Telematics and Transport Policy: Making the Connection

Book Section

INTELLIGENT ENVIRONMENTS

Chapter

TELEMATICS AND TRANSPORT POLICY: MAKING THE CONNECTION

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1 Introduction

In recent years transport issues have risen sharply in the political agenda of most countries. This is due to a number of disturbing aspects associated with the historical link between economic and traffic growth, not least of which is the growing realisation that environmental imperatives and continued traffic growth cannot be reconciled. The search is now on for policies and technologies that can decouple economic and traffic growth.

At the same time, a number of major telecommunication and IT developments have emerged, into which large sums of research money have been invested. Transport-related examples include in-car route guidance, parking and traffic information for motorists, advanced control systems for vehicles to replace manual driving, (involving automatically driven ‘convoys’ of vehicles), and road or congestion pricing.

A problem exists in that the transport telematic developments have been rooted in the old, unsustainable perspective of continued traffic growth. Indeed, many of the technologies being developed have the specific aim of overcoming barriers to further traffic growth. Rather than being used to try to decouple traffic growth from economic growth, these technologies reinforce the coupling even more. The failure for advances in telematics to be linked to advances in the transport policy debate presents a real danger of transport telematics being used in an ineffective and inappropriate manner.

This chapter explores the emerging gulf between advances in transport telematics and developments in the transport policy and addresses the question as to how the two could be reconciled.

2 The mobility explosion

In all developed countries, the last 40 years have witnessed a 'mobility explosion', with one very much in prospect for post-1989 'eastern' Europe and the developing world as well. People are travelling more and further than ever before. For example, in Britain, the amount of personal travel undertaken has risen from less than 200 billion kilometres in 1952 to 600 billion today (Figure 1). Britons spend more of their income on transport than ever before. In 1953, 7% of an average British household's weekly expenditure was spent on transport; today it is nearly 20% (Potter and Hughes 1990) Bovey et al (1992, p 5) cite 15% as the 1985 European and USA average with the Japanese spending only 9.5% of household expenditure on transport. As Figure 1 shows, most of the growth in travel demand is attributable to the rise in car ownership and its effect on the way in which people arrange their lives.

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The growth in motorised traffic has been associated with feedback effects that have gradually increased the amount of travel that is necessary (Potter 1993, CEC 1992, Hughes 1993). Local shops are being replaced by the out-of-town hypermarket, retail warehouse and shopping mall; hospitals and schools are getting bigger and more remote; journeys to work are increasing in length. Settlements themselves have become more dispersed. Although not entirely a product of more cars and better roads, better transport facilities have played a major enabling role in stimulating these economic and lifestyle trends.

Increasing trip length, rather than the generation of more trips, appears to be the major factor behind the growth in travel. For example, in Britain, for the last 20 years the number of journeys undertaken has remained virtually static, whereas the distance travelled increased by 31% and the average journey length went up from 7,2 to 9,7 km.

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Quite aside from growing environmental concerns, if we are devoting an increasing proportion of our GDP, time and resources in general to undertake the same number of journeys less efficiently, then ways to reduce the amount of travel needed should be welcomed rather than seen as a threat to personal freedom. Travelling is, after all, essentially a means to another end and not something of economic or social value in its own right. We appear to be devoting more and more of our GDP and our lives to an essentially unproductive activity. Perhaps we are, almost unknowingly, in a 'high mobility trap'.

Access and mobility becomes polarised. Those with a car readily available have unparalleled freedom of travel. Those who do not have a car (particularly children, the old, women and people with disabilities) find themselves increasingly isolated. This process has been documented by several authors: Adams (1985) notes the loss of mobility suffered by many elderly people 'trapped' in their homes by hostile road conditions in their neighbourhood; Hillman, Adams and Whitelegg (1991) detail the increasing restrictions parents feel they have to place on their children due to danger from traffic. As Cleary (1992, p 154) notes, "ironically, while siblings are now ferried to school or recreational events by car rather than enjoying the freedom to walk or cycle, their anxious parents are actually adding to the threat to children posed by growing motor traffic." One of the significant conclusions of a study (TEST 1991) comparing the car-oriented urban structure of Milton Keynes to the more walk/bike-oriented Dutch town of Almere was the liberating effect of the latter to children and teenagers. Whereas in Milton Keynes a third of trips of 5-18 year olds was by car, in Almere it was only 5%.

