can go up or down unrelated to levels of demand and congestion. To get around this, calculating what the size of road network should be, working out its total cost and estimating a return on capital (or depreciation) has been proposed. This is clearly open to errors from estimating the size required, the cost, and the interest rate.

In addition, while this approach gives an overview of costs and revenues, economists prefer to maximise efficiency in the current situation, and this would be better achieved if the true additional cost of using an individual road vehicle for an extra kilometre is charged, rather than an average figure. This is called marginal cost pricing, and is the option most often studied.

In this scenario, the capital cost of the road network or any additional building is set to one side. Instead the calculation is based on the cost of the extra congestion which would be caused by an additional kilometre from an individual vehicle. This is then added to the cost of the extra environmental damage from that vehicle, road maintenance, accidents and any other costs not paid directly by the user.

However, it is possible to extend short run marginal costs to include capital expenditure set to build enough capacity to limit or reduce congestion to a desired level. This would have the effect of reducing congestion costs but increasing road track costs beyond maintenance, lighting, etc.

Thus in one sense congestion and road building costs are substitutes for each other in the two approaches, although it is theoretically possible to combine them. However, one or the other should be included in any assessment which seeks to create the full cost picture.

It is possible to create variations on how either are calculated but this basic principle holds. It was further explored in work undertaken for the Department for Transport in 2001 ^{iv}.

Implications for charges

At first sight it may seem that differences between the two are theoretical, but they can produce significantly different levels of cost. In addition, there are major implications for any charges, such as VED or fuel duty.

In the allocated cost model, the aim is to retrieve costs and any appropriate sum towards general Government revenue. In the original calculations the surplus from cars was said to contribute towards meeting environmental costs which were unquantified. At the time, cars paid much more than their identified costs, and HGVs paid less or slightly more according to their weight and axle loads. This disparity was justified because it was policy based, and rail freight, for example, was financially supported by Government. The structure of rail freight charging has, of course, changed significantly since privatisation.

In the marginal cost model, the individual user should face the true cost of use, and thus any excess revenue elsewhere, for example from car drivers, is not available as a subsidy to HGVs. The use of averaging over different vehicle weights and road types is also less acceptable in marginal cost pricing – the point is to price accurately at the point of use. This is the principle behind proposals for national road pricing, which varies the cost by vehicle and road type and level of congestion. The marginal cost approach promotes economic efficiency by making the relationship between cost of travel and the benefit from the travel clear to the user. As a result, it promotes a reduction in unnecessary travel which will reduce the costs imposed on third parties such as congestion or environmental damage.

Implications for tax revenues

For the cost allocation approach, the Government simply wants to get a view on how much the sector costs the public purse and what revenues it gets back specifically from that sector. Sales tax revenue (VAT) is not usually counted against environmental costs. On the other hand, use of public transport is held to cause a loss of VAT revenue (it is zero rated).

Once the general picture is assessed, the Government can go on to decide what additional level of tax to apply, taking into account its various policies for reducing congestion, improving the environment and safety, and addressing climate change. In regard to the latter, this objective is slightly different in that in future years there will be a mandatory reduction target. Thus the issue becomes more one of how much it costs to reduce emissions (usually called the **abatement cost**), rather than estimating the marginal damage cost.

Charges in the marginal cost model are calculated at the point of use, this is sometimes referred to in Government appraisal as the perceived user cost. For businesses this means that all VAT should be ignored since it is claimed back and is not a perceived cost. This is the approach currently recommended in the Government's Guidance for Appraisal (webtag)^v. It should be noted that for private motoring, including commuting, the VAT cannot be claimed back and is thus included in the motoring costs and revenues.

This complication is sometimes avoided by including VAT on fuel duty as income, whichever road user pays it, whether they claim it back or not. This is on the grounds that it simply enhances a transport specific tax. VAT can then be ignored as income in relation to other costs (fuel without duty added, vehicle maintenance etc.).

This is probably not appropriate in an assessment of the marginal cost of HGVs. These are run by public businesses, each with specific operating licences. They normally claim back VAT and thus it is not counted by the user at the point of use. This means it is not really part of a user's marginal cost.

