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THE TRACK AND EXTERNAL COSTS OF ROAD TRANSPORT.

A.S. Fowkes.
C.A. Nash.
G. Tweddle.

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1. Abstract and Summary of Results.

1.1.1The purpose of this study is to review:

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ii)The likely effect of harmonisation of taxes within the European Community.

iii)Future prospects regarding the level of spending on roads.

iv)Alternative methods of dealing with social costs, including lorry routing, regulation and subsidy.

v)Experience elsewhere in Western Europe and in North America.

1.1.2We review the theory behind the allocation of road infrastructure costs, finding a number of items on which the current British approach can be criticised, in particular the treatment of capital costs on a pay-as-you-go basis. Comparisons with other countries suggest that the British system is relatively sophisticated, but this and other evidence suggests that the proportion of capital costs of new roads allocated to heavy vehicles is too low.

1.1.3A spreadsheet model of the current British track costs allocation system is constructed, and the effects tested of proposed increases in road spending, of overloading, of the allocation those items of cost currently allocated on a vehicle km basis in accordance with pcu km and of the allocation of the external costs of accidents. It is found that, even without adjusting the treatment of capital costs, an increase in taxes on the heaviest lorries of some 30 % is justified, and on buses 60%. Evidence on the values of vehicle delay and environmental costs is examined but it is considered that these factors are not yet sufficiently well quantified to test the adequacy of the current 30% margin to allow for them. More work in this area is recommended.

1.1.4The possibilities for harmonisation of vehicle taxation within the European Community are considered. Since Britain has a far higher level of taxation than most other European countries, any move towards harmonising tax levels would reduce taxes in Britain at a time when they should be increasing. Such moves should be resisted, but if they come then there would be a case for compensating action to relieve competing modes of part

of their infrastructure costs.

2. Introduction.

2.1.1The purpose of this study is to review the evidence regarding the infrastructure and other social costs of road transport and the degree to which these are covered by taxes in the U.K., with particular reference to:

i)Developments in methodology and data regarding issues such as vehicle delay, accidents, overloading and valuation of environmental effects.

ii)The likely effect of harmonisation of taxes within the European Community.

iii)Future prospects regarding the level of spending on roads.

iv)Alternative methods of dealing with social costs, including lorry routing, regulation and subsidy.

v)Experience elsewhere in Western Europe and in North America.

2.1.2. From the Department of Transport's "The allocation of road track costs" (DTp 1989a) it is clear that the DTp's position is that lorries more than cover their allocated costs, and that the 'margin' to cover non-allocated costs (such as environmental costs) is sufficient to fulfil the recommendations of the Armitage Committee as regards taxation of lorries (Armitage 1980).

2.1.3. These included recommendations to "increase the VED on the heaviest vehicles so they covered their track costs" (which they did not at the time of the report in 1980). "The public costs of accidents should be included in the calculation of track costs" (this has not been done). "A notional element of tax should be include in road track costs for damage to underground services. The Chancellor of the Exchequer should cease the then current practice of overtaxing the lightest lorries and in the main should take any excess of taxation over road track costs from the heaviest lorries since in general these create more environmental problems."

2.1.4 Some of the methods used in the allocation of costs are open to debate, and new evidence now available on the extent of external costs may allow more accurate estimates of costs to be made. Another area of concern is the level of capital expenditure on roads. Earlier work (Fowkes, Nash and Tweddle, 1988) shows that public expenditure cuts during the 1980's effectively reduced the allocated cost of using the road system, at least in real terms, given that expenditure reductions were combined with an increase in traffic. As planned capital expenditure on roads has now been increased by around 25% for the next few years, then either tax revenues will have to increase to recover such expenditure from road users, or the ratio by which taxes cover costs will be eroded.

2.1.5. The pattern of expenditure on the maintenance of roads follows a similar pattern, though the reduction in reconstruction schemes (a capital expense) has to some extent been offset by increased minor repairs. Nevertheless, the results of the annual National Road Maintenance Condition Survey (NRMCS) clearly show that the condition of Britains roads deteriorated during the period 1980-85. Since then the situation seems to have stabilised, and may be improving as a result of funds being made available to tackle the backlog of maintenance. However, the roads are in a worse condition now than when the NRMCS was first undertaken in 1977 and they are carrying substantially more traffic. Although current expenditure on maintenance has increased in real terms, it has not kept pace with the increase in the volume of traffic, reducing costs in terms of vehicle kilometres.

2.1.6. The extent by which taxes can be adjusted may be restricted by the harmonisation of road taxes within the European Community. However, the changes in the fuel duty and VED resulting from the 1990 budget indicate that the Government is in fact still following the guidance provided in the 1968 Road Track Costs Report (Ministry of Transport, 1968), and by the Armitage Committee (Armitage 1980). That is, lorries should cover their track costs through a combination of VED and fuel duty, with a margin to provide for external costs. The Chancellor has tended to fix that margin at around 30%.

2.1.7In the next section, we consider the basic theory behind the allocation of road track costs. The following section looks at current practice in Great Britain; it is followed by sections on the U.S. and on continental Europe. We then consider the sensitivity of the current method of allocation to changes in the level of spending on roads and to changes in the treatment of issues such as accidents and overloading. We also consider the valuation of vehicle delay and congestion, and the environmental costs of road transport. Following this, we consider the likely effects of moves towards the harmonisation of road taxation within the European community. Finally, we present our conclusions.

3. Basic Theory.

3.1.1 It is well-known that the efficient allocation of resources requires that prices be set equal to marginal social costs throughout the economy. This rule is particularly important in the case of intermediate goods such as freight transport, where price distortions may lead not just to distortions in the pattern of final goods produced but also in the way in which goods are produced. Although even for the heaviest lorries, taxes only constitute some 20% of total operating cost, and overall the demand for road freight transport is believed to be relatively insensitive to price, nevertheless there are ways in which a failure to tax appropriately could have significant distorting effects.

3.1.2 The most significant of these is probably through its influence on choice of vehicle type. Different vehicle types have very different costs, particularly in terms of road maintenance, and a failure to reflect this in relative tax levels would undoubtedly distort choice of vehicle. Secondly, distribution systems involve trade-offs between warehousing, transport and stockholding costs, and unduly low transport costs will lead to excessive centralisation of these systems. Thirdly, almost all rail freight is carried in competition with road, and road hauliers determine the rate that the rail operator can charge. At a time when British Rail is being pressed to achieve an 8% real rate of return on the assets it employs in its freight business, the future size of the rail freight industry will clearly be affected by the level of taxation on road haulage.

3.1.3 If the importance of marginal cost pricing is widely accepted, there is more dispute about what this constitutes in practice. In the first place, there is a distinction to be made between short run and long run marginal cost. Short run marginal cost refers to the extra costs that will be incurred by expanding output with a given capital stock (or in this case amount of road space). Long run marginal social cost refers to the extra costs allowing for the optimal adjustment of the capital stock to the level of output. In other words, long run marginal cost will include the additional capital costs of expanding the road system, but will exclude additional congestion and environmental costs to the extent that these are offset by the extra road space provided.

3.1.4 If the provision of road space were perfectly divisible, and the amount of road space were always optimally adjusted to the amount of traffic, then it can be shown that short run and long run marginal cost would be equal, and there would be no problem as to which to use as the basis of charging. If this is not the case, then there is a trade-off to be made between the advantages of short run marginal cost pricing, which ensures an optimal use of the current stock of roads, and long run marginal cost pricing, which gives appropriate signals about the long run costs of expanding road traffic. In a world of perfect knowledge, in which everyone correctly foresaw future price movements, short run marginal cost pricing would clearly be the appropriate approach. In the real world, in which people often base their expectations as to future price levels on current prices, the issue is less clear-cut.

3.1.5 Whichever basis for pricing is adopted, an important point is that marginal social costs will vary enormously according to time and space. Extra traffic at peak times and on heavily used parts of the network will create more congestion and more case for new road capacity than extra traffic at off-peak times and on lightly used parts of the network. Similarly environmental costs vary enormously according to the characteristics of the road in question. Marginal cost pricing could only be accurately implemented in the context of a national electronic road pricing scheme, which tracked the exact way in which each vehicle was used.

3.1.6 In the absence of such a road pricing scheme, the best that can be done is to charge some kind of average rate per mile for the system as a whole. This could be administered by a system which simply recorded the total mileage operated by the vehicle, as in Scandinavia or New Zealand (see section 6.1.3). In practice the British system is still more crude, relying on a tax on fuel, plus a lump sum based on the average mileage of a vehicle in the class in question to make up for divergences in the ratio of the marginal social cost per vehicle mile and the fuel consumption of various types of vehicle. The result is that only vehicles covering the average mileage for a class of vehicle pay an appropriate amount of tax; low mileage vehicles overpay and high mileage the reverse. (It may be true that vehicles covering very high mileages tend to spend a greater proportion of their time on trunk roads and at night, and this might offset the above conclusion to some degree). The tax system is particularly a problem for operators of vehicles engaged in inter-modal work, and there may be a case for a remission of a part of VED in the case of vehicles engaged in this work (this is already allowed by EC regulations in the case of road vehicles engaged in piggyback traffic).

4. The Track Costs Allocation System in the U.K.

4.1 The Basis of the Current System.

4.1.1 The practice currently used by the DTp in dealing with track costs is a cost allocation exercise under which all costs they consider to be public costs are allocated to individual types of vehicle. The system of allocation used dates back to the 1968 Road Track Costs report (Ministry of Transport, 1968) which was endorsed (with some updating of evidence) in the 1976 Transport Consultation Document (DoE, 1976).

4.1.2 In the 1968 Road Track Costs Report costs were placed in three categories. User costs are those which directly fall on road users, such as petrol, and tyres, as well as the time involved in travelling. Public costs consist mainly of road construction and maintenance, and fall upon central and local government. Other costs occasioned by road users do not fall on the road user or the government and are classed as community costs. Some costs fall within two, or all three categories, an example being accident costs.