Transport has thus become another factor dividing the 'haves' from the 'have nots' in our society; indeed it has created new groups of 'have nots'.

2.1 Supply-led transport planning

Traditionally, transport policies in all developed countries have involved a ‘supply-led’ response whereby government investment is used to increase road capacity roughly in line with traffic growth. For example, Britain’s current roadbuilding programme is based on the 1989 White Paper *Roads for Prosperity*, in which road traffic is predicted to rise by between 83 and 142% by the year 2025, accommodated by a 22 billion ECU (£17 billion) roadbuilding programme.

The credibility of this policy is increasingly questioned. A major reason for this is worsening road congestion. For example, the M25 orbital motorway around London, completed at a cost of over 1,3 billion ECU (£1 billion) in 1986, was congested on the day it opened. In September 1991 the government announced plans to rebuild it at a further cost of 3,5 billion ECU (£2,8 billion) on the basis that upgrading to 14 lanes (the widest motorway outside the USA) might help matters. The pro-government *Daily Telegraph* dismissed this plan as a waste of money that "will ultimately have little effect on congestion" and highlighted the experience of Los Angeles, where it concluded that only "revolutionary methods involving a change in lifestyle will really ease the problem" (Hiscock, 1991).

The widespread view that throwing money at congested roads will only create bigger, more congested roads is not simply media cynicism. Goodwin et al (1991) provide rigourous proof that "all available road construction policies only differ at the speed at which congestion gets worse" (Goodwin et al, 1991 p.111). Quite aside from the environmental concept of sustainability, traditional supply-led transport policies are physically and economically insupportable, but politically, governments have considerable difficulties in accepting that the 'rationing' of car use is inevitable.

2.2 Transport and global environmental issues

Recent trends in transport demand have created concerns as to where a high-mobility society is leading us. It seems to be producing economic inefficiencies and social divisions, and we cannot buy or build our way out of these problems. Added to such misgivings are political concerns over more difficult transport issues.

In particular, transport has emerged as a major source of environmental pollution. Road traffic is responsible for over half of all nitrogen oxide pollution in the European Union and 85% of carbon monoxide emissions (CEC, 1992). Such local air quality concerns have led to legislation in the USA and the EU requiring 'technical fixes' to be applied to cars, in the form of catalytic converters and alternative fuels. However, many of these improvements are threatened by the projected growth in traffic volume. Improvements in the characteristics of individual vehicles may be overturned if the aggregate use of cars continues to grow. In the USA, for example, catalytic converters, although producing an initial reduction in some pollutants, have proved to be incapable of delivering a sufficient improvement in air quality. This is largely due to the sheer amount of traffic even though the individual vehicles emit fewer pollutants. Air pollution from cars remains a very serious problem. As Deakin (1990, p 27) notes, "about seventy-five metropolitan areas (containing 100m of the USA's population) did not meet the air-quality standards."

Eventually, local air quality concerns could possibly be addressed by alternative fuels that result in pollutants being emitted outside of cities and in more controlled conditions. However of growing concern is the emission of carbon Dioxide (CO_2) from the burning of fossil fuels. This is not amenable to the sort of 'technical fixes' used to improve local air quality, indeed some of these technologies worsen fuel efficiency (e.g. catalytic converters or the use of electric vehicles linked to fossil fuel power stations) and hence result in an increased amount of CO_2 emitted.