Environmental charges are also very different from conventional taxes. New thinking on how environmental charges are constructed suggests that the final outcome is to avoid damage and thus raise as little income as possible. If new revenues are raised on this basis, they may be recycled. Thus they may appear at the point of use but be returned elsewhere in the business sector. They are, however, unlikely to be paid back to the specific user.

This approach needs to be considered carefully in relation to marginal cost pricing. However, most environmental costs are in fact values derived from surveys of what people would be willing to pay for various degrees of nuisance or damage and are highly variable. The cost of these as currently estimated depends very much on the assumptions behind the survey. If the level of charge is based on the ability to achieve Government policies, it may well be much higher.

Approach in this report

As a starting point, this report reviews the marginal cost approach in the light of recent studies, bearing in mind the mandatory targets likely to be included in the Climate Change Bill for reducing greenhouse gas emissions.

3 Calculating all the external costs of road use

Real costs – different methods of valuation

Apart from congestion costs there are two basic types of cost which are outside the normal expenditure of transport operators. These externalities are the focus of attention in a marginal cost analysis. The first type is a measurable market price – for example the cost of repairing roads. The second contains a group of costs for which there is no market price but there is a value. Examples are health, environmental quality and safety (avoiding accidents).

In the case of HGVs, the first group is generally included as the cost of using the road network. There are arguments that the second group are often not really appropriate for valuation in the same way as the lost of laying tarmac. However, Governments in the UK and elsewhere have put considerable effort into calculating these costs so that they can be included in a cost benefit analysis. These figures are becoming increasingly common, but must be used with extreme caution.

The reason for this is that there is usually a double uncertainty in preparing any valuations. The first is measuring the impact itself. For example, how many people are affected by how much noise? How do different levels of noise affect health and social well being? How many people will suffer what level of air pollution? Will that pollution lead to a shorter life, or a hospital admission, or a day off work?

The second problem is that people then have to be surveyed in order to get them to put a value on the effects listed above. The values given by individuals are notoriously variable in relation to life expectancy, as might be expected. The usual approach, known as “willingness to pay” (WTP) is not examined in detail in this report. However, most studies are based on limited surveys and this means that there is considerable variation in the values obtained.

This is reflected in recent studies, as shown in the Table below.

Table 1
Comparison of external costs in 4 recent studies
Cost per vehicle kilometre, all HGVs

	SLM 2003	McKinnon 2007	INFRAS 2004	CE Delft 2007
Social and Environmental externalities	27.9p	14.6p	47.4p	0 – 90p
Marginal congestion costs	Ave 27.3p From 3.9p (Motorway low congestion) to 84.2p (conurbation)	Ave 9.7p From 4.2p (rural any time) to 72.9p (urban any time)	From 4.2p (uncongested M-way) to £12.11 (congested urban)	From 23.3p (off peak) to 38.9 (urban peak)

The SLM values^{vi} are currently used by the Department for Transport to assess the value of reducing HGV traffic. They were originated by the Strategic Rail Authority's consultants, who reviewed a range of studies, and then scrutinised by the DfT. The second source above is the most recent UK study of HGV costs^{vii}, and the third is one of the more recent EU reports, which tried to assess the externalities of all freight modes (including rail and air)^{viii}. The fourth is a recent overview of European studies including the UK^{ix}.

The detailed definitions of the external costs are also slightly different, for example McKinnon uses a recent DEFRA value for air pollution which is based on the health impacts involving hospitalisation and premature death only. INFRAS has upstream and downstream effects (such as oil refining) which are included in a less accurate fashion in the SLM study. PM10s from tyres and brakes are included in INFRAS (as the new Euro standard engines are introduced this is at least as important as exhaust PM10s).

Nor are the valuations consistently in one direction, as the comparison between the current SLM values and McKinnon study shows. In fact, the congestion costs differ little by type of road, but the averages are calculated differently.

