HIGH LEVEL GROUP ON
TRANSPORT INFRASTRUCTURE CHARGING

FINAL REPORT ON
OPTIONS FOR CHARGING USERS DIRECTLY FOR
TRANSPORT INFRASTRUCTURE OPERATING COSTS

9 September, 1999
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Executive Summary

i. The High Level Group on Transport Infrastructure Charging has produced two previous reports. The first, in June 1998, expounded the pricing principles that are appropriate for achieving an economically efficient transport sector, with due account being taken of safety, environmental and other external costs. It recommended the use of social marginal cost pricing (for recovering both internal and external marginal costs) as the basis for setting prices. At the same time, it recognised that there might be circumstances under which higher charges might be necessary; in particular, where the marginal costs of a project are below average costs and higher levels of cost recovery are necessary for financial reasons. The second report, in May 1999, discussed how to identify, measure and estimate the various components of transport costs, including infrastructure maintenance, environmental, congestion and accident costs.

ii. This report assesses the economic instruments available for recovering each type of cost in each mode of transport, and recommends the most appropriate reform of the existing pricing regime for the practical implementation of marginal social cost pricing (including both internal monetary and external costs). The focus is on the charges levied by infrastructure managers for the use of existing infrastructure in a regulated market. Questions of how to best recover full infrastructure costs, where necessary, using two-part Tariffs or Ramsey-Boiteux pricing, are not dealt with further in this report, but are recommended for future consideration.

iii. Choosing which type of instrument (pricing, regulation, etc.) is appropriate for achieving any particular policy requires that options are selected and appraised against specific criteria. These include the policy instrument’s effectiveness in achieving the policy goal, the degree of transparency and simplicity of the chosen instrument, compliance and enforcement, the cost of implementation, operation, information and transactions associated with the policy, and the acceptability of the policy to the differing political and public views (including those of various stakeholders). The choice should also be made taking into account the current policy mix and a full assessment of the relative costs and benefits (such as gains in effectiveness in reaching the policy goal).

iv. This report briefly surveys each major category of marginal social (internal and external) cost for each mode of transport. Based on this information, the High Level Group has identified the most effective instruments for reflecting marginal social costs (such as advanced distance based road charges) and has made recommendations on further reform of global agreements to achieve more efficient pricing at the appropriate level. The Group has also reviewed the existing charging instruments and makes recommendations for improvements to some of these existing instruments, in some instances as a stop-gap measure - we believe that there are no technical barriers to their adoption in the short term.

v. The Group found that broadly similar pricing instruments are appropriate in each of the five modes of transport. However, differences between modes in the structure of infrastructure markets and in the number of purchasers of infrastructure services affects the practicality and cost effectiveness of different charging regimes, thereby strongly influencing the selection of the most effective and efficient pricing instruments. Cost effectiveness and wider impacts must be assessed before implementation, aided by the development of a number of pilot studies of particular modes and contexts. User charges that are able to reflect the marginal infrastructure and environmental costs, and to recover fixed costs where necessary, are the ideal policy instruments. These should be implemented through road
pricing schemes and through a combination of track/station/port/airport access charges and en route charges for the other modes.

Recommendations

vi. In the short to medium term, to cover infrastructure damage costs in the roads sector, the Group recommends using further differentiated road tolls, extended where appropriate to other parts of the road network, and the development of distance-related charges for HGVs (as already planned by Germany and Austria) to succeed fixed period user charges. Congestion costs should also be reflected in user charges that vary with location, vehicle type and time of day (or network speeds/average travel times, where practical). Until generalised road pricing is available, a second best alternative would be beacon based urban toll rings. For congested sections on the interurban road network, the High Level Group recommends that for all existing and planned charging schemes, charges should be varied to reflect congestion costs.

vii. Systems for allocating scarce capacity in air, rail and maritime sectors may need to vary by mode, to reflect the different numbers of players, the regularity of the vehicle movements and the complexity of the networks involved. Three possible solutions are worth further consideration: peak period pricing, slot trading, and auctioning.

viii. For all transport modes, most environmental costs can be recovered through a combination of distance-related charges that take into account the type of vehicle, its speed and type of propulsion, and the vehicle’s noise characteristics. In the case of CO₂ costs are best reflected directly through charges related directly to fuel consumption.

ix. For accident costs, insurance that closely relates premiums to those likely to incur accident costs (or with a bad rack record) should be extended to all modes in all Member States.

x. In the rail sector, user charges that reflect marginal infrastructure, environmental and noise costs should be introduced in all Member States.

xi. Finally, the High Level Group has identified several remaining areas where further analysis is required to enable the introduction of a comprehensive system of transport infrastructure charging. These include criteria for full cost recovery charging, allocation of scarce capacity and common cost benefit analysis procedures. Further practical issues that still need addressing include implementation issues relating to who establishes, sets, levies charges and how revenues are allocated.

xii. Evaluations of existing charging schemes should be carried out, to identify any possible unintended and perverse effects. In addition, we recommend that the Commission should encourage, and where, appropriate support pilot studies conducted in selected areas for the range of modes, in order to illustrate what charges would actually be incurred by transport infrastructure users under the kinds of charging regimes advocated in this report, taking into account their impact on competitiveness.
1 Introduction

1. The High Level Group on Transport Infrastructure Charging has produced two previous reports. The first, in June 1998, expounded the pricing principles that are appropriate for achieving an economically efficient transport sector, with due account being taken of safety, environmental and other external costs. It recommended the use of social marginal cost pricing (for recovering both internal and external marginal costs) as the basis for setting prices. At the same time, it recognised that there might be circumstances under which higher charges might be necessary; in particular, where the marginal costs of a project are below average costs and higher levels of cost recovery are necessary for financial reasons.

2. The second report, in May 1999, discussed how to identify, measure and estimate the various components of transport costs, including infrastructure maintenance, environmental, congestion and accident costs.

3. The European Commission subsequently invited the High Level Group to reconvene in order to take the subject a step further, by considering how in practice transport infrastructure users could be directly charged for the social marginal costs of their infrastructure use, once estimated. This is the subject of the Group’s third report.

4. This report assesses the economic instruments available for recovering each type of cost in each mode of transport, and recommends the most appropriate reform of the existing pricing regime for the practical implementation of marginal social cost pricing (including both internal monetary and external costs). The focus is on the charges levied by infrastructure managers for the use of existing infrastructure in a regulated market. Questions of how to best recover full infrastructure costs, where necessary, using two-part Tariffs or Ramsey-Boiteux pricing, are not dealt with further in this report, but are recommended in section nine for future consideration.

5. The report deals with charges imposed directly on infrastructure users (road users, rail companies, airlines and shipping companies), rather than on individual passenger prices or freight charges. These latter charges are levied on end users by individual enterprises and operators where, in general, stronger market forces are at work and prices are likely to adjust to incorporate any changes in costs incurred by the operators themselves, including any additional marginal costs of infrastructure use.

