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Improving mobility & access for the off-road rural poor through Intermediate Means of Transport

Gina Porter

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In the first section I briefly review the range of difficulties commonly faced by men, women and children resident in off-road locations as a result of restricted mobility and poor access. The second section of the paper focuses on the potential of Intermediate Means of Transport for alleviating access / mobility problems in off-road areas. Constraints on IMT use among different sectors of the off-road rural poor are examined through presentation of a case study from coastal Ghana, while recent evidence from the Jos Plateau, Nigeria, is used to illustrate the enormous potential of IMTs, in favourable circumstances, for improving access and reducing isolation.

Keywords

Ghana, Intermediate Means of Transport, Jos Plateau, Nigeria, paved roads, Sub-Saharan Africa, transport infrastructure

Unprofitable rural bus services: Market structure & tender prices since Deregulation

Robert John Langridge

Many of the cost benefits to local authorities of post-deregulation competitive tendering have recently been reversed. This has been attributed to increases in wage costs resulting from driver shortage. This article argues that the situation is more complex and that factors such as the level of competition, operator motivation and tendering strategies also have a part to play. It also argues that responses such as the Rural Bus Subsidy Grant involve a high-risk premium and could merely represent a subsidy to operators.

Keywords

Buses, competition, costs, deregulation, grants, investment, subsidies, tendering

Driver road rule knowledge & attitudes towards cyclists

Chris Rissel, Fiona Campbell, Bruce Ashley & Lisa Jackson

Many potential cyclists do not cycle on the road because of safety concerns. Drivers' knowledge of road rules and attitudes towards cyclists on the road were assessed. A telephone survey of 105 randomly selected adults in Sydney, Australia, with a current driver's licence was conducted. Less than half the sample (43%) was aware of recent changes to the Australian road rules. The majority of respondents (76%) reported high perceptions of danger associated with cycling, although respondents who had recently cycled on the road were significantly less likely to report these concerns of danger.

Keywords

Cycling, road rule knowledge, road safety

Household-focused travel behaviour change initiatives – Critical new tools in Travel Demand Management

Alan Perkins

Two *travel behaviour change* approaches, which focus on the provision of information to households about how they can use private motor vehicles less and more efficiently, have shown promising results in Australia. These approaches are described and the results summarised.

Reductions in car use of around 14% have been measured, with associated increases in public transport patronage, walking and cycling. The approaches serve to increase awareness of the societal reasons for reducing car use, and also assist people to change their own travel behaviour in ways that provide individual benefits.

Keywords

Individual marketing, IndiMark™, Perth, Travel behaviour change, Travel Blending®, Travel demand management, Travel diaries, TravelSmart™, Australia

U.K. Regional Air Services Consultations: a summary of & commentary on the RASCO Reference Case

Paul Upham

In July 2002 the U.K. Department for Transport released its consultations on Regional Air Services, as a precursor to issuing a White Paper designed to provide a policy framework for the next thirty years of U.K. aviation. Key among the scenarios is the RASCO Reference Case, which assumes a near-tripling of U.K. demand over 2000 – 2030 to about 500 mppa. This paper summarises the characteristics and impacts of the reference scenario, collated from the seven regional studies, and shows a clear disjunction between a commonly accepted noise threshold and the implications of Reference Case demand forecasts. Even under the politically challenging assumption of significant technological improvement by aircraft (–14 dB(A) on present 'Chapter 3' standards), enforcement of a rule of no additional daytime residential exposure to > 57 dB(A) Leq would prevent the expansion necessary to meet reference case demand at Heathrow, Stansted, Luton and Birmingham, with lesser problems at Liverpool John Lennon and Newcastle airports. There is a need for legally-binding, long-term agreements between airports and regulators, designed to phase incremental reductions in the size of populations exposed to annoying levels of aircraft noise (> 57 dB(A) Leq).

Keywords

airports, aviation, forecasting, land use planning, noise pollution

Had enough of Auto-dominance yet?

Jerry Schneider

With future urban growth, we are facing a serious problem of even greater congestion, with all its unpleasant side-effects than at present. Solutions based on 19th century transit systems, such as light rail, have not proved effective in shifting commuters from automobiles – rather they have moved passengers from existing modes, such as buses. It is time to look carefully at cutting edge alternatives which can offer a high speed, clean, efficient and seamless journey.

Keywords

Buses, light rail, Seattle, transit

Emerging Innovative Transit Systems: A sceptical view

Mayer Hillman

This is a response to 'Had Enough of Auto-Dominance Yet?' by Jerry Schneider who advocates the use of new high-tech modes of transport. The origin of these modes appear to lie in the simplistic notions that there can be the prospect of transferring onto them a significant proportion of journeys currently made by car and that, from an environmental and ecological perspective, as they are 'public' transport, they are unquestionably 'good'.

Keywords

cars, progress, mass transit, public transport

A challenge for the imagination: How will ubiquitous wireless change cars?

Graham Seibert

Personal transportation has not been touched nearly as much by the information revolution as other sectors. The Wireless Internet on one side, and global warming and congestion on the other, will accelerate change. Will car-to-car communication make roads sufficiently safer and more efficient to extend the reign of the private car? Car sharing appears positioned to benefit more, but replacing fixed public transit with intelligent jitneys is most likely to offer order-of-magnitude improvement.

Keywords

Cars, communication, information technology, internet, technology

Another deluded car fanatic. Reply to 'A challenge for the imagination: How will ubiquitous wireless change cars?'

Robert Davis

This is a response to 'A challenge for the imagination: How will ubiquitous wireless change cars?' The paper is fundamentally flawed by two key delusions: all car transport problems can be solved – without reducing the 'right' of motorists to carry on as usual – by applying high-powered electronic technologies, and that motorists are being restricted, when in fact they are not. This latter delusion is profoundly dangerous.

Keywords

cars, cyclists, human rights, pedestrians, technology

London is about to go 'live' on its congestion charging plans. From 17th February 2003 all cars entering the charging ring around central London will have to pay £5 and will be closely monitored by over 700 cameras at 180 sites around the zone where vehicles can leave and enter. This is the culmination of a 70 year debate in London and represents a radical mind shift in the way transport problems are tackled. This is not the first time that money has been taken from vehicles for the use of transport infrastructure. Britain is still peppered with the remnants of toll roads and toll bridges and the list of charges for each pig, cow, person and horse. Singapore and several Norwegian cities have road pricing in place and Melbourne charges motorists to use a city centre motorway access route. What is different about London is the scale of the exercise, the scale of the income and how it fits into a bigger plan for solving transport problems.

The £5 charge will raise about £130 million each year and £84 million of this will be spent on improved bus services. This is a substantial revenue stream and establishes a very neat solution to both funding problems and problems around solving congestion. The cars cause the problem, they take up too much road space (especially per person in the car) and they obstruct buses. Charging them reduces congestion by 15% in London, frees up road space and provides cash to improve buses in other ways. This is the key to unlocking many more creative solutions. We need to charge lorries for freight in a way that will make local food producers cheaper than those food products shipped in from distant sources. The revenue from lorry charges can also be used to fund rail and waterways. We need to charge aircraft for the damage they do to the atmosphere, global climate and to human health and to use the money to improve quality of life for those who live near airports and under flight paths.

The congestion charge in London will only happen because the Mayor of London, Ken Livingstone, was elected with this as part of his policies and because he has a degree of determination and tenacity to ride the inevitable crises that litter the path to February 17th. This tells us a lot about transport failures elsewhere in the world. Most politicians are fearful of motorists, fearful of newspapers and fearful of losing the next election. This is why they build roads, charge small amounts for car parking and pursue failed policies with more vigour as each year goes by. If slavery, city wide sanitation and votes for women had been handled in the same way as transport we would still have slavery in 2003, we wouldn't have fresh drinking water and sewage disposal systems in our large cities and women would not have the vote. Transport has a way of switching off the intelligence chip in the minds of politicians. This makes Ken's congestion charge all the more remarkable. He stood for election on this policy, he was elected and he is still doing it.

Sadly all is not well in London. The mayor of London is determined to build a new bridge across the Thames in the poorer eastern part of the city. The so-called 'Thames Gateway Bridge' will be 6 lanes wide (2 reserved for buses and bikes) and will generate over 30,000 cars per day through some of the poorest areas and most blighted environments in London. The irony of reducing traffic (the congestion charge) at the same time as increasing traffic (the new bridge) has not struck the Mayor or his advisors and the whole concept has been surrounded by a lack of clear thought, clear argument and a complete lack of meaningful consultation with the local residents most directly affected. Similarly London still has a very poor cycling network and low levels of cycling use. One in 3 trips each day in Copenhagen in Denmark is by bike and this could be equalled in London if congestion charge revenues were spent on safe, segregated, joined-up bike routes.

The next few months will be very interesting indeed as half a dozen cities in Britain watch London's efforts to solve congestion through a £5 charge and even more cities around the world worry about following London's example. We will soon find out if there are any more Ken Livingstones out there and if they will be any better at making sure that all their policies point in the same direction.

John Whitelegg
Editor
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Improving mobility & access for the off-road rural poor through Intermediate Means of Transport

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Abstract

This paper is concerned with the potential of Intermediate Means of Transport (IMTs) for improving mobility and alleviating access problems in off-road areas in Sub-Saharan Africa. Off-road rural populations appear to be disadvantaged and vulnerable in many respects. They characteristically appear markedly poorer in income terms, in health and in life chances than those in comparable roadside locations in the same region, though, obviously, not all off-road people are disadvantaged to the same degree by their location: women and children in Sub-Saharan Africa suffer much of the burden of off-road transport, for instance.

In the first section I briefly review the range of difficulties commonly faced by men, women and children resident in off-road locations as a result of restricted mobility and poor access. The second section of the paper focuses on the potential of Intermediate Means of Transport for alleviating access / mobility problems in off-road areas. Constraints on IMT use among different sectors of the off-road rural poor are examined through presentation of a case study from coastal Ghana, while recent evidence from the Jos Plateau, Nigeria, is used to illustrate the enormous potential of IMTs, in favourable circumstances, for improving access and reducing isolation.