Most industrialised countries, under the the 1992 Climate Change Treaty, have agreed, as an initial measure, to stabilise national CO_2 emissions at 1990 levels by the years 2000. However, the Intergovernmental Panel on Climate Change (Houghton et al 1990) has estimated that to halt the net growth of CO_2 in the atmosphere, and so limit the effects of global warming, emissions must be reduced worldwide by at least 60% . The 2000 stabilisation target is thus simply a holding position and a number of countries have developed national programmes for significant cuts in CO_2 emissions by the early years of the 21st century.

Energy use for transport is the fastest-growing source of CO_2 emissions. For example, in Britain, during the last 30 years transport has grown from being a moderate consumer of energy to the largest and fastest growing sector (Potter, 1993; Hughes 1993). Within the European Union as a whole, transport consumes just under 30% of total energy used (CEC, 1992 p12).

Were car use stable, achieving a 60% cut in CO_2 emissions would be an ambitious technical target, but account needs to be taken of traffic growth. For example, as noted earlier, in Britain traffic is anticipated to grow by up to 142% by 2025. Allowing for this would require a 72% cut in CO_2 emissions per vehicle. The UK's rate of traffic growth, of course, is nothing compared with the 600-800% growth (or more) anticipated in developing countries. In such cases, a 95% cut in CO_2 emissions per vehicle becomes necessary to achieve an overall 60% cut from their car stock.

Such calculations lead to the conclusion that, on their own, technical improvements to the car cannot meet the emerging environmental targets for the transport sector. A project at the Open University, (Hughes, 1993), assumed that the British transport sector might be given an 'easy' target of a one-third reduction in CO_2 emissions. Even this would require stringent fuel economy measures (reducing CO_2 emissions per vehicle by half) combined with demand management measures to restrict traffic growth to no more than 20% over 1990 levels. This 'soft' target for reducing CO_2 emissions per vehicle by 50% compares with more stringent targets of up to 95% if there is less control on traffic growth.

3 'Intelligent' technologies and transport

Intelligent vehicle and control systems have a great potential to address many strategic concerns in the emerging transport policy crisis. But this is a potential that may never be realised simply because the development of transport telematics has occurred with little apparent thought to such strategic issues. Indeed, it seems that the rapidly emerging transport telematic technologies are being developed in almost total ignorance of the crucial strategic debate as to what is, or is not, a social, economic and environmentally sustainable transport system. Worse still, vehicle telematics research and development appear to be rooted in the old, divisive and unsustainable perspective of seeking continued rapid traffic growth.

There is a very real danger that the technologies of the future are being developed to serve yesterday's discredited and out-of-date concept of transport policy.

This can be seen by examining some of the major intelligent vehicle/control projects currently under development, which include a great many funded by the European Commission's DRIVE and Prometheus programmes. The EU Prometheus programme includes the development of control systems to permit individual cars to be formed into convoys of vehicles in heavy traffic. Each vehicle would be electronically linked to the others, braking and accelerating automatically while keeping a short distance apart. The drivers would be able to sit back, read a paper, snooze or do what they like until they wish to leave the convoy. Volkswagen have already developed a working 'road train'.

This would significantly increase the capacity of existing motorways without requiring vast sums to be spent, hundreds of square kilometres of countryside engulfed in tarmac, and probably thousands of homes destroyed to expand road capacity. But if the major problem is that traditional transport policies have increased journey lengths and the aim of most city planners (where the most congested motorways are) is to reduce traffic levels, of what benefit would be systems that cram more cars on to a road and make long distance driving more comfortable and economic? The answer is almost entirely negative.

But there are benefits from such a technology. The individual vehicles become more energy efficient in an electronically-controlled road train. However, this benefit is totally overwhelmed by the growth in traffic the system is specifically designed to facilitate. The argument is exactly parallel to that of conventional roadbuilding; extra capacity reduces congestion and so makes individual vehicles more fuel-efficient, but the overall system effect is to generate more traffic and so increase energy use.

If combined with effective demand management telematics (or other methods to hold demand constant, such as the narrowing or closing of urban motorways), such road trains would be beneficial, but this is not the way in which the technology is being developed.