Table 2
Comparison of Sensitive Lorry Miles average values and Mackinnon (converted to miles)

	SLM	Mckinnon
Accidents	2.9	7.4
Noise	3.8	0.8
Pollution	6.3	2.7
Climate Change	2.5	3.1
Infrastructure	12.5	9.0
Congestion	43.9	15.7
Unquantified	16.9	0

It should be noted that the unquantified amount is meant to represent a group of known impacts, which did not have a current WTP study. The SLM report lists them as:

- driver frustration/stress (comparable to journey ambience in Government Guidance on appraisal)
- fear of accidents
- restrictions on cycling and walking
- upstream and downstream effects
- community severance
- visual intrusion

This is not exhaustive, for example other impacts from HGVs include:

- loss of unique habitats
- damage to underground structures (including gas and water mains, electricity and telecommunications)
- low frequency noise (vibration) associated with the largest vehicles

Variations in total costs

These variations in costs per kilometre can generate very different total costs for HGVs in the UK. Again using the three examples above, the traffic (vehicle kilometres) from HGVs can be used to show the difference in total costs.

Table 3

Comparison of total HGV external costs in the UK (identifying congestion element) £billion

	SLM 2003 (2005)	McKinnon 2007	INFRAS 2004
Total cost of externalities	10.4	7.05	23.3
Of which environmental cost	N/A	4.23	14.8
Of which congestion cost	N/A	2.82	8.5

Please note:

SLM figures are from National Freight Model run by MDS Transmodal^x and are in 2005 prices

McKinnon is in 2006 prices

INFRAS figures have wider range of externalities and price carbon above UK Government figure at €140 per tonne CO₂

INFRAS prices are €2000 converted to £ at €1.34 per £.

Further variations are due to changes over time, and the introduction of improved HGV engines (Euro standards I to IV) which has reduced emissions. For example, particulates from tyre and brake wear are now as important as those emitted from the latest diesel engines.

Conclusions on costs

The calculation of externalities is clearly very much a work in progress across Europe and is likely to always be subject to errors in defining the impact and in deriving a value, often based on relatively small surveys.

Ranges of values can be derived to give some idea of the scale, and it is fairly clear that even the lowest values for HGV damage shows a significant level of cost. On the other hand, it still leaves many external costs uncounted in the assessment of what HGVs should be charged. The UK's SLM values appear to be in the middle to low end of the estimates.

Government policies will also tend to require charging levels which achieve their objectives, rather than charging for environmental impacts that in reality it wishes to avoid. The obvious example is how freight transport must make its contribution to the challenging target for reducing greenhouse gas emissions.

4 Tax revenues – specific charges or general taxation?

UK taxation principles and HGV tax revenue

The main taxes paid by HGV operators are fuel duty, annual Vehicle Excise Duty (VED), VAT on their business supplies, including fuel, and other local and national business taxes such as corporation tax, rates and national insurance. The latter are usually ignored as part of general taxation, and the main discussion over tax related to environmental damage and road costs caused by HGVs relates to fuel duty and VAT on fuel. Over the years, several different interpretations of what should be counted against the costs of HGVs have emerged.

Before exploring these, the point should be made that tax in the UK, no matter what the source, has traditionally been seen as general income, and not related either to a specific “pay back” to fund projects related to the source of tax, or to compensate for damage caused by a specific activity. For example, duty on tobacco is not used to directly fund medical research into smoking related illness. This is known as the taxation principle of “**non-hypothecation**”.

This principle has been relaxed in the environment field by various taxes, such as those on waste disposal and climate change, some of which have been allocated for specific types of relevant projects. In transport this has been done for local authority parking income and road pricing which can be ring fenced for transport purposes.

In the case of HGVs, they have paid fuel duty as part of general taxation before any concept of paying their costs was introduced. They have also paid the annual Vehicle Excise Duty (**VED**) which was originally called the Road Fund Licence – raised to support road construction and maintenance. By the 1960s, the idea of Road Track Costs was introduced, and the VED was compared to these costs and was significantly higher for the heaviest lorries which did most damage.

