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TRANSPORT AND THE ENVIRONMENT: RESEARCH AND POLICY ISSUES

PG Hopkinson and CA Nash

A submission to the Royal Commission on Environmental Pollution by the Institute for Transport Studies, University of Leeds

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CONTENTS

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1.INTRODUCTION

This paper provides a response from the Institute for Transport Studies to the invitation from the Royal Commission to provide evidence for its investigation into transport and the environment. This evidence is presented under the headings, though not in the same order as, set out in the original letter of invitation. The main focus of our response is to present recommendations for reducing the environmental impact of transport consistent with the requirements for sustainability. We highlight areas where there are gaps in understanding about the environmental impact of transport and where further research, understanding and action is needed.

Whilst recognising the impact that all forms of transport can have on the environment we mainly refer in this paper to surface motorised forms of travel, particularly private and commercial vehicles. Given the burgeoning literature on transport and the environment we have been selective in our approach, choosing to draw on work primarily undertaken within the Institute for Transport Studies itself or in collaboration with others. For the sake of the reader we have tried to be brief.

2.NATURE, SCALE AND COSTS OF THE ENVIRONMENTAL EFFECTS OF TRANSPORT

Recent years has seen a growing awareness of and concern about the environmental impacts of transport systems. The transport sector is a major cause of environmental impact arising from the construction of infrastructure, the movement of traffic and the manufacture and disposal of vehicles. Various reports have attempted to list the nature of the impacts (eg Nash et al, 1991, TEST, 1991). In the case of new infrastructure the principal direct effects are landtake, the destruction of property, severance, and visual intrusion. Concern about the loss and damage to nature conservation sites from new road building has been reported and catalogued in various documents (Harwood and Hillborne, 1992, Bowers, Hopkinson and Palmer, 1992). The movement of traffic gives rise to numerous environmental externalities including noise, air pollution, visual intrusion and severance. A recent report by has attempted to define separately such impacts and ways by which they can be appraised (Institute for Transport Studies, 1992). These impacts vary in their nature. Air pollution for example includes both local air quality affected by emissions of CO, particulates and lead etc, and transnational problems such as acid rain and global warming. These latter effects are generally unaffected by the time and place in which the emissions occur. In other words it is the total pollution loads that are important whereas in the case of impact such as noise and severance, these vary by time and place. Such a distinction is important when we come to consider mechanisms for reducing the environmental effects of transport.

Concern about the environmental effects of transport have been heightened in recent years for two broad reasons. The first is that the transport sector, particularly road traffic, already makes many areas unpleasant, unhealthy and dangerous to live in and move around. Despite this however, there is generally little comprehensive, up-to-date data which catalogues and monitors the quality of the environment affected by the transport sector. For example the National Environment Survey, which attempted to determine,

amongst other things, the effects of road traffic on people, is now over 30 years old. This still however provides a primary source material for many other studies. There have been a number of studies in the past which have surveyed the scale of various impacts at the National level including road traffic noise problems, rail noise and more recently air pollution and health. One of the major problems of determining the current scale of impacts is the inadequacy of data. The quality of data collection and monitoring by local authorities is mixed and generally at a very coarse level. Recent developments in Environmental Auditing and State of the Environment Reports by local authorities means that greater attention is being paid to base-line data, without which it is difficult to detect trends. The continued tightening of local authorities resources means that attempts to remedy the gaps in data will be likely to be heavily restricted. A national co-ordinated State of the Environment report identifying the scale of different transport problems is an import future requirement.

The second reason is the rapid growth in demand for the most polluting transport modes - namely road and air. As an example, in Britain road traffic has doubled since 1968 and the DOT forecast that road traffic will grow by between 83-142% by the year 2025 relative to 1988. Whilst various commentators have been critical of the forecast figures, for example that the rate of growth is not independent of supply, meaning that the policy responses to meeting or constraining growth will affect the actual growth levels. Others have agreed that the rate of growth will be much higher in certain areas, eg the countryside, and for certain types of travel, eg leisure, than others, eg heavily congested urban areas. Nonetheless the pressures for growth bring great cause for concern. Transport is now the largest major source of CO_2 emissions in the UK, and the main growth area. Recent evidence has shown that in the long-run growth in traffic will more than offset any gains which may arise from greater fuel efficiencies or end-of-pipe technology such as catalytic convertors. Globally the trends and potential for future transport demand growth in the developed and developing world presents a scenario for ever greater environmental problems, particularly global ones, than at present.