Electronic route and parking guidance is another example of a rapidly developing intelligent vehicle technology where the logical implications of its widespread use appear to have been ignored. Although initially introduced for motorways, this system is seen of greatest potential in towns and cities to help guide motorists along the least congested routes and to identify empty parking spaces. Yet most city authorities now seek to reduce car use in cities and certainly nobody wishes to encourage motorists to be guided along previously quiet residential back streets. In Britain, the Confederation of British Industry is lobbying for extensive pedestrianisation in central London coupled with a car reduction policy over the whole of the capital - 2 500 sq kilometres containing over 8 million people (Honigsbaum, 1994). As currently developed, route and parking guidance systems would make such policies harder to achieve. Research evidence suggests that route guidance would increase traffic in city centres and other congested areas by helping motorists to bypass the worst trouble spots and find the elusive empty parking space. Half the drivers using the pilot Bosch Travelpilot system in Britain said that it would give them confidence to travel at busy times of the day or to places they would not otherwise go, including congested city centres (Local Transport Today, 1994).

Such strategic concerns have not featured in discussions on the development of intelligent vehicle or traffic technology. Marvin (1994) considers there to be "a lack of critical debate" and "a relatively superficial view of the environmental role of telecommunications" (see also his contribution in this book). The only real technology assessment debate within the IT culture appears to be on much narrower (and esoteric) matters. For example, Tibbs (1994) reports, “the ethical questions implied by the development of ‘intelligent’ systems have already received serious consideration by the Prometheus research teams and others. There is the crucial question of whether we should ever totally entrust our fate to a machine”. The really strategic ethical dilemmas of the telematic revolution, as to the sort of transport system they encourage, have remained largely unaddressed. Indeed, they appear to be specifically ignored.

3.1 Are intelligent technologies policy neutral?

About two years ago, at a transport telematics conference, I expressed such concerns about the purpose for which intelligent vehicle technologies were being developed. The reply was that the development of technology is independent of how it can be used. Indeed, the opinion was expressed that what is needed is an independent technology, which is flexible and can be adapted to changing policy needs. There is a good deal of truth in this, but in practice any major technology is always developed with a vision in mind of how it will affect and change society. Henry Ford's vision of mass car ownership serviced by his mass production technology is one such example.

The development of a technology with a particular intention of how it will be used closes off (or at least makes very difficult) alternative options. "Although a particular (IT) application may have 'environmental' potentials it is not inevitable that these will be realised in practice (Marvin, op cit). For example, over the past 20 years, the fuel efficiency of cars has improved immensely through the use of a number of related technologies. These include aerodynamics, lightweight materials, turbocharging, multi-valve cylinders, fuel injection and electronic engine management systems.

Does this mean our cars are now more energy efficient and less polluting? Largely it does not. Even though these technologies could have been used to reduce fuel consumption, they were developed with the goal to increase the power and performance of cars. Thus most of the improvements in fuel efficiency has gone into increasing acceleration and speed, not the car's fuel economy. What improvements in fuel economy that have been achieved have been counterbalanced by an indirect effect of the drive towards speed and acceleration. This is that motorists have been encouraged to trade up to more powerful cars and drive faster. The net effect is that over the past 20 years there has been virtually no improvement in the fuel economy of cars in Britain or the EU as a whole (Schipper 1991). This is quite aside from the increase in traffic, which has simply led to a proportionate increase in energy use and emissions. The purpose for which fuel efficiency technologies were developed has thus meant that an alternative purpose (fuel economy) which the technologies *could* have achieved, has never been realised.

There is one exception to this example of fuel efficiency improvements failing to improve fuel economy, and that is in the United States. Here, the CAFE fuel economy regulations have resulted in the car industry using the fuel efficiency technologies to reduce the fuel consumption of cars to a significant degree. In 1970 the US car fleet averaged 18 litres per 100km and European cars about 10 litres per 100 km. Today European cars still average 10 l/100km, but the US cars are down to 14 l/100km. The policy context to give a direction and purpose to a technology is crucial and its presence or absence will be crucial for the development of intelligent vehicle systems.