6. The approach of the Group so far has been to provide a general and clearly cross-modal approach to pricing principles and cost estimation methods. This is because of the necessity to strive at all times for a consistent approach to enable the different modes of transport to compete on a level playing field.

7. This third report discusses appropriate new charging methods for each mode in turn, but does not deal with practical issues of implementation. However, where possible, the same or a similar method of charging has been proposed for application to different modes that have similar cost profiles. It is also recognised that implementation needs to be carefully phased to avoid distortions, with the main competing modes adopting new charging structures at the same time, as far as possible.

8. Previous High Level Group reports have recognised the benefits of mobility to society, businesses and individuals, and have stressed that the introduction of marginal social cost pricing is intended to increase efficiency and transparency, and is not a signal to increase
transport charges in general (though there may be some cases where infrastructure users do not pay their full social marginal costs and so certain charges should be higher). Where taxation is currently acting as a surrogate for direct user charging, the latter should replace the former; in cases where taxation proves to be the most cost-effective means of recovering elements of cost, then that element of taxation should be identified and hypothecated to cover those costs.

9. Whilst the focus of the Group's deliberations is on transport pricing at the level of the European Union, there are two important situations where a broader view needs to be taken to avoid distortions of competition. First, implementation of transport policy at a global level is appropriate for a number of policy areas, particularly in the maritime and aviation sectors; the European Commission should continue to vigorously pursue the reform of charging instruments at this level where relevant, while doing what it can within the Union to modify charging structures in such a way as to minimise modal distortions. Second, whilst the Group is dealing with the transport sector, it must be emphasised that efficient pricing in all sectors of the economy, particularly the energy sector, is wholly appropriate and this end should also continue to be promoted by the European Commission.

10. This third report draws heavily on a discussion paper prepared by a panel of expert advisors as an input to the High Level Group’s deliberations. Those who contributed to the paper or otherwise assisted are listed in an Appendix to this report. The Group would like to acknowledge their appreciation of the very valuable work of the panel.

2 Reform of existing economic instruments

11. The intention of this report is to contribute to improving the existing pricing regimes, as one component of European transport policy implementation. It seeks to identify where current price signals are poor, and in these cases to propose the most suitable form of economic instrument to improve the situation. The significance of the various internal and external costs will differ between modes and areas (e.g. population density), but in all cases, the greater the degree of “variability” in the charges that can be imposed on users, the more accurately they will reflect costs and so they can become more effective and transparent.

12. Taxes and charges in the transport sector have generally been levied just to raise additional government revenues and not as policy instruments, in the expectation that even high charges will not have any significantly distorting impact on transport use or patterns. The position of the High Level Group on Infrastructure Charging and of the European Commission, is that current transport taxes and charges can have a distorting impact and that there is a role for carefully formulated economic instruments as policy instruments. For each mode, it is appropriate to confront the users of transport with the direct costs of their activities.

13. Once the need for government action in any area has been identified, and the magnitude of the issues or costs at stake are broadly known, then a range of policy options are generally available to the "legislator" to respond to the situation. These include: direct government provision of a good or service; laws or regulations, such as standards for vehicle safety or emissions standards; economic instruments such as taxes, tradable permits or charges to achieve the policy goals by changing people's behaviour through price signals; and a range of "softer" non regulatory approaches such as facilitating voluntary agreements, establishing "best practice" and "persuasion" through communication or information campaigns.

14. In the area of transport and environmental pollution, the traditional response of governments has been to provide much of the transport infrastructure and many transport services (often largely
funded from general taxation) and, in more recent years, to use laws and regulations. For instance, governments have often imposed safety standards, emissions standards, speed limits, and driver qualifications for all types of transport. Relying solely on a regulatory, standard-setting approach to policy and ignoring economic instruments as a policy option can have significant drawbacks.

15. The clear message of the High Level Group's earlier reports and of the European Commission's White Paper "Fair Payment for Infrastructure Use" is that current transport charges do not offer positive incentives to increase efficiency and may distort the European transport market. Within the existing regulatory framework therefore, improved charges can correct price signals and provide an extra policy instrument that is complementary to existing standards, rules and laws.

16. The key attraction of cost-related charges and taxes (for example, noise-related and peak charges at airports) is that they can be used to address market failure, by increasing economic efficiency and reducing the social and environmental costs of transport.

17. There is a range of pricing instruments available. These include general taxation, fuel taxes, tradable permits, vehicle taxes, infrastructure user charges, tolls, access charges, docking charges, lock fees, landing charges, some fines, insurance premiums and emissions charges. The choice of instrument depends on the degree to which it will reflect the internal and external costs - or more pragmatically, its effectiveness in providing price signals that alter behaviour in an economically efficient manner.

3 The evaluation of policy instrument options

3.1 Assessment criteria

18. Choosing which type of instrument (pricing, regulation, etc.) is appropriate for achieving any particular policy requires that options are selected and appraised against specific criteria. The first criterion is the policy instrument’s effectiveness in achieving the policy goal, which in the case of transport includes the need to encourage open and competitive services between and within transport modes and operators in different countries, in a manner that is sustainable and takes into account external impacts.

19. The degree of transparency and simplicity of the chosen instrument is also important, as no policy instrument can be fully effective unless its purpose and signal is clear and understood by users. For this reason, simple instruments can have the advantage of transparency.

20. Compliance and enforcement is another general issue that concerns all policy instruments and all modes of transport. It also applies to all existing laws associated with transport standards, operations, and taxation and charging. It is important to consider the enforcement costs of any planned policy instrument, but such considerations should focus on the cost and degree of enforcement of existing measures as well. Goals of 90% or 100% compliance may not be realistic or cost-effective, and may be out of line with the levels of compliance achieved for existing or alternative proposed policy measures. Attention should therefore focus on any extra costs of enforcement and thence any possible need for higher enforcement, which can be achieved through greater monitoring or higher penalties.

21. The cost of implementation, operation, information and transactions associated with any policy are also factors that should be included in the policy appraisal, as part of the general assessment of the cost effectiveness of the policy. Completely effective schemes, but which are
also highly elaborate, technically complicated, information intensive and costly to operate are rarely the best policy instrument.

22. **Acceptability** of a policy is another important consideration and includes the differing political and public views (including those of various stakeholders) on equity, privacy and so on. Acceptability is also partly a function of other criteria, such as the effectiveness of the proposed policy; and the degree of enforcement can in turn influence people's views of the policy instrument. Most importantly, the economic impact of the policy instrument will also affect the cost effectiveness and acceptability of the proposal.

23. The choice should also be made taking into account the current policy mix and a full assessment of the relative costs and benefits (such as gains in effectiveness in reaching the policy goal).