In assessing the costs of the environmental effects of transport systems it is the case that, in spite of much research over the years, we have little understanding of the costs incurred, either locally, nationally or globally. This is due in large part to the extreme difficulty in measuring such cost but also an historical tendency to ignore, or disregard such costs. We return to this point in a later section. Despite recognition of the costs imposed by transport on peoples health, eg the rise in reported asthma cases, which have been linked to elevated air pollution levels, or buildings and property, or various ecological systems and peoples general well-being there has been little attempt to calculate total costs to the UK. By contrast, such studies have been attempted in a number of continental countries.

3.TRANSPORT POLICY - THE INSTITUTIONAL FRAMEWORK

Responsibility for and direction of transport policy in the UK stretches across a number of institutions and organisations. The Department of Transport (DOT) forms the single most powerful institution affecting transport policies in the UK with prime responsibility for discussions regarding the national road network but also exerting considerable control over the funding and decisions made by local authorities and public transport operators.

The recent trend towards deregulation of the coach and bus industry, the proposed privatisation of BR and heavily prescribed funding mechanisms within the Transport Supplementation Grant (TSG) system are some of the key factors influencing the co-ordination and integration of transport policy. In a recent report Nash et al (1991) compared the organisational structure and philosophy towards transport planning in the UK with other European countries. It was argued that in France and Germany there has been a longstanding recognition and commitment to co-ordinate and provide public transport for environmental, congestion and regional development reasons. In the UK prior to bus deregulation, the Passenger Transport Executives (PTEs) had a similar role. Since 1986 the PTEs however have had no control over the bulk of bus services, which are operated commercially. The lack of a single organisation to plan routes, timetables and fares between bus and rail and to integrate public and private transport, particularly in city areas has been in stark contrast to our European counterparts. Since deregulation bus traffic has fallen substantially.

In Britain, rail subsidies other than in PTE areas are paid entirely by Central Government out of general taxation and have diminished greatly in recent years: the only source of grants for capital on rail public transport is a S56 grant. In practise these grants have proved difficult to obtain and been expensive and time-consuming operations for local authorities to develop (Nash and Preston, 1991).

By contrast, both France and Germany have specific earmarked taxes providing guaranteed resources for urban public transport as well as Central or Regional State Funds for worthwhile investments. Other sources of finance are also available.

The upshot of this is that investment in public transport facilities, which can be used to provide alternatives to private car travel and thereby reduce various environmental impacts, in the UK has proved difficult to secure. Matched with the lack of co-ordination between different types of public transport system, this makes public transport a much less attractive proposition for the general public than in many European countries.

A further factor which militates against public transport and provides, in our opinion, a systematic bias in favour of road transport, lies in the different basis for investment appraisal between public and private transport. It has long been argued that the method of financial appraisal for public transport investment ignores many of the benefits of such investment whereas the method of social cost-benefit analysis and EIA for road scheme automatically includes them. It has been shown for example (Nash and Preston, 1991) that using a social cost benefit analysis for public transport schemes can turn apparently uneconomic investment in public transport (using financial appraisal criteria) into a robust economic return.

Recent work by the Institute for Transport Studies and the MVA Consultancy (1991) has begun to investigate in detail with various local authorities the development of a common appraisal framework for public and private transport projects. Such an approach allows alternative types of schemes to be identified and evaluated against a full range of economic and environmental criteria. It is encouraging to note that the DOT has begun to take an interest in such an approach to investment appraisal, although as yet, no financing under these procedures has been released.

Such an approach can be seen as an extension to a recent shift in transport policy formulation at the local level, sometimes referred to as Integrated Transport Strategies (May, 1991). In the last 4-5 years around 20 urban areas in the UK have commissioned or considered conducting such strategies. One of the principle features of such strategies has been the explicit recognition and analysis of transport-land/use interactions, a point we return to in the next section.

The refreshing feature of this approach to policy formulation is the move away from treating different modes of transport and policy investment as mutually exclusive. Rather the approach attempts to match policy investment and modes of transport to the particular problems facing an area. This involves a change of emphasis away from considering transport systems in isolation towards a consideration of an overall vision for a city or urban area and then working through how transport policy can contribute towards such goals (May, 1991).

One of the requirements for such an approach is co-ordination between all relevant parties with responsibility, both institutional and financial, for the various transport systems within an area. We would hope that such an approach continues to flourish and be supported by the DOT and other relevant national bodies.

One important conclusion of such studies should be stressed at this point. Whilst improving public transport in isolation will achieve some diversion from car (Nash, 1991), it will also generate significant new trips, whilst the rural space released will quickly fill up again. Significant relief of the congestion and environmental problems from rural traffic requires simultaneously effective restraint of the car and improvement of public transport (May, 1992).

