COMPUTERS ON THE ROADS

The Social Implications of Automatic Vehicle Identification

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Electronics and computer technology is now available to automatically identify cars, trucks and buses as they travel on a road. Massive research and development programs are under way in several countries to test and implement this technology in order to reduce congestion and make more efficient use of the roads. Australian authorities are watching overseas developments closely.

So far there has been little discussion of the social implications of this technology. There is certainly a possibility of increased surveillance, and also implications for the question of who pays for use of the roads. These issues need public discussion.

Several years from now, there may be a computer in your car to help you find the best route to your destination. When you get in, there will be a small console for you to key in where you're going. The computer system will figure out the best way to go, considering possible routes and taking into account current traffic conditions. A little screen on the dashboard – and, if desired, a synthesised voice – will tell you where to go next. This is called a route guidance system.

With a somewhat different technology, it is possible that as you drive along, your car's position will be monitored by beacons beside the road, hooked into a central computer system. Because the central computer knows where cars are, it can optimise traffic light timing. It can also despatch police and emergency vehicles to bottlenecks and accidents. The electronic identification of your car could also prove valuable in case of theft. This is called automatic vehicle identification.

The future may also bring computer systems that are used to charge for use of the roads. You might have a pre-paid 'smart card' in your car. Whenever you pass by a beacon, a small toll will be subtracted from your account on the card. The toll would be larger at peak periods and on crowded arteries. This, it is hoped, will encourage drivers to travel at other times or by other routes, thereby reducing congestion. Such a system is called electronic road pricing.

But what if your smart card had run out of money, or wasn't working properly – or you were trying to cheat the system? If a vehicle went by a beacon

and didn't have a working smart card with sufficient credit for the toll, a camera would automatically photograph its licence number, and payment would be sought later.

It is at this point that some people start to worry. Any system that could monitor a vehicle could also be used for surveillance. A system of automatic vehicle identification could be used to try to improve traffic flow, but could also be used to monitor your movements if you were considered to be a threat to society, or just to someone powerful? Furthermore, who will control the scale of charges for electronic road pricing? Couldn't this become another way to charge those who can least afford it?

These are not hypothetical questions. Technologies for automatic route guidance and electronic road pricing are being tested in several parts of the world today. Yet there has been minimal public discussion of the social implications.

Computers and traffic

The development of microelectronics has had a large impact on the construction of road vehicles. Most of this new technology is built into engines and other vehicle systems and has few wider social implications. But the developers of computer systems have been enterprising in their search for applications, so it is hardly surprising that traffic management has been a focus for attention.

The massive road-building programs of the 1950s and 1960s in industrialised countries did not succeed in solving the problem of traffic congestion. As quickly as freeways were built, they were filled by more and more vehicles. Eventually, the boom in road construction declined, in the face of mounting costs and opposition from local communities. Although vehicles have become more sophisticated, traffic jams have remained.

The promoters of computer solutions have seen a lucrative market. Instead of building more roads, why not use the present ones more efficiently? Automatic electronic identification of road vehicles can help improve traffic signal coordination; automatic route guidance can encourage individual drivers to choose better routes; and electronic road pricing applies the principle of supply and demand to the roads, thus improving efficiency. At least this is the theory.

There is a considerable selection of competing technologies to accomplish these tasks. One system involves loops buried underneath roads, in the style of the present triggers for traffic lights. An electronic licence plate or tag – a box the size of a video cassette – is attached to the underside of each car, truck or bus. When the vehicle drives over the loops, the tag is energised by a radio signal from a power loop and sends out its unique identification number. This is picked up by a receiver loop and transmitted to a central computer.

A similar system involves beacons beside roads, perhaps linked to the switching boxes on traffic lights. The beacon transmits an infrared signal, generating a reply from a small panel inside the windscreen. As well as infrared, systems can use microwaves, visual light and radio waves.