Keywords

Ghana, Intermediate Means of Transport, Jos Plateau, Nigeria, paved roads, Sub-Saharan Africa, transport infrastructure

Introduction

This paper is concerned with the potential of Intermediate Means of Transport (IMTs) for improving mobility and alleviating access problems in off-road areas in Sub-Saharan Africa. I define 'off-road' as areas located away from a paved (or good gravel) road which, for at least part of the year, are inaccessible or accessible only with difficulty by motorised transport. My focus in the paper is on people who live off-road in rural areas with limited – albeit basic – transport infrastructure (i.e. a regional paved road network along which motorised vehicles operate), rather than on very remote areas without any transport infrastructure.

In the first section I briefly review the range of difficulties commonly faced by men, women and children resident in off-road locations as a result of restricted mobility and poor access, drawing both on my own research in Ghana[1] and Nigeria[2] and on the (limited) published literature specifically concerned with off-road areas and populations. The second section of the paper focuses on the potential of Intermediate Means of Transport for alleviating access / mobility problems in off-road areas. Constraints on IMT use among different sectors of the off-road rural poor are examined through presentation of a case study from coastal Ghana, while recent evidence from the Jos Plateau, Nigeria, is used to illustrate the enormous potential of IMTs, in favourable circumstances, for improving access and reducing isolation.

Living off-road: perspectives from the village

There is remarkably little published material which specifically focuses on poverty in off-road rural settlements in low income countries, yet the inhabitants of off-road villages are almost inevitably disadvantaged in terms of both service provision and access to transport and it appears that this has substantial impact on livelihood opportunities (Moore, 1979; Airey, 1985; Barwell *et al.*, 1985, 34–47; Ahmed & Hossain, 1990; Porter, 1997 & 2002). Moreover, regional road construction programmes can actually make conditions even more difficult for those who live away from the new roads (Porter, 1995; 1997). In this section of the paper I briefly review off-road service provision, off-road transport deficiencies and costs, and the feelings of isolation, invisibility and

[1] The Ghanaian currency is the Cedi, ¢. The exchange rate in November 1998 was £1 = ¢3,900; in March 2000 it stood at £1 = ¢6,300 and by October 2000 it was £1 = ¢9,500. In December 2002, the rate is £1 = ¢13,000. Borrowing to purchase IMT in a hard currency can have drawbacks; in the space of a little over 4 years, repayments will have more than tripled.

[2] The Nigerian currency is the Naira, N. The exchange rate in January 2001 was US$1 = N100. In December 2002, the rate is US$1 = N125.

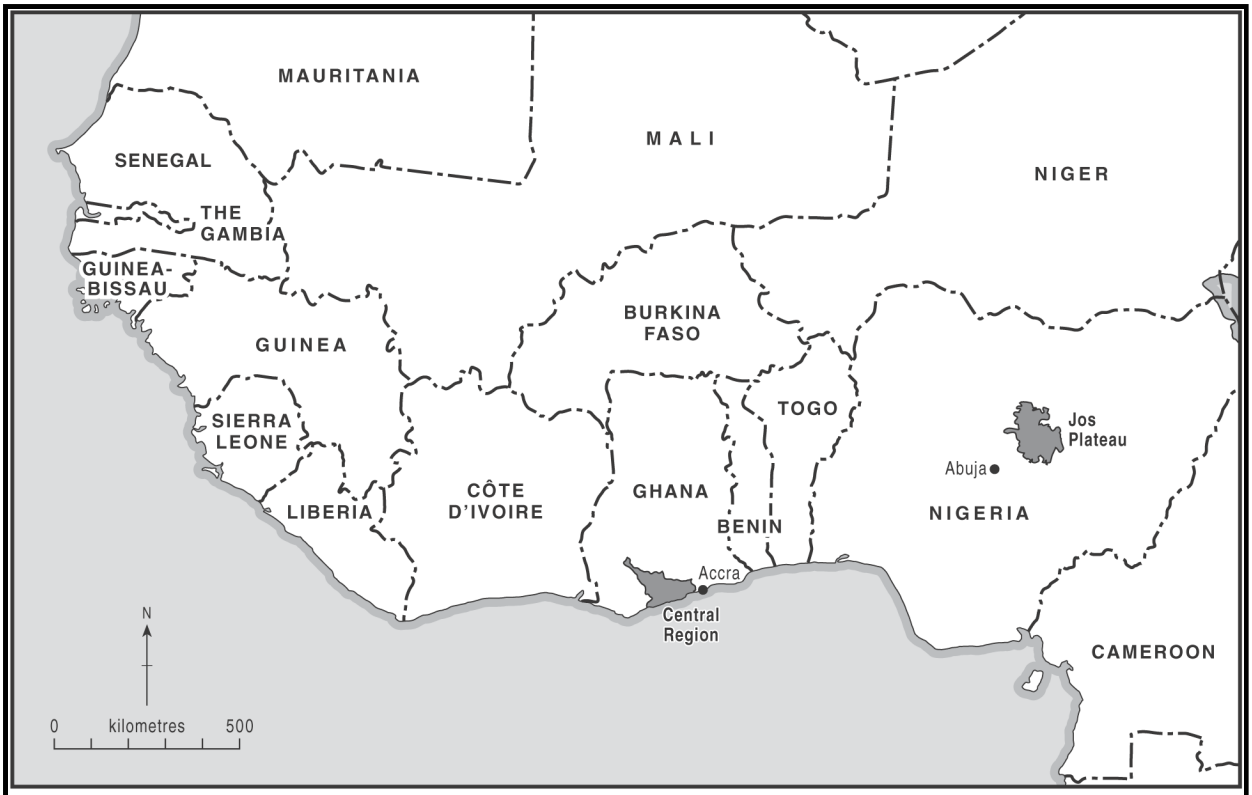

Figure 1: Map of West Africa, showing locations of Jos Plateau in Nigeria and Central Region in Ghana

powerlessness frequently experienced by off-road residents, even in settlements located just a few miles from the paved road. A fuller discussion of the issues is available in Porter (2002).

So far as service provision is concerned, most secondary schools, hospitals, banks, post offices, major markets, government agricultural extension services and other public facilities are located in centres with relatively good access: generally along paved or good gravelled roads. Electricity supply lines tend to follow major routeways. In the context of limited funds for rural service provision in low income countries, this is inevitable. Some low order services – notably primary schools and dispensaries – may be located in less accessible locations, but it is extremely difficult to find professional staff who will work there for any length of time: lack of electricity and good water supplies are commonly major deterrents. In coastal Ghana off-road village primary schools tend to be mostly staffed by young (male) graduates on their first appointment. As soon as they have experience they want to move on. Stephen, a young teacher based in a Gomoa village described the difficulties he experiences living off-road:

'Living here is not easy at all. I wasn't used to such a place… And I must spend two years on this, as it's my first posting… You don't get access to anything you want. I have to go and buy everything and bring it down [here]. Food is not so costly over here, but the water!… it's not good drinking water… the borehole water is salty and so not easy to drink.'

Stephen walks to the paved road junction and picks up a minibus travelling to the nearest market centre once every fortnight. He has to charter a taxi to bring him back to the village, and finds it difficult even then to get anyone to bring him in, because the road is so bad. He only gets back to his home in Eastern Region in the vacations. When asked if he mixed with the villagers, his response was direct:

'I personally don't want to mingle with them. I want to keep a distance… They're not so civilised in their speech. I only have contact with the new person here [the other teacher].'

Stephen's attitude is by no means uncommon among teachers and other professionals encountered in this region. I interviewed a village headmaster in another Gomoa village who was in the process of relocating his residence to a roadside village, from which he intended to commute by bicycle. He complained that he had been stigmatised because of living 'in the bush' (just three miles from a paved road), and feared he would never obtain a good posting and better himself unless he moved.

Regional road improvements do not necessarily improve matters for those who are resident off road. Indeed, they may lead to growing disadvantage for those unable or unwilling to move to the improved road. In parts of northern Nigeria during the oil boom period when there was a massive road construction programme, I observed a spiral of decline set in

whereby the more enterprising and younger off-road inhabitants migrated to the roadside and the off-road villages became less viable as locations for markets, schools and clinics. Subsequently, as recession set in and Structural Adjustment Programs were imposed, trained personnel such as teachers become even more reluctant to live in the off-road villages as track conditions deteriorated and transport services were refocused along the improved routes. The weakest, poorest and least entrepreneurial tend to be left behind in such circumstances: i.e. essentially those probably most in need of the services which are becoming increasingly remote.

Mobility to service / market centres at the roadside is commonly severely hampered by transport deficiencies in off-road areas. When roads are in poor condition vehicles are frequently delayed and may fail to arrive at all, particularly in the rainy season. This has serious implications particularly for produce traders who usually need to reach markets early in the morning in order to meet their 'customers'. Many off-road women in coastal Ghana complain about the loss of sales caused by transport failure: the urban traders with whom they deal will buy from other traders if they fail to arrive at market in good time and they may even have to return home with their goods unsold. Vehicle owners interviewed in this region regularly bar their drivers from taking specific routes which are known to be in bad condition.

High transport costs present a further major deterrent to off-road mobility. Transport charges tend to be much higher for both passengers and goods along roads in poor condition than along paved roads; this is usually ascribed by transport providers to greater wear and tear on vehicles. In 1998 minibus transport costs along earth roads in coastal Ghana were roughly double those along paved roads (¢100 as opposed to ¢50) over distances of around ten miles. In off-road areas the GPRTU (Ghana transport union) leaves individual operators to set their own charges, whereas charges along major routes are regulated by the union. On the Jos Plateau, Nigeria, in January 2001 minibus transport cost N4– N4.5 per passenger mile on earth roads, compared to N3 per passenger mile on paved roads over the same distance of about 10 miles; the rather more favourable ratio for unpaved roads in Nigeria probably reflects the higher frequency of services and greater competition between transporters on the Jos Plateau. Ratios for Zambia are similar to Ghana, averaging US$0.045– US$0.05 per passenger kilometre on poor quality earth feeder roads, compared to US$0.025 on the main bitumen roads. In Ethiopia, goods transport statistics suggest enormous differences between trucks travelling along bitumen (US$0.05– US$0.12 per tonne km) and earth or gravel roads (US$0.60– US$1.00 per tonne km) (Dennis, 2000). In Tanzania studies indicate that, over a 50 km distance, an increase in road roughness of 50% would increase truck charges by 16% and increase pickup charges by just under double (Ellis & Hine, 1998). The impact of these high charges is, on the one hand, to deter both off-road travel by urban and road-based traders and professionals and, on the other, to hinder off-road residents travelling to the roadside to take advantage of goods and services available there. In many cases, the solution for off-road inhabitants is simply to walk to the roadside, headloading any goods which have to be transported.