Whilst such positive development are developing locally the situation nationally is less encouraging. The major policy response to date, following the issuing of the revised National Road Traffic Forecast (NRTF) has been an expansion of the roads programme. Commitment to a reduction in CO_2 emissions remains a source of controversy. The recent SACTRA report identified the lack of strategic environmental policy objectives for the road transport sector as a major shortcoming and made recommendations for their development. In stark contrast the Dutch *Second National Transport Structure Plan* provides a model for integrated, co-ordinated transport planning at a national level. This plan presents an overview of trends in transport growth nationally and the impact and implications of current and future growth on the environment. Using various national and sub-national transport models a wide range of policy instruments have been run and tested against defined goals for environmental quality, accessibility, safety etc. The policy instruments examined not only include the usual public and private investment options but also proposals for traffic calming, teleworking and various technological innovations. Whilst there may be some debate about the precise nature of certain goals and their formulation, such a plan provides clear and comprehensive policy guidance. We would recommend such an approach for the UK linking transport and environmental objectives more closely. Such an approach would require the construction of appropriate traffic models and much closer working between the Government departments and agencies responsible for transport and environmental responsibilities.

4.TRANSPORT AND LAND-USE

The relationship between transport and land-use can be regarded as a two-way process. Firstly transport systems and investment can affect land-uses by altering accessibility and by altering environmental quality and conditions. These effects are not easy to measure and the major conclusion reached by numerous authors is that the impact of transport on land-use is relatively weak leading mainly to relatively localised redistribution of activities. Thus whilst availability of transport may be a necessary requirement for new development it is not, in isolation, sufficient to generate new land- use patterns. The second part of the relationship, namely the effect of land-use on transport, suggests itself to be more significant. This conclusion has arisen, in part from a recognition that the greatest proportion of the growth in road traffic over the past 20 years has arisen from people making longer journeys, primarily in the journey to work. The reasons for this trend are not altogether understood. In part it results from the migration and loss of employment in many of the densely populated urban areas but also due to people choosing to migrate away from urban areas, to the siting of new facilities such as retail facilities, hospitals etc, to changes in patterns of leisure activities and to a reduction in real terms in the marginal costs of motoring.

At lower population and residential densities it becomes more difficult to provide cost-effective public transport services. Research has borne out that area with low population densities typically generate journeys with times as long as those in high density areas, and that these are predominantly car-based. This has led a number of observers to conclude that lower density land-uses create greater transport related environmental impacts than high density land-uses, and that policies ought to be geared towards land-use control for certain types of development and increasing population/residential densities.

Given the general lack of understanding of the processes underlying the land-use/transport interaction such a simplistic argument should be treated with caution for a number of reasons. Firstly, whilst lower land-use densities may generate more car travel it is not clear that this necessarily generates a higher level of environmental impact than higher density areas. Congested urban travel conditions for example can produce more pollution and consume more energy per unit distance travelled than in certain lower density areas as shown in a recent study of Milton Keynes.

Secondly, the argument rests on the belief that people wish or can be persuaded or forced to live at higher densities or in alternative land-use configurations. It may be for example that people wish to live at lower densities and travel by car rather than by public transport, or may wish to reduce their amount of travel overall independently of the land-use density. Thirdly the argument presents a somewhat optimistic scenario for the role of the land-use planning and control system to influence travel patterns. Whilst there have been some spectacular rapid changes in land-use patterns eg Docklands, northern manufacturing, in the past 15 years it is generally the case that land-use patterns change very slowly over time, that probably 90% of land-use for the next 20-30 years is probably fixed and that the statutory system for regulating and directing land-use is under considerable pressure and is in many ways unpredictable.

None of this diminishes the importance of land-use/transport interactions. It may be however that as well as looking at the physical dimensions of land-use as a causal factor capable of influencing transport-related environmental impacts that we examine some of

the underlying human and social processes. For example why, according to the latest census figures, are people continuing to move away from dense urban and city areas; how can we make it easier for people to live closer to their work or sets of amenities consistent with their aspirations or how can we bring work and amenities closer to where people want or choose to live. Clearly much more research and investigation is needed into the travel behaviour and lifestyle choice in low-density land-use areas.