In 1993 this changed when the fuel duty escalator (**FDE**) was introduced specifically as an environmental tax, designed to slow down traffic growth and encourage more efficient vehicle use^{xi}. The increases above inflation did not appear to be part of a general revenue raising exercise, although this is in fact what happened. In the final year of the escalator (2001) the annual HGV excise duties were reduced significantly, specifically to balance the fuel duty escalator's impact on road freight.

VAT is of course added to the cost of fuel plus the fuel duty as well as other costs such vehicle maintenance and other business expenses. It is important to understand the difference between VAT on fuel, which is clearly general taxation, and VAT on fuel duty which it has been argued by some UK analysts to be extra duty and thus included as an environmental compensation payment.

To summarise, the only fees originally related to the costs of HGV use were the annual excise duty. The subsequent fuel duty rise above inflation was also justified in relation to the external costs of vehicle use. Fuel duty before this date was part of general taxation, although often counted as a charge for road use.

The final complication is that there is also a “base level” of duty on fuel which does appear to be general taxation in most definitions. It is applied, for example, to home heating fuel and some transport uses such as rail.

It is thus possible to identify a range of taxes in addition to VED which may be considered to compensate for HGV costs. The levels for fuel duty have been estimated, taking into account the latest figures for April 2008^{xii} and are in 2007 prices.

- Total fuel duty 52.4p per litre
- Fuel duty if escalator not introduced (FD1): 32.2p per litre
- Fuel duty added by the escalator (FD2) 20.2p per litre
- Fuel duty in excess of home heating base level (FD3) 42.7p per litre
- VAT on any of the above fuel duty amounts
- VAT on other HGV business expenses

A range of assumptions which different studies have made in relation to the above options is set out below.

Table 4
Track cost income assumptions for UK based HGVs

	Sansom et al 2001	McKinnon 2007	Various EU UK studies*	Fowkes et al. 1988**	Nominated taxes only***
No escalator FD (FD1)	Yes	Yes	Yes	N/A	No
Escalator FD (FD2)	Yes	Yes	Yes	N/A	Yes
Fuel duty in excess of base (FD3)	N/A	N/A	N/A	Yes	N/A
VAT on Fuel Duty	Yes	Yes	No	FD3 only	No
VAT on other general expenses	No	Yes	No	No	No
VED	Yes	Yes	Yes	Yes	Yes

* This approach is probably the most common in European studies, for example see the European Environment Agency 2004^{xiii}, and the Dutch CE Delft report^{xiv}. The UK LRUC scheme in 2005 proposed a fuel rebate as compensation for the user charge and neither included VAT. The MDS Transmodal study does not and nor did the earlier Armitage Report in 1980^{xv}.

** Fowkes Nash & Tweddle 1988, Preferred Option

*** This provides a minimum for comparison by counting only the additional income from the Fuel Duty Escalator and VED as specific environmental charges and is calculated for the purposes of this study

Note: foreign vehicles revenue not included

There are several conclusions which can be drawn from the above.

First, there is widespread support in the studies that annual VED and at least the revenue from the fuel duty escalator increases are charges which are related to the costs of HGV use. On the other hand, only one study (McKinnon 2007) has suggested that VAT on anything other than fuel duty should be counted as a direct compensation for HGV costs. According to the European Environment Agency, most European studies do not appear to include VAT at all^{xvi}. In this sense McKinnon represents a maximum definition of income, while the nominated only option takes the most limited view. It should also be noted that transport appraisal does not count VAT in goods vehicle operating costs^{xvii}.

One potential complication has been the much lower duty on bio fuel, which is 20p per litre lower than normal fuels. If HGVs had begun to use this to any great extent, it would have seriously reduced the income from HGV fuel duty and thus the amount by which they meet their external costs. The 2008 budget appears to avoid this problem by proposing that differential is scrapped in 2010.

This illustrates the complexity of mixing charges for environmental damage and road use charges in with general taxation in any analysis. This is at least partly responsible for the variations in estimates of how far HGVs meet their costs.