Livelihood opportunities in off-road settlements are constrained in a variety of ways. So far as agriculture is concerned, inputs and market output must be transported from and to service centres, adding to the costs of production[3]. Information on market prices and supply conditions in major bulking centres is commonly poorer in off-road areas (Lyon, 2000). Extension services are usually few and sporadically provided off-road; staff tend to restrict their visits to more accessible areas. Off-farm employment opportunities are often similarly restricted by high transport costs and infrequent and unreliable transport services. Madulu (1998) in a rare comparison of an on- and an off-road village in Kwimba district, northern Tanzania, found only 7% of villagers in the off-road village engaged in non-farm activities, compared to 31% in the village on a major road, where a whole range of occupations, from trading to cooked food selling, tailoring, cycle repairing and butchering were pursued. Food selling is a common source of income, particularly for women, in roadside villages and can lead to substantially higher incomes in roadside than off-road villages for women (Kaur, cited in Booth *et al.*, 2000, 70). Trading from an off-road base is commonly hampered by the difficulties of finding transport and reaching markets in time to meet customers. Trading opportunities within the off-road settlement are usually restricted by the low incomes of potential customers and the similarity of items produced at home. Jobs in the formal sector are extremely rare in off-road settlements since, as discussed above, neither government nor private services are likely to be located there.

Off-road inhabitants are thus less likely to have a broad-based income to help them withstand either seasonal shortages or crop failure and other disasters. Women and children usually bear the brunt of the particularly heavy porterage burden imposed by costly and limited transport services. For children, residence in an off-road village probably implies a particularly

[3] There is substantial evidence to show that road construction increases agricultural productivity at the roadside (e.g. see Platteau, 1996). However, off-road impact is less certain and could be negative as I have argued (1997).

disadvantaged start in life: they are less likely to be vaccinated, go to school, or see a doctor if they are ill. It seems likely that infant mortality rates will be substantially higher in off-road than roadside villages in the same region (though I have found no data which compares on- and off-road populations). Often it seems only the absolutely poor, particularly the elderly, find solace in village life off the beaten track. An elderly cooked food seller in a small off-road village in Gomoa, coastal Ghana, who ekes out a very precarious living selling maize balls, together with a little farming, weighed the pros and cons:

> *The people at Apam and Ankamu [roadside settlements] are rich… They live by the road, they get access, they get car, they get jobs, go fishing. Here there is no money. It's better living at the road… But if you don't have money it's better to live here… if rain comes all the time you can go farm and don't have to buy… if you stay here and have land'*

Finally, a brief comment is needed about the invisibility of off-road populations to policy makers and the consequent feelings of powerlessness which are so often expressed in off-road villages. The common trend towards administrative decentralisation in Sub-Saharan Africa might have been expected to aid off-road dwellers, since it is supposed to bring government closer to the people, but evidence to date is not encouraging (see, for example, Samoff, 1990; Ayee, 1996). In Ghana elected district representatives frequently live outside the district and can often barely afford transport costs to visit even their roadside constituents. Development projects initiated by local government tend to be located in the district capitals and other major centres, all usually located on paved roads, as Kyei (1999) illustrates with reference to two districts in Ghana, (Nadowli in Upper West Region and Andansi West in Ashanti Region). This is unsurprising, Kyei suggests, because district administrative officers and political leaders are university graduates who have spent most of their lives in urban areas and have inadequate understanding of the nature of rural poverty, particularly in less accessible regions. Moreover, as comments from the teachers quoted above illustrate, there is a tendency among urban-based professionals to look down on the remote rural poor who have had least opportunity to acquire education as uncivilised 'bush people'. Even local NGOs tend to prefer to site their activities in on-road settlements (Kyei,1999, 267). *The significance of these negative attitudes among local professionals cannot be underestimated; it is often extremely difficult to get them to visit off-road settlements even on an occasional basis.* Yet the only way they are likely to develop a real understanding of the lived experiences and needs of off-road dwellers is through regular visits.

To summarise, off-road rural populations appear to be disadvantaged and vulnerable in many respects. They characteristically appear markedly poorer in income terms, in health and in life chances than those in comparable roadside locations in the same region, though, obviously, not all off-road people are disadvantaged to the same degree by their location: women and children in Sub-Saharan Africa suffer much of the burden of off-road transport, for instance. Unfortunately, there is very little detailed published evidence to support this view of off-road disadvantage and very little interest at either local or central government in most low income countries in ameliorating it. Chambers pointed to the dangers of tarmac bias twenty years ago (1983, 13–16), but few researchers or policy makers appear to have made access beyond the tarmac a priority, in investigating and addressing issues of rural poverty. There remains a clear need for livelihood studies which focus on on-road / off-road comparison.

Intermediate Means of Transport (IMTs) as a means of improving off-road access

It is clearly impossible to provide an all-season access road and a regular conventional transport service to every off-road settlement in Africa, although the provision of a good road (together with a health centre) tends to come at, or close to, the top of the development 'wish-list' of most off-road villagers, men and women (Francis, 1996, 8; Crook & Manor, 1998, 257). Nonetheless, there are various means by which problems of off-road disadvantage might be alleviated. These could include improvements in conventional motorised transport services through such interventions as subsidies on targeted routes and community owned transport; and, perhaps, the greater provision of mobile services. Non-transport interventions might also have a role to play: improvements in low-cost crop storage and processing technologies, for example, and development of high-value organic agricultural produce could reduce input and output loads. The potential of telecommunications developments has recently received much attention, though their impact on less powerful groups is by no means uncontentious (Graham, 1998; Hillis, 1998; Schreiner, 1999). Donors, however, increasingly see the development of Intermediate Means of Transport as a principal key to improving access and mobility in both on- and off-road conditions, and a number of initiatives are now in place across Sub-Saharan Africa to promote IMT use among the rural poor. The World Bank, through its Sub-Saharan Africa Transport Policy Programme, is playing a major role in this. Consequently, a consideration of the potential for IMTs in off-road contexts seems particularly appropriate.

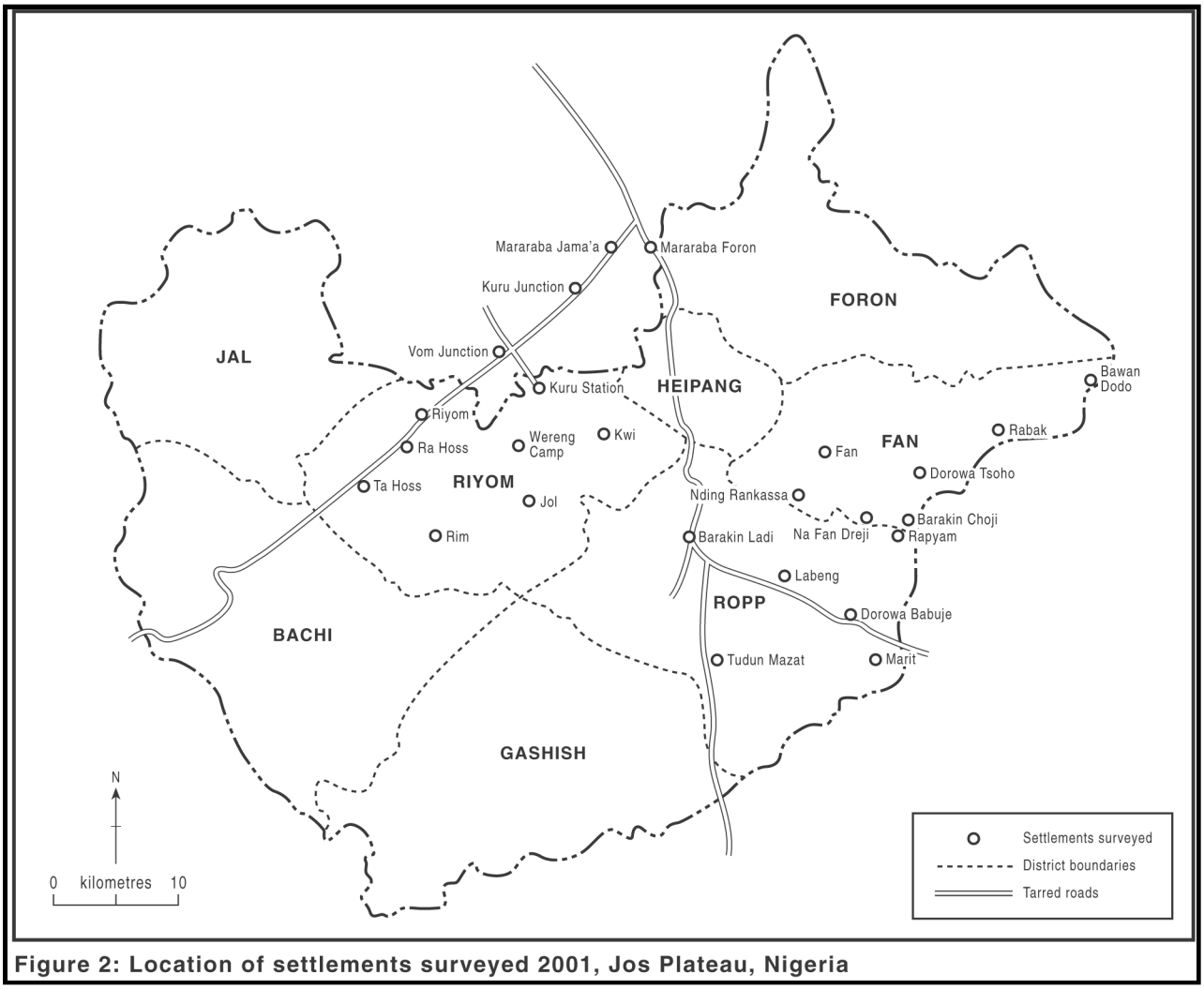

Figure 2: Location of settlements surveyed 2001, Jos Plateau, Nigeria

A long line of studies has shown, in broad terms, many of the advantages to be gained through the introduction and promotion of equipment such as animal-drawn carts, wheelbarrows, motorised and unmotorised cycles and tricycles (with or without trailers), all of which are relatively cheap to acquire and operate, by comparison with conventional motor vehicles. So far as off-road populations are concerned IMTs seem to offer particular advantages, in view of their low cost and – in many cases – their suitability for operation along uneven, unpaved tracks. Nonetheless, the limited success of many IMT programmes has led to growing caution about their benefits, about the dangers of 'hobbyism' among IMT specialists, and to calls for a more realistic appraisal of the difficulties associated with their introduction (Starkey *et al.*, 2001). In particular, the difficulties of promoting IMT use among women due, above all, to problems of affordability, have been observed in a number of regions (Bryceson & Howe 1993, Fernando & Porter, 2002).