More comprehensive than these systems is satellite tracking. The position of vehicles is continually monitored by a satellite, and this information is in turn sent to a central installation. Satellite tracking is more appropriate for long distances, such as those covered in transcontinental truck deliveries, than for city streets.

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For our purposes, the technical details are less important than the common characteristics of the systems. Systems of automatic vehicle identification (AVI) involve a unique identifying number which is transmitted to a central location when the vehicle passes specified locations. A more comprehensive arrangement is automatic vehicle monitoring (such as the satellite systems), in which a vehicle's location is known centrally at all times.[1]

The first major test of AVI was in Hong Kong in the mid 1980s. Due to escalating congestion, it was decided to run a pilot scheme for charging vehicles for entering the downtown area. A fleet of vehicles – all volunteers – was fitted with electronic tags. Loops were placed under all roads into the central business district. The experiment ran for two years. The technology worked with high reliability and the pilot program was judged a technical success. In spite of this, the scheme did not go ahead. Opposition came from the Hong Kong Automobile Association and others, and concerns were expressed about civil liberties and equity.[2]

In spite of this setback, research and development have continued unabated. In London, an automatic route guidance system called Autoguide is being tested, while in Berlin a similar system called Ali-Scout is undergoing trials.

Various projects totalling on the order of $1000 million are being carried out by Western European governments and industries to apply computer technology to road transport. A similarly massive program is under way in Japan.

In Oslo, Norway, all drivers will soon have to pay a toll to enter the city. A typical system includes three separate lanes for payment: by cash, by token and by an electronic tag and microwave communication. The latter lane requires no stopping. Payment of tolls electronically is also possible in the Norwegian cities of Alesund and Trondheim.[3]

In the United States, developments are not so advanced. But there is a large program to test the automatic identification of trucks, called the Heavy Vehicle Electronic License Plate or HELP program. It involves an AVI system to monitor the movement of trucks over a large number of states.

Developments in Australia do not match those in Europe, Japan or even the US, but there is certainly interest in AVI in a number of quarters. The Victorian Road Freight Transport Industry Council and the Victorian Roads and Traffic Authority held a conference on AVI in 1988 attended by representatives of companies, trade unions and government bodies. The NSW Roads and Traffic Authority has funded a tracking system used by some Sydney taxi companies; this provides the RTA with useful information about traffic flow.

There has been continuing interest in automatic electronic payment of the toll for the Sydney Harbour Bridge. A survey was held to determine the attitudes of motorists. It would be interesting

to know, for example whether they would expect a discount rate and whether they would be willing to pay in advance. Since there have been no moves to set up an electronic tolling system, it may be inferred that the assessment so far is that the capital cost of setting up the system cannot be justified by the Harbour Bridge toll alone. But the continuing interest in this possibility suggests that additional applications will be sought in the future.

Surveillance

There is no doubt that one possible consequence of AVI systems is an increased potential for surveillance of the population. Whether this is justified by the benefits of the technology is something that the public has not yet had a chance to consider.

The first likely use of AVI systems is to monitor truck and bus fleets, providing a much closer surveillance over workers.[4] The focus in this article, though, will be on the implications for private motorists.

Surveillance can be defined as the systematic monitoring of individuals without their consent. The usual aim is to collect information about them. Surveillance has been a feature of societies for millenia, and certainly does not require computers. Permanent secret police were first established under Napoleon and are now an established feature of the modern state.[5]

Many people have the idea that they are at risk from electronic surveillance, such as phone taps, but it is much more likely that inside information would be obtained by old-fashioned informers.[6] Nevertheless, computers do provide a vastly increased capacity for certain types of surveillance, especially through interconnection of databases. It is now possible, and routine, for police to key in the licence plate number of a car seen on the street and to quickly obtain details of any previously recorded information about the owner. Databases from tax and welfare files can be meshed to pinpoint possible cheating.