UK Lorry Road User Charging (LRUC) proposal

This has led to a variety of possible interpretations of which HGV taxes should be counted as “paying” for their environmental damage and the road building and maintenance costs for which they are responsible. One way of creating a more transparent and efficient method of relating use to costs is to apply a charge to vehicles according to the costs appropriate to where and when they are used. This was the principle behind the UK proposal for Lorry Road User Charging^{xviii}. In order to meet the concerns of industry, a political decision was made not to increase total tax revenue. Since VED had already been reduced, a fuel duty rebate scheme was proposed. It appears that both the charge and the rebate would not have been subject to VAT.

It should also be noted that foreign vehicles with full tanks of fuel do not pay for their UK costs through either VED or fuel duty, and the latter is often lower in other EU countries. The industry was concerned that for this reason they do not compete fairly with UK based hauliers. The DfT surveyed foreign HGVs in 2003^{xix} and found they were about 6% of the UK’s articulated HGV traffic. They had grown threefold from 1993 to 2003 and are still growing at 2-3% per annum^{xx}. LRUC would have addressed this issue.

There were three problems which the consultation on LRUC revealed. The first was its complexity, including the rebate scheme, and subsequent fears concerning the cost of administration and future increases. The second was how far the scheme could address the different costs on different roads and whether this would cause some damaging re-routing. The final one was that a fuel duty rebate would weaken the spur to improving vehicle efficiency which was one of the reasons behind fuel duty increases. The scheme was postponed to be included in a national all vehicle scheme.

5 Do HGVs meet their external costs?

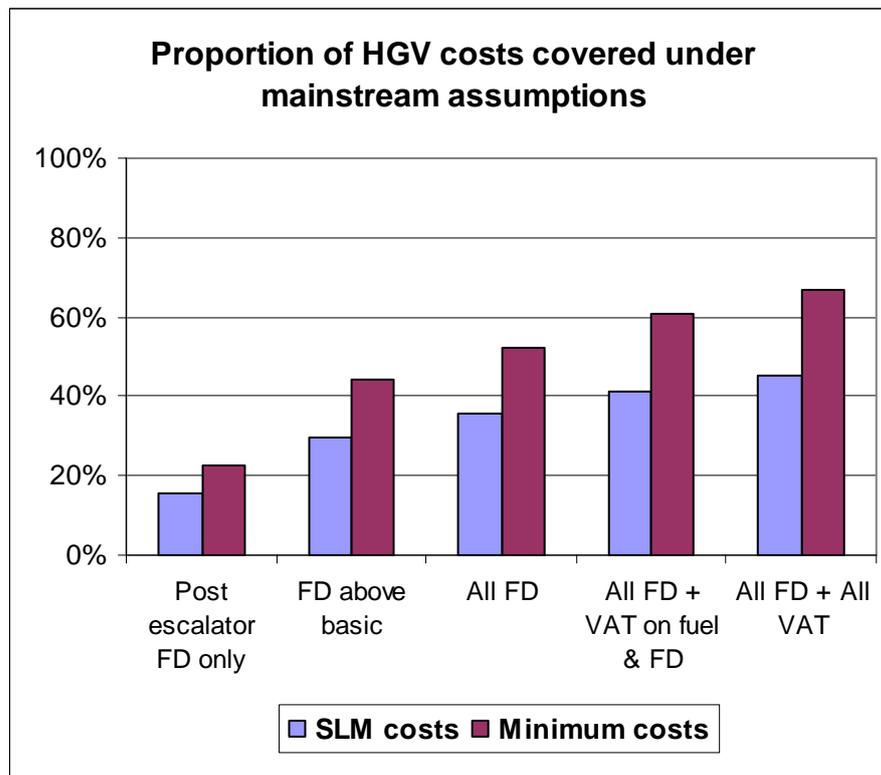
The overall results of this report suggest that there are several different ways of looking at the balance sheet for costs and revenues. We thus report the headline results of the two UK studies which represent the low to middle of the costs range, below. The first assumption for revenue represent the most commonly used approach in Europe while the second adds in the VAT on fuel duty which has been counted as part of environmental charges by some UK researchers (see Table 4 above). Other combinations of costs and benefits would at one extreme reduce the amount covered to around 30%, and at the other rise to 67%. Only by excluding congestion altogether do HGVs just about meet their costs overall. Even using this congestion free average figure, the revenue exceeds costs on motorways, but costs still exceed revenue on all other roads.