In this section I first discuss the impact which IMTs have had on men and women in three districts on the Jos Plateau over the decade 1991-2001. I then briefly outline a small IMT project currently underway in coastal Ghana, aimed at assessing the potential of IMTs for alleviating farm to village and village to market access in off-road areas, where IMTs have – potentially – the greatest role to play.

'Achaba' aids a revolution in rural access: a case study from the Jos Plateau, Nigeria

In 1991 I undertook a dry season rural markets study in the former mineland region of the Jos Plateau, in Nigeria's Middle Belt. The study covered 23 markets and their associated settlements in three rural vegetable-producing districts and revealed that, while markets situated on the paved road were thriving, many off-road markets were in serious decline or had already died as a result of track deterioration and decline in off-road transport services (Porter 1993, 1995, 1997). The deterioration in roads was associated with the decline of tin mining and the introduction of Structural Adjustment Programs, both of which had led to cut-backs in road construction and maintenance. There was growing reluctance at that time for transporters and traders to take vehicles off-road, as roads deteriorated, and it became increasingly difficult to obtain spare parts for vehicles. The consequences of off-road market decline were

particularly serious for rural women who were faced with long journeys with their own and their husbands' produce to the paved road (along which commercial vehicles continued to ply.) There were other implications of declining off-road transport too, including a decline in off-road education and health services as staff became more reluctant to reside in increasingly inaccessible settlements. Meanwhile, richer farmers resident in settlements by the paved roads had begun to purchase irrigation pumps in order to utilise surface water from streams and defunct mineponds to grow dry season vegetables. Those markets situated on the paved roads close to suitable irrigation sites were growing impressively, but off-road conditions appeared to be deteriorating rapidly.

In the dry season of 2001, exactly a decade later, I repeated the study in the same three districts in order to reassess rural trading conditions and the significance of access in the light of changing political, institutional and economic conditions in Nigeria. In terms of transport and access conditions in off-road areas, remarkable change was observed and confirmed during discussion with villagers. Although off-road laterite tracks mostly appeared to be in as poor or only slightly better condition than in 1991, transport availability is now vastly superior in all the villages except one particularly remote off-road village which has little irrigation potential. Of particular note are the numerous motorcycles now to be seen speeding along remote dirt tracks carrying passengers and their loads, even including the occasional sheep or goat. There has also been a substantial expansion in vehicle ownership and the ownership of bicycles and a range of other IMTs. The key to these changes includes firstly an enormous expansion in irrigated vegetable production, secondly a change in government policy on vehicle import duties[4] and, thirdly, the availability of cheap imported motorcycles. In the following section, following a brief discussion of the irrigation developments which have underpinned the massive improvement in rural access on the Plateau, I focus on the latter component of change – the availability of motorcycles and other IMTs and their impact.

Across the study area, wherever water is available from streams and former mine ponds, irrigated vegetable production was found to have expanded substantially since 1991. This expansion is particularly marked in areas along the paved road, but is also evident even in settlements most remote from the paved road. As a result of the increased availability and reduced price of irrigation pumps since 1991, irrigation is no longer solely a rich man's activity – around 20%–30% or so in many villages now participate. Few women, however, have been able to enter irrigation production because of the cost of pump purchase or hire, petrol, fertiliser, etc. The impact of this expanded vegetable production has been enormous, but is most marked where it has occurred in off-road areas because of the implications for transport and access conditions. Since farmers are dealing with a highly perishable product, investment in improved access has gone hand-in-hand with investment in irrigated production. The increased profits from expanded vegetable production has brought individual investments in both motorised transport and IMTs, and even some community investment in road maintenance, necessary to keep roads open in the absence of local government investment. Although only a portion of villagers can afford to participate in irrigated production, the expansion of transport has had much broader impact.

There are many facets to the access changes evident in the study area, but probably the most remarkable change is the massive expansion in motorbike ownership and the emergence of motorbike taxi services (*achaba*) in both roadside and many off-road villages. Achaba was absent in the Jos Plateau survey area in 1991, and probably even in Jos town, though it was already well established in southern Nigeria, where it is known as *okada*. Yunusa (1999) reports that operating one's motorbike as a taxi in Doma, a roadside settlement in Plateau State, is considered a sign of 'poverty and economic degeneration', but I did not come across anyone in any of the off-road survey villages who took such a stance[5]. On the Plateau the appearance of achaba is linked to the increased availability of cheap motorbikes and is now widespread in the urban centres, where a new motorbike costs around N35,000 (about £200 in January 2001), a used one c. N19,000– N25,000 (compared to N6,500 – around £38 – for a sturdy new bicycle). Dealers travel to Onitsha to buy motorbikes (which have been split into parts to avoid customs) and these are reassembled in Jos. It is clear that a situation of 'critical mass' has been achieved so far as motorcycles are concerned on the Plateau: well stocked spare parts dealers cum repairers are found at major road junctions across the region and even in some off-road villages.

Motorbike ownership is particularly high, as a proportion of all vehicle ownership, in off-road villages (where conventional motorised vehicle ownership is generally limited, though much higher than in 1991) (see Table 1). Many owners here are vegetable farmers who use their motorbikes principally for their own purposes, such as taking

[4] Import duties on second-hand vehicles ('Belgians') are reportedly now down to 5% in Nigeria.

[5] The concept of achaba is believed to have originated in the Calabar area of south-eastern Nigeria. It is very widespread particularly in congested urban areas where achaba is often used to avoid traffic jams and the fare is around the same as by taxi, but much more expensive than bus.

Table 1. Vehicle & motorcycle ownership in the Jos Plateau survey area, Nigeria, 2001

a) Estimated vehicle ownership in selected off-road market centres (village-based vehicles only) (M = male, F = female)

Market	Car	Taxi	Minibus	Lorry	Pick-up	Motorbike
Marit	15M	0	4M	0	0	0
Dorowa Tsoho (3 operated as achaba)	0	6M	0	0 (nearby village has 3 lorries)	2M	6M
Ropp Labeng* (3 operated as achaba)	8M	15M, 2F	0	0	Many M, 1F	12M
Barakin Choji (3 operated as achaba)	0	0	0	0 (3 in nearby villages)	0	5M
Kushe Rabak (4 operated as achaba)	4M (1 = clinic staff)	2M	4M, 2F	0	3M	15M
Kuru Station (7 operated as achaba)	1M	3M	0	0	2M	c. 15M
Na Fan Dreji (3 operated as achaba)	3M	4M	0	0	4M	5M
Nding Rankassa	5M, 1F	12M	0	0	15M	8M (7 operated as achaba)
Kwi	0	8M	1M	0	5M	25M (c. 20 operated as achaba)
Rim	c. 15M	10M	5M	0	3M	10M
Wereng Camp	0	2M	3M	0	0	3M
Bawan Dodo	1M, 1F	5M	0	0	?	10M, 2F
Fan Loh (many operated as achaba at the roadside)	4M	0	0	0	c .10M, 1F	25M, 1F
Jol	0	0	0	0	1 (owned by church)	40M

* 4 tractors also used for transport

b) Estimated vehicle ownership in selected roadside survey market centres (M = male, F = female)

Roadside Market	Car	Taxi	Minibus	Lorry	Pick-up	Motorbike
Dorowa Babuje	Plenty M, 0 F	Plenty M, 1 F	Plenty M, 1 F	3 M, 0 F	Plenty M, a few F	Plenty M, a few F (for achaba)
Tudun Mazat	3M	2M	1M	0	3M	6M
Ra Hoss	0	0	c. 15M	0	?	Many
Riyom	12M, 3F	4M	8M, 2F	1	?	20M, 5F
Bindi Hoss	0	0	1M	0	?	4M
Ta Hoss	24M, 6F	12M, 3F	3M, 2F	0	?	30M, 10F

inputs to the farm, but operate achaba on an occasional basis according to demand and their own movements out of the village. Motorbikes purchased purely or principally for use in achaba services appear to be more common in roadside villages, where some people (mostly men) own a number of motorbikes and employ (mostly young, male) drivers. They can be commonly seen waiting for customers at major road junctions, often a dozen or so together. Most services operating from such roadside centres, however, are focussed on routes out to the off-road villages, rather than along the paved road, where frequent conventional motorised transport services limit the demand for achaba.