### 3.2 Identifying policy instrument impacts

24. For all modes and all instruments, the assessment and prior appraisal of the impact of any new policy instrument is vital. When existing knowledge is limited, pilot studies are an essential means of investigating these issues.

25. In the transport sector, the analysis of impacts must include: the assessment of the revenue implications, the impact on both passenger and freight transport and the sector overall, the distributional impact (on governments, industry and consumers/income groups), and the implications for land use patterns, competition, economic growth, sustainability and employment.

26. A further aspect that policy makers should bear in mind is the possibility of synergetic effects – and unintended effects, both positive and negative. For example, a satellite based charging system can also be used to provide vehicle drivers with en-route information about congestion ahead, plus the chance to book a parking space at their destination, etc. Conversely, the tolling of specific roads may result in diversion to less suitable routes (depending on the number and quality of alternative routes). And the current annual vehicle taxes also provide the basis for the official registration of vehicles in the name of their owners - which assists in enforcement.

27. The application of this general approach should be consistent across modes and implementation should be carried out in a non-distorting manner, in order to avoid perverse changes in relative price signals and operating conditions.

28. More pragmatically, government or infrastructure managers’ revenue requirements are another consideration which often influence choice of policy instrument in some areas of transport, particularly when infrastructure managers have to meet cost recovery targets. This includes the issue of whether marginal cost pricing alone will cover a project's total costs and, where this is not the case, the question of whether government funds should be used to make up the shortfall.

29. Finally, the degree of compatibility of a policy instrument with others can be important, as inconsistent or incompatible instruments can raise costs and reduce policy effectiveness. Ideally this notion should include a European dimension, and co-ordination of instruments such as charging procedures and technologies at a European level should help reduce costs and increase efficiency in the use of transport infrastructure.

30. The appraisal criteria outlined above are generally applicable in applicant countries and in peripheral areas of the European Union, as well as in the more central areas of the EU. Whilst
the costs and concerns of regions will differ, possibly widely, the approach to the development of policy options and appraisal should be the same. Common procedures for a comprehensive cost benefit analysis of all transport proposals are needed, based on all these criteria, if the appropriate trade-offs are to be made and the most efficient policy outcome is to be achieved.

3.3 Application

31. The next five sections (3 to 7) of this report consider how practical charging regimes based on marginal social cost pricing might be introduced in each of the major transport sectors: roads, rail, inland waterways, maritime and aviation. In each case the existing situation is briefly outlined, followed by explicit consideration of how the marginal infrastructure, congestion/scarcity\(^1\), environmental and accident costs might best be met by users. Each section concludes with some practical recommendations.

32. Section 8 brings together the earlier material and recommends a set of preferred pricing instruments for reflecting marginal internal and external social costs. Some areas requiring further work are identified in section 9.

4 Roads

4.1 Context

33. In recent years, most of the road network in Member States (with some exceptions in France and Southern Europe) has been provided and managed as a public good. Costs have been met through charges or taxes, including general taxation, transport related taxes (e.g. fuel excise duty), and vehicle and registration taxes, which in most cases are unrelated to use.

34. More accurate use-related road tolls have also been used, however, on some roads at certain points of time, for particular forms of infrastructure such as tunnels, bridges, and specific sections of main road or motorway. This has resulted from the need to raise revenues but also because the structure of the infrastructure makes direct user charging feasible. Another instrument less accurately related to the use of the vehicle is the "vignette", a permit that is purchased to access given road networks for a certain time period (year, month etc.), where road tolling does not exist.

35. The commonest form of use-related road toll still requires vehicles to stop for payment. However, electronic fee collection (EFC) systems are now being introduced at an increasing rate (e.g. as implemented in France, Italy and Portugal)\(^2\). They offer the possibility of charging road vehicles in a highly flexible way; on the basis of the cost-related characteristics important for efficient and effective charging instruments, such as vehicle weight and environmental type, and according to actual distance travelled. More advanced satellite technology will also be fully available within the next ten years, to allow even more accurate cost-related charging.

36. One particular issue that needs addressing with "non-stop" systems is the billing system. Whilst various invoicing systems are possible, a pre paid electronic card would avoid the administrative

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\(^1\) Congestion arises where there is unrestricted access to a transport network and demand is in excess of capacity. Scarcity arises where demand is in excess of capacity but use is restricted by the allocation of paths or slots.

\(^2\) In the case of commercial vehicles for example, this new technology is also being used for various other purposes, such as to monitor driving times, driver safety and for fleet management purposes.
burden of regular invoicing and also avoid drivers’ privacy concerns, as identification and notification would only be necessary in cases of non compliance, as with existing traffic offences.

4.2 Marginal infrastructure costs

37. Here the social marginal costs include the maintenance and repair of road infrastructure caused by vehicle use - the damage costs - as well as certain services and operations. The categories of infrastructure type relevant in this instance, as indicated in the High Level Group’s previous report, include general road categories (motorway, national, state, regional roads, urban streets) and specific infrastructure (tunnels and bridges). The factors that are the direct causes of infrastructure damage costs - and which should therefore be the points of leverage for an economic instrument - are axle weight and configuration, which can to a considerable extent be proxied by existing categories of vehicle type.

38. Already in Europe there are a number of major charging instruments that are commonly applied by Member States that are differentiated according to vehicle type (but usually vary in level of charge from one country to another). These include:

- Vehicle taxes, where rates usually vary with weights and/or axle configurations and in a limited number of cases, pollutant and noise emissions;
- Time-period user charges (Eurovignette and Austrian vignette), which distinguish between different types of heavy goods vehicles (two axle categories by three Euro-emission categories);
- Distance-related road tolls;
- Fuel excise duties (which vary with fuel type and are proportionate to fuel consumption).

39. Clearly, a charge that takes into account vehicle type is necessary if infrastructure damage costs are to be properly reflected. However, it is crucial that the charge varies with amount of use made of the infrastructure. For this reason, annual vehicle taxes and non use-related instruments are not suitable for passing on infrastructure damage costs.

40. The most effective instrument in this case is one that recognises different cost categories and levels in its charging structure. Of the options identified above, distance related instruments are the most appropriate - ideally a generalised system enabling charging for kilometres driven on the basis of vehicle or axle weight (vehicle type), location and road type. Knowledge of specific location and road type is particularly useful for international traffic; this improves the "territoriality" of the charge, as existing schemes for reallocating and dispersing revenues (such as that used by Eurovignette countries) are not very satisfactory. This geographical identification is also important as different locations can reflect highly different costs; so a scheme which blurred or ignored such a distinction could have serious unintended consequences.