5.TECHNOLOGY

There are numerous ways by which the technological developments and advances may be used to reduce or offset mostly the environmental impact of the transport sector. In discussing technology we do not include new infrastructure provision or design although such measures clearly can be important in removing traffic from certain locations. The technological advances we believe to be most promising in terms of being able to significantly affect the environmental impact of transport can conveniently be thought about in relation to individual vehicles themselves, and decisions affecting the planning and various choices involved in travel, providing alternative to travel and traffic management and control. Examining these in turn briefly. Firstly, the design of vehicles may be changed in a number of ways - they may be made lighter and given more fuel efficient engines; the type of fuel they use may be changed; air pollution may be reduced by the fitting of catalytic converters or noise of source limited by various devices.

Despite much promise however the progress with technical change in terms of fuel economy, noise reduction, etc has been slow and patchy. Benefits of increased fuel efficiency have been offset in recent years by the trend to larger cars. Greater success has been developed with the introduction of catalytic converters to reduce certain types of exhaust emissions (it is worth noting that this development has been prompted by legislation), although CO_2 emissions are unaffected and there is evidence to suggest that converters are least effective for classes of trip-making which tend to produce the highest levels and worst ambient air pollution conditions namely short, urban journeys.

The rapid developments in Information Technology has made possible the development of systems to assist people in planning travel and during their journeys. Such systems has been suggested could help people make more optimal journeys and improve the performance of the transport system as a whole (Hopkinson and May, 1990).

A home-based trip planning system could help people avoid travel times or routes which are congested; find ways of travelling which are cheaper or more convenient or reduce the need to travel altogether. A review by Hopkinson and May (1990) found evidence to suggest that such systems could be effective in managing the demand for travel particularly during holiday periods. Further work on this topic is being undertaken by ITS and by various groups under the EC DRIVE programme. In-vehicle and passenger information systems are also being developed along a number of fronts. For private vehicles such systems again offer the user the ability to avoid congested conditions and influence route choice decisions. The design of such systems, and the response of users and ultimately the system are highly complex. Work at ITS has begun to analyse possible responses to such systems and control strategies to maximise benefits to individuals and the system.

Developments in IT and linked to telecommunication systems provides a further technical possibility to affect the total amount of traffic by reducing the need to travel altogether. Tele-working or home-based working provides the opportunity for certain types of employment and employee to alter the place of work. PC's, FAX machines, modems, video phones, and the conventional telephone line all provide ways of linking and connecting employees to the workplace without the need to travel. Various studies have begun to examine the form and implications of the New Workplace (eg Kinsman, 1990). Results from the California teleworking experiment indicated that teleworking could reduce the overall amount of travel by individuals per week as well as the timing and distribution of trips undertaken.

Future advances in road-side management information, traffic signal programming traffic surveillance systems are all likely to continue to assist in more effective and efficient traffic management systems. Systems for electronic road pricing are well advanced at the technical level, although the political and public acceptance of such systems lag some way behind.

Overall there is no doubt that technology and technical innovation could play a significant part in reducing the environmental impact of transport. The experience to date however is that the introduction and acceptance of technological change is slow. A review by Hopkinson and Berrett (1991) for the SERC Clean Technology Unit identified some of the reasons for this slow up-take and conclude that we are not short of technical solutions to environmental problems but rather fail to understand and match technical ideas to social, political and economic realities. What is needed therefore, in addition to further development of `clean and green technology' for the transport sectors work on understanding why current technical developments are not being used and how to speed up the process of implementation. Moreover, whilst technology may be able to mitigate some of the environmental consequences of the transport sector, they will be unlikely in isolation and in the short to mid-term be sufficient to reduce or even hold back current levels and trends in traffic growth and environmental impacts.

6.FREIGHT

Separate consideration of freight transport is appropriate for a number of reasons. Firstly as with road transport generally, there has been a significant growth in freight transport over the past 20 years, almost totally in road freight, and that 75% of this growth is accounted for by increased trip length (ECMT 1991). These increases have resulted from various practices such as the centralisation of manufacturers and warehousing facilities and just in time. Most of this increase has taken place on motorways. During this time the composition of traffic by vehicle size has changed, with the total number of vehicles movements remaining constant but a much greater proportion carried by the largest vehicles. Theses trends are likely to centre in the UK with the liberalisation of EC markets and increases in the permitted lorry sizes. Most freight movement is by diesel powered vehicles. Such vehicles emit NO_X and particulates NO_X are primary precursors to acid rain and smog formation. The proportion of NO_X from freight vehicles will rise as a proportion of the total NO_X emissions from road transport as catalytic convertors for petrol driven cars become more widespread. Such convertors can not remove NO_X diesel exhausts.