Computers allow certain forms of surveillance of records to become routine. Every customer who makes a transaction at a bank can be automatically checked for outstanding payments. With manual systems, a special search would be required, and would only be undertaken when suspicions were aroused. With computers, checking can be made routine. Beyond this, databases can be scanned and compared with each other even when there is no reason to suspect anyone.[7]

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2. Sandford F. Borins, 'Electronic Road Pricing: An Idea Whose Time May Never Come', *Transportation Research A*, Vol. 22A, Nº 1, January 1988, pp. 37-44; J.A.L. Dawson, 'Electronic Road Pricing in Hong Kong. 4. Conclusion', *Traffic Engineering + Control*, Vol. 27, Nº 2, February 1986, pp. 79-83; Pam Scott, 'Whatever Happened to Electronic Road Pricing?', unpublished paper, Informatics Faculty, University of Wollongong, 1990.
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4. Pam Scott, 'Road Transport Informatics: Challenging the Freedom of the Road?', unpublished paper.
5. Thomas Plate and Andrea Darvi, *Secret Police: The Inside Story of a Network of Terror*, London, Sphere, 1983.
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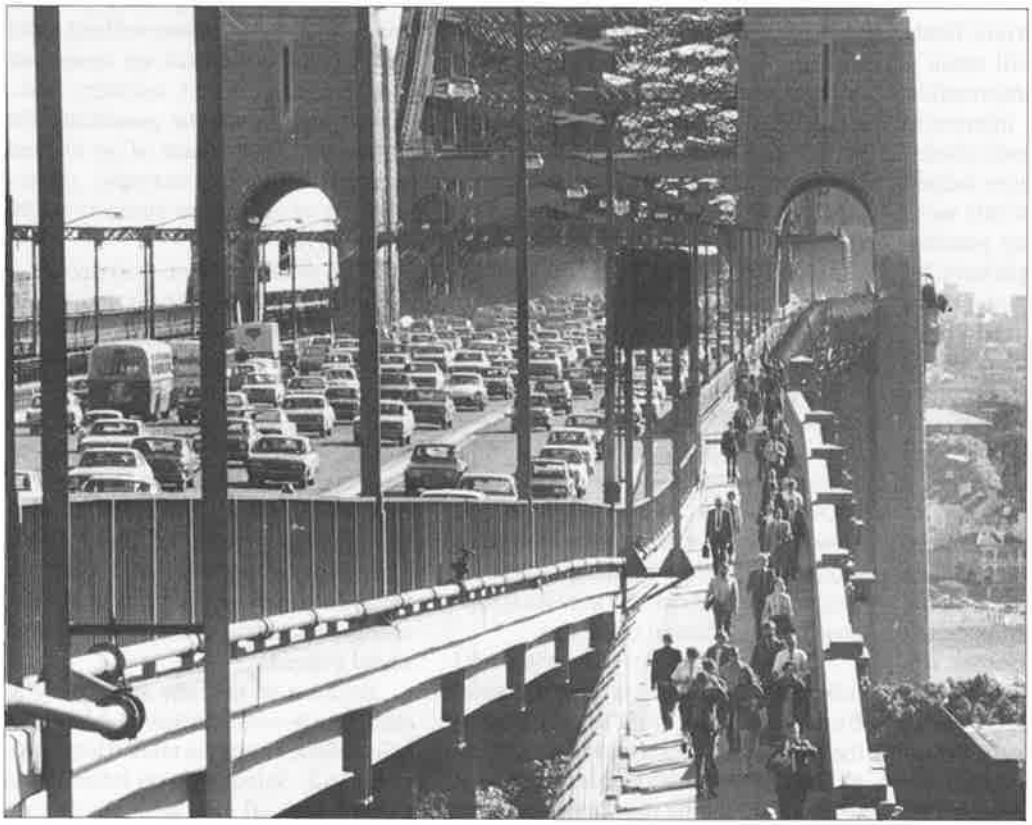
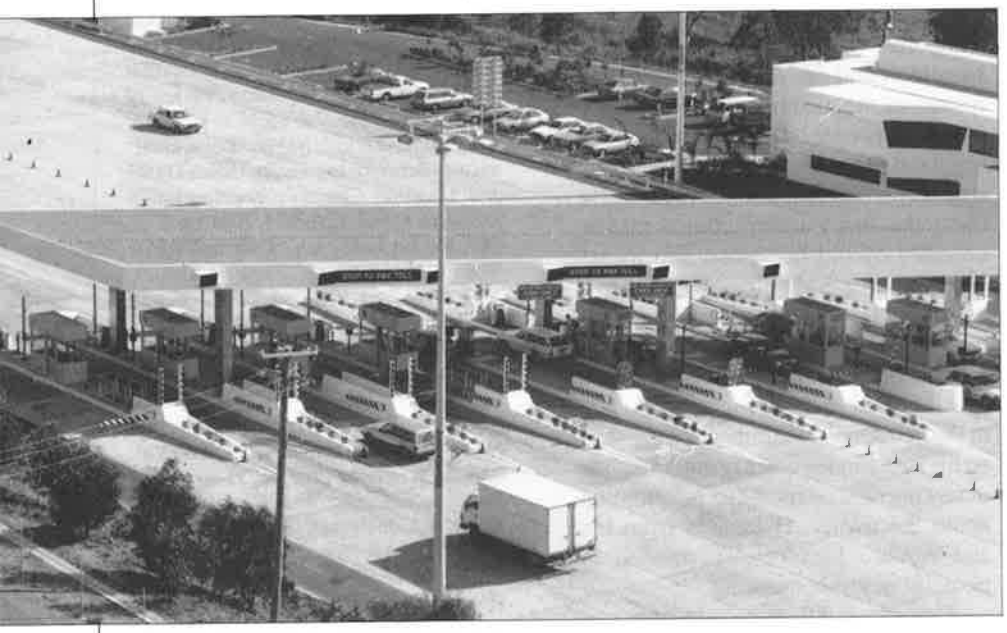