A small number of achaba drivers were interviewed about their work. One young man at the off-road settlement at Na FanDreji described how he sometimes uses his motorbike in the afternoon for achaba services when there is no transport out of the village (the village transport generally leaves in the morning). The motorbike is his own possession. He also runs a

Table 2. IMT ownership in the Jos Plateau survey area, Nigeria, 2001

a) Estimated IMT ownership in roadside survey market centres

Roadside Market	Bicycle	Donkey & cart	Handcart	Wheelbarrow	Other
Tudun Mazat	M= almost every household. F= 0	0	0	0	0
Ra Hoss	M= many. F= 0	M= 1 (no cart)	0	M= 10–15	0
Riyom	M= 50. F= 7	0	0	M= 150 households. F= 0	0
Bindi Hoss	M= 12. F= 0	0	0	M= 2	0
Ta Hoss	M= over 200. F= over 10	M= 2 (no cart)	0	M= over 100. F= 0	0

b) Estimated IMT ownership in off-road market centres (village-based vehicles only)

Market	Bicycle	Donkey & cart	Handcart	Wheelbarrow	Other
Marit	M= 150	0	0	M= every household	0
Dorowa Tsoho	M= 90% of households. F= 0	0	0	M= over 8. F= 0	0
Ropp Labeng*	M= every household. F= 8	0	0	M= 12. F= 0	0
Barakin Choji	M= almost every household. F= 0	0	0	0	0
Kushe Rabak	M= almost every household. F= 2	0	0	M= almost every household. F= 0	0
Kuru Station	M= almost every household. F= 0	0	0	M= many but not all households. F= 0	0
NaFan Dreji	M= most households. F= 5 (all Birom)	0	0	M= 4. F= 2	
Nding Rankassa	M= every household. F= 1 (a Birom schoolgirl)	0	0	Over 8	0
Kwi	M= 200, almost every household. F= 0	0	0	M= many. F= 0	0
Rim	M= 100+. F= 0	0	0	M= 50-60	0
Wereng Camp	M= 50–60. F= 0	0	0	M= 5. F= 0	0
Bawan Dodo	M= almost every household. F= 1	0	0	M= 7	0
Fan Loh	M= almost every household. F= many	0	0	M= many. F= some	0
Jol	M= 34. F= 4	0	0	0	0

Notes
Excludes motorcycles; these are listed in Table 1
M= male, F= female
* 4 tractors also used for transport

shop in the village and so usually only operates his motorbike in emergencies, such as when someone is sick, or a woman is in labour and needs to go to hospital. Another achaba driver in his early twenties, interviewed at a major (paved) road junction, works for himself on a regular basis, carrying, he estimates, 10 to 50 people per day. He also sometimes carries loads alone for people he knows; he farms throughout the year. Most of his passengers are young people, women as well as men, and many of his journeys are made to off-road settlements.

Achaba services appear to have contributed substantially to the altered perceptions evident among both men and women in off-road villages regarding their position in relation to major service centres, which are now seen as fairly easily accessible. This is despite the fact that the principal function of achaba seems to be to provide emergency or occasional, as

Table 3. % of traders interviewed in on-road & off-road market owning various means of transport, Jos Plateau, Nigeria, 2001

	2001 rural markets data set		2001 on-road data set		2001 off-road data set	
Transport type	Men as a % of all men interviewed	Women as a % of all women interviewed	Men as a % of all men interviewed	Women as a % of all women interviewed	Men as a % of all men interviewed	Women as a % of all women interviewed
Bicycle	28.1	4	27.1	3.7	29.1	4.6
Motorbike	9.9	2.9	7.1	4.2	12.8	0
Minibus	0	0.4	0	0	0	1.1
Pick-up	0	0.4	0	0	0	0
Donkey	0	0.4	0	0.5	0	0
Other	4.1	1.4	0	0	1.2	3.4

opposed to routine, transport (Few market traders interviewed at markets in the study area had used achaba to get crops to market, for example.) In villages where roads are particularly bad, men and women say achaba has provided a lifeline for them, being used in medical emergencies, or when people have missed the morning bus or when there is no market bus. In the wet season when motor vehicles have difficulty leaving off-road settlements the achaba services are reportedly particularly important. And achaba has the great advantage of providing transport to the doorstep at all seasons. However, achaba fares are high; for instance it costs three times the bus fare to travel by achaba from the village of Kushe Rabak to the market centre at Mangu; over shorter distances the fare is around double the standard bus fare. Clearly, only better off villagers will pay such a high premium, except in emergencies.

According to villagers, achaba benefits both men and women living in rural areas, particularly in off-road areas where transport services are fewer and less frequent, but most passengers I observed were men. Lower usage of achaba by women in rural areas is probably partly due to high fares but is also in part a reflection of the dangers of achaba riding[6]. Despite the overall visibility of IMTs on the Jos Plateau, it is important to note that ownership (and use) of all types of IMT among women – both (Moslem) Hausa and (Christian and Moslem) Birom – is very low (see Table 2). I was told (by men) that '*women don't have an interest in buying IMTs… and women don't have an association so they are difficult to afford; women can't afford them*' (Kwi village head and male elders)[7]. It would be necessary to undertake detailed studies with women to assess the extent to which they actually benefit, directly and indirectly, from achaba and other IMTs. Observation suggests that while the expansion of motorbike and other IMT ownership has had an enormous impact on the everyday mobility of young and middle-aged men in off-road villages, its impact on women of all ages may be mostly limited to emergency situations.

Introducing IMTs in off-road villages: a case study from Coastal Ghana

In northern Nigeria there is a long history of IMT usage. The Jos Plateau case study illustrates that, if economic and policy conditions are favourable in regions like this, the potential for expanded ownership and use of IMTs is substantial, in both on- and off-road areas – at least among men – and is likely to occur spontaneously, without external intervention. The impact on off-road mobility can, in these circumstances, be marked. In many parts of Africa, however, IMTs of any kind are rare. This has encouraged the development of a number of recent projects aimed at IMT promotion across the continent.

In rural Ghana IMT use is limited, though substantially higher in the north of the country. In northern Ghana IMTs consist principally of bicycles; in southern Ghana, particularly in the forest zone, there

[6] There is a serious need for road safety training for achaba drivers to reduce reported high accident rates. This would also probably encourage more women to use achaba services. Traffic accidents can have devastating impact on individual families and their livelihoods, as recent research in Uganda (Paul, 2002) indicates. Training of the type provided by the NGO Riders for Health would be enormously beneficial. There have apparently been some moves to introduce helmets on the Plateau, but these are resisted. Legislation on helmet wearing, etc., is unlikely to be effective unless accompanied by adequate training.
Many women ride achaba in urban areas in Nigeria. (In Zamfara State, where Sharia law operates, women were reportedly banned from riding achaba, leading to major protests by urban women. Plateau State, by contrast, is relatively liberal.)

[7] Male village elders stressed that it is quite acceptable for Birom women to ride bicycles if they wish (married Moslem Hausa women are not allowed to cycle), but added that though there are no restrictions on Birom women riding bicycles: *'most women don't like to ride bicycles… they have no interest in riding and thus few learn to ride'*. Few women in the survey area rode their husbands' bicycles, with the possible exception of women in the remote off-road villages of Bawan Dodo and Kushe Rabak, towards the eastern edge of the survey area.