41. In selecting a distance-related charging system, there are a number of factors to consider. First, the means by which vehicles are tracked and charged. Here there is a basic distinction between continuous and point-specific charging options:

- Satellite-based road charging schemes can provide near perfect knowledge of road usage to allow accurate charging on a continuous basis. However, there may be identification

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3 Charging and receiving revenues in the area or territory where the cost is incurred.
problems where different types of road run in parallel, and the systems are not yet in general use;
• Road-side beacons and gantries can register passing vehicles with greater precision, but give
a much more limited geographical coverage and so lose effectiveness on roads with many
access points. Such schemes are thus more restricted in their potential, but are already in
operation.

42. Second, an implementation strategy will need to be phased, when applied to an area as large as the
European Union. In the case of the road network, as well as phasing by road type and location, it
might also be appropriate to first introduce electronic road charging for a smaller range of
vehicles.

43. In the case of infrastructure damage costs, further differentiated road tolls, extended where
appropriate to other parts of the road network, and the development of distance-related charges
for HGVs (as already planned by Germany and Austria) should be developed to succeed fixed
period user charges⁴.

44. However, in order to avoid inefficiency and market distortion, it is important that consistent
charging structures are introduced on competing transport modes (especially rail and, in the case
of goods transport, inland waterways) as soon as practical.

4.3 Congestion

45. When significant levels of congestion exist on the road network, often due to the volume of
private cars, capacity management is needed to alter driver behaviour in order to reduce the
periods of peak congestion, the number and length of traffic jams, and to increase the speed of
traffic (and so to lower travel and freight delivery times). The High Level Group’s previous
report on estimating transport costs identifies both infrastructure type and time of travel as two
key parameters affecting congestion. When charging for congestion costs, these two items
should therefore be identifiable.

46. For congestion on the main interurban road network, existing charging schemes can offer
variable charges to reflect congested periods, levied at certain points such as bridges, tunnels or
stretches of motorway in some countries. It is recommended that for all existing and planned
charging schemes, variations in charges to reflect and reduce marginal congestion costs (based
either directly on traffic speeds or on travel times on the network) are appropriate, effective and
feasible.

47. Few existing road charging schemes exist in Europe to deal explicitly with urban congestion; the
Trondheim toll ring is an exception as it has differing peak and off-peak charges, as do some
urban tunnel or bridge tolls. However, a number of schemes are currently being examined by a
large number of cities across Europe; these include corridor rings in or around cities and
automatic payment equipment for each vehicle crossing the ring.

⁴ Sweden's kilometre tax for diesel vehicles (used until recently) provides a useful example of the net benefits and the importance of
correct price signals of such a tool. When the structure of the kilometre tax was changed from a weight-distance tax to a weight-axle-
distance tax, new, more cost related incentives arose. A 30t three axled vehicle was charged almost 6300ECU for 100,000km. With four
axles, the charge fell to 4000ECU which after the costs of conversion, provided a net saving of 1700ECU (based on a 10-year write-off
period and a distance per year of 100,000kms (Hansson Ch. 2.7). This is a consequence of refining and improving price signals.
48. The charging parameters appropriate for recovering marginal congestion costs overlap to a considerable extent with those identified in the previous discussion on road infrastructure costs. The most practical instrument, particularly for inter urban congestion, could be the same: a distance-related charge for all motor vehicles, with variations in charges according to vehicle type, time of day, location and infrastructure type. In some situations, it might also be possible to charge according to average speed (either measured by spot speeds as in the British Trafficmaster system, or along timed sections of road).

49. A currently available instrument for reflecting urban congestion costs in a very crude way is the use of car parking charges; however this does not meet several of the criteria listed in section 2. Many urban areas in Europe today levy car parking charges, both as a means of allocating scarce parking space and as a method of raising revenues. By increasing the level of non residential private and public car parking charges, and introducing a time-of-arrival/departure differentiation to reflect congestion costs, this could provide a short term proxy measure in urban locations in those cases where congestion is caused by terminating traffic, rather than by transit traffic. This would need to be introduced in conjunction with improvements to alternative modes, to cater for the intended modal switch.

1.1 Environmental costs

50. Environmental costs include local, regional and global air pollution, local noise and water run-off, and other effects documented in the previous High Level Group report. The cost parameters identified in that report focus on population characteristics and proximity to emissions, and emissions that can be related to vehicle type (with more refined categories relating to the presence of catalytic converters, different fuel types, road types and vehicle speed). Given the diversity of impacts, it is necessary to identify the best mix of instruments for passing on the different types of environmental costs.

51. Global air pollution, especially CO$_2$, is highly correlated with fuel consumption. Consequently fuel taxation according to fuel type (carbon content) is the best means of reflecting global environmental costs.

52. In the case of regional air pollution (including secondary pollutants like aerosols, ozone and acidifying substances), specific location is a less relevant factor and vehicle, fuel and engine type and driving pattern are important. As distance-related charging schemes develop they should be capable of reflecting most of these cost differences better (particularly insofar as they can then be related to usage), though fuel quality effects may need to be reflected directly in fuel prices. The impacts of these forms of pollutants depend very much on existing concentrations, and so any charge should be adjusted over time to reflect the change in cost. Where distance related charging is not possible, annual vehicle taxes or a vehicle purchase tax can be used as a crude proxy for reflecting the costs associated with vehicle type.

53. For local air pollutants (NO$_x$, particulate matter, benzene, VOCs and CO) and noise, it is vehicle technical characteristics, driving pattern (location, speed, acceleration) and population density, which are the key determinants of costs. To account for the technical characteristics in the absence of a distance related charge, a charge based on vehicle type is appropriate – though a poor second best - with as much technical specification as is feasible, such as distinguishing between vehicles with and without catalytic converters, engine size and so on, also based on a typical mix of driving patterns and locations. Again, impacts of fuel type would need to be reflected in fuel price differentials.
54. As costs increase substantially in densely populated areas, access, cordon or road charges should be used in addition. As with regional air pollution, the development of a distance-related charge which varies with vehicle type and location would be a better instrument for more accurately passing on these local environmental costs.

1.2 Accident costs

55. Currently drivers are not generally charged for the marginal external costs of road traffic accidents (injury costs, loss of earnings, delays to other traffic, etc.), except where fines are imposed or there is a civil court case to recover costs. Most countries cover these costs from general taxation, or implicitly from transport taxes such as fuel and vehicle taxes. However these are poor proxies as they are not based on the costs or cost drivers of accidents. If such instruments are used at all, they should take into account transport safety features (for instance reducing vehicle taxes when safety features are added). The greater use and variability of traffic fines, based more closely on incremental accident risks could also be a means of improving the incentives to take more care travelling.

56. The use of insurance premiums is the commonest means of covering personal liability for accident costs. In a deregulated insurance industry, premiums vary considerably to reflect quite fine degrees of accident risk and cost. A sophisticated insurance structure based on detailed risk information and reflecting the different variable components of the costs of accidents might offer a satisfactory practical instrument for charging for accident costs. Particularly in the case of medical costs, the use of insurance premiums switches expenditure from general taxation to users, in the manner required in a user pays system. However, it removes the direct element of the cost by insuring against incurring the actual charge, and it cannot take into account the accident risks associated with travelling on different types of road.