The second reason is that numerous research surveys have shown that the social impact of noise and safety are often regarded by the public as serious impact, and are often associated with freight traffic. This leads to a popular argument that more freight should be moved by rail and reduce the number of lorry movements. Various ways of encouraging this modal shift have been suggested. One way would be to encourage investment in rail freight facilities, either to transfer freight from road or to provide inter-modal technology to allow parts of journeys to be undertaken by rail. In previous work Nash et al (1991) highlighted the limitations of the Section 8 Grant system designed specifically to encourage rail freight, and whilst it is encouraging to note recent changes to this system we feel that this has not gone far enough.

The second approach is to ensure that the environmental costs of freight travellers are properly and fully valued. Work by Nash, Fowkes and Tweddle (1991) for example suggest that road freight traffic fails to pay its full track and external costs. Correction of these costs could help to arrest the growth in road freight traffic.

Again, the simplistic view that a large volume of freight traffic can easily be diverted from road to rail should be guarded against. Transport of bulk materials, in which rail excels, has tended to decline in recent years. Transport of manufactured goods by rail tends only to be economic over long distances, even with modern developments in inter-modal technology, and whilst the above measures would improve the competitive position of rail, much domestic traffic would remain too short distance. What is most important is to ensure that the full potential of the Channel Tunnel for diverting long haul international freight is exploited.

Various technological developments could help to alleviate certain environment impact resulting from road freight traffic. Evidence from a recent ECMT seminar on Freight transport and the environment suggested for example, that a 2-3 dB(A) reduction in noise levels was achievable without engine redesign. For gaseous emissions enforcement of speed limits, say through the introduction of horse-power limits of 10hp per tonne weight, could generate substantial emission reductions without substantial time penalties (ECMT, 1991).

7.ECONOMIC ANALYSIS

From an economic standpoint a number of arguments can be used to address the current and predicted set of transport-environmental problems. Central to the whole debate is to ensure that the full environmental costs are properly accounted for in investment appraisal and pricing systems.

In terms of overall policy the critical issue is that of sustainability. Work by Nash et al (1991) and subsequently by Bowers et al (1992) suggested that current road transport policy was inconsistent with sustainability objectives. In the case of transport the key issues concerning sustainability are at the strategic level and mainly concern the greenhouse effect and depletion of natural resources. The development of strategic environment policy objective for the transport sector which would operate as a set of sustainability constraints were recommended including shadow projects, conservation taxes and valuation of localised environmental degradation. The recent SACTRA report included in its recommendations a number of these suggestions.

The treatment of emissions from the transport sector by the imposition of taxes whilst an appealing prospect is somewhat more difficult than might at first appear. For strategic pollution issues, which are not dependent on the time and place of the emissions, the issue could in principle be handled by estimating the level of tax on each pollutant that would seem to reduce the total emission to a sustainable level. Thus a tax could be used at a project level, on the basis that it represents the opportunity cost of being able to produce an equivalent amount of pollution from some other project.

However given the enormous uncertainties involved we do not believe such an approach is either sensible or currently feasible. For local pollution problems optimal emission taxes require a pricing system that can change at a rate that varies according to the type of vehicle and the time and place at which it is used. No such system has yet been implemented although various road pricing proposals are currently being investigated by the Institute for Transport Studies. For investment appraisal purposes the use of monetary valuation of environmental effects has recently investigated by SACTRA. Such an approach is desirable to ensure that the environmental costs of new infrastructure are properly accounted for. Whilst there has been much interest in the use of monetary valuation studies providing reliable values remain scarce. The DOT is currently in the process of commissioning research in this area. Clearly much further research is needed before any positive recommendations and reliable values can be obtained. In the meantime we consider it important that at the project level that sustainability constraints derived from a national policy are incorporated to avoid further long-term environmental degradation and resource depletion.

8. SUMMARY AND CONCLUSIONS

Both transport infrastructure and transport movement give rise to extensive environmental problems at both the local and the global levels. Whilst numerous ways of ameliorating these (including public transport improvement, land use controls and improved efficiency for road use) none provides a simple panacea. We believe it is important that any strategy to reduce the environmental impact of the transport sector should contain two essential features.

1.An integrated set of measures dealing with all aspects of the problem.
2.Recognition of the problem of predicting the behavioural response to the measures, which may often work to offset some of the intended benefits (for instance, more efficient engines lead to the purchase of larger cars. Improved public transport leads to more and longer trips).

We recommend specifically:

(a)a major new study of the environmental impact of the transport sector on people, backed up by extensive new survey work;
(b)development of an integrated national transport strategy designed to satisfy environmental sustainability constraints.

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