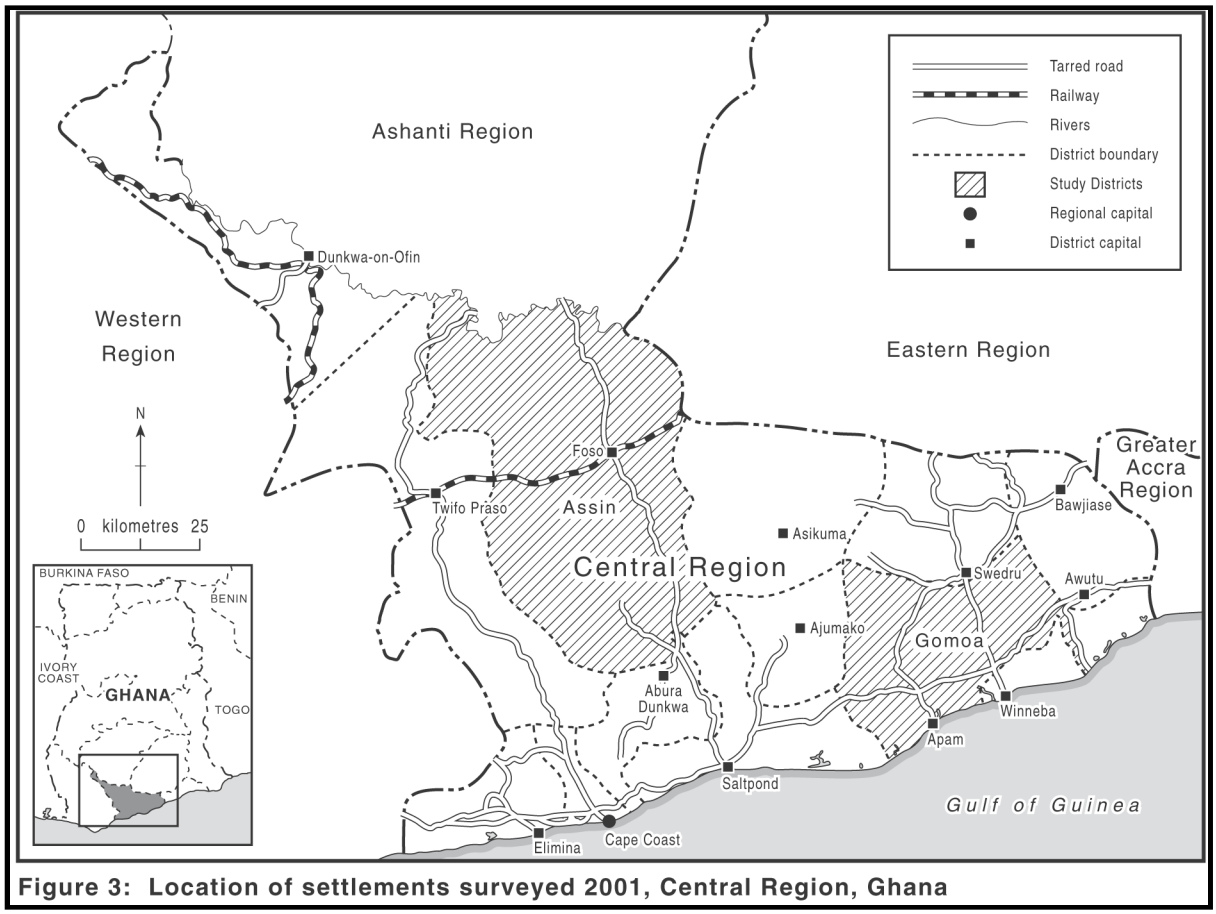

Figure 3: Location of settlements surveyed 2001, Central Region, Ghana

are remarkably few IMTs of any type (Howe & Barwell, 1987). The World Bank has sponsored a series of studies of IMT use and potential in Ghana (Howe & Barwell, 1987; Anchirinah & Addison, 1998; White *et al.*, 2000) and is now funding a Village Infrastructure Project (VIP) that incorporates an IMT component (Anchirinah & Yoder, 2000). Ghana's past experience of IMT schemes has not been positive; a World Bank-funded bicycle trailer project in the 1980s in northern Ghana seems to have been a conspicuous failure (Salifu, 1994; White *et al.*, 2000). Along with technical problems, few of the expected beneficiaries could afford to purchase a trailer in addition to the bicycle, while group ownership proved difficult due to arguments over maintenance. The current project's pilot programme, which was completed last year, has also experienced some difficulties, both of a technical and organisational nature. In particular, there were problems with the connecting rod between the power tillers which were supplied and their trailers, and difficulties in getting beneficiary groups to combine and work together effectively. Furthermore, a shortage of trained mechanics meant that it was difficult to get equipment serviced at reasonable cost (Anchirinah & Yoder, 2000). Discussions with recipients of the pilot project in southern Ghana suggests that bicycle trailers manufactured in Ghana have suffered technical problems and some collapsed soon after their receipt. IMT adoption in Ghana clearly still faces many hurdles.

The second case study is based on some recent off-road mobility / access studies and a small ongoing action research project on IMT adoption, conducted in five off-road villages in Ghana's Central Region. Research on rural marketing in four coastal savanna villages in Gomoa district and one rainforest village in Assin district emphasised the enormous obstacles created by lack of reliable transport, particularly for women traders here. Conventional motorised transport was rarely available when needed and the very few vehicles owned by villagers were usually kept at the paved road (where they were used as taxis) because of the bad condition of local tracks. IMT ownership was also extremely low[8]. Only a few men in each village owned bicycles and these had usually obtained the cash to buy them from hunting or farming profits. Only one woman owned a bicycle, obtained through her job as a 'motivator' with an NGO. Men usually did not loan their bicycles to their wives and, in any case, few women knew how to cycle. Many of the bicycles were out of use and awaiting new parts, which had to be

[8] There is limited use of bicycles and other IMTs such as push carts and wheelbarrows in the region as a whole. This may be attributable, in part, to factors such as the rolling topography, the high humidity and to cultural preferences for conventional motorised transport (further north, in Ashanti areas, bicycle riding purportedly makes you lower class!) Nonetheless, IMT use along the paved road is certainly far higher than in off-road settlements in the region.

Table 4. Village based transport in Ghana's Central Region: motorised & non-motorised ownership in five study villages, 1998

Village	Abora		Sampa		Adabra		Lome		Aworabo	
	M	F	M	F	M	F	M	F	M	F
Private car	0	0	0	0	0	0	0	0	0	0
Taxi	0	1	0	0	0	0	0	0	0	0
Tro-tro	0	0	0	0	0	0	0	0	0	0
Bicycle	2	1	2	0	6	0	5	0	6	0
Motorbike	0	0	0	0	0	0	0	0	0	0
Handcart	0	0	0	0	1	0	2	0	0	0

purchased from roadside repairers; there was no cycle mender in any of the villages. Hand carts were mostly restricted to the district capital and no one in the off-road villages owned a motorcycle (see Table 4).

The reason most villagers put forward for low levels of IMT ownership and use in 1998 was – perhaps unsurprisingly – simply expense. At that time a new bicycle could be obtained for under £50 and a reasonable second-hand one for under £20: IMTs, while cheap by comparison with motorised vehicles, are still expensive to poor farmers (Barwell, 1996). Across all the settlements, a principal restriction on increased IMT use appeared to be financial constraints imposed by the need to purchase IMTs with a cash lump sum. Lack of a 'critical mass' had also created problems for the few existing IMT owners, because there was insufficient demand to support village menders or parts dealers.

Discussions with villagers about transport suggested there was considerable interest in IMTs, particularly among women, who saw the potential for assisting in a wide range of tasks, encompassing both farm to village as well as village to service centre transport. This prompted some further research on IMT preferences in which groups of men and women in different age sets were asked to discuss and rank a collection of IMT photographs.

Subsequently, a small action research project was initiated in collaboration with the Ghanaian Ministry of Agriculture. This was partly a response to local access problems which had emerged in the marketing study, and partly to the growing interest in IMTs in Ghana which was being generated by the Village Infrastructure Project. Our project offered an opportunity to look at the impacts (economic, social and environmental) of introducing a range of IMTs in villages where market access problems had already been researched in some detail. The project would also take a slightly different approach from VIP, in the type of equipment introduced, the mode of selecting equipment and the arrangements through which it was provided. Thus, IMTs were to be selected by the villagers, women would be given priority in the scheme, and both individuals and groups would be eligible (in contrast to VIP which requires group acquisition). A villager would be offered the opportunity to purchase IMTs on credit, through the project, in return for allowing us to monitor their use and impact over a two year period. The VIP co-ordinating unit in the Ministry of Agriculture were willing for us to compare progress and impact in our project with the VIP IMT introductions in the same region.

A workshop was thus held in each village where villagers were given the opportunity to try out a range of IMTs which, from our earlier work with photographs, appeared likely to be of interest to them. They comprised a wheeled handcart based on drawings from IT Transport and manufactured locally, a locally made wheelbarrow, a locally made push-truck of the kind typically used in Ghana's urban markets, a man's bicycle, a women's bicycle, and a power tiller. Information was also provided at the workshop on prices and credit arrangements were discussed. Following the workshop we received orders (approximately half of which came – ostensibly – from women) for 44 push trucks, 1 hand cart, 3 power tillers, 16 bicycles (all men's with cross-bar) and 7 wheelbarrows, all of which have now been supplied. Most of the purchases (except for the power tillers) were by individuals, rather than groups. Of note, in the light of the Nigerian study, is the fact that only one person expressed any interest in purchasing a motorcycle. By comparison with Nigeria, motorcycles are relatively uncommon in Ghana, though ownership appears now to be expanding, particularly near urban centres. The most interesting element in the selection of IMTs was the strong preference for the quite heavy but familiar local pushtrucks, when a lighter, more manoeuvrable option, the hand cart, was being made available at the same price.

The project is still in progress; the IMTs were introduced in the villages in early 2001 and while they have been employed through major harvest

seasons (September-November), it is still being analysed. Villagers are very positive to date about their potential and even those men and women who were unable to purchase equipment currently seem to view the innovation favourably, arguing that it assists the village as a whole. In all the settlements there have been encouraging reports by women that the push trucks were being used to transport firewood from farm to village before the onset of the rains, and that this reduced their work burden to some degree, since children are keen to push the trucks (a fact which village children themselves confirm.) One of the power tillers has been used to provide a regular passenger service (in the trailer) to the main market centre (until recent objections were made by the GPRTU).

Nonetheless, the project has already raised a number of issues which indicate some of the complexities of IMT introduction in general and the particular complexities faced in off-road areas. For example, although the project focussed on aiding women, who face the largest transport burden, and who are often neglected in IMT schemes, it has transpired that very few women had the funds to purchase a piece of equipment, even on easy terms over two years. (This is partly a consequence of Cedi devaluation which has raised the cost of the IMTs very substantially since our first studies were conducted in 1998). Consequently, their husbands often contribute most of the cost of repayment, and thus gain first call on the equipment. In a few cases the IMT has even been removed to a settlement at the paved road where it can be hired out, in order to provide ready funds for repayment (in the off-road villages many people are too poor to hire an IMT).

Another difficulty has arisen around the regular monthly repayment collections, which are supposed to be made at the off-road villages by rural bank staff. An arrangement had been made with two banks to pay staff to travel to the off-road villages for collection of repayments, so that villagers would not need to spend time and money finding transport to reach the banks (which are located some distance away on paved roads). Despite initially expressing a willingness to collect repayments in the off-road villages, bank staff have frequently failed to turn up on the days appointed for collection; their excuses revolve inevitably around the difficulties of getting transport to off-road villages! Obtaining access to credit has long been a particular problem for inhabitants of remote and off-road settlements (Hine & Riverson, 1982; Creightney, 1993; Richards, 1985, 127; Meagher, 1999). Experience in this project suggests that it is very difficult for off-road villagers to conduct business with the banks, not just because of their poverty *per se,* but because of bank staff attitudes towards them.

Conclusion

Improving off-road mobility and access will be crucial to successful rural poverty alleviation in Sub-Saharan Africa and Intermediate Means of Transport can play an important part in this. The potential of IMTs to alleviate off-road access problems appears to vary considerably, however, particularly in the short term. The evidence from the Jos Plateau in Nigeria is extremely encouraging: in this case 'critical mass' has clearly been achieved for a wide range of IMTs. While small unpowered equipment like wheelbarrows provides considerable assistance for farm to village transport tasks, the impact of high motorcycle and bicycle ownership has been substantial in facilitating movement between off-road and roadside centres and reducing the feeling of isolation which is so common among inhabitants of off-road settlements over the last decade. Nonetheless, women's access to IMTs is clearly wholly insufficient, as a result of a mix of economic and cultural constraints.