4.1.3 The report recommended allocating only the public costs of road usage, using Long Run Marginal Cost (LRMC) pricing. The basic method is to identify any cost component which can be said to be incurred by a particular class of vehicle and to charge those costs items to the relevant classes of vehicles. Fifteen percent of capital costs are shared between heavy vehicles according to the kilometres they run weighted by their gross weight on this basis. Other capital costs are shared out according to pcu km. Maintenance costs such as pavement reconstruction are allocated according to standard axle km. The definition of a standard axle takes account of the 'fourth power law' relating road damage done by axle weights applied. The exact definition is complicated by a switch from imperial to metric measurements, so we shall quote the DTp definition (DTp 1968, p3):

"A Standard axle is a computational device for comparing the damaging effects of different vehicles, taking account of the 'fourth power law' of road pavement damage. The 'Standard Axle' value of a particular vehicle can be calculated by summing the fourth powers of the weights (in tons) on each axle, and dividing by 10 to the power 4 (ie 10,000). Thus for a fully laden 16 tons, 2 axle rigid vehicle with estimated axle weights of 6 tons and 10 tons, the 'Standard axles' would be:-

$$\frac{6x6x6x6 + 10x10x10x10}{10x10x10x10} = \frac{1296 + 10000}{10000} = 1.1296 \text{ imp. tons}$$

ie. the vehicle does 1.1296 times as much damage to the road pavement as a 10 tons axle. In this paper, axle weights quoted in metric tonnes have been used to calculate 'Standard axles' and the divisor has been 10.16 to the power 4, ie 10 imperial tons, 22400lb."

Some other maintenance costs are allocated according to average gross weight km. Those costs which remain are shared between all classes of vehicles according to vehicle kilometres run. Since 1984, the entire exercise has been undertaken separately for four classes of road; Motorway, Trunk, Principal and Other. The 1989/90 allocations are shown in detail in Tables 4.1 and 4.2.

4.1.4Clearly this method would only account for the public costs associated with the use of roads. External costs were not taken into account except via maintenance of a margin between taxes and allocated costs. Even so the U.K. is one of the few countries to attempt to make any allowance for these external costs in its system of taxation of road vehicles.

4.2 Adequacy of the Method.

4.2.1That road vehicles should pay for the use of the roads is generally accepted. Objections to the method are of three types. Firstly, is apportionment of costs between the various classes of vehicle correct, eg. should the total cost of winter maintenance be allocated equally by vehicle kilometres when some evidence shows that a combination of freezing conditions and heavy axle loads may be responsible for the damage? In any event should any costs be allocated by vehicle kilometres when, if they are truly a part of the marginal cost of providing road space, they must surely be related to the amount of road space provided and this is related to P.C.U. kilometres rather than vehicle kilometres?

Table 4.1 Road Costs for 1989/90 Classified by Road Class and Parameter.

Source: The Allocation of Road Track Costs 1989/90. DTp, London.

Table 4.2. Maintenance Costs for 1989/90 Classified by Road Type and Expenditure Item.

Source: The Allocation of Road Track Costs 1989/90. DTp, London.

4.2.2 Secondly, arguments surround the treatment of capital costs. At present, current capital expenditure (or more strictly the average of spending in the current and the two adjacent years) is spread over the traffic level of the year in question. This is a very curious way of treating capital costs, which should surely be spread over the life of the road, but related only to the extra traffic carried. For instance, let us make some very simple assumptions. Suppose that roads have an infinite life, so that the only cost of investing in them is the fact that capital is tied up. This capital may be assumed to have an opportunity cost of 8% p.a.in real terms (8% is the required rate of return on new road investment, and also the rate of return required on all rail assets including infrastructure). Thus the economic cost of investing £100m in new roads today is 8% of this sum, or £8m per annum indefinitely. Suppose also that the current level of capital spending on roads is just sufficient to cope with the current rate of growth of traffic, of say 4% per annum. This would imply that an annual cost of 8% of the current roads budget is incurred to provide capacity equal to 4% of existing traffic levels. This would suggest that marginal capital costs per unit of traffic are of the order of double the figure given by the existing process of spreading actual capital spending over total traffic levels in the year in question.

4.2.3Thirdly, arguments surround the allocation of external costs. Is the arbitrary 30% supplementary charge on the calculated track costs adequate? In any case the DTp appear to interpret this percentage as an average over all HGV's, with some categories of lorry having a revenue/cost ratio of less than 1.30:1.

4.2.4Over time improved evidence of individual items of external cost have become available, such as the costs of accidents. If this evidence is considered to be robust, then those external costs quantified should be allocated on a specific basis.

4.2.5The sensitivity tests we have carried out (section 7) show that these arguments can have a profound effect on the overall allocated costs of road use. In particular the allocation of the costs of road accidents, accepted by the government for use in planning road improvements but not included in track cost, almost wipes out the external element before consideration is given to pollution and congestion.

4.3 Recent Sources of Evidence.

4.3.1During the last decade the increasing awareness of environmental effects have lead to a number of studies into specific issues. Some were directly related to road track cost issues, though many are the by-product of other studies.

4.3.2One important source of data has been the work carried out into the valuation of life (Jones-Lee, 1985, 1987). Using Stated Preference survey methods, the results produced gave much higher valuations on a 'willingness to pay' basis than the previously used Human Capital approach. Unfortunately there is a large disparity between the average figure for the cost of a statistical life and the median, the authors recommending the use of the latter. We have followed their recommendation in carrying out the sensitivity tests. However, one study (Newbery, 1987) does use the average figure.

4.3.3An area of some concern is that the DTp allocation method relies for its information on the average weights of goods vehicles on a survey using data supplied by HGV operators. For obvious reasons, this does not disclose the extent of overloading taking place. The most unbiased data on overloading we have been able to produce is a survey undertaken in Cheshire (Urquart, 1987), and this data has been used in one sensitivity test.

4.3.4In some countries the effect of weathering is an important factor. Conflicting evidence has been produced concerning this, results of a study in Brazil indicating that roads deteriorate even if they are not used, or used very little (Newbery, 1987). On the other hand evidence from U.S.A. would indicate that the excessive wear experienced, particularly in conditions of frost and moisture, is a combination of standard axles and weather conditions (Small, Winston & Evans, 1989). If it was accepted that some deterioration was caused by weathering, then these costs should be allocated by pcu km and not standard axle km.. This would clearly reduce the share of costs allocated to heavy goods vehicles.

4.3.5 We shall consider the implications of changing some of these assumptions in section 7. But first we survey existing approaches to the subject in the U.S. and continental Europe, to see what may be learned about alternative approaches, and in particular what the implications of tax harmonisation in Europe might be.

5. Recovery of Expenditure on Roads in U.S.A.

5.1 Current Method.

5.1.1Currently the U.S.A. adopts similar allocation procedures to those used in the U.K., "cost allocation on the basis of cost occasioning" (U.S. Federal Highway Authority, 1982). The policy means those vehicle groups giving rise to capital expenditure should pay for that expenditure; thus thicker or wider pavement costs are allocated to lorries, more road capacity to traffic in general on an incremental basis.

5.1.2In some respects, the method appears to be not quite so sophisticated in its fine detail as that used in the U.K. For example, though some data is collected on vehicle use this is not used in such detail as is the Continuing Survey of Road Goods Transport (CSRGT) in Britain. The figures quoted in the American report are somewhat distorted in that there is a greater use of toll roads, and by the fact that large vehicle revenues are collected by state and local government. The position relative to Federal Highways is given in Table 5.1 with regard to total revenue per vehicle in 1977, together with an estimate for 1985.

5.1.3From this table it is apparent that, to a greater extent than in the U.K., there tends to be some degree of cross-subsidisation of heavier lorries by lighter vehicles. Thus the U.S. equivalent of a 38 tonne artic (say 80 kips) does not cover its track costs, whereas a large rigid more than covers its costs.

5.1.4Note should be made that U.S. practice does not include an allowance to cover external or environmental costs. Also, although the gross weights of vehicles are higher than the maximum in many parts of Europe, individual axle weights tend to be lower.

Table 5.1. Annual User Payments per Vehicle ($).

	1977		1985	
	$	Ratio	$	Ratio
Cars	37	1.1	25	1.0
M/c	3	0.5	3	0.6
Buses	86	0.5	6	0.0
Vans	49	1.2	40	1.1
Single unit trucks GVW				
<26 kips	105	1.3	132	1.7
>26 kips	405	1.7	554	2.2
Combination trucks GVW				
<50 kips	569	0.8	798	1.2
50-70 kips	889	0.9	1292	1.3
70-75 kips	1331	0.6	1663	0.8
>75 kips	1452	0.5	1819	0.6

Note:- 1 kip is 1000 U.S. pounds.
Source: U.S. Federal Highway Cost Allocation Study, 1982.

5.1.5 The taxes on vehicles are mainly a duty on fuel (the report advising that consideration be given to a higher tax on derv than gasoline), and a highway use tax for heavy vehicles (equivalent of VED) of $3 per 1000 pounds for all trucks greater than 26 kips GVW. However, unlike the U.K., this is not graduated by weight or number of axles. Another proposal of the report was the introduction of weight*distance taxes which were already in use in the state of Oregon. However, these do not distinguish between roads of various pavement strengths, taxes being based on the average, and would involve operators keeping accurate records for tax purposes.

5.1.6The 1982 study examined three methods of cost allocation. It recommended the 'uniform removal technique' for pavement thickness of new facilities, and estimated pavement wear functions for traffic related pavement rehabilitation; the 'incremental method' for bridge strength of new bridges, a special function for load related bridge replacement, and incremental assignments for grade steepness and road width. Residual costs within cost assignment groups would be allocated by vehicle miles travelled (vmt).