57. Closely linked to the use of insurance as a pricing instrument is the liability regime within which the insurance system operates. The nature of the liability and fault regime should ideally reflect the user pays principle, so that those most likely to generate accident costs pay the highest premiums (taking into account different vehicle characteristics). This is practical in the road sector, with a very wide range and large number of infrastructure users (but much more problematic in the case of rail, for example, where there may be only one infrastructure user in a Member State).
4.4 Recommendations

58. The range of current taxation and charging instruments is only capable of reflecting the various marginal costs of road use to a very limited degree, except in the case of fuel duty and the volume of CO₂ emissions.

59. A general distance-related road pricing system, able to detect and charge all vehicles on all parts of the road network according to network characteristics and current conditions (i.e. congestion, pollution levels) would allow for charges that reflect more accurately than any other instrument most of the external costs of road use (replacing many existing charges). Such a system is not, however, expected to be introduced on a general basis within the next decade.

60. The principles of marginal social cost pricing should be extended to all categories of road user, including private cars, as soon as practical – as well as to the major competing transport modes. In particular, for the short term, we recommend the following set of measures:

• (Euro)vignettes, annual vehicle and registration charges should all be varied according to the technical characteristics of the vehicle (fuel type used, axle weight, safety characteristics etc.) to reflect the different marginal costs they generate.
• Differentiating existing road tolls by time and location to manage inter-urban traffic in order to reduce congestion, with a refinement of the differentiation in charges by vehicle type and axle weight; and with a more direct measure of congestion (e.g. average speed along a section of road) being used where practical. As an interim measure, these tolls should be extended to other parts of the road network.
• The introduction of an electronic distance-related charge for HGVs that exploits the capabilities of new mandatory tachographs (to replace existing HGV user charges and road charges).
• More extensive and rigorous use of urban access rings and parking charges, differentiated by time and location, to contribute to reducing urban congestion, coupled with improved modal alternatives (e.g. light rail systems, cycle networks, urban freight distribution centres).
• Greater use of motor insurance premiums that enable recovery from users of the external accident costs, including medical and health costs.

These should be introduced in parallel with equivalent charging structures on the main competing modes, as discussed in the following sections and should take account of implementation costs.

5 Rail

5.1 Context

61. Whilst the general impression in the current literature is that overall the external marginal social costs of rail are significantly less than those arising from the use of road infrastructure, they are nevertheless still significant. It is therefore still appropriate that prices faced by the rail operators should also be reformed to reflect these costs and to provide a further incentive to increasing the efficiency of operation of the railways.

62. Recent EC directives requiring the separate identification of rail infrastructure and operating costs have enabled costs to be identified more clearly, and with the growth in the number of operators accessing rail systems in some Member States (e.g. Great Britain), issues such as track allocation in a competitive situation are growing in importance.
5.2 Marginal infrastructure costs

63. In the rail case, once costs are known, implementation is comparatively uncomplicated as the actual users (rail operators), their characteristics and train path needs are known. A system of track pricing can be used by infrastructure managers (and is used already in some cases) to reflect the cost drivers identified in the previous High Level Group report (i.e. train speed and weight). Such charges would be kilometre based, differ with track type and formation (design speed) and train weight and speed.

64. The High Level Group confirmed the need to distinguish between charges for track access and station access. Quite different costs are involved in each case; the use charges should clearly be related to relevant cost types and to the marginal costs of operations - including those of managing passengers as well as trains. Finally, as platform space is scarce and closely linked to path allocations, an element of scarcity pricing, discussed below, applies to stations as well as to track paths.

5.3 Scarcity

65. The High Level Group’s previous report on estimating transport costs identified scarcity, rather than congestion, as the dominant consequence of existing capacity constraints on the rail network (along with overcrowding on existing services). Speed relative to that of other trains on the line at the time is a key influence on the amount of capacity any particular train requires. Whilst the costs of unplanned delays could be included in poor performance penalties, scarcity should be measured and charged for in an appropriate manner.

66. Scarcity results in situations where the rents to be extracted can be very high and particularly in monopolistic situations, can greatly affect competition. There therefore needs to be a regulatory framework within which issues of scarcity are resolved.

67. The scarcity value of rail infrastructure capacity represents its value in the best use to which it could be put. In other words, it is the cost (or lost earnings) to train operators - and ultimately their customers - of their inability to get the slots they want. It represents a peak problem, for which there are two main solutions: peak period charges on existing users, or an open market using an auctioning system. In both cases, for maximum efficiency the full marginal costs (including external costs) should be borne by transport operators.

68. One problem with the approach of applying fixed peak period tariffs is getting the information on the value of different slots on which they are to be based. In a rail system with a number of operators and a separate infrastructure manager, knowledge of the value of the different slots rests with the operators. These have to be ‘teased out’ over time, by progressively setting prices to clear the market.

69. Auctioning systems are often suggested as a way of encouraging these operators to reveal their values. They have a number of problems however. Rail infrastructure can be used in a wide variety of ways to provide different types of service between different points. The value of a particular slot to an operator depends on the whole package of slots they get, since this determines their costs and revenues. For instance, a particular slot will be of far more value if it is associated with other slots that permit efficient scheduling of assets and an attractive service to the public. The value of a slot also depends on what slots competitors have.
70. In addition, re-allocating slots among competing operators on a periodic basis can cause severe disruption to service patterns and threaten long term investment programmes. Furthermore, it is only feasible in Member States where there are several train operating companies competing for track access on an equal basis.

71. For these reasons, this may suggest a combination of a bidding process with a degree of negotiation as the best practical solution. Without the possibility of renegotiations, there will be no scope for mutually beneficial adjustments in services. However, there will be a fear in such a process that the market power of a dominant operator will unduly influence the outcome. The presence of an independent regulator and the publication of finally agreed tariffs will help to prevent this, but the task of a regulator in this situation will not be easy.

5.4 Environmental costs

72. As in the case of road, it is useful to distinguish between the different forms of environmental pollution. In general, the small number of operators renders charging policy much simpler and less costly than in other modes. Fuel taxes should be levied to reflect the global (CO2) environmental costs of rail transport. And charges for local and regional emissions should be levied through track fees based on location, train and engine fuel type (diesel or electric), time of travel and speed. As noted earlier, for a truly balanced implementation, new charging structures should be introduced on competing modes at the same time, and the High Level Group believes that efficient pricing should also exist in the energy sector. For example, electricity producers should pay for the environmental damage they cause, as should oil producers for the ‘up-stream’ pollution costs that they generate.