Sydney Harbour Bridge in morning peak-hour—would an electronic tolling system ease the congestion?



Paying a toll for access to a section of highway is a routine for most motorists, but is it the most equitable way of apportioning the costs of road use?

These developments have come in a gradual way, and there has been comparatively little public opposition. A prime example is banking at electronic tellers. The registration of a person's account number means that there is a record of a person's location (or at least the location of their card) at a particular time and place. Access to this information could be used for unscrupulous purposes, and its existence certainly reduces the 'invisibility' of a person's transactions.

The introduction of electronic funds transfer at points of sale will mean a much greater gathering of information that can be used to make inferences about the personal habits of individuals. Yet, so far, people seem to have judged that the personal benefits of this technology have outweighed any possible threats to privacy. Also, people have, by and large, felt that they are voluntarily using the technology. A forced imposition of a technology with surveillance capacity would be another thing altogether.

This was shown by the groundswell of opposition to the Australia Card, a national identity card (and, more importantly, a unique identifying number) proposed by the federal government. At first the card seemed to receive public support as a measure to eliminate tax fraud and cut administrative costs. But then critical voices emerged, government claims were challenged and a massive opposition movement developed, bringing together elements from the political right and left. Eventually, the discovery of a legal flaw provided the pretext for the federal government to withdraw the card.[8]

The government's new tax file number is a substitute for the Australia card, and so the success of the anti-card movement can be questioned.[9] But it certainly showed that computer-based surveillance provides the basis for widespread and vociferous citizen concern. No one knows whether such concern is likely to be directed against an AVI system.

Consider a standard AVI system in which a vehicle's unique identification number is registered whenever it passes a particular location. The information gathered could provide a detailed record of driving patterns. Speed (and speeding) could be determined. Daily routines could be identified, and also deviations from them. It would be relatively easy to determine the location of the driver's home, employment, shopping and so forth.

Many would not object to this – depending on benefits to be gained – if there were sufficient safeguards against disclosure or abuse of the information. Unfortunately, weak control and unauthorised use of databases are commonplace. Some companies routinely determine credit risks by accessing supposedly confidential databases.