3.2 Making the telematics - policy link

The USA also provides some indications of how telematics can develop within a positive policy context. For several years, the South Coast Air Quality Management District (SQUAD) Regulation XV in California has required employers of more than 100 people to develop plans to reduce single occupancy car commuting trips by their employees. This has prompted serious interest in telecommuting. Interestingly, the most relevant intelligent technologies are not those being developed for vehicles or vehicle management, but are those which can provide very acceptable alternatives to frequent and/or long distance travel.

A survey of telecommuters by Pendyala et al (1991) provides strong evidence of the positive transport effects of telecommuting within this transport planning context. Not only does telecommuting cut car use for commuting purposes, but it also affects non-work trips. It appears that once telecommuters no longer have a long drive to work, driving long distances for other purposes becomes less acceptable and they tend to undertake shop and leisure trips more locally.

This illustrates that the full systems effects of telecommuting need to be examined. Increased energy to heat homes or air conditioning in warmer climates for home-based telecommuters is clearly one such indirect impact. British Telecom (1992) views this effect as marginal, though it would very much depend on the primary energy source and the efficiency of both the heating/cooling appliance and insulation standards of the home. Of possibly more significance are longer-term structural life-style effects. The Californian study did suggest a reduction in non-work trip lengths, although this might be exceptional as the commuting trips displaced were very long. Adverse effects, such as telecommuting freeing people to live in energy-intensive remote or low-density places seem very likely.

Historically, improvements in the availability and speed of travel has not led people to stay where they are and travel less, but (as was briefly described at the beginning of this chapter) has always led to lifestyle changes that have resulted in more motorised travel being generated. There is a real danger that telematics could well end up generating more travel than is eliminated. Indirect systems impacts have yet to be adequately assessed.

There are indications that the form of teleworking is crucial to its transport impact. A broad consensus seems to be emerging that home-based teleworking (homeworking) has limited potential and a number of problems. For businesses, all management trends are towards teamworking and personal interaction is needed to maintain team unity and to brainstorm and generate ideas. Equally junior member need personal interaction for professional development. Added to this, the cost of providing the homes of all staff with poorly utilized equipment is a further disincentive.

For the individual employee, home teleworking has drawbacks too. They need to have a room for an office, there can be conflicts with domestic life (particularly if the teleworker is inclined to be a workaholic or if her/his kids love to play 'wiping disks' when they are not around!) Partial teleworking (say on 3 days a week) would address the problems of teamworking, but in terms of economics and environmental impacts would represent the worst of both worlds. Two workplaces (home and office) would have to be equipped, paid for and heated/cooled.

The concept of the local Telecommuting Office (TCO) may have a wider applicability and could herald a more radical change in working lifestyles for the majority of office workers. The study by Roarke Associates (1993) has compared the potential impact of the TCO to that of the skyscraper had in the 1920s. Then the combination of three technologies - the steel-framed building, the elevator and the telephone - spurred the development of the city centre concentration of offices we know today. Telematic technologies have the potential to disperse these offices into a totally new pattern, with headquarters functions remaining in city centres, but most other office staff travelling to local TCOs.

This study has interestingly shown a wider range of transport benefits of telecommuting than had previously been considered. It looked at the problems of London's congested suburban railway and metro (Underground) network. Providing a network of TCOs to reduce peak-hour commuting would actually result in significant improvements to both the transit operators and the vast bulk of non-telecommuting passengers. Eliminating some peak hour travel and shifting other journeys to the off-peak would reduce congestion and result in a smaller train fleet being needed and better stock utilization. Peak-hour trips would become more reliable and off-peak frequencies service frequencies would improve. One particular benefit would be that there would be room on the previously congested lines to the south of London to introduce a more intensive service of international trains via the Channel Tunnel.