73. Noise is one of the largest external costs caused by rail transport. Whilst existing measures have been implemented in some areas to combat this, through tighter engine standards, investment in infrastructure (such as noise barriers, walls or rail loops) and modern breaking systems, track charges should also include noise charges. These would vary with location, train and engine type, the time of travel (day or night) and the speed of the train.

5.5 Accident costs

74. In cases where the marginal costs of accidents are borne by the rail operator, the operator faces a direct incentive to achieve efficient levels of safety, but this is not the current practice in all Member States. Accident costs, either internal to rail or involving road vehicles, should be borne by those at fault, rather than by the general government. As with the road sector, insurance could be appropriate as a means of rail operators covering their accident costs, although where there are few operators this may not be practical.

5.6 Recommendations

75. The high degree of knowledge of movements and regulated nature of rail traffic makes the development of quite precise pricing instruments relatively easy (indeed seven European railways already have user charges in place). As the operator, engine or train type and mileage is easily determined, user charges based on distance and train type can be used to reflect all the significant elements of marginal infrastructure, environmental and accident costs.

76. Train path scarcity is a more difficult problem both to value and charge for. It is recommended that systems of peak pricing, path auctioning and secondary negotiations under the control of a public regulator, represent the best means of achieving an efficient allocation of existing track
space whilst maintaining a degree of market access for new entrants. However, more work is required into the practicalities of these instruments before such schemes can be widely introduced.

6 Inland Waterways

6.1 Context

77. The bulk of inland waterway traffic is on the Rhine and faces no navigation charges. However, where navigation charges are levied (in Luxembourg, France, Belgium, Finland, the UK, The Netherlands and some parts of Germany), they can be quite sophisticated. Each country has its own approach, but charges may be set according to type and size of vessel, type and volume of cargo, number of passengers, frequency of travel, and time of day. In those cases where charges are levied, they contribute up to 25% of the operating and maintenance costs of the waterways and recover some capital costs.

6.2 Marginal infrastructure costs

78. The marginal costs of inland harbour and waterway infrastructure maintenance and operation should be included in user charges such as harbour, waterway access and lock fees. As noted above, current charging practices range from some cost-based charges to completely free use - specifically along the Rhine which, partly as a consequence, carries over 70% of European inland waterway traffic. As with the rail sector, the knowledge about users makes it comparatively easy to identify and charge individual boats according to engine type, size, and so on. Access and lock charges could and should be clearly related to the marginal navigational costs of the use of the waterway (reflecting the size of boat or other cost related criteria).

6.3 Congestion

79. In those particular instances where capacity is scarce, then boats will queue for lock access and berthing points. There is a strong case for increasing waterway charges on congested sections of the network at peak times (e.g. through specific lock surcharges), to reduce time losses and increase efficiency.

6.4 Environmental costs

80. Inland waterway transport emissions include CO₂, SO₂, NO and noise which can have significant environmental impacts. Knowledge of who the individual users are (boat and barge characteristics) facilitates the introduction of waterway access and lock fees that reflect these environmental costs. Such fees should depend on emission factors and location, according to the waterway segment, and should be distance-related. Impacts directly related to fuel quality and CO₂ would best be met through differentials in fuel price taxation.
6.5 Accident costs

81. The arguments relating to the application of insurance premiums to reflect the costs and accident risk in a market with multiple users apply in the inland waterway sector in the same way as they do in the roads sector. Material, personal non material, and environmental accident costs should therefore all be borne directly by vessel operators.

6.6 Recommendations

82. At present significant sections of the inland waterway network levy no charges at all for navigational rights of access and use. In situations where the overall marginal external costs of inland waterway transport are comparatively low, there may be little distortion to the transport market by providing ‘free’ access. However, where external costs are significant navigational and lock charges should be levied, at the appropriate administrative level. They should then be structured to reflect the marginal social (internal and external) costs and so should depend on boat size, emission factors, time of day (where congestion arises) and location.

7 Maritime

7.1 Context

83. Charging systems in the Community differ considerably between European seaports. They nevertheless include certain common elements. These are generally related to the provision of services and facilities to enable a ship to enter safely and use the port; payments for specific services (loading/unloading) or supplies rendered; and rents or charges for the use of land or equipment owned by the port.

84. There are no charges for operating ships on the open sea; however, some Member States charge for fairway use. In 1998 Sweden introduced environmentally differentiated fairway charges.

7.2 Marginal infrastructure costs

85. The marginal costs of coastal, waterway, port and harbour infrastructure maintenance and operation should be included in port user charges such as harbour fees. Current practice appears to range from imposing negligible charges, with finances coming from the government, to ports where high charges are levied to meet full cost recovery requirements. The first report of the High Level Group recommended that in the case of transport ‘nodes’, full cost recovery was likely to be appropriate in most cases.

86. As with the rail and inland waterway sectors, the knowledge about users means it is comparatively easy for a port to identify individual users (ships or boats) according to engine type, size, and so on. It is therefore perfectly feasible for ports to include the marginal costs of port and dock access in their charges (reflecting size of ship or boat or other cost related criteria).

7.3 Scarcity

87. In those particular instances where there is scarce capacity then the allocation of “slots” also needs consideration. Similar arguments apply as in the rail discussion relating to the determination of scarcity value. However, as there is more variation in port usage patterns than
in the case of a fixed railway timetable, peak pricing would seem to be a more appropriate means of reflecting scarcity than through a process of auctioning slots.

7.4 Environmental costs

88. Shipping emissions include CO$_2$, SO$_2$ and NO which can have significant environmental impacts, as well as oil and ballast discharges. Monitoring ships’ emissions is a costly and difficult process, particularly when inter-continental shipping is involved.

89. If charges for emissions (based on fuel type and quality, vessel type, speed, route) could be levied, then they offer the most efficient economic instruments and could be levied as part of the port or harbour access charge.

90. Fuel charges are, again, the second best option, and the High Level Group believes that efforts should continue at a global level to tax maritime fuels according to their carbon and sulphur content. The Group believes that in the short term the most promising route to dealing with local and regional emissions could be port charges, based on common agreed pricing principles across the European Union.

7.5 Accident costs

91. Precisely the same arguments and theory of accident costs applies in the maritime sector as in the case of the other modes. Material, personal non material, and environmental accident costs should therefore all be borne by vessel operators.

92. In fact, maritime insurance is quite advanced in this regard and unlike the motor vehicle insurance market, generally covers accident and rescue costs. In this particular instance therefore, an appropriate economic policy instrument is already in place and functioning, although it may not cover all the external costs.

7.6 Recommendations

93. In certain areas, such as in accident costs, the maritime sector is quite advanced and provides a good example of the way the market should work with charges reflecting most costs. In other areas, such as in environmental costs, the damage from emissions can be quite high; but the use of regulation and pricing is complicated by the global nature of the maritime market, managed partly by international agreements under the auspices of the International Maritime Organisation (IMO). Whilst efforts should continue to achieve a global basis for charges, in the meantime European ports should levy port charges on a common basis to reflect these various marginal social (external and internal) costs.