The incentives for accessing AVI information could be considerable. Businesses might want to check up on the behaviour of executives under suspicion. Private individuals might want to check up on the movements of their spouses or children. Police would want to use the system to monitor or apprehend known or suspected criminals. Secret intelligence organisations would want to monitor those they consider to be threats to the security of society.

The Privacy Commission of New South Wales believes that it is likely that Australian police already use electronic tracking of selected road vehicles.[10] If many vehicles were equipped with electronic licence plates, covert surveillance would become much easier for police, private investigators, employers and others.

Having tight controls over collected information is one way to prevent misuses, but controls and ethics committees often can be circumvented. A much more secure way of avoiding problems is to make collection of compromising data impossible in the first place. It is here that examination of different technologies becomes relevant.

Any system that identifies or monitors individual vehicles is open to the sorts of abuse that have been mentioned. It is true that some systems do not require regular identification. An example is electronic road pricing using pre-paid smart cards. But for those without valid paid-up cards, the back-up system of photographing licence numbers is required. This opens the possibility for monitoring. In the case of an alleged terrorist threat, for example, photographing of all licence numbers might be employed.

With route guidance systems too, it is not necessary to identify individual vehicles at all, since guidance can work by giving drivers information based on knowledge of overall traffic flow. The surveillance threat from such systems derives from the technological infrastructure, which would make it much easier to introduce vehicle identification at some later stage. In other words, capital investments in route guidance mean that AVI becomes a cheaper and, hence, more attractive option to obtain added benefits.

Because of this, the surest way to eliminate possible misuse of AVI is not to introduce any of the related technologies at all. Safeguards on information collected are all very well, but they do

not provide protection in the face of real or manufactured emergencies or in the face of a different, more repressive, government. Even without special pretexts, new surveillance technologies may result in much tighter social control in the liberal democracies.[11]

Freedom of the road?

Civil liberties on the road is virtually a contradiction in terms. This may sound strange to those who subscribe to the idea of 'freedom of the road'. One of the great attractions of the car and driving is that people can decide when to leave, where to travel and what route to take, all in a way impossible using public transport and with a speed, range and comfort not attainable by walking or cycling. Australia is one of the countries where the ideology of the 'open road' holds sway and where constraints on driving are resented by many.

However, a closer examination of road transport reveals an impressive range of constraints. To begin, drivers are expected to obey the rules of the road, such as driving on the correct side and obeying traffic signals. This is taken for granted. Then there are laws concerning speeding and other road behaviour, and also parking. Violations are common, as are warnings and fines. Vehicles must be registered and working properly. There are special laws requiring the wearing of seat belts and having low blood alcohol. It is safe to say that most people have more interactions with the police and the legal system because of driving than any other activity.

Most of the police attention to drivers and driving can be considered to be a form of surveillance. Indeed, it is now routine for cameras to record traffic at particular intersections and for pictures to be used in court proceedings. Surveillance on the road is already a reality in many ways. AVI would only be a high-tech extension of this.

The underlying reason for all this surveillance is quite simple: road vehicles are dangerous. Traffic accidents are responsible for large numbers of deaths and injuries. Police surveillance and legal penalties are designed to protect people.

The problem is built into road transport as a system of transportation, and is ultimately a product of the choice of technologies. A comparison with nuclear power is revealing here. Critics of nuclear power have argued that because of the potential for massive environmental disaster, terrorism or criminal sabotage would become major concerns and, to prevent this, extensive police powers and surveillance become necessary. These police powers could even be used against peaceful critics of nuclear policy. The result would be a 'nuclear police state'.

Even though the nuclear industry has been stalled far short of the hopes of its proponents, many of the concerns of the critics have been shown to be valid. There have been special police forces to guard nuclear facilities, and there has been police surveillance of anti-nuclear activists.[12] The problems are built into the nature of the technology. Many critics have concluded that nuclear power cannot be reformed, and therefore should be opposed altogether.