5.1.7 The first method, the "uniform removal technique", assessed the additional capital costs of increasing the thickness of pavements to withstand increased axle weights. These additional costs would then be allocated directly to the classes of vehicles involved.

5.1.8The second method, 'incremental technique' grouped all pavement costs, which were allocated in a fifteen stage incremental approach using axle miles travelled to allocate intra incremental costs. Bridge costs, and width and grade costs were allocated as per the recommended method. Residual costs and costs remaining within group costs were assigned by vmt. This method seems the nearest to the U.K. system of those examined.

5.1.9The third alternative examined was 'short run marginal costs' (SRMC). It differs from the other two in that expenditure on building roads is ignored, while variable costs for each trip are estimated. These comprise pavement damage and associated user operating cost changes; travel time and accident increases due to traffic, administration and maintenance costs that are a function of traffic, and traffic related environmental damage.

5.1.10 The practise in the U.S.A. has been acceptance that the highway system has considerable non-user benefits, and the use of general taxation for highway expenditure can be justified on this basis. The report estimates that of total Federal plus State and local highway expenditure, the user share was 70.9% and the non-user share 29.1%.

5.1.11 Obviously non-users benefit from improvements to the economy in general resulting from an efficient road system.

However, these benefits are largely those enjoyed by goods vehicle operators, passed on through competitive markets. Most studies of the effects of road schemes on economic growth in Great Britain have concluded that there is no significant further effect that needs to be taken into account (Parkinson, 1984)

5.2 Criticism of U.S. Method.

5.2.1Economists generally favour the short run marginal cost (SRMC) approach to charging for the use of roads. This was the case in the main critique (Small, Winston & Evans, 1989) of the U.S. Highway Cost Allocation study.

5.2.2If the capital stock is optimal, the short or long run marginal cost approaches should give similar results. However, Small et al argue that substantial investment would be needed to bring the two close together. This would be required to improve the long term durability of the road network.

5.2.3In the long run they propose that costs can be reduced by a radical change in the charging system. This requires a shift from the current method of reliance on fuel taxes and weight graduated licence fees, to one based on direct mileage charges graduated with respect to axle loads. The authors assume that this approach would encourage truckers to switch their heavier loads to vehicle types which have more axles, and reduce road damage as a result. It is not clear whether the effect of reduced payload which would result from this change has been taken into account; it is possible that it would be more economical for truckers to simply pay the higher charges and continue using the existing type of truck.

5.2.4The authors have calculated that the cost coverage in the U.S.A. for the years 1975, 1980 and 1985 was 65.0%, 61.2% and 62.0% respectively inclusive of State and local taxes. They also claim that the relationship of pavement wear to axle weight rises at a rate closer to its third power, rather than its fourth based on re-analysis of the AASHO test data allowing for residual life of some sections of pavement when the tests were completed.

5.2.5Congestion charges would be charged separately from pavement wear. This reflects the fact that roads are a multi-product business; peak auto travel requiring capacity, and truck travel requiring durability.

5.2.6Having produced a theoretical SRMC model, the authors simplify it to make it more easily applicable to actual conditions. In doing so, the system would become less efficient as well as being a less convenient way of collecting road taxes than those currently in use. Perhaps the conclusion of the 1982 Federal Highway Cost Allocation Study was correct; SRMC is not a practical method of raising revenue. However, it should be stressed that the practical problems in obtaining a true LRMC system are almost as great; neither the US nor the UK system as currently practised really conform to LRMC pricing principles either.

5.2.7 In conclusion then the U.S. system is not all that different from that in use in the U.K. However, it is worth noting the much greater attention posed in the U.S. system to the incremental capital costs of thicker pavements, wider lanes and stronger bridges required by heavy vehicles. It is likely that this leads to a much greater share of the capital costs of new roads being allocated to heavy vehicles than is the case in the U.K.. It should be noted that a study of car only roads, which took account of such factors as well as effects on necessary gradient and curvature concluded that car only roads could be built for some 75% of the cost of existing roads, rather than 85% as assumed by DTp. (Echenique, 1987)

6. Continental Practice.

6.1 Variation in Approach.

6.1.1 Within Europe, including Scandinavia, each country uses different methods to recover expenditure on its highway system. There is also a large degree of variance of the proportion of road costs users of different categories of vehicle pay. In many countries it is considerably less than the total costs of using the road, and few countries incorporate a surcharge to cover external costs.

6.1.2 The main sources of road taxation throughout Europe are fuel taxes, together with some fixed element tax. The amounts payable as tax varies enormously, those on derv being shown in Table 6.1.

6.1.3 In addition a few countries impose weight-distance taxes on various classes of vehicle, notably goods vehicles. These include Norway, Sweden and Finland. In Norway a typical 38 tonne GVW vehicle would pay 0.19 ecu/km whereas in Sweden it would pay 0.7 ecu/km.

Table 6.1 Tax on Derv (ecu/100lt) in 1984.

Denmark	4.42
Fed. Rep. of Germany	19.75
France	17.58
Italy	7.79
Netherlands	7.91
Norway	0.37
Switzerland	33.60
Sweden	7.97

U.K.	24.52

£1 = 1.6931 ecu.
Source: ECMT Round Table 71, "International Road Haulage: Taxation Systems." ECMT, Paris 1986.

6.1.4 Though outside Europe, this form of goods vehicle taxation has been applied in New Zealand where operators buy a licence for each 1000 kilometres covered by a particular vehicle. For a 40 tonne articulated lorry of the 3+2 axle configuration this costs $11.79. This tax does not take account of the weight actually being carried (Starkie D. 1989). However, evasion is perceived to be widespread; even with hubodometers it is difficult to determine whether a lorry has paid for the distance it is covering, unless large scale inspection is imposed.

6.1.5 The most recent set of calculations of the marginal social costs of road traffic for Sweden are interesting for two reasons; firstly, they are based on SRMC (including congestion but not capital expenditure), and secondly, they include explicit quantification of the environmental and accident costs (Hansson and Nilsson, 1989). The results of these calculations are shown in Table 6.2.

6.1.6 Environmental costs include noise and air pollution, valuation of the former being based on the hedonic price technique, and of the latter on the cost of alternative methods of achieving specific targets for reductions in nitrous oxides, hydrocarbons and carbon monoxide (including fitting catalytic converters). An air pollution tax is also levied on diesel fuel used by the railways.

6.1.7 The result of these calculations is that, even though road haulage taxes in Sweden appear high by international standards, they fall far short of covering marginal social costs even in rural areas (see Table 6.3)

6.1.8 Items of taxation which are included as being recovery of highway expenditure also vary from one country to another; Belgium even including car radio licence fees (ECMT 1989). In some countries variable rates of turnover tax (or VAT) apply to road vehicles and spares, and any supplement above the standard rate can be construed as being specifically road taxation.

Table 6.2. Social Marginal Costs for Road Traffic 1987.
(ore/km, 1987 price level)

	Private car		Truck		Bus	
	Rural	Urban	Rural	Urban	Rural	Urban
Road maintenance	0.8	0.7	31.8	23.0	27.8	20.1

Traffic surveillance	1.1	1.1	1.1	1.1	1.1	1.1
Congestion	0.8	18.0	5.5	54.0	2.2	54.0
Accidents	11.0	38.0	15.0	46.0	16.0	148.0
Environmental impact	6.5	29.0	27.5	68.0	23.0	161.5
Total	20	87	81	192	70	386

Notes:
i) 100 ore=1 SEK=£0.094 at May 1989.

ii) Road maintenance costs for trucks (22.5 tons) and buses (16 tons) are mean values for different axle combinations.

iii) Environmental impact for car with no catalytic converter; equivalent values if fitted are 1 and 5 ore.

Source: 'A New Swedish Railroad Policy'. Hansson L. and Nilsson J-E. Paper presented at Fifth World Conference on Transport Research, Yokohama, Japan, 1989.

Table 6.3. Road User Charges as a Percentage of Social Marginal Costsin Sweden 1987.

	Rural Traffic	Average Road Traffic (incl. urban areas)
Private car:		
With catalytic converter	93	45
Without catalytic converter	76	65
Truck	70	50
Coach	55	40
Bus	--	10

Source: 'A New Swedish Railroad Policy'. Hansson L. and Nilsson J-E. Paper presented at Fifth World Conference on Transport Research, Yokohama, Japan, 1989.

6.1.9The operation of HGV's in Europe is affected in other ways, mainly in a wide variation in regulations between countries. Some countries within the EC are totally de-regulated, and in the U.K. and the Benelux countries road transport operators have complete commercial freedom. Regulations controlling safety and some environmental restrictions apply.

6.1.10 Probably the only country in which quantity regulation of hauliers is still effectively enforced is the Federal Republic of Germany. Germany controls the numbers of vehicles public hauliers can use for long distance work, making expansion difficult. The tariffs charged are also controlled within a 'fork'. These practices will presumably cease with completion of the Single European Market, although the limited arrangements for cabotage so far agreed are unlikely to overturn them, and it seems likely that regulation will survive in Germany beyond the end of 1993.

6.1.11 The position in France is one of rapid de-regulation of road transport. At one time France, like Germany, partly justified control of road transport as a way of protecting the rail network, but quantity and tariff restrictions have now effectively disappeared.

6.1.12 Trans-Alpine traffic between EC countries is controlled in both Austria and Switzerland, mainly by night and weekend movement restrictions. There are exemptions to these aimed at allowing movement of domestic traffic. In the case of Switzerland there is also a maximum GVW of 28 tonnes. However, there is some pressure from Swiss manufacturers to have this weight increased as retaliatory action by neighbouring states has reduced their competitiveness.

6.1.13 Nevertheless, regulatory factors have probably had a greater effect on freight mode choice than a road taxation system which recovers HGV track costs. This is most marked in the case of German domestic traffic, and traffic between Italy and the rest of the EC.

6.2 Comparison of Taxation Levels.

6.2.1Because of the wide variation both in methods of collecting road taxes, and the approach to the subject, comparison between European countries is difficult. However, one study has attempted to determine the costs of operating a typical 38 tonne GVW vehicle, a size popular both in international haulage and approximating the maximum size lorry widely used in many countries (ECMT, 1986).

6.2.2Even within the constraint of a particular size of vehicle, the 'reference vehicle' in this study was markedly different between countries. In Scandinavia the three plus three axle drawbar combination was the vehicle for which costs were produced. In Germany it was also a drawbar, but with a 16 tonne tractor and 22 tonne trailer. The Swiss gave an average of three different axle combinations of 28 tonnes, their maximum weight; though the tax level also varies between Cantons. The U.K. reference vehicle was a 2+3 axle artic, whereas the French costed a 2+2 axle artic.

6.2.3In order to produce comparative figures between countries, we assumed that the reference vehicle in each country achieved the same mileage per year (74,000 kms) and fuel consumption (2.08 kms/lt). The revenue per annum per vehicle could then be produced as shown in Table 6.4.

Table 6.4. European Highway Revenue/Cost Ratios.

	Duties	Revenue/Cost

	Fixed	Fuel	Total	Ratio
Denmark	3200	1537	4773	0.41 : 1
F.R. Germany	4185	7026	11211	0.96 : 1
France	760	6255	7015	0.60 : 1
Italy	375	2771	3146	0.27 : 1
Netherlands	1625	2814	4439	0.38 : 1
Norway	2650	132	2780	0.24 : 1
(Incl km. tax)		(14060)	16842	1.44 : 1
Switzerland	1320	11954	13274	1.14 : 1
Sweden	2000	2836	4836	0.41 : 1
(Incl km. tax)		(51800)	56636	4.85 : 1
U.K.	5185	8708	13893	1.19 : 1

Notes: i) Assumes rates of duty as per ECMT Round Table 71.
ii) Lorry averages 74,000 km. per year at consumption of 2.08 kms/lt.
iii) Track costs equal £93.15 (157.71 ecu) per 1000 km.

6.2.4 The costs occasioned by the use of the vehicle on the road was also assumed to be the same as for a 38 tonne artic in the U.K. This is £93.15/1000 km (DTp, 1985), or 157.71 ecu/1000km.; 11,670 ecu per year.

6.2.5 In the analysis of the ratios in Table 6.4 many assumptions have been made. It is unlikely that the 'reference vehicle' in the various countries will have the same standard axle weights as that of the U.K. Fuel consumption will vary, mainly because of traffic conditions, quality of roads and terrain. Many European countries are thought to have stronger pavements than in the U.K. If these are nearer to the optimum durability for 38 tonne lorries, then the track cost figure will be lower.

6.2.6 Another factor is the extent to which heavy vehicles use toll roads whose revenue is not included in the revenue/cost ratios. Such roads are fairly extensive in Italy; less so in France. In most other countries tolls only apply for the use of short sections of the network, such as river crossings. Many of these major pieces of infrastructure operating in deficit.

6.2.7 Nevertheless, even when allowance is made for the differences between the countries involved, it seems very likely that there is a considerable difference in the rate of highway cost recovery in Europe, with the level of taxation and of cost recovery being very much lower than in the U.K. This is obviously of some concern in the light of possible proposals to harmonise tax levels within the EC, an issue considered further along with other sensitivity tests in the next section.

7. Testing the Sensitivity of the Current U.K. Allocations

7.1 Calibration of the Model.

7.1.1Using a proprietary spreadsheet for a micro computer, the figures published in 'The allocation of road track costs 1989/90' (DTp 1989a) have been used to calibrate a model, the published figures being compared with the base position of the computer model in Table 7.1. The slight differences are the result of using fewer classes than in the DTp estimates. It should be noted that these figures follow the usual D.Tp. practice of ignoring the fact that fuel tax on local bus services is entirely rebated. The results have been subjected to a number of sensitivity tests. In some cases these test the allocation of the current level of expenditure on roads, whilst others examine the effect of an increase in such expenditures, or the effect of inclusion of specific external costs. Since these sensitivity tests were completed the DTp have published 'The allocation of road track costs 1990/91'. Some of the resulting revenue tax ratios have changed significantly in the most recent edition as shown in Table 7.7. These are partly the result of revenue changes in the budget, which were tested in the model, but also the result of adjustment to the mileage travelled on various classes of road, the most notable being for large rigid vehicles.

7.1.2The external costs of road transport (such as environmental costs) are only covered to a limited degree by tax revenues from road vehicles. These external costs are largely covered by adding, on average, 30% to the track costs of goods vehicles, as calculated by the DTp. Where more specific data can be obtained to assess the extent of these external costs sensitivity tests have also been carried out.

Table 7.1 Calibration of Model.

Vehicle class	Tax/cost ratio.	
	DTp figures	Base figures
Cars + vans	3.4	3.35
Buses + coaches	1.1	1.02
HGV Rigids		
2 axle 7.5t2.00	1.99	
2 axle 17t1.14	1.15	
3 axle 25t1.16	1.14	
4 axle 31t1.17	1.15	
HGV Artics		
2+1 axle 25t1.43	1.41	
2+2 axle 28t1.42	1.43	
2+2 axle 32.5t1.27	1.28	
2+3 axle 38t1.36	1.34	
3+2 axle 38t1.38	1.36	
3+3 axle 38t1.46	1.45	

7.2 Increased Expenditure on Roads.

7.2.1The Government have decided to increase the expenditure on roads in real terms over the next few years (DTp 1989b). This is partly to undertake the backlog of maintenance that is now required, though the major change is an increase in capital spending, particularly on new roads or substantial modifications to stretches of existing roads to increase capacity (HM Treasury 1990). The expenditure plans are shown in Table 7.2.

Table 7.2. Planned Expenditure on Roads 1990-91 to 1992-93. (by Central Government on national roads system).

	£ million.				
	1988-89	1989-90	1990-91	1991-92	1992-93
Current	102	93	120	130	140
Capital	897	1301	1694	1770	1850
Administration	93	105	121	130	140

Source: The Governments Expenditure Plans 1990-91 to 1992-93, Chapter 7-Department of Transport. HM Treasury, London, 1990.

7.2.2. It is clear that from 1990 that the increase in expenditure is of the order of 23%, allowing for inflation at 6% during the current year and 4.5% thereafter. The cost of administration is expected to rise at about 7.5% per annum in real terms.

7.2.3. Some items of expenditure considered to be capital by HM Treasury are in the maintenance budgets of the DTp. These cover reconstruction, haunching, resurfacing, surface dressing, skid treatments, bridges, and remedial earthworks on motorways and trunk roads. In the road track cost allocations over recent years, capital expenditure has formed about two thirds of the total on national roads. For our sensitivity test we have adjusted the increased total spent on motorways and trunk roads so that 67% is of a capital nature (as defined by the DTp), the balance being current expenditure. Thus maintaining the current proportions.

7.2.4. We have thus increased expenditure on national roads in our model of the 1989/90 Road Track costs by 23% while leaving local roads at the same level of spending. The results are shown in Table 7.3. While most classes of vehicle still cover their allocated track costs, large rigid HGV's and buses are not providing any margin to cover any external costs. For some categories of HGV's tax revenues would need to be increased by almost 30% to provide the currnet 30% margin; buses and coaches do not do so at the present time anyway. The four and five axle artics (with two axle tractors) would face increases of between 15% and 20% in tax revenues in order to provide a 30% margin for external costs.

Table 7.3 Effect of Increased Expenditure on DTp Roads.

Vehicle class	Tax/cost ratio. DTp figures	Base figures	Expenditure +23%
Cars + vans	3.40	3.35	3.14
Buses + coaches	1.10	1.02	0.99
HGV Rigids			
2 axle 7.5t	2.00	1.99	1.83
2 axle 17t	1.14	1.15	1.08
3 axle 25t	1.16	1.14	1.07
4 axle 31t	1.17	1.15	1.05
HGV Artics			
2+1 axle 25t	1.43	1.41	1.27
2+2 axle 28t	1.42	1.43	1.22
2+2 axle 32.5t	1.27	1.28	1.10
2+3 axle 38t	1.36	1.34	1.12
3+2 axle 38t	1.38	1.36	1.15
3+3 axle 38t	1.46	1.45	1.22

7.2.5. The result of this sensitivity test indicates that the standstill period on increased road vehicle taxation may be at an end, and that the annual budget speech for the next few years will contain increased rates of fuel duty (as did the speech in 1990), or VED, or both. It should be remembered that the allocation of track costs is based on a three year average figure, therefore, the full impact of the increased expenditure will not take effect until 1992-93. We have argued previously (Fowkes, Nash and Tweddle 1988) that the main reason for the fall in the real costs of using the roads was that less money was being spent on road investment, while the number of vehicle kilometres was increasing more rapidly.

7.2.6. The expenditure plans show that while expenditure is planned to remain at a higher level for the next few years, annual increases beyond 1990-91 only take account of inflation. If the forecast increase in traffic materialises, then track costs will once again be allocating a fixed sum over a larger volume of traffic, for which investment is not providing sufficient road space.

7.2.7. Apart from the government, several interested parties have proposed increased expenditure on roads, most without detailed examination or quantification. An exception is a Review of Highway Investment Needs (County Surveyors Society 1989).

7.2.8. This report concludes that to provide adequate long term investment requires an increased level of funding of at least 20% per annum until the end of the Century. This increase applies particularly to local authority roads which in the current expenditure plans receive 12% additional funding for 1989-90, but this is not sustained in 1990-91 where a fall in real terms is planned.

7.2.9. Using these findings as a basis for another sensitivity test, where spending on national roads is increased by 23% (as above) but with local authority roads funding increased by 20%, as shown in Table 7.4.

7.2.10. This produces the results shown in Table 7.5. In this case few large rigid lorries cover their costs, though the large artics do cover their track costs. However, only vehicles of less than 10 tonnes GVW produce a margin of 30% to cover environmental costs.

7.2.11. The Chancellor of the Exchequer announced increased rates of duty on fuel (of about 10%) and on the VED applied to large rigid lorries during his budget speech in March 1990, which occurred during the period of this study. We have taken the adjustments into account in our model, and the results shown in Table 7.6 have been produced. As these tests were undertaken before the current year's allocations were available, we have assumed that all the other allocations are unchanged; unfortunately the publication of the detailed allocations did produce some significant changes (DTp, 1990). The levels of VED announced in the 1990 budget have been applied together with increased fuel duty, both adjusted to take account of an assumed rate of inflation of 8% for the year.

7.2.12. The effect of the budget revenue changes for 1990-91, when applied to the 1989-90 costs, has not only increased total revenue from road taxation, but has considerably reduced the numbers of HGV's which were not meeting their external costs ratios. Most important among these categories are the 32.5 tonne four axle articulated outfit. The 31 tonne gross rigid lorry now has the highest rate of VED at £3250, which compares with £2450 and £3100 in the case of maximum weight four and five axle artics respectively. Nevertheless, these vehicles and those in the

Table 7.4. Expenditure on Roads Proposed by County Surveyors Soc.
(by Central and Local Government on the road network).

	£ million. 1989-90	£ million. 1990-91 onwards
Capital	1,919	2,334
Current	2,777	3,351
Administration	35	43

Police	327	327
Maintenance	2,415	2,981
Total	4,696	5,685

Sources: The Allocation of Road Track Costs 1989-90, DTp. London, 1989. Review of Highway Investment up to the Year 2001 on Motorways Primary and Strategic Routes in England (excluding London); Report No. 3/7, County Surveyors Society, 1989.

Table 7.5 <u>Effect of Increased Expenditure on All Roads.</u>

Vehicle class	Tax/cost ratio. DTp figures	Base figures	Expenditure +20-23%
Cars + vans	3.4	3.35	2.80
Buses + coaches	1.1	1.02	0.83
HGV Rigids			
2 axle 7.5t	2.00	1.99	1.65
2 axle 17t	1.14	1.15	0.94
3 axle 25t	1.16	1.14	0.93
4 axle 31t	1.17	1.15	0.94
HGV Artics			
2+1 axle 25t	1.43	1.41	1.15
2+2 axle 28t	1.42	1.43	1.16
2+2 axle 32.5t	1.27	1.28	1.03
2+3 axle 38t	1.36	1.34	1.07
3+2 axle 38t	1.38	1.36	1.09
3+3 axle 38t	1.46	1.45	1.16

Table 7.6. <u>Effect of Changes in Duty on Fuel and VED.</u>
(1990-91 tax rates with 1989-90 level of spending all in 1989-90 prices).

Vehicle class	Tax/cost ratio. DTp figures	Base figures	Post 1990 Budget
Cars + vans	3.4	3.35	3.34
Buses + coaches	1.1	1.02	1.04
HGV Rigids			
2 axle 7.5t	2.00	1.99	2.01
2 axle 17t	1.14	1.15	1.17
3 axle 25t	1.16	1.14	1.19
4 axle 31t	1.17	1.15	1.23
HGV Artics			
2+1 axle 25t	1.43	1.41	1.43
2+2 axle 28t	1.42	1.43	1.46
2+2 axle 32.5t	1.27	1.28	1.29
2+3 axle 38t	1.36	1.34	1.35
3+2 axle 38t	1.38	1.36	1.38
3+3 axle 38t	1.46	1.45	1.47

categories of 17 tonne and 25 tonne rigids still do not cover their external costs, the VED adjustment not being sufficient to take account of the damaging power of such vehicles. Buses and coaches cover their track costs with a small margin.

7.2.13. When the expenditure figures planned for future years are used instead of the 1989-90 levels the position reverts to one of many categories of HGV's not covering their external costs (see Table 7.7). The most important to note are that four axle rigids and artics cover their costs by a ratio of 1:1.09, while for five axle artics the ratio is 1:1.12. Clearly external costs of 30% of track costs are not being covered by the largest lorries even though lorries as a whole produce such a margin to provide for external costs.

7.2.14 Reference to column (d) in Table 7.7 shows a number of discrepancies. In the case of the large rigid lorries the latest allocations show a significant change in the distances travelled on the various types of road, in the case of four axle rigids the increase on 'other' roads (where costs are highest) is 240%, as shown in Table 7.8. Another change is that light commercial vehicles, those of less than 3.5 tonnes GVW, are now incorporated with cars.

7.2.15. The increases in the budget are roughly in line with general inflation, with fuel duty rising by 10% (more than inflation) and VED increases applied to certain HGV's. It is clear that these increases are not sufficient to cover the expenditure which is planned for the next few years. As the calculations for road expenditure contained in the road track costs are based on a three year average, we can predict that the

Table 7.7. Effect of Changes in Duty on Fuel and VED. (1990-91 revenue with increased spending).

Vehicle class	Tax/cost ratio. DTp 89/90 figures (a)	Base figures (b)	Post 1990 Budget figures (c)	DTp 90/91 figures (d)
Cars + vans	3.35	3.35	3.09	3.16
Buses + coaches	1.07	1.02	1.00	1.18
HGV Rigids				
2 axle 7.5t	2.00	1.99	2.67	2.08
2 axle 17t	1.14	1.15	1.08	1.30
3 axle 25t	1.16	1.14	1.09	1.21
4 axle 31t	1.17	1.15	1.10	1.09
HGV Artics				
2+1 axle 25t	1.43	1.41	1.27	1.42
2+2 axle 28t	1.42	1.43	1.24	1.33
2+2 axle 32.5t	1.27	1.28	1.09	1.20
2+3 axle 38t	1.36	1.34	1.12	1.21
3+2 axle 38t	1.38	1.36	1.14	1.22

3+3 axle 38t	1.46	1.45	1.22	1.31

Note: Col. (a) As 'Allocation of road track costs 1989/90'. DTp, London 1989.
Col. (b) model calibration of col (a).
Col. (c) results expected from adjustment to revenues post budget, plus higher level of expenditure on DTp roads.
Col. (d) actual ratios as per 'Allocation of road track costs 1990/91'. DTp, London 1990.

Table 7.8. Changes to Percentage of Distance by Road Class. (1989/90 figures in brackets).

Vehicle class	Motorway	Trunk	Principal	Other
Cars, vans	12 (12)	16 (18)	33 (36)	39 (34)
Buses	11 (10)	12 (15)	38 (47)	39 (28)
HGV rigids				
2 axle	21 (21)	22 (24)	31 (34)	26 (21)
3 axle	18 (21)	25 (28)	30 (35)	27 (16)
4 axle	23 (27)	27 (34)	26 (29)	24 (10)
HGV artics				
3 axle	29 (34)	29 (31)	26 (25)	16 (10)
4 axle	44 (48)	33 (33)	16 (15)	7 (4)
5 or more axles	45 (48)	36 (36)	15 (14)	4 (2)

planned increased levels of expenditure indicate that either VED or fuel duty (or both) are likely to increase at above the rate of inflation in the next few years, until 1993 at least.

7.2.16. Other adjustments to the rates of VED should result from the changes in maximum weights proposed for 1.1.1993. These will increase the GVW of three axle rigids from 24.39 tonnes to 25 tonnes (26 tonnes if fitted with air suspension). More importantly, the maximum weight of four axle articulated vehicles and drawbar combinations is increased to 35 tonnes from 32.52 tonnes.

7.2.17. Any likely increase in taxation levels will almost certainly be more than offset by an increase in carrying capacity of up to 12% for weight constrained loads. This comes after the introduction of longer articulated lorries in 1990, which increased their volumetric capacity.

7.3. The Costs of Accidents.

7.3.1. The costs of road accidents used by public authorities when assessing road schemes are published in HEN1, Highways Economic Note No. 1 (Department of Transport 1989c). Until 1988 the basis for valuation of all categories of casualty had been the 'human capital approach', which includes costs of lost production, medical services, and a notional allowance for pain and grief. This method is still used for non-fatal injury accidents but the valuation of a fatality is now based on the 'willingness to pay' approach.

7.3.2. Research evidence on which to base the change in approach has only recently become available. The main British study has given very high valuations of between £1.2m and £1.5m for ones own life plus £0.5m for ones value to others (Jones-Lee 1985). This study also gave results indicating that the willingness to pay to avoid being seriously injured was about 1% of being killed. However, there was a substantial difference between the mean and median values from this study (a highly right skewed frequency distribution). This means that a minority are 'dragging along' the majority of respondents, and the use of the median value of £0.8m (1.046m at 1989 prices) may be more appropriate. A more recent report recommends a minimum value of life of £0.5m (Jones-Lee 1987).

7.3.3. There is some corroboration for these seemingly high figures (Marin 1983). A study of high risk occupations gave a statistical value of life of £1.25m (at 1981 prices, or £1.95m at 1989 prices).

7.3.4. The DTp have used this and other evidence to arrive at an average cost. These compare with costs per fatality of £610,235 at June 1989 prices, serious casualty £18,497 and slight £376. These figures have been used to produce a total cost of road accidents in 1988 of £6,155m (at September 1989 prices). It has been customary to apply one quarter (Department of Environment 1976) of these as community costs on the basis that much of the costs are borne by road users partly in the form of insurance. Given that the approach to the valuation of fatalities has been altered the 25/75 split should be re-examined.

7.3.5A recent report concerning the costs of damage only accidents indicates that the costs of these accidents are also under estimated (Taylor M.C., 1990). The comparison of the two sets of figures is given in Table 7.9, though those currently used in HEN 1 include property damage, whereas Research Report 256 only includes damage to vehicles. Though these are costs incurred by the user in general, there is a significant differential between the two estimates.

7.3.6. In order to apply these figures to our model of track costs we have broken down the accident costs given in HEN1 by severity and urban or non-urban road. The latest available road accident figures (DTp 1989d) were used to apply these proportionately to vehicle types (axle configurations in the case of HGV's) by their involvement rates on urban and non-urban roads (including motorways).

Table 7.9. Estimates of Damage to Property (£).

Accident Type	Source RR 256	Source HEN 1
Serious	3261	1714
Slight	2246	1224
All injury	2532	1357
Damage only	850	632

Table 7.10. Effect of Accident Costs.

Vehicle class	Tax/cost ratio. DTp figures	Base figures	Accident Costs (25%)	Accident Costs (47%)
Cars + vans	3.4	3.35	2.39	1.91
Buses + coaches	1.1	1.02	0.87	0.78
HGV Rigids				
2 axle 7.5t	2.00	1.99	1.50	1.23
2 axle 17t	1.14	1.15	1.09	1.05
3 axle 25t	1.16	1.14	1.06	0.99
4 axle 31t	1.17	1.15	1.07	1.00
HGV Artics				
2+1 axle 25t	1.43	1.41	1.25	1.14
2+2 axle 28t	1.42	1.43	1.29	1.18
2+2 axle 32.5t	1.27	1.28	1.21	1.15
2+3 axle 38t	1.36	1.34	1.25	1.19
3+2 axle 38t	1.38	1.36	1.27	1.20
3+3 axle 38t	1.46	1.45	1.33	1.24

7.3.7. The results are given in Table 7.10. The cost ratios of most lorries are substantially reduced, though as the largest lorries spend most time on high quality non-urban roads their involvement rates tend to be lower than two axle rigid vehicles. Buses and coaches clearly do not cover their track costs which is largely due to fairly high involvement rates of buses in urban areas. The results demonstrate vividly the risks associated with motorcycles where the cost ratio falls from 2.3:1 to 0.36:1.

7.3.8 In order to establish whether 25% of accident costs was still a realistic proportion to be borne by the community, we have re-worked the figures given in HEN 1 in a form so that they can be compared with earlier years. We have then applied the proportions borne by the community used when the one quarter estimate was establish (DoE 1976). At that time it was estimated that the road user bore half the cost of lost production and all property costs. In the case of pain and grief the portion borne by the user was estimated as 20% in the case of a fatality, 80% if the accident resulted in serious injury, and 100% if slight injury. These figures are shown in Table 7.11.

7.3.9A weighted average of the costs of the different types of accident was then calculated from the breakdown of costs in Table 7.12. On this basis the proportion borne by the community would now be considerably higher at 47% of the total accident costs. This figure has been used for another sensitivity test which shows many categories of goods vehicles not covering their costs if accident costs are taken into consideration (see Table 7.10).

7.3.10 In practice, the DTp have never taken these accident costs borne by the community into consideration when calculating road track costs, even though the Armitage Committee recommended that they should be included. The main reason for this is because other sectors of the community do not specifically bear their accident costs. Given the enormous sums involved resulting from road accidents, and the very high value placed on life by recent studies, the current approach should be re-examined.

Table 7.11. Percentage of Accident Costs Borne by the User.

Type of Accident	Cost element Lost Output	Medical & Ambulance	Pain & Suffering	Police	Property
Fatal	50	0	20	0	100
Serious	50	0	80	0	100
Slight	50	0	100	0	100
Damage only	-	-	-	0	100

Source: Department of Environment. Transport Policy:A Consultation Document. HMSO, London, 1976.

Table 7.12. Costs Borne by Community or User (£).

Type of Accident	Cost element Lost Output	Medical & Ambulance	Pain & Suffering	Police	Property
Fatal	148741	1108	457681	410	2380
Community (72%)	74370	1108	366145	410	0
User (28%)	74370	0	92536	0	2380
Serious	2340	2400	14480	330	1860

Community (32%)	1170	2400	2896	330	0
User (68%)	1170	0	11584	0	1860
Slight	30	120	270	250	1340
Community (19%)	15	120	0	250	0
User (81%)	15	0	270	0	1340
Damage only	0	0	0	80	690
Community (10%)	0	0	0	80	0
User (90%)	0	0	0	0	690

Sources: Department of Environment. Transport Policy:A Consultation Document. HMSO, London, 1976.
Department of Transport. Highways Economic Note 1. DTp, London,1989.

7.4 Overloading.

7.4.1In a previous study the evidence on the overloading of goods vehicles was examined (Fowkes, Nash & Tweddle 1988) and it was concluded that the best available evidence was that produced as a result of a random survey conducted in Cheshire in 1986 (Urqhart and Rhodes, 1987). The estimates of the average weight and standard axles from this survey compared to those used by the DTp is given in Table 7.13.

7.4.2The figures produced by the Cheshire study are always higher than those used by the DTp. When the average GVW and standard axle figures from the Cheshire study are used in the computer model the costs incurred by these parameters remain the same in total, but are re-distributed among different classes of vehicle. The tax/cost ratios which result are shown in Table 7.14, the ratio of the largest rigid lorries changing dramatically because they show the greatest propensity to overloading.

7.4.3Dr. Rhodes of Newcastle University has been undertaking research into the dynamic effects lorries have on pavements. However, we understand that he has not succeeded in obtaining funding to allow this potentially fruitful study beyond the first stage, so only limited knowledge will be gained from the project.

Table 7.13. Comparison of Lorry Weights- DTp versus Cheshire Survey.

HGV axle group	Average GVW		Standard axles	
	DTp figures	Cheshire study	DTp figures	Cheshire study

Rigid
2 axle<7.5t 4.0 4.220.00470.010
2 axle>7.5t 8.6431 9.030.18550.226
3 axle14.6872 14.880.44350.479
4 axle19.851822.430.65231.030

Artic
3 axle11.243213.370.14920.232
4 axle20.137020.920.62060.724
5 axle26.2627.050.83271.092
6 axle26.6027.100.49880.697

Source:- Derived from The allocation of road track costs 1989/90, and TORG Research Report 64.

Table 7.14. Effect of Overloading.

Vehicle class	Tax/cost ratio. DTp figures	Base figures	Overloading
Cars + vans	3.4	3.35	3.35
Buses + coaches	1.1	1.02	1.12
HGV Rigids			
2 axle 7.5t	2.00	1.99	1.92
2 axle 17t	1.14	1.15	1.14
3 axle 25t	1.16	1.14	1.23
4 axle 31t	1.17	1.15	0.97
HGV Artics			
2+1 axle 25t	1.43	1.41	1.24
2+2 axle 28t	1.42	1.43	1.47
2+2 axle 32.5t	1.27	1.28	1.32
2+3 axle 38t	1.36	1.34	1.31
3+2 axle 38t	1.38	1.36	1.33
3+3 axle 38t	1.46	1.45	1.37

7.5. Cumulative Effects of Sensitivity Tests.

7.5.1 The effects of allowing for the increases in road spending, accident costs and vehicle overloading are shown in Table 7.15, together with adjustment for revenues as a result of the 1990 budget and the planned increase in spending on roads. In this table we have also allocated those elements of cost which DTp allocates on the basis of vehicle km using pcu km, for the reasons given above (section 4.2). The result suggests that a further increase in taxation of the order of 30% is justified in overall terms. This is without moving towards a truly marginal cost pricing treatment of capital costs, which might require a very much higher increase in taxation (see section 3), and without questioning the adequacy of the 30% margin to cover other social costs.

7.5.2. In examining the various categories of vehicle the degree by which their total tax revenues should be adjusted varies significantly, as shown by the last column in Table 7.15. The large articulated lorries all require an increase of around the average of 30%. In the case of rigid vehicles, some of which currently pay less than the 1.30:1 tax to cost ratio, a few categories require substantial tax increases, notably the four axle rigid vehicles with which rail competes for some bulk traffics should face tax levels 59% higher than they are at present.

7.5.3. Buses are another category which significantly underpay their true costs on the basis of our calculations, and their taxes should be increased by 60%. The major factor in buses underpayment is the relatively high costs of accidents in which they are involved in urban areas. These estimates do not make any allowance for fuel tax rebates to psv operators.

Table 7.15. Cumulative Effect of Sensitivity Tests.

Vehicle class	Tax/cost ratio.			
	DTp figures	Base figures	Cumulative effect	Min. Increase
Cars + vans	3.4	3.35	1.85	
Buses + coaches	1.1	1.02	0.81	60%
HGV Rigids				
2 axle 7.5t	2.00	1.99	1.12	16%
2 axle 17t	1.14	1.15	0.97	35%
3 axle 25t	1.16	1.14	0.99	32%
4 axle 31t	1.17	1.15	0.82	59%
HGV Artics				
2+1 axle 25t	1.43	1.41	0.91	43%
2+2 axle 28t	1.42	1.43	1.04	24%
2+2 axle 32.5t	1.27	1.28	1.00	30%
2+3 axle 38t	1.36	1.34	0.96	35%
3+2 axle 38t	1.38	1.36	0.98	33%
3+3 axle 38t	1.46	1.45	1.03	26%

Notes:
i) Of total accident costs, 47% allocated to track costs.
ii) Vehicle kilometres converted to pcu kilometres.
iii) Vehicle overloading taken into account, as per Cheshire study.
iv) Increased VED as per 1990 budget, plus fuel increase of 10% adjusted for inflation.
v) Capital spending on DTp roads increased by 23%.

7.6. Vehicle Delay and Congestion.

7.6.1. It has long been recognised that every vehicle on the road tends to delay others to some extent, slower moving lorries tending to delay more vehicles to a greater extent than cars.

However, the power to weight ratios of HGV's have been increasing in recent years, and as average speed differentials of traffic narrow vehicle delay is reduced, and theoretical lane capacity is increased. It is sometimes argued that, since delays are imposed by one vehicle on others, delay costs are internalised from the point of view of the road system as a whole. Nevertheless, there remains a divergence between the marginal cost of a trip (including delays imposed on all other vehicles) and the average cost, and this properly forms part of the external costs of road transport (Walters 1961).

7.6.2A number of reports have attempted to calculate the cost of congestion. One produced valuations for various types of road at three levels of capacity utilisation (Buchanan 1984). We have recalculated these figures converting from passenger kilometres to pcu kilometres, and to 1989 prices, as shown in Table 7.16.

7.6.3From Table 7.16 it is apparent that congestion costs are much higher in urban areas rather than on the inter-urban routes where rail is competing for long distance freight and passenger traffic. They will also be lower at night than during the daytime. However, many long distance movements have trip ends within urban areas, though this part of the journey may be made by road whether the mode used for the trunk movement is road or inter-modal. It is also the case that a considerable proportion of delays are created by roadworks or accidents, and these delays should be charged to the vehicles which cause them.

Table 7.16. Resource Cost Saving from Road Congestion per PCU Kilometre. (In 1989 pence).

Road type	Capacity utilisation 70%	90%	100%
Rural			
Motorway	2.57	3.22	5.15
All purpose dual carriageway	1.93	2.57	3.22
Single carriageway (10m)	2.57	3.86	5.15
Single carriageway (7m)	2.57	3.22	3.86
Urban			
Suburban dual carriageway	5.15	8.37	10.94
Suburban single carriageway	8.37	14.16	18.66
Urban non-central	10.30	17.38	23.17
Urban central	19.95	37.97	53.41

7.6.4 Calculation of appropriate congestion charges would require a knowledge of the distances run by each vehicle type by type of road and level of capacity utilisation. We know of no adequate source of data on this. In any event, congestion delays should only be included in longrun marginal cost to the extent that they are not offset by increased road capacities. What should be included in any event is the delay caused by heavy goods vehicles to other vehicles even on uncongested roads. We know of no evidence on this since a study back in 1969 (Everall 1969) and the power to weight ratios and general performance of lorries have changed considerably in recent years.

7.7. Environmental Effects.

7.7.1The major environmental effects of traffic are noise, visual intrusion and pollution. HGV's are the worst offenders in the first two of these, and produce objectionable smoke if not properly maintained. However, in total cars produce far more air pollutants than lorries, though this situation will change in the U.K. as car emissions are reduced and commercial vehicles will produce a much greater proportion of the total traffic pollution (Fergusson Holman & Barlett, 1989). See Table 7.17. Most of the reductions in car exhaust emissions come as the result of fitting catalytic converters required from 1992. These have the effect of converting virtually all the pollutant gases into carbon dioxide which is less harmful, but nevertheless a 'greenhouse' gas.

7.7.2The current EC proposals for levels of emissions from commercial vehicles are given in Table 7.18. They are similar to those planned for the U.S.A. Their effect will be to increase the cost of large automotive diesel engines in the interim period by between 10 and 15%, with a further 10% to meet the 1996 standard. However, many of the largest engines currently available may meet the interim standards and those that cannot easily be made to do so may be deleted from manufacturers lists. The effect on fuel consumption will be an increase of about 5% in the interim period, and a further 5% to 7% after 1996 though the latter will also require fuel with a lower sulphur content (Cunningham 1990).

Table 7.17. Changes in the Percentage of Commercial Vehicle Pollution.

Year	1988	2020 Low	2020 High
Pollutant			
NOx	44	75	76
CO	4	10	12
CO2	20	27	33
HC	6	11	18

Source: Derived from Fergusson et al. Atmospheric Emissions from the Use of Transport in the U.K. World Wildlife Fund for Nature, Godalming, 1989.

Table 7.18. Mode Measurement of Diesel Emissions. (Grammes)

Type of emission:	CO2	HC	NOx	Particulates	
Engine output (Kwh):				0-85	85+
EC 10/1990	11.2	2.4	14.4	-	-
EC 10/1992	4.5	1.1	9.0	0.63	0.36
EC 10/1996	4.0	1.1	7.0	0.3	0.15
USA 1991	15.5	1.3	5.0	0.34	0.34
USA 1994	15.5	1.3	5.0	0.13	0.13

Source: Motor Transport, Vol 135, No. 4423, p6.

7.7.3 Development of techniques to place money values on the environmental effects of road traffic has received new impetus from the publication of the Pearce report in 1989 (Pearce & Markandya, 1989). A variety of methods exists (Nash and Bowers, 1988). In the case of damage to buildings and agriculture, the costs of offsetting the damage, or replacing the lost production may be estimated. For the amenity effects of noise, air pollution and visual intrusion, either revealed preference methods (based for instance on the relative house prices in areas of different levels of disturbance) or stated preference methods (using hypothetical questions regarding the willingness to pay to avoid disamenity) may be used.

7.7.4 The results of various studies into the cost of traffic noise are given in Table 7.19. These were estimated using the Hedonic Property Prices technique, which compares values of houses in situations where the level of traffic noise is different. From these results we can deduce that a change of one unit of Leq (the equivalent continuous sound level) equals half a percentage change in house prices.

7.7.5. The large variations found in Table 7.19 are replicated in similar studies of aircraft noise. In general it has been found that depreciation of prices per unit in noise increases with the noise level itself. One exception is the most recent study of British aircraft noise, which concluded that house prices in the vicinity of Manchester airport were unaffected by aircraft noise when other factors were properly taken into account (Pennington, Topham & Ward, 1988).

7.7.6. Similar studies have been used in North American cities to estimate the cost of air pollution in terms of property prices. Of course not all air pollution emanates from motor vehicles. The results of such studies indicate that a one per cent increase in sulphation levels will result in falls in property values of between 0.06 and 0.12. In the case of particulates the range is 0.05 to 0.14 per cent of property values. Where more than one pollution variable is being measured, then property prices fall between 0.09 and 0.5 per cent (Pearce & Markandya, 1989).

Table 7.19. The Impact of Traffic Noise on House Prices. (per cent of house price).

Location	Impact of one unit change in Leq
United States,	
North Virginia	0.15
Tidewater	0.14
North Springfield	0.18-0.50
Towson	0.54
Washington	0.88
Kingsgate	0.48
North King Country	0.30
Spokane	0.08
Chicago	0.65
Canada, Toronto	1.05
Switzerland, Basle	1.26

Source: Pearce D.W., and Markandya A. Environmental Policy Benefits:Monetary Valuation. OECD, Paris 1989.

7.7.7. In applying any estimate of the effect of traffic noise and exhaust pollution on house prices to the total of road track costs, it is necessary to note that most of these costs will be incurred in urban areas. They will have a lower effect on the costs of long distance movements over rural trunk roads. As most of the population is concentrated in urban areas similar arguments apply to the pollution effects on health.

7.7.8. A Swedish study based on the costs of achieving target reductions in pollution by alternative means has estimated the emissions from vehicles (a weighted average of NOx, HC and CO) to be valued at between 10 and 80 SEK (£0.95-£7.61) per kilogram (Hansson and Nilsson, 1989). The sum used for evaluation purposes by the researchers was 15 SEK (£1.43).

7.7.9. Air pollution, especially in the form of acidification has widespread effect on the value of agricultural crops. However, one study of soyabeans found that a 50% reduction in wet acid deposition from acid rain would increase the value of the crop by only 0.5% (Pearce and Markandya, 1989).

7.7.10. On the other hand, the total cost to the Netherlands of air pollution has been estimated at between Gld 580-688 million per annum (1984 prices). Damage to the German forestry sector has also been estimated at DM 2.3 billion (Pearce & Markandya, 1989).

7.7.11. A possible area of cost of air pollution which may be overlooked, but which may be significant, is that of household soiling. This is mainly the costs of cleaning particulate deposits on walls and windows, and increased painting of surfaces.

7.7.12. Allocating the external costs of pollution of various types to the numerous categories of vehicle is complex. It is apparent that most costs would be borne by people in urban areas, and large vehicles on long distance journeys may be allocated relatively small proportions of the total cost of pollution.

7.7.13. Current evidence on the appropriate valuation of the environmental costs of transport is not adequate for robust cost allocations to be undertaken. However, a recent report to TRRL (so far unpublished) recommended that more work should be undertaken on this subject. SACTRA is also currently investigating this issue, and one of the authors of this paper in evidence to them argued that a combination of stated preference techniques with the house price approach (posing hypothetical questions about the willingness to pay for alternative houses with known levels of disamenity) would be a potentially fruitful little explored approach (Nash, ed,1990).

7.7.14. Over and above all these factors lies the major problem of the greenhouse effect. If it is accepted that the costs of this are so great that action has to be taken to reduce the buildup of greenhouse gases to an acceptable level, then it is likely that the growth of road transport will have to be constrained. An obvious approach to this would be a further increase in road taxation. Such an approach to transport policy has already been proposed in the Netherlands, but it is the private car on which attention is to be concentrated, with priority being given to commercial vehicles (Ministerie van Verkeer en Waterstaat, 1989).

8. Harmonisation of Taxes in Europe.

8.1 Range of Tax Levels in Europe.

8.1.1We have already seen that there may be good reason to increase taxes on heavy goods vehicles in Britain over the coming years. We have also seen that levels of taxation in the various countries of the EC vary enormously, but are generally substantially less than in Britain. The question then arises as to the possible effects of tax harmonisation within the EC.

8.1.2. Most countries have a two tier system as in the U.K., with the majority of revenues raised from a tax on fuel (which is related to use of the vehicle), and a fixed licence fee per year similar to our VED. Currently British registered lorries pay more VED than in any other country, and we also have one of the highest rates of fuel duty. Naturally this has led to calls for harmonisation of taxes between the member states, in order that competition may take place on equal terms.

8.1.3 In an ideal world, the level of taxation would vary between countries according to the costs in the country concerned. Lorries, wherever they were registered would pay taxes according to the mileage run in each country at the level appropriate to the country concerned. However, this would require lorries to be fitted with reasonably sophisticated equipment to monitor the mileage operated in each country. We believe that electronic tachographs would cost about Dm300 per vehicle, or Dm1 billion for the international fleet alone (based on an estimated 16.5 million commercial vehicles in EC countries, and up to 20% of these would at some stage be used on international journeys). Although this would represent the most appropriate interpretation of the "territoriality principle", the EC appears to accept that it will not be feasible in the short run. What is more likely in the short term then is some attempt to harmonise actual tax structures and levels between countries. This is the subject to which we now turn.

8.1.4. Although it would probably be the case that such a harmonised tax regime would involve both a VED and a fuel tax element, we have chosen to represent it as a single harmonised tax on fuel. In most countries fuel tax dominates the tax take from heavy vehicles; it has advantages in terms of relatively simple administration and resistance to fraud. It has been suggested as a Europe-wide approach because it makes allocation of revenues by territoriality relatively simple. We have undertaken some sensitivity tests on the revenues which would be generated by various levels of duty on fuel, without any VED being applied. The results are shown in Table 8.1. The EC Commission is currently proposing a level of duty in a bracketed

Table 8.1. Fuel Taxation.

Vehicle class	Tax/cost ratio.			
Derv tax (p/litre)	a) DTp.	b) .1782	c) .2535	d) .1450
Cars + vans	3.4	3.4	3.4	3.4
Buses + coaches	1.1	0.98	1.40	0.80
HGV Rigids				
2 axle 7.5t	2.00	1.73	2.46	1.41
2 axle 17t	1.14	0.73	1.04	0.59
3 axle 25t	1.16	0.70	1.00	0.57
4 axle 31t	1.17	0.73	1.04	0.60
HGV Artics				
2+1 axle 25t	1.43	1.09	1.56	0.89
2+2 axle 28t	1.42	1.15	1.63	0.93
2+2 axle 32.5t	1.27	0.91	1.30	0.74
2+3 axle 38t	1.36	1.00	1.42	0.81
3+2 axle 38t	1.38	1.06	1.51	0.86
3+3 axle 38t	1.46	1.30	1.85	1.06

Note: a) Assumes VED rates as published in the Allocation of Road Track Costs 1989/90. In b), c) and d) VED is assumed to have been abolished.

range of 285-300 ecu/ltr (16.71-17.72p/ltr). The current UK duty is outside this range at 19.02p/ltr.

8.1.5. If the base vehicle which must cover its road costs is taken to be a 38t artic with a 2+3 axle configuration, then the level of tax would need to be increased by 3% (ignoring any external costs). However, on this basis some large rigids would pay only 70% of their road track costs.

8.1.6. If fuel duty is increased by 47% to 25.35p per litre then all vehicles will at least cover their track costs, the largest artics by a considerable margin, though the large rigids (with whom rail is in competition for some bulk movements) only just. If the EC were to decide on a tax system based on fuel duty only, then it should be at a rate substantially higher than those which currently prevail within the Community if vehicle revenues are to cover costs.

8.1.7. Among the proposals for future taxation is an averaging of the current state taxes. This could produce a duty of about 14.5p per litre, a much lower figure than the current U.K. tax. In this case the vast majority of commercial vehicles, as well as buses and coaches, would pay considerably less than their track costs. A VED type tax could redress the balance (at least for a vehicle covering the average distance in its class) if introduced at a high enough level, but if this was also to be averaged across the EC states as a compromise then operators of commercial vehicles in the U.K. would find their road taxes considerably reduced. In the case of international journeys, it is also unlikely that vehicles would cover their track costs, possibly influencing mode choice decisions for interstate flows of traffic. Obviously, most of these problems could be overcome if the level of fuel duty were set towards the upper end of the range found within Europe.

8.1.8. In the foregoing statement we have made the presumption that the costs of the provision and maintenance of roads is the same throughout Europe. Obviously some factors vary. Winter maintenance costs will be considerably more in some parts of northern Europe than in the south. More importantly, different methods of construction and maintenance may achieve lower whole life costs for road provision, and these costs may be spread over different volumes of traffic of various profiles in terms of composition of vehicles. This simply reinforces the need to preserve a system which allows for different tax levels in the various member states.

8.1.9. In order to allow individual countries within the EC to keep their own system and level of taxation, and recoup revenues from foreign vehicles using the roads, a 'territoriality taxation system' is proposed for international road transport. The system is currently under investigation by consultants, and the results are not yet available.

8.1.10. We believe that the data being produced will show that allocated track costs per 1000 vehicle kilometres in the UK are among the lowest in Europe. Once again, this reflects the high traffic volumes combined with relatively low levels of investment in this country. Under the principles of the territoriality system this means that when UK registered vehicles travel on the continent, a relatively large transfer payment would have to be made to a foreign government compared to that for a foreign lorry covering the same distance on British roads.

8.1.11. Total inter-state transfer payments will be based on surveys of the use of one nations roads by vehicles registered in other countries. It is not clear how these payments will be re-charged to the vehicles actually engaged in international transport, but if it is not done in an equitable manner then unfair competition between hauliers of different countries will arise, and this will also have an effect on mode choice decisions.

8.2 Preferred Policy Options of the EC Commission.

8.2.1Our understanding is that, though the detailed policy has not been decided, the attitude of the Commission staff is to promote a harmonisation policy which would raise sufficient revenue (in the form of fuel duty) to cover the 'average' road infrastructure costs of the EC members as a whole. This should also cover the variable costs of infrastructure provision (including maintenance, police and renewal costs). Countries which currently have tax levels above the EC average such as the UK, would be allowed to retain them if they wished to do so.

8.2.2Problems which remain, apart from Benelux countries having low fuel duty and UK/Eire high duty, are that the calculation of 'average' infrastructure cost may be dragged down by countries such as Portugal which spend little on roads. On the other hand France and Italy have extensive networks of toll roads, which lower the average infrastructure expenditure of the respective governments while retaining duty income from fuel used by vehicles on the toll roads.

8.2.3Currently there are no plans to propose a federal/state road infrastructure system similar to that in the USA. This is thought to be politically impossible in the foreseeable future.

8.2.4The objective of the EC Commission in its harmonisation policy is to eliminate distortions in the market (not only in transport), and to cover the cost of infrastructure. Their thinking is also to apply environmental costs to road traffic. This, it is thought, would double road taxes, but they are not yet able to calculate the basis for the tax levels.

8.2.5In the case of international haulage, harmonisation in the technical and social fields is almost complete, represented by the 40 tonne 'Eurotruck' and the tachograph and plating regulations. However, in the fiscal field much remains to be done, and Germany will not agree to liberalise until it is done.

8.2.6Even without full harmonisation on vehicle taxation, liberalisation is proceeding (with objections from Germany), and all EC quota restrictions should be removed by 1/6/1993. As from 1/7/1990 cabotage permits became available, and it is hoped that cabotage will be freely undertaken by 1993.

8.2.7Differences in costs and duty revenues for the different states arise when lorries from one country operate on another's roads. Article 10 of Document 700/16 puts forward the 'territoriality principle' whereby the imbalances would be transferred via an EC fund, the members having rejected direct inter-state tax transfers.

8.2.8Although the territoriality system transfers balances between states, it does not automatically debit or credit the individual vehicles and operators concerned. Unless this is done, operators in low cost states will still benefit, and the Commission does not have the powers to direct domestic legislation within member states so that the adjustment occurs. This means that in practice, there will be unfair competition between the haulage companies of different states, and this may also influence mode choice decisions. The degree of unfair competition will depend in part on the range of fuel duties applied in different states as most international operations will involve purchase of some fuel in a foreign country.

8.2.9In general, the EC favour remissions for combined transport operations. They have allowed aid to be given to the construction of terminals for some time, and now this has been extended to systems as well.

9. Conclusions.

9.1.1 We have seen that there are a number of respects in which the current British system of allocating road track costs fails to measure accurately the long run marginal costs of increases in traffic of various types of vehicle. These may be summarised as:

- charging capital costs on an inappropriate "pay-as-you-go" basis

- failing to allow adequately for the extra costs imposed by heavy vehicles in terms of pavement thickness, lane width, gradient, curvature and bridge strength.

- failure to include quantifiable public costs of accidents

- failure to allow for overloading.

- use of vehicle km rather than pcu km for the allocation of some elements of cost.

- failure to allow for environmental costs (except by maintenance of an arbitrary 30% margin between revenue and allocated costs).

Allowing for the last three effects alone, plus the current plans for increased spending on roads would be sufficient to add some 30% to the taxes on heavy lorries. A proper treatment of capital costs could add a much greater amount to the charge.

9.1.2. Although methods of quantifying environmental costs have greatly improved in recent years, and there is much interest in the subject at the present time, no study to value the environmental effects of heavy goods vehicles has yet been sponsored. We belief that this is a promising area, and that the appropriateness of the current 30% margin to allow for environmental effects could now be tested, although some aspects, such as the greenhouse effect, would probably defy monetary valuation.

9.1.3. Despite the above arguments which suggest that heavy goods vehicle taxation in Britain is probably still to low, it must be said that the methods of allocating costs in Britain are more sophisticated than in most other EC countries, and the degree of cost coverage much higher. There is a real danger that moves towards harmonisation of tax levels in EC countries may lead to an undesirable reduction in the current U.K. level. This should be resisted, on the basis both that current charges in other European countries are generally too low, and that appropriate taxation requires different levels of tax, within a harmonised general structure, according to the costs in the country concerned. However, if the desire for harmonisation should lead to a reduction in road taxes, then there would be a clear case for the government to take responsibility for meeting a part of the infrastructure costs of competing modes, as is provided for in current EC legislation.

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