8 Aviation

8.1 Context

94. Airport charging systems currently cover a variety of charges related to the use of landing, apron, lighting, parking, security, refuelling, terminal and other facilities by aircraft, passengers and freight services. While there is a standard basis for the different airport charges, the level of charges differs widely between and within Member States, generally reflecting different operating cost levels. They are often related to aircraft weight and passenger numbers or freight
tonnage, noise category, duration of parking time and in some instances, distance/origin of flight. In addition, varying proportions of airport operating costs are cross-subsidised through charges on retailing and other commercial activities that are not directly related to aircraft movement.

95. Charges for en route air traffic services (ATS) are levied by national air traffic services and Eurocontrol. The complex charge calculation reflects investment and operating costs (including air traffic services, communications, meteorological services, aeronautical information service) and varies with distance and aircraft weight. In some Member States there may be separate charges for the use of airport air traffic control services. These are usually based on the weight of the aircraft.

8.2 Marginal infrastructure costs

96. Infrastructure costs include airport operations and use of facilities as well as air traffic management costs. In both cases, current charges (landing charges and air traffic control fees) are quite strongly related to levels of usage (kilometres of journey, aircraft size and number of passengers carried), but are only indirectly related to the actual costs incurred.

97. Therefore, in order to achieve an effective cost internalisation strategy, these costs should be refined, clarified and tied more clearly to the marginal cost of the use of infrastructure. In particular airport charges (as with rail stations) should reflect all the marginal costs of operations, including those of managing passengers as well as aircraft. To some extent this occurs already, as a component of the charges paid by airlines reflects their passenger numbers, although charges are diluted by the revenues derived from retailing and other service provision.

8.3 Congestion and scarcity costs

98. As with the rail and maritime sectors, the main focus of capacity constraints in aviation is on airport slot scarcity rather than congestion problems. However capacity shortages and interface problems between different ATS regions mean that airways congestion is also a major problem. It has been estimated that 350,000 hours of flight time are wasted in Europe annually as a result of delays and non optimal routings [ECAC].

99. This congestion is correlated with busy air traffic service (ATS) ‘sectors’ and correspondingly high marginal operating costs. Charges levied to meet ATS costs should therefore also include an element to deter congestion (based on travel time or the occupation of a particular sector).

100. The issue of allocating scarce capacity (slots) has been discussed extensively in the airport pricing literature; the general conclusion is that slot trading (or, alternatively, auctioning and negotiation) is the best available means of efficiently allocating airport slots and air routes. However discussions in aviation generally occur at a global level and whilst the issue of slot trading is discussed, other concerns such as the effect on airline competition are also drawn in.

101. The High Level Group believes that the Commission should continue to investigate the possibility of European airport slot trading or auctioning.
8.4 Environmental costs

102. In Europe, many airports have introduced aircraft landing charges which are noise-related and are aimed at encouraging the use of quieter aircraft. These noise surcharges in some cases are very substantial.

103. The air pollution produced by the aviation sector is particularly significant in terms of global pollution and specifically CO₂ emissions. However, the preferred policy instrument for recovering this cost - an aviation fuel tax - is not practical in the short term due to the range of international and bilateral agreements that would require amending. The development of tradable CO₂ permits within the aviation sector is a second option that is being explored in the context of meeting Kyoto agreements, but this again is not a short term option. It is therefore appropriate to consider instruments for global emissions along with instruments for regional and local emissions.

104. Global, regional and local environmental air pollution costs can be divided into two parts. First, impacts during the LTO (landing and take-off) cycle (including CO₂ emissions during take-off when this is not charged for through a fuel tax); these should be reflected in the aircraft landing charge, based on the type of aircraft the number and type of engine (e.g. as implemented at Geneva and Zurich airports). Second, impacts during the flight in high altitudes; these costs should be recovered through en-route charges, based on distance flown and the aircraft and engine characteristics.

8.5 Accident costs

105. Whist accident costs in the aviation sector are relatively low, the same broad policy approach and instrument is appropriate. As with the maritime sector, the aviation sector already uses insurance to cover its accident costs. Greater use should be made of this principle; that is, all claims for costs incurred (by airports or others) as the result of an aviation accident should be met by the airline (or those responsible if not the airline) and hence covered through insurance premiums.

8.6 Recommendations

106. Despite the constraints of negotiating global agreements, the aviation sector is probably the sector of transport with the most advanced and sophisticated charging instruments most able to reflect marginal social infrastructure use costs. However, with notable exceptions (e.g. noise surcharges on landing and peak charges at some airports), these charging instruments have not been utilised to reflect congestion, scarcity or environmental costs.

107. Greater differentiation of the existing forms of charging (such as en route charges and airport landing charges) is necessary to reflect these congestion and environmental costs and to send clear signals to operators and aircraft manufacturers. Efforts at a European level are recommended to reform both charges along these lines and the Commission is encouraged to continue to press for aviation fuel taxation at a global level.

108. The development of instruments to manage airport scarcity also needs to continue to be promoted. The High Level Group believes that the Commission should continue to investigate the possibility of refining peak period charging, as well as the practicality of introducing European airport slot trading and/or auctioning or negotiating systems which do not further distort or reduce competition.
9 Recommendations for implementing cost-related charges

9.1 General principles

109. This report has briefly surveyed each major category of marginal social (internal and external) cost for each mode of transport. Based on this information, the High Level Group has identified the most effective instruments for reflecting marginal social costs (such as advanced distance based road charges) and has made recommendations on further reform of global agreements to achieve more efficient pricing at the appropriate level. The Group has also reviewed the existing charging instruments and makes recommendations for improvements to some of these existing instruments, in some instances as a stop-gap measure - we believe that there are no technical barriers to their adoption in the short term.

110. It is important to recognise that use-related transport charges need to be introduced for all competing modes of transport in order to avoid distortions. While a phased programme of implementation will be necessary, it should be introduced in as short a period of time as possible, and in such a way as to minimise disruption to transport markets. There should be comparability of charging mechanisms across modes and Member States.

111. Whilst this report focuses on the use of charging instruments as policy tools, the High Level Group does not suggest that the existing standards or other forms of current regulation should be abolished. Neither does it suggest that the current balance of policy instruments needs to alter greatly in favour of economic instruments. But the Group does advise that current economic instruments and current charging regimes under-perform and frequently generate perverse price signals.

112. The Group therefore recommends the reform of the existing economic instruments, to create price structures that reflect marginal social costs, and enable full cost recovery where necessary. This would improve the fairness of charges, increase the efficiency of operations and lower the economic and social costs of the transport sector overall.