In coastal Ghana the potential value of IMTs in alleviating off-road transport burdens is also evident, but the challenges of promoting IMT ownership and use in an area where current IMT ownership is very low are considerable, as the research project outlined indicates. It also illustrates some of the complexities involved in introducing IMTs to women in off-road areas. As in northern Nigeria, it would appear that women face particular obstacles in obtaining access to equipment, due to economic circumstances which restrict their ability to purchase even relatively low cost items. Nonetheless, credit availability has certainly encouraged women to contemplate IMT purchase in coastal Ghana. This suggests that in areas where a critical mass of IMTs is already present – as in northern Nigeria – credit arrangements for women specifically to purchase IMTs, coupled with training programmes to teach women how to ride bicycles and drive motorcycles, could have a massive impact.

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Unprofitable rural bus services: Market structure & tender prices since Deregulation

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Abstract

Many of the cost benefits to local authorities of post-deregulation competitive tendering have recently been reversed. This has been attributed to increases in wage costs resulting from driver shortage. This article argues that the situation is more complex and that factors such as the level of competition, operator motivation and tendering strategies also have a part to play. It also argues that responses such as the Rural Bus Subsidy Grant involve a high-risk premium and could merely represent a subsidy to operators.

Keywords

Buses, competition, costs, deregulation, grants, investment, subsidies, tendering.

Introduction

The passing of the 1985 Transport Act forced the British bus industry to undergo a major shake-up in the way it was owned, regulated and structured. At the time, legislators hoped that injecting competitive elements into the industry would achieve efficiency gains that benefited the general public both directly, as the user of more responsive services, and, indirectly, as a taxpayer through reduced subsidy levels.

Initially, as one might expect, the industry experienced a period of destabilisation as operators felt their feet under the new regime. Nevertheless, the changes heralded a large amount of route mileage becoming registered as commercial, and thereby, no longer in need of public subsidy. It is significant that general operating costs fell from 176p / km in 1985 / 86 to 112p / km in 1992 / 93 during this period (DETR, 2000, Table 30). Meanwhile, the non-commercial sector was subjected to a much more transparent form of competitive tendering process than the over-arching and opaque blanket-subsidy system that had appertained hitherto. Hence, public transport revenue support outside London, excluding concessionary fares, fell initially by approximately 35% between 1985 / 86 and 1987 / 88 and by a further approximate 40% between 1985 / 86 and 1990 / 91 (DETR, 2000, Table 20).

Most tender invitations by local authorities to fill gaps in the commercial network were met with bids from more than one operator. The system might not have been a textbook model of competition but it did provide an opportunity for a level of competition hitherto unseen, and permit a clearer idea as to the market price for providing such services. Nevertheless, *de minimis* provisions in the 1985 Act allowed many contracts to be awarded without undergoing market testing. It is sometimes suggested that informal cartels developed in which operators carved up the tenders between themselves. Moreover, there was never going to be the completely even playing field due to a number of factors. Langridge (1995) identified the main ones as absolute cost disadvantages, loss-leading strategies, defensive strategies, predatory strategies and imperfect information and knowledge. Notwithstanding this, the costs of tendered services fell from 28.27p / km in 1985 / 86 to 10.85p / km in 1992 / 93 thereby appearing to vindicate the effectiveness of the 1985 legislation (Department of Transport, 1993).

However, by the early 1990s, storm clouds were gathering both in response to internal and external factors. Firstly, the industry underwent a period of restructuring which, through a process of acquisition and merger, resulted increasingly in a small number of large players dominating the industry and, arguably, possessing the power to respond successfully to any challenge from an outsider. Secondly, this restructuring was achieved at the expense of capital asset replacement; hence, the vehicle fleet overall was becoming progressively older. In 1990, when the average vehicle age was 8.5 years, but had risen to 9.9 years by 1994; since then, however, there has been investment in new vehicles bringing the average vehicle age down to 8.7 years by 1999, thereby creating a ‘stepped’ upward pressure on capital costs. Nevertheless, in 1999, 20% of all buses were still over 15 years old confirming that many operators had significantly under-invested over a number of years. The overall number of new registrations also hide unit cost differences between the 1980s low-cost minibuses, based upon commercial van conversions, and the relatively expensive and sophisticated specialist vehicles that they replaced. Although the 1990s saw a move back to more sophisticated and increasingly low-floor vehicles, there has also been continued growth in the number of small (below 35 seats) buses,

25,000 in 1999/2000 compared to 9,600 being in stock in 1985/86; the real casualty throughout has been the traditional double-decker.

More important than capital expenditure, in terms of overall costs, was the day-to-day cost of labour. A public transport industry is, by nature, highly labour intensive. A fall in overall operating costs (from 176p/km in 1985/86 to 112p/km in 1992/93) while costs of most inputs were rising, had to be, in large part, due to cuts in labour costs. Although in the early days of deregulation, many inefficient labour practices were rooted out, reductions in wage costs were probably a more potent influence. Indeed, drivers' wages were 107% of male manual workers' earnings in 1986 but had fallen to 83.5% by 2000. Moreover, between 1985 and 2000, hourly earnings of bus drivers had risen by only 70% compared with 143% for all occupations (Department of Employment, 1987; 2001). This contributed to driver shortages even in areas of high unemployment.

The resultant shortage of staff will affect all services but it is unlikely that the impact would be uniform. Small operators in rural areas would be unlikely to face the same labour market pressures of a large operator in an urban area where competition for staff would be much greater. In addition to this, operators with highly profitable, and by definition, commercial, services, still need to watch for incursion by competitors. If, for financial and strategic reasons, commercial services would be viewed as the top priority, non-commercial service withdrawals might be an early response to shortage. Consequently, a general driver shortage could exert a disproportionately stronger impact on the subsidised sector.

There is evidence that there had been a reversal in the decline in the level of support required in order to maintain non-commercial services. Initially, in 1985/86, the sum had been £352m but this fell quite sharply to a low of £210m in 1990/91. Although there had been a slight rise in the amount required in order to support local services, in the intervening years, a sudden sharp rise took place to £258m in 1998/99 just prior to the introduction of the Rural Bus Grant. This phenomenon cannot be explained though simply in terms of response to driver shortages. Operating costs had not risen significantly in real terms over the period while costs of local bus services outside London during the period 1985/86 and 1999/2000 had fallen from 183p/km to 92p/km, and 64p/passenger journey to 56p/passenger journey adjusted for inflation (DETR, 2000, Table 30). In addition to this fares have risen by nearly 33% above the rate of inflation from 1985/86 to 1999/2000 (DETR, 2000, Table 9).

This apparent rising gap between, on the one hand, rising fares revenue and grant subsidy, and on the other, falling operating costs, needs further examination. One factor that might explain the rising costs is the reduction in competition that has resulted from the re-oligopolisation of the bus industry since the fragmentation that took place in the mid-1980s. This is not to say that monopoly profits were necessarily the problem; it could well be simply that, with low-cost competition eliminated, operators could concentrate on long-awaited fleet replacement and, more recently, action to raise wage rates to more competitive levels.

Rising Contract Prices

As stated above, in the early days of regulation, the level of public expenditure given to non-commercial bus services dropped dramatically. In some measure, this was the result of a move away from the blanket subsidy scheme operated by National Bus Company and the Passenger Transport Executives; then, local authorities were just presented with largely existing overall service levels and the subsidy prices required to maintain them. In the absence of any significant competition from within the market, or any independent watchdog to investigate price levels, councils really had little option but to pay for that which was asked or negotiate a reduced level of service which met their target budget level.

Extricating commercial services from the overall subsidy package at least gave a better indication of the true costs of providing services even if, the then government's goal of totally eliminating cross-subsidy entirely was never likely to be achieved. It did, nevertheless, depend on some level of competition, or, at least, threat of competition. If a service could be run commercially and an operator claimed it could not, that claim could soon be challenged. Equally, if an operator tried to make a profit from a subsidised service, another operator could be waiting in the wings to undercut the incumbent and take over the service. In other words, the market may not have been characterised by more than one or two players, but it was, nevertheless, contestable (for a more detailed discussion of contestability in the bus industry, read Langridge & Sealey, 2000).

There was some anecdotal evidence, particularly of new entrants, undercutting price too much but such operators would eventually come to grief, not only losing the contract through non-compliance, and/or their operators' licence through lack of vehicle safety, but also rendering their business insolvent. As such, some operators left the business, while the remaining operators, often suffering from a shortage of new capital, underwent a series of mergers; meanwhile, price competition became less critical. With a greater degree of stability, the industry was again able to

raise prices in order to pay for re-investment. Of course, while the degree of stability was good from an investment point of view, it raised questions regarding the degree to which the market remained contestable. Allegations were beginning to be made regarding price cartels by bus operators during the tendering for local authority school bus contracts (see, for instance, Brown, 1998).

Despite this, subsidy levels failed to rise significantly throughout the 1990s although subsidy levels never returned to the real price levels of the early 1980s. It is only recently that a sharp upturn in price levels has been experienced. One commentary places the sharp upturn on driver shortages and rising drivers' wage costs, albeit, adding that there have been wide variations within different local authority areas (ATCO, 2001). It continues, 'it appears that whilst there is considerable upward pressure on contract prices because of cost increases in the bus industry it is the actual level of competition in each authority's area which determines the extent to which bus operators are able to obtain higher contract prices' (*ibid.*, para 3.3).

Table 1. Average number of bids per tender for the periods 1 October 1999/2000 & 1 October 2000/1

	1999/2000	2000/2001
Service Bus Contracts	3.1	2.9
School Bus Contracts	4.4	4.3
RBSG Contracts	3.4	2.9

Adapted from ATCO (2001) Table 8

The Rural Bus Subsidy Grant (RBSG)

The Labour government, elected in 1997, committed to reducing dependence on the car and concerned about the level and quality of public services in rural areas, decided to introduce the Rural Bus Subsidy Grant (RBSG) in 1998. The grant amounts to £32.5m per annum currently, rising to £48.5m in 2003/4 (provisional allocation). Originally, it could only be used to subsidise new or improved services, to/from settlements of less than 10,000. So far, the RBSG has provided 1800 new or enhanced services with additional passenger numbers rising from 10 million in 1998/9 to 16 million in 1999/2000.