Road transport introduces a similar set of inherent problems but, unlike nuclear power, the technology has become well and truly entrenched. Surveillance of road vehicles is already a reality. The key questions are, how greatly would AVI increase the scope for surveillance, and how significant would the difference be to people?

Equity

In a financial sense, the idea of freedom of the road is a contradiction when one considers registration payments, petrol tax and road tolls. Yet it is likely that any attempt to introduce comprehensive road pricing would lead to massive resistance. To many, the slogan 'freedom of the road' means not only being able to drive when and where one likes, but also doing so without making special payments.

Road pricing at the moment is a system of vast subsidies from some groups to others. Registration payments take no account of a vehicle's use of the roads, and constitute a subsidy for heavy road users. Petrol taxes are roughly proportional to overall road use, but do not take into account a vehicle's contribution to congestion, which depends on which roads are used and at what times. Cars subsidise trucks, which cause a vastly disproportionate share of damage to roads due to their weight.

Road vehicles also cause massive impacts on society as a whole which are not covered by registration and petrol taxes. These impacts are called externalities in economics because they are not included in the normal equations of supply and demand. They include air pollution (which may be responsible for numerous deaths and illnesses as well as property damage), a contribution to the greenhouse effect and increased demands on police, emergency and medical facilities. Land covered by roads and related infrastructure is not available for other uses, but drivers do not pay the rent it would demand as real estate.[13]

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The automobilisation of society has shaped the development of cities, industry, energy systems, and life styles to such an extent that conventional economics cannot readily put a price on the 'cost' of road transport.

8. Roger Clarke, 'Just Another Piece of Plastic for Your Wallet: The "Australia Card" Scheme', *Prometheus*, Vol. 5, Nº 1, June 1987, pp. 29-45; Peter Graham, 'The Australia Card: A Burden rather than a Relief', *Australian Quarterly*, Vol. 58, Autumn 1986, pp. 4-14.
9. Catherine Lumby and Paul Cleary, 'Australia Card through Back Door', *Sydney Morning Herald*, 26 October 1990, p. 6.
10. Privacy Commission of New South Wales, *Electronic Vehicle Tracking*, Issues Paper Nº 62, Sydney, August 1990, p. 11.
11. Gary T. Marx, 'The Iron Fist and the Velvet Glove: Totalitarian Potentials within Democratic Structures', in James F. Short, Jr (ed.), *The Social Fabric: Dimensions and Issues*, Beverly Hills, Sage, 1986, pp. 135-162.
12. Robert Jungk, *The New Tyranny*, New York, Grosset and Dunlap, 1979; Donna Warnock, *Nuclear Power and Civil Liberties*, Washington, DC, Citizens' Energy Project, 1979.
13. A Swedish calculation shows that the total social cost of road traffic, including road costs, traffic control, accidents and pollution, is perhaps twice as great as total vehicle and fuel taxes: Ingemar Leksell and Lars Hansson, 'Road Traffic: Far from Paying Its Way', *Acid News*, Nº 1, January 1990, pp. 11-13.
14. James J. Flink, *The Car Culture*, Cambridge, Mass., MIT Press, 1975.

have been marginalised in direct terms but also by having to compete in a society built around the car.

Given this context, it is possible to see why electronic road pricing (ERP) may encounter resistance. The immediate prospect is that ERP would end the subsidy for drivers using congested roads. Those using heavily travelled roads at peak periods would pay more; most others would pay less. The former group might well protest louder, especially since it would include more affluent commuters than outer-suburban shoppers.

More importantly, ERP could open up the entire issue of road subsidies to wider examination. ERP would make it easy to charge different types of vehicles different rates. For example, heavy trucks could be charged more for using certain roads. The trucking industry, which is massively subsidised by present pricing policies, would have much to lose by a greater scrutiny under ERP.