The principle of investing to reduce travel need rather than investing to provide for increased travel demand receives a boost in this study. It looked at the cost of reducing transport demand via building a network of TCOs as opposed to the traditional demand-response method of increasing capacity and concluded that the TCO network would cost about half that of building additional rolling stock and platform extensions to ease current overcrowding. For new roads, the cost of traditional demand-based policies are even higher than for rail. The Roarke study indicated that for an investment of under 600 million ECU, a London TCO network would displace the traffic growth accommodated by the planned 3 500 million ECU M25 expansion.

The crucial element of the Roarke study is the careful planning and integration of telematic developments with transport and planning policy. This was also true of the Californian study, where telematics technologies were developed quite specifically to *reduce* car use. Such examples are rare, but they point the way to a more positive approach to transport-related telematics than is the norm.

4 Summary

Current transport trends are unsustainable in economic, social and environmental terms. A number of key indicators suggest that we cannot continue as we are now. Intelligent vehicle and control systems are at the crucial stage where they could be used to simply contribute to traffic growth and pollution or could be used to manage traffic demand and help us on a path towards a more sustainable use of transport in a far more acceptable way than other policy options.

Intelligent vehicle technologies are not a neutral technology; they can either be used to reinforce current unsustainable and undesirable transport trends or to help solve the underlying causes of the transport crisis. At the moment so much attention is focussed on developing intelligent vehicle technologies that few people have noticed that this crucial dilemma even exists. If they serve a discredited vision, then these telematic systems will will worsen the environmental crisis and the quality of life of us all.

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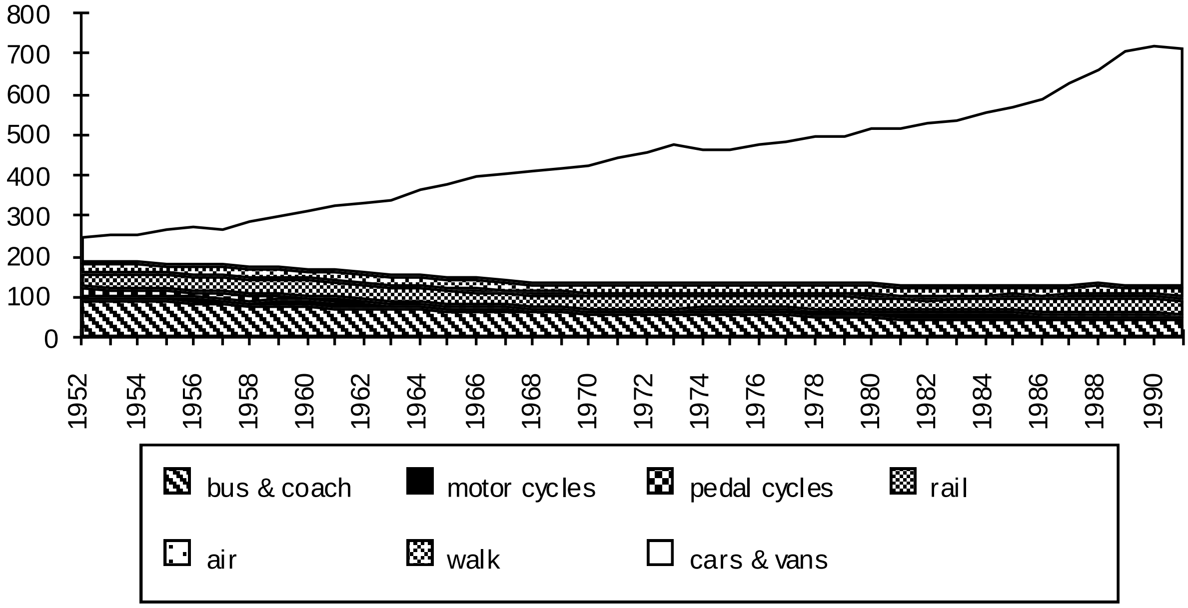
Table 1: Average Journeys and Distance travelled per Person a Year 1978-90

	Journeys	Km per person a year

1978/9	1 097	7 970
1985/6	1 025	8 565
1989/91	1 090	10 433

Source: National Travel Survey, 1989/91 Report



Source: Potter, 1993 (updated)