The Government recently has relaxed the eligibility criteria to include new services in and around market towns and continued support to existing bus services. The first relaxation is generally welcome in the sense that the 10,000 maximum population figure was always going to result in absurd decisions. However, the second is more worrying as it opens the scheme to exploitation by bus operators who estimate that they face little competition for particular services and, consequently, inflate tender prices. It was also a temptation to operators to de-register rural services in the knowledge that there was a sum of money available from public funds that could pick up the costs of these services and boost operators' profits.

Laudable though the Government's attempts to underwrite the costs of expanding further rural bus services were, there was a danger that it was simply adding to the supply of services in a market already characterised by rising costs, falling competition and staff shortages. Moreover, unless operators were likely to have surplus staff and vehicles available to meet the upsurge in demand for services resulting from the inception of the grant, there was likely to be heavy start-up costs involved, e.g. the cost of additional buses. One might expect this to be inevitably reflected in higher tender prices for RBSG routes.

Declining Competitive Pressures

There is evidence at aggregate level of substantial real rises in subsidy levels over time. A recent survey into price, expenditure and competition in local authority bus contracts suggests substantial average price increases for contracts renewed on a like-for-like basis of 11.8% in 1998/1999, 17.0% in 1999/2000 and 16.7% in 2000/2001 among participating local authorities throughout Great Britain (ATCO, 2001).

While these figures represent increases well above price inflation, they might be dismissed as the inevitable consequence of a response to the uncompetitiveness of wage rates. However this picture is not reflected to the same extent in school bus contract prices where one might expect many of the cost pressures to be similar if not identical. While not wishing to suggest that this provides a totally adequate proxy for subsidised bus services' cost functions, they do at least provide food for thought. Comparable figures for average price increases for contracts over the three years are as follows:- 11.0% in 1998/1999, 13.1% in 1999/2000 and 11.1% in 2000/2001.

Of course one has to be cautious with these figures. There are differences in cost structures between subsidised service buses and school contract vehicles. Some school contracts may be coupled to excursion traffic, use staff on a part-time basis or use vehicles no longer considered acceptable for service bus routes. In addition, conscious of the need to cater for the elderly, infirm and disabled, local authorities are offering a premium to tenderers in return for using vehicles which are either low-floor or comply with the Disabled Persons Transport Advisory Committee standards (DPTAC, 2000). For instance, 50% of all first year RBSG-funded contracts specified the use of vehicles containing some DPTAC features (DETR, 2000, Appendix 2, para. 6) All these factors should have

some impact on differences between tender prices.

Nevertheless, the factor so far not discussed is the level of tender competition proxied, in this instance, by the number of bids per tender. Table 1 shows this information for contract periods beginning in October 1999 and 2000.

It is clear that, while school bus contract bids have remained above an average of four per contract, both service bus contracts and rural bus contract bids have fallen to less than an average of three per tender. While this is not conclusive evidence that the rate of tender price increase is inversely related to the level of competition, it does suggest that such a hypothesis is worthy of further investigation.

There is evidence to suggest that RBSG tender bids also varied between regions. A DTLR survey of local authorities appears to be in broad agreement with the ATCO findings of an average of three bids per tender across most regions. However, in the Yorkshire and Humberside region there was only an average of 2.3 bids per tender, while in the Southwest, an average of 1.9 (DTLR, 2001a, Appendix 1, para. 19). It is also worrying that 30% of all first-year RBSG-funded contracts were awarded outside of the competitive tendering process by way of *de minimis* provisions (DTLR, 2001b, Appendix 2, para. 11).

A further consideration is the degree to which service bus contracts have been entered into in order to replace withdrawn commercial services. This has risen by 32% in 2000/2001 compared to 1999/2000 incurring additional costs to local authorities of £5.343m (ATCO, 2001, para. 8.2). What is hard to determine is the extent to which this 32% represents real cost increases, a lessening of general competition and/or the seeing of the RBSG as a milch-cow.

However, over the same period, there has been a reduction of costs of having to replace early terminations of service bus and school contracts of 25% and 20% respectively (ATCO, 2001, para. 8.3). This finding does not accord with the hypothesis that cost increases and levels of competition are inversely related. This might be explained in terms of a learning curve with a growing reluctance by operators to tender right at the margins and then discover, as the contract proceeds, a deepening loss.

It is never going to be easy to delve deeper into the behaviour of bus operators in relation to bidding for local authority contracts. Much of the information is highly sensitive and some admissions might leave those operators open to potential fraud charges. Nonetheless, the next section at least provides a glimpse at operators' behaviour even if it is a glimpse through a glass darkly.

Interviews were carried out with public transport officers responsible for the provision and monitoring of contracts for non-commercial bus services. They were asked their views on the reasons for the sudden rise in tender prices, despite the lack of a similar rise in operating costs, the reason why the level of competition has fallen for subsidised service bus contracts but not school contracts, to what degree do they believe competition in tendering was, and still is, sufficient to protect the public purse, and to what extent has RBSG really achieved its goal of providing new and improved bus services rather than simply propping up existing commercial service withdrawals.

Interviews

Cost Differentials

The principal reason given for the rising contract prices in recent years has been the need to increase drivers' wage rates. It was felt that there would always be driver shortages and that operators, either consciously or subconsciously, built a degree of shortage into their calculations. However, in a relatively tight labour market, pay rates of drivers were becoming highly uncompetitive. In one city, drivers wage rates have risen by 70% – 80% in the last few years but still shortages prevailed. However, there were factors that differentiated the degree of driver shortage and the degree to which wages needed to rise at least in order to reduce the shortage to manageable proportions. The large bus groups were said to have an advantage in attracting existing staff from Scotland and the North-east to hot spots in the South-east; this source of labour was more readily available to those subsidiaries of nationwide companies. Aggregate figures for drivers' wage rates hide significant regional differences.

School contracts drivers were likely to cost least and were least in short supply. The job had regular, and not particularly, unsocial hours and often employed part-timers and retired full-time drivers. For them money was less important as the job virtually constituted a hobby or a means to supplement other earnings. Nevertheless, the need to raise drivers' pay well above the rate of inflation was common even among school contract tenderers. Also, despite behaviour problems on school buses, such as vandalism and rowdiness, it seldom turned to the kind of violence that might be met elsewhere. However, there had been an increase in verbal and, occasionally, physical abuse of drivers by pupils and parents.

Rural bus services shared many of the virtues of school bus contracts. Most services did not attract violent passengers, many operated during the day and driving conditions were less stressful than that experienced by city bus drivers. Consequently, one might expect less of a differential between school contract and non-commercial bus service tender prices.

The only major difference would be the cost of vehicles. School contracts often employ time expired

and fully written-down vehicles bought second hand. As long as vehicles met traffic commissioners' standards, they were considered fit for purpose. The most cited issue of complaint was that of seat belts. If a contractor used coaches, then seat belts were required to be fitted whereas, with buses, they were not. This led to parents and schools complaining that their children should only travel on a vehicle with seat belts, a demand which, if met, could result in higher costs as only coaches could be used for school services. It was added that seat belts were seldom used for the purposes intended!

While a similar choice of vehicles often used to apply to non-commercial service buses, both the Disability Discrimination Act and local authorities' own disabilities policies are encouraging bus operators to buy modern, low floor vehicles. Many of the users are partially disabled and some choose to use buses rather than drive because of their infirmities. A longer term problem was perceived to be looming with respect to the eventual cascading of low-floor vehicles on to school contracts; low floor vehicles tend to carry fewer people seated which is less of a problem with subsidised service buses. However, with school contracts, seating capacity is critical and, consequently, more vehicles would be need to transport similar numbers of pupils in the future. This could result in a two buses-for-one replacement programme thereby doubling costs.

Therefore, while some of the tender costs differences may be explained by differences in vehicle costs, driver shortage should neither act as a particular barrier to rural service provision and nor should tender prices rise faster than general operating costs. Neither is it clear why there is less competition for service bus contract bids compared to those for school contracts. This is all the more bewildering as there is some evidence of operators dove-tailing school contracts with service bus contracts to find a full day's work for a vehicle and driver. The only explanation offered is that there is more financial risk in buying a new, or at least modern, bus for a service that has an uncertain future. Conversely, a school contract has a more certain future and the lesser amount of capital investment in a second-hand vehicle constitutes less of a financial risk.

Protecting the Public Purse

The notion of competitive tendering provides good safeguards against the waste of public money even though the system is not failsafe. On the other hand, the decline in bids per tender for non-commercial service bus contracts does weaken the potential for safeguarding public funds. A major criticism of the situation prior to deregulation was that the local bus monopoly could employ a take-it-or-leave-it attitude. With the effective re-oligopolisation of the industry, there was a fear that this attitude was beginning to return.

One reason for the decline in bids might be to do with the more mature market for tendered services after the post deregulation free-for-all. After the early years of bidding for everything at bargain-basement prices and the high number of financial failures among operators, things have settled down somewhat. Operators still have different strategies for tendering. One might bid for everything building a high profit margin into the price and win just those contracts where more localised operators did not exist or simply were not interested in running those services. Others, worried about protecting their network, might bid in a highly localised way often at marginal costs simply to avoid allowing others a foothold in 'their' territory.

The situation with school contracts seemed to be more stable. There had been little change to the number of operators bidding for services and this might also explain, in part, the differences between the rates of increase in contract prices. However, the number of tender bids varied by area; this was explained in terms of the number of local operators in any given area. Operators employed different strategies. The small localised operators were found to bid just for their existing services because it reduced elements of risk; operating conditions, costs and even knowledge of the customers gave these operators elements of certainty. As a result, these operators tended to be more competitive with respect to their existing services.

Other operators, as with subsidised service bus contracts, would bid for everything, invariably at a high price, in the hope that they would catch a few high-cost contracts where competition was weak. The larger operators were considered to be better at milking the system tendering at low prices and then re-negotiating the price upwards once in possession of the contract. While there were attempts by local authorities to resist this strategy, if it were done incrementally, each increment was cheaper to concede than starting the tendering round again.

Finally, it was hard to find any evidence of the existence of cartels. Despite the amount of merger and takeover activity and the decline in the number of bids for non-commercial service bus contracts, it was felt that