113. A simplified summary of the main options and recommendations of the High Level Group are presented in Table 1. The recommendations for implementing cost-related (i.e. social marginal cost) charging are designed to increase efficiency and transparency, by sending out clear and well-targeted price signals. The intention is not to increase the total cost burden on the transport industry per se (in some instances it may reduce it). In cases where transport taxes have hitherto served as a proxy for transport charges, these should be phased out as the use-related charges are introduced.

114. The High Level Group reiterates its view expressed in the first report that, where transport users are charged for the marginal costs they incur, that net revenues should be used to ameliorate the impacts. Accordingly, revenues from congestion charges and slot auctions should be used to improve the transport infrastructure in a socio-economically efficient way. This is an important mechanism for improving the capacity and environmental effectiveness of the transport system in a financially viable manner.

115. The Group also recognises that in certain situations, marginal cost recovery will not provide sufficient revenue to cover all the necessary cost of infrastructure operation (in particular, where all or part of the costs of investment need to be recovered from users). Here we reiterate our
previous recommendation that marginal social cost pricing should be introduced in conjunction with two-part Tariffs or Ramsey-Boiteux Pricing, in such a way as to minimise distortions to competition. In section 9 we recommend further work on this issue.

Table 1: Pricing Instruments Options for Reflecting Social Marginal Costs

<table>
<thead>
<tr>
<th>INSTRUMENT</th>
<th>Infrastructure</th>
<th>Congestion</th>
<th>Scarcity</th>
<th>CO₂</th>
<th>Regional emissions</th>
<th>Local emissions</th>
<th>Noise²</th>
<th>Accidents</th>
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<tbody>
<tr>
<td>All Modes</td>
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<td>Slot auctioning/ negotiation³</td>
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<td>(urban road) area access charge</td>
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1. when cost element (time of travel, emissions etc.) can be specified.
2. not applicable for road transport.
3. regulation also plays an important role in this area.
4. These taxes should be reduced when replaced by more efficient user charges.

Table 1 indicates recommended instrument for reflecting given cost.

1. indicates short term proxy instrument.
2. indicates less desirable proxy instrument.
- indicates instrument is not applicable.

The Group found that broadly similar pricing instruments are appropriate in each of the five modes of transport. However, differences between modes in the structure of infrastructure markets and in the number of purchasers of infrastructure services affects the practicality and cost effectiveness of different charging regimes, thereby strongly influencing the selection of the most effective and efficient pricing instruments. Cost effectiveness and the impact on competitiveness must be assessed before implementation, aided by the development of a number of pilot studies of particular modes and contexts.

User charges that are able to reflect the marginal infrastructure and environmental costs, and to recover fixed costs where necessary, are the ideal policy instruments. These should be
implemented through road pricing schemes and through a combination of track/station/port/airport access charges and en route charges for the other modes.

118. This report recommends the reform and adaptation of current charges, within the existing policy context, to provide packages of charging instruments that are appropriate and available in the short term for charging the four core transport costs to users (i.e. marginal infrastructure costs, congestion/scarcity, environmental and accident costs). And whilst appraisal of specific policy proposals according to the criteria outlined in section two is crucial, the development of fair and efficient pricing in transport urgently requires the reforms proposed.

9.2 Short and medium term recommendations

119. To cover infrastructure damage costs in the roads sector, the Group recommends using further differentiated road tolls, extended where appropriate to other parts of the road network, and the development of distance-related charges for HGVs (as already planned by Germany and Austria) to succeed fixed period user charges.

120. Congestion costs in the road sector should also be reflected in user charges that vary with location, vehicle type and time of day (or network speeds/average travel times, where practical). Until generalised road pricing is available, a second best alternative would be beacon based urban toll rings; where this instrument is not available, a weak proxy would be the expanded and improved use of urban car parking charges to deal with urban congestion. For congested sections on the interurban road network, the High Level Group recommends that for all existing and planned charging schemes, charges should be varied to reflect congestion costs.

121. Scarcity is significant in the rail and aviation sectors and possibly in the ports sector too. Systems for allocating scarce capacity may need to vary by mode, to reflect the different numbers of players, the regularity of the vehicle movements and the complexity of the networks involved. Three possible solutions are worth further consideration: peak period pricing, slot trading, and auctioning. In each case, negotiations should be carried out exclusively between operators and under the supervision of a regulator, in the case of the air and maritime sectors at a global level where appropriate and possible, or else at a European level.

122. For all transport modes, most environmental costs can be recovered through a combination of distance-related charges that take into account the type of vehicle, its speed and type of propulsion, and the vehicle’s noise and emission characteristics. In the case of CO₂ costs are best reflected directly through charges related to fuel consumption.

123. For accident costs, similar forces are at play in all the major modal markets that have a large number of operators, which currently excludes rail in most Member States. Insurance that closely relates premiums to those likely to incur accident costs (or with a bad rack record) is quite advanced in the maritime and aviation sectors and is also developing in the road sector. This is a good example of efficient market development and this approach should be extended to all modes in all Member States.

124. In the rail sector, user charges that reflect marginal infrastructure, environmental and noise costs should be introduced in all Member States.

125. In all cases, the proposed charges should be reviewed on a periodic basis, to ensure that they take into account changes in the quantity and quality of outputs that give rise to internal and external costs, and in the light of new information on the severity of their impacts.
For the transport modes other than road, no major new charging devices appear to be necessary to deliver marginal social cost pricing, except in relation to scarcity issues in the air and rail sectors. In the main, all that is required is the modification of existing charging structures to reflect the range of costs outlined in this and previous High Level Group reports, with a general switch from fixed to variable costs.

10 Recommendations for further work

The High Level Group has identified several remaining areas where further analysis is required to enable the introduction of a comprehensive system of transport infrastructure charging:

- Further consideration and clarification of the criteria under which full cost recovery is necessary, and the best ways of achieving it.
- Further work on the methods for the allocation of scarce capacity, where it is not cost effective to increase provision.
- The development and adoption of common Cost Benefit Analysis procedures that can be applied to proposed investments in all major modes of transport, at the appropriate geographical level. This would ensure that long term infrastructure investments are clearly justified and would help to address the question of scarcity and necessary infrastructure capacity.

There are also a number of practical issues related to implementation that need to be addressed. Implementation strategies for marginal social cost pricing (plus additional charges where necessary) need to be devised, that take into account the time lags for full implementation and the need for a phased strategy that minimises distortions between modes and Member States.

In determining implementation strategies for each mode there are some key questions that need to be answered:

- Who sets the charges and at what level?
- Who collects charges and distributes revenues?
- Who receives the revenues and how is the money used?

Evaluations of existing charging schemes should be carried out, to identify any possible unintended and perverse effects. In addition, we recommend that the Commission should encourage, and where, appropriate support pilot studies conducted in selected areas for the range of modes, in order to illustrate what charges would actually be incurred by transport infrastructure users under the kinds of charging regimes advocated in this report, taking into account their impact on competitiveness.
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