Drivers might also legitimately fear that the implementation of ERP would establish a powerful 'road pricing bureaucracy' that could increase prices unilaterally. No doubt some environmentalists would welcome such central control if it were used to charge motorists for their impact on the environment.

But environmentalists would be only one group competing to influence road charges. Others would include trucking companies, the National Road Motorists Association, central business district employers, bus and rail interests, private motorists, trade unions, politicians and many others. It is even possible to envisage 'road pricing rorts', analogous to schemes to avoid income taxes. Central taxation encourages the powerful to both shape the rules and to subvert them.

So far, little has been said about what a truly equitable road pricing system would be like. The difficulty is that equity means different things to different people. How does one compare the interests of a single parent with small children in an outer suburb with a truck driver? There are no value-free answers. Perhaps the key issue is how the decisions are made. The present transport system is a product of powerful vested interests.[15] An ERP system would just change the vested interests. Certainly, it is hard to imagine ERP leading to greater community participation in decision making.

Further complications

There is no objective way to make a decision on AVI. The benefits of congestion control and reduction of travel times, improved use of existing roads and crime reduction are difficult to quantify and compare with the necessary investments in the computers, beacons, tags and so forth required to achieve them. There is the additional complication that no one knows whether such a system will work as well as planned.

But this is just the economic part of the calculation. How is it to be compared to the potential threat to civil liberties?

The risks and benefits will affect different groups. There will be large benefits for companies that produce and install the AVI system. The cost of setting up the system will probably be borne by the government. Some motorists will gain more benefits than others from altered patterns of road use and from different pricing methods. If the system is used for surveillance, this will affect some groups much more than others.

An indirect effect of an AVI system is that further investments are made in road transport rather than other forms of transport. While many hundreds of millions of dollars are being spent world wide on the application of computer technology to road vehicles, virtually nothing is being spent on computers for those travelling by foot, bicycle or train.

It is possible to imagine, for example, a carriage in every train equipped with the latest electronics and communications devices (not to mention an ordinary telephone). Because trains travel on a predictable path and schedule, the technical obstacles to be overcome are far less than for road vehicles. The continuing investments in road travel hide the absence of investments in alternatives.

There is one last complication. Even the claimed benefit of reduced congestion from AVI can be disputed. Traffic planners agree that full road pricing would change the distribution of road users. For example, high prices would deter many motorists from using key roads at peak periods, reducing congestion for those with more money or greater urgency who continued to use them. Some motorists would pay more and some less, and their use of the roads would change. But would this reduce congestion and increase the average speed of urban traffic?

Some traffic planners think not. They argue that there is such a large untapped demand for road travel that any improvements in efficiency will result in more people using the roads, thereby bringing congestion and average speeds back to the old level. This is precisely the reason why building more roads does not reduce congestion. For the same reason, full road pricing will not reduce congestion either.

Their view is that the only way to increase average speeds is to increase the speed of urban mass transit. With a more efficient (and comfortable) rail service, more people will use trains, the roads will become less congested and average road speeds will increase too.[16]

Because of the many social implications, conflicting interests and areas of dispute, it is important that no decision about AVI be taken without widespread public discussion. One factor that has allowed developments to proceed so far in so many countries without public discussion of social implications is that there is no relevant social movement.

The environmental movement can be expected to put issues affecting the environment on the public agenda and, similarly, specific issues are addressed by the peace, feminist and consumer movements, among others. Some aspects of computer developments are addressed by civil liberties groups (surveillance and privacy), trade unions (employment) and health groups (effects of visual display units). But there is no significant group that puts computer developments at the centre of its concerns. It remains to be seen whether the prospect of AVI or some other development changes this situation. ❖

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16. M.J.H. Mogridge, 'Road Pricing: The Right Solution to the Right Problem?', *Transportation Research A*, Vol. 20A, N° 2, 1986, pp. 157-167; Robert L. Pretty, 'Road Pricing: The Solution for Hong Kong?', *Transportation Research A*, Vol. 22A, N° 5, September 1988, pp. 319-327.

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