Table 5
Proportion of costs covered by revenue under different assumptions

	SLM costs	Minimum HGV cost
Fuel duty + VED	36%	52%
Fuel duty + VED + VAT on fuel duty	41%	61%

Source: MDS Transmodal 2005, McKinnon 2007, MTRU calculation

Figure 1
Range of values using UK study assumptions



Annex A

Example calculation of damage factors using 4th power law

This Annex clarifies the position regarding the very much higher road surface damage caused by HGVs compared to cars.

HGV damage factor 6 axles, 44 tonnes

Axle number	1	2	3 (drive)	4	5	6	Total
Weight in tonnes	6	6	10	7	7	8	44
4 th power	1296	1296	10000	2401	2401	4096	21490

Car damage factor 2 axles, 1 tonne, 2 options

Axle number	1	2	Total	1	2	Total
Weight in tonnes	.5	.5	1	.6	.4	1
4 th power	.0625	.0625	.125	.1296	.0256	.1552

Comparison of HGV to car

Car with 2 X .5 tonne axles
Car with .4 + .6 tonne axles

171,920 times more damaging
138,467 times more damaging

It should be noted, however, that such calculations have to be treated with caution in relation to vehicles which are able to lift axles off the road. This can change, for example, a 6 axle vehicle into a 4 axle vehicle. The trade off is reduced vehicle costs but higher road damage. At maximum weights the lifting of axles should not be allowed, but at lower weights there is no real monitoring of how this is affecting road damage. Observation suggests that axle lifting is common for both articulated and rigid HGVs at the heavier plated weights. This does not affect the calculations given above.

References

-
- ⁱ For example see *The Value of Travel Time on UK Roads*, Accent Marketing & Research and Hague Consulting Group, DfT 1996
- ⁱⁱ *Starting with: Road Track Costs*, Ministry of Transport 1968
- ⁱⁱⁱ *Allocation of Road Track Costs 1995/96*, Department of Transport 1995
- ^{iv} Table 4.1, *Surface Transport Costs and Charges*, Sansom et al., ITS & AEA Technology, DfT 2001
- ^v See: webtag, Unit 3.5.6, para 1.1.9
http://www.webtag.org.uk/webdocuments/3_Expert/5_Economy_Objective/3.5.6.htm
- ^{vi} See DfT Sustainable Distribution Fund
<http://www.dft.gov.uk/pgr/freight/railfreight/slmp/>
- ^{vii} *Internalising the External Costs of Road Freight Transport in the UK*, Piecyk & McKinnon, December 2007
- ^{viii} *External costs of transport*, IWW/INFRAS, October 2004
- ^{ix} *Handbook on estimating external costs in the transport sector – part of IMPACT*, December 2007
- ^x *The Impact of Road Pricing on Transport in Great Britain*, MDS Transmodal, December 2006
- ^{xi} *Fuel Duty Escalator, Overview of the Best Practice*, Etheridge, Z, DETR 2002
- ^{xii} *HM Revenue & Customs leaflet BN53*, October 2007
- ^{xiii} *Transport Price Signals, Monitoring changes in European transport prices and charging policy in the framework of TERM*, European Environment Agency, March 2004
- ^{xiv} *The price of transport*, CE Delft, Dutch Ministry of Transport, December 2004
- ^{xv} *Report of the Inquiry into Lorries, People and the Environment*, December 1980
- ^{xvi} See reference ix
- ^{xvii} See: webtag Unit 3.5.6, para 1.1.9
- ^{xviii} See: *Modernising the taxation of the haulage industry: lorry road user charge*, HM Treasury, HM C&E, DfT, January 2005
- ^{xix} *Transport Statistics Bulletin 03/29*, DfT, 2003
- ^{xx} See *Transport Statistics GB*, DfT, 2007