

Annex F

Environmental and Wider Impacts

Introduction

- F.1** The terms of reference for the study set out that the objectives for any new charging scheme should include the delivery of environmental benefits. Some impacts on the environment and wider issues, such as land-use, may take some time to develop as the location of development and housing choices evolve. Hence this Annex considers the potential for both short-term and long-term impacts.
- F.2** A carefully structured road pricing scheme could make a valuable contribution to reducing the environmental impacts of transport by:
- helping to reduce greenhouse gas emissions in line with UK and international climate change targets
 - contributing to further improvements in air quality
 - securing reductions in noise, severance and nuisance by cutting down congestion
 - minimising the impact of and need for new infrastructure provision through better use of the existing network.
- F.3** However, the impact of road pricing on these issues will depend both on how drivers react to it initially and whether it changes their behaviour:
- if their response is to make fewer journeys, to use public transport or to share cars, the impacts will, on the whole, be beneficial
 - if their reaction is to make their planned journey at a different time, the impacts, generally, are likely to be beneficial as a result of reduced congestion
 - if they choose to make longer journeys or more journeys as a result of freer flowing traffic this could reduce benefits otherwise achieved
 - if their reaction is to make the planned journey by a different route the benefit of a reduction in congestion could be reduced or even negated if the different route was longer or on less suitable roads.

Environmental issues

- F.4** Road transport accounts for almost a quarter of CO₂ emissions in the UK, which contributes to global warming, and adds substantially to local air pollution that damages health. As the number of motorists increase we will be faced with increases in traffic not just in cities, but in smaller towns too. The tranquillity of the countryside will be further eroded, there will be more damage to the environment and our health will suffer.
- F.5** At the local level, traffic has an impact on the quality of life of those living near roads in urban and rural areas. A road pricing scheme, which enables a range of prices to be applied, could use price mechanisms to deal with specific local environmental issues as well as congestion. In order to lock in the benefits a scheme would need to ensure it did not incentivise traffic to divert to times and places which would cause adverse environmental impacts.

Carbon Dioxide emissions

- F.6** Road pricing has the potential to help deliver the Government's Climate Change objectives by cutting congestion and reducing carbon emissions.
- F.7** Engines operate more efficiently in free-flowing conditions than in congestion. But modelling undertaken for this study using the National Transport Model has confirmed that CO₂ emissions otherwise respond to the quantum of price rather than variations in it. Fuel duty is thus an effective price mechanism for targeting CO₂. To this extent it differs from local air quality and congestion, both of which respond more directly to the variations in charges by time and place that road pricing enables, rather than to the overall price.
- F.8** Nevertheless, a national road pricing scheme with charges set at the level of the marginal social cost could deliver a significant reduction in carbon emissions. The size of that reduction would depend on the value attributed to carbon, as well as whether any net revenue would be used to encourage the use of more sustainable modes of transport. The modelling suggests that an additional 1.5p/km raised either through fuel duty or by adding the same amount to road user charges would reduce CO₂ emissions by 1MtC. But the road user charge would deliver significantly higher welfare benefits because of its greater impact on congestion.
- F.9** The impact on CO₂ of a road pricing scheme which did not raise the overall quantum of cost to motorists is less clear. The reduction in congestion would lead to a reduction in CO₂. But this could be negated by any encouragement to drive longer distances where prices were lower. In addition, any reduction in fuel duty would reduce the incentive on motorists to choose a lower emissions vehicle and drive in a more fuel-efficient way. Therefore any national scheme which replaced or reduced fuel duty as a means of offsetting the cost road user charges would need to find a means of replicating this incentive if reductions in carbon emissions were to be achieved.

Local air quality

- F.10** Local air quality is a measure of the direct impact of emissions of primary air pollutants (NO_x and PM₁₀) on the local population and is therefore local in nature and is time-dependent (e.g. emissions are greater at peak traffic times than off-peak due to the concentration of traffic). Secondary pollutants (such as secondary particles or low-level ozone formed by NO_x emissions) generated by vehicle emissions also contribute to adverse health effects over a

longer distance. Therefore, the effects of road pricing on the location of driving and time of driving are relevant as well as the total emissions of air pollutants.

- F.11** Deprived areas tend to suffer the most and are often designated as air quality management areas. Any improvements in the air quality could have the added benefit of reducing social inequalities by improving the health of residents in these areas.
- F.12** NO_x and PM₁₀ emissions vary in relation to speed, with 65km/hr being the optimum speed for the lowest emission rate (Figure F1). The Government continues to focus efforts on reducing them, as part of its Air Quality PSA target, via technological improvements.

Figure F1. Speed Ranges with the Lowest Emission Rates (km/hr)

	NO _x	PM ₁₀	CO	NMHC ¹	CO ₂
Minimum	60-65	65-80	75-80	90-100	65-70
Within 10 per cent of minimum emissions	40-90	55-85	60-95	75-115	45-90

- F.13** Annex B demonstrates that road pricing has the potential to significantly improve local air pollution, with these pollutants reducing by up to 8 per cent in large urban areas.

Noise

- F.14** Road traffic noise is mainly generated by vehicles' engines (at lower speeds) and by the tyres (at higher speeds). The level of noise generally increases in accordance with the width and thickness of the tyres, which tend to be found on larger and higher performance vehicles. EU directives limit the level of noise emitted from vehicles and allow for the development of economic instruments such as incentives for purchasing quieter vehicles. Policies to reduce road traffic growth and to improve traffic flow by reducing the amount of stop-start driving should help reduce the levels of noise in our communities. However, on motorways, reduced congestion could lead to increased speed and more noise.

Natural resources and sensitive areas

- F.15** There is a strong presumption against new or expanded transport infrastructure in sensitive areas such as National Parks, Areas of Outstanding National Beauty or near Sites of Special Scientific Interest, archaeological sites etc. If a scheme were to be implemented in or near such an area the introduction of new technology would have to comply with the strict planning regulations. By managing traffic and reducing the demand for new road building, a road pricing scheme could be beneficial. However, if it resulted in the re-routeing or dispersal of traffic through sensitive areas, it could have unfavourable consequences.
- F.16** On the other hand, a sophisticated system of variable road pricing could potentially be used to incentivise people not to drive vehicles through particular landscapes in order to safeguard them further.

1 Non Methane Hydro Carbons.

Other local impacts

- F.17** Many of the environmental impacts resulting from road pricing will depend on where, when and how it affects the local population. Local scheme assessments will be essential in measuring any impact on the surrounding environment, including an assessment of tranquillity, health benefits, severance, water quality and modal shift.
- F.18** The tranquillity of rural areas could potentially be disturbed if road pricing results in increased traffic passing through such areas as a result of re-routing. However, a reduction in the overall level of traffic could encourage more people to use bicycles or walk, resulting in significant health benefits².
- F.19** A reduction in emissions as a result of reduced congestion could lead to a number of health benefits such as reductions in respiratory illnesses, circulatory disorders and certain cancers.
- F.20** Heavy traffic acts as a barrier to community life, and disadvantaged groups often suffer most from poor air quality and noise because they tend to live closest to busy roads. Severance also deters beneficial physical activity such as cycling and walking, particularly amongst children and it can reduce social contact. A sensitive charging structure has the potential to bring benefits in this area.

Road user issues

- F.21** Road users interact with the environment to the extent that they affect and are affected by what is around them. This covers the road users' response to journey ambience and road safety, which could affect how they respond to road pricing.
- F.22** With a reduction in congestion, motorists should benefit from a more fluid, comfortable and less stressful journey. However, as an experience, some motorists tend to find travelling on motorways boring and consequently take different more scenic routes. Journey ambience is one factor taken into account in standard appraisals.
- F.23** Speed is a major contributory factor in about one-third of all road accidents. The impact of re-routing, if it were to occur, could in certain places and at certain times result in an increase in accident levels. This is due to the increased number of vehicles using smaller roads, not built for a high level demand, which could lead to higher accident rates. However, a well-informed charging structure could minimise the incentives to re-route.
- F.24** If motorcycles are exempted from road pricing they could become more popular, which could have implications on road safety. This is because motorcyclists have been found to be eight times more likely than car drivers to be involved in an injury accident, over 20 times more likely to be injured themselves, and over 35 times more likely to be killed or seriously injured (Chesham *et al*, 1991)³. However, preliminary evidence⁴ from the London Congestion Charge scheme suggests that increased speeds and greater prevalence of motorcycles has not led to changes in the downward trend in accidents or their severity.

2 Cycling for 30 minutes per day can reduce the risk of cardiovascular disease by as much as half (http://europa.eu.int/comm/environment/urban/thematic_strategy.htm).

3 Chesham, D. J., Rutter, D. R. and Quine, L. (1991). Mapping the social psychological determinants of safe and unsafe motorcycle riding. In G. B. Grayson and J. F. Lester (eds), *Behavioural Research in Road Safety*. Transport and Road Research Laboratory, Crowthorne.

4 Transport for London. 2004. *Impacts Monitoring – Second Annual Report*.

- F.25** The improved free flow of traffic could also lead to an increase in the severity of accidents i.e. from shunts to fatalities. Revenue raised from a charging scheme could fund traffic calming measures in urban areas to alleviate this problem, although journey time benefits would not be so great.
- F.26** Driver distraction could become a concern if interactive OBUs were introduced into vehicles, especially if consumers constantly monitor them.
- F.27** The charging structure should be designed to avoid encouraging people to hurry to avoid an increase in the charge or dawdle to benefit from a reduction on the next link.

Long term and wider impacts

- F.28** As well affecting people's choices on whether or how to travel, road charging has the potential to influence a wider range of outcomes, both in the long and the short term. It may impact on decisions such as where businesses locate, where people live, on the competitiveness of regional economies, or on the vehicles people buy.
- F.29** Over history, transport developments (canals, railways, roads, motorways and air travel) have been an important determinant of land-use patterns and have affected individuals' long-term behavioural choices. Any type of road pricing will also invoke such responses. Some of these may take many years to develop. Balanced against these responses are the implications of not tackling traffic growth, which itself will impact on long-term behaviour as well as on business efficiency and UK competitiveness. The knowledge of the scale and direction of long-term changes is weak and needs further study.
- F.30** Long-term responses will be conditional on whether expectations of future costs of road use are altered. A long-term commitment to a form, coverage and level of charge would be necessary to bring about some of the impacts described in this paper. In addition, people's experience of the results of their short-term decisions (e.g. change mode from car to public transport) will frame their long-term response (e.g. change job due to discontent with commuting).
- F.31** Short-term responses will include relatively simple choices between different modes, routes, trip lengths, trip times or even whether a trip occurs or not. Long-term responses may have widespread impacts on the economy ranging from changes in house prices, the location of businesses and the population characteristics of communities, changes in the mean size and fuel efficiency of vehicles, to changes in the vehicle balance of payments deficit. Some of these impacts may be minimal but should not be ruled out *a priori*.
- F.32** Modelling for PROPOLIS⁵ found that environmental and social sustainability deteriorates in cities if no actions are taken to control growing traffic. Best results were found from combination policies – 'push and pull' measures of road pricing and improvements in public transport.

5 Planning and research of policies for land-use and transport for increasing urban sustainability. February 2004, funded by EU. Case cities were Helsinki, Dortmund, Inverness, Naples, Vicenza, Bilbao and Brussels.

- F.33** The main emphasis of Government planning policy is to concentrate on existing urban areas in the first instance. In general terms, a road pricing scheme and accompanying measures could make a valuable contribution to meeting the planning system's aim of sustainable development by:
- emphasising the benefits of concentrating most development on existing urban areas, towns and villages and on brown-field land
 - making commercial, service, retail and leisure outlets more easily accessible or attractive by public transport, cycling or walking by siting local services in more easily accessible locations
 - securing reduction in noise and improving air quality, thereby making certain areas more attractive for different types of development
 - cutting down on congestion, by providing road users with more choices about when, how and whether to travel.
- F.34** On the other hand, if not carefully structured, a road pricing scheme might produce disbenefits by:
- providing incentives for out of town developments, thereby potentially weakening town centre economies, lengthening trips and increasing car dependency
 - producing steep cliff-edge pricing boundaries with impacts on house prices
 - redirecting traffic onto inappropriate routes or otherwise increasing traffic, leading to new capacity needs that cannot be accommodated within existing policies
 - providing perverse incentives for long-distance commuting with subsequent business or residence location choices leading to longer trips
 - encouraging more people in rural areas to travel further with a negative effect on the provision of accessible local services.
- F.35** The South and West Yorkshire Multi-Modal Study (SWYMMS) found that wide-area charging would reinforce urban renaissance and shorten car commuting trip lengths on the motorways and A1 by over 20 per cent. The Orbit study found that there would be a tendency for some movement of households, employed residents and jobs into London as a result of the 'very high' charge scenario, again with reduced trip lengths.
- F.36** PROPOLIS found that combining public transport and car pricing policies produced cumulative positive results, avoiding or mitigating the negative land-use effects of individual policies. Combining a variety of policy instruments does, however, complicate the identification of the effects of each element.
- F.37** The city with arguably the most experience of road pricing is Singapore. It does not appear that any observer has found it possible to disentangle the effects of road pricing from the effects of other measures. Apart from quotas on car ownership, these include long-term integrated transport and land-use planning, a strong single-tier Government and supply-side measures such as targeted increases in road capacity, traffic management measures and major investment in an integrated public transport network. The small scale of the country may also be a helpful factor.

Business impact

- F.38** The impact of road pricing will differ between and within industry sectors⁶. Its significance will depend on the relative importance of the cost and time of road travel in business costs. Business traffic generally has a higher value of time than personal traffic and should therefore enjoy a greater benefit from time saved than from additional costs. However, we recognise that more research is needed on the potential impacts on business.
- F.39** Where travel is an essential characteristic of the business (e.g. logistics or the taxis business) and/or where such costs are unavoidable, the impact will depend partially on the ability and willingness of businesses to pass costs/savings on to customers. This may differ for small and large businesses. Sectors supplying alternative modes of personal transport (e.g. mini-cabs or taxis) are likely to see increased usage where the cost of car travel increases, depending on the level and type of any exemptions or discount.
- F.40** Transport for London interviewed over 700 businesses during October and November 2003. They found that the impact of the London Congestion Charge varied across sectors with the retail sector most likely to report the Congestion Charge as a significant negative factor⁷. TfL attributes (at least some of this) to general economic trends and a reduced number of overseas visitors rather than the charge itself, though interpretation differs on the relative impact of these factors.
- F.41** In September 2003, the Commission for Integrated Transport reported the perceived impacts of the London charge on the following sectors:
- taxis and private hire vehicles
 - couriers and express delivery companies
 - small food outlets and convenience stores
 - large retailers and their logistics partners.
- F.42** The research found that compared to the effects of a general economic downturn and international events, there was limited evidence of a significant impact of the charge on the London economy. The lack of evidence could be due to the absence of an impact, to the business information and organisational models employed, particularly by smaller companies, or to the inability to disaggregate the charge from other economic factors.
- F.43** Particularly unclear is the potential for impacts on rural businesses – this will no doubt depend on how they compete with currently congested urban areas, and how total travel costs were to be affected in the long term.
- F.44** Increasing the efficiency of road transport could lead in the long-term to distributional industries relocating to take advantage of economies of scale, rather than compromise location to counteract poor travel conditions. This could have important implications for regional development priorities. The local planning system could act as a medium-term brake

6 The Standing Advisory Committee on Trunk Road Assessment report "Transport and the Economy" (1999) has a fuller discussion of the impacts of transport improvements on business.

7 Transport for London, Impacts Monitoring Second Annual Report (2004), Chapter 6. Although the majority of respondents reported little or no change in business performance between 2002 and 2003, there were small but significant sales decreases for the retail, leisure and distribution sectors. On the other hand, the charge was mentioned as an influence on business performance by only 12 per cent of respondents, rising to 18 per cent amongst retailers.

on these moves, or could encourage the process by relaxation of controls. There would be short-term adjustment costs for areas from where businesses relocated.

Residence choice

- F.45** The cost of travel is just one parameter of many in the decision of where to live. The time-scale for residential location is very great, taking into account inter-generational issues such as living near or with family, quality of schools as well as the large transaction costs of moving, lifestyle changes, etc. On the other hand, the property market has a speculative element and some price adjustment is likely to occur quite quickly (perhaps even preceding the introduction of charging).
- F.46** Theory would suggest that road charging is unlikely to have a significant short-term impact on the housing market, except in locations where the road price differential is great, there are few alternatives to road use in the charged area, and the housing market is flexible (with a large rented sector). This is most likely to be the case in urban areas and if there were a clear edge between the charged area and the non-charged. However, the literature⁸ suggests such price changes are likely to be obscured by other factors, such as economic trends.
- F.47** The significance of travel cost in the housing decision will increase over time, however it is difficult to disentangle such drivers from other person-specific influences. Any reduced travel costs in rural areas may increase the demand for remote houses and on rural locations generally. Demand for different residential locations will impact on the profitability of housing developments and on land values in charged and uncharged areas.

Vehicle choice

- F.48** Road pricing may impact on the purchase decision for new or second-hand vehicles. It could delay replacement purchases if road pricing were to reduce the net income available for transport use or if fewer annual miles were to lengthen the period before vehicle replacement became necessary. The average vehicle age could therefore increase, with implications for the delivery of environmental and safety gains. The significant determinant of the overall impact will be how the overall costs of motoring are affected.
- F.49** As mentioned above, a move away from a fuel-based charge to a distance/time/place charge would reduce the incentive to purchase fuel-efficient vehicles, unless a compensatory mechanism were to be introduced. In addition, were car sharing to become a more widespread social phenomenon, demand for larger vehicles might increase, with subsequent environmental implications. However, the balance of impacts between more multi-occupied vehicles and less single-occupied vehicles is likely to be environmentally favourable. The depth of research in this area is limited.

Regional issues

- F.50** Road pricing could be a source of revenue for funding infrastructure investment in growth areas or other regional development areas. On the other hand, road prices could reduce the attractiveness of locations currently suffering high travel demand, although this again heavily

depends on the use of revenues. Whether the growth areas or other regional locations benefit from this depends on the areas competing for development, the relative total net costs of location, and the mix of industries – especially their exposure to travel costs.

- F.51** Regional or sub-regional co-ordination of road charging may be necessary in growth areas or other regions to limit the stand-off between competing areas, if they feared losing their competitive position by introducing road pricing.

Development control

- F.52** At a less strategic level, road pricing may have a part to play in providing signals for development in appropriate places or as a mechanism to fund transport infrastructure improvements to new or existing development sites.
- F.53** Consideration could be given to using road pricing as a mechanism for funding transport infrastructure in these circumstances or, conversely, for signalling where development is encouraged. Road pricing should work well in combination with workplace travel planning or other localised measures.

Summary

- F.54** Road pricing has the potential to deliver a wide range of benefits to the environment and to wider policy areas (such as to competitiveness and health), provided that it is carefully introduced. Potential adverse impacts should be identified and either removed at design stage or mitigation provided. There is little evidence of the longer term impacts of road pricing, though it is clear that schemes need to be integrated with complementary measures, notably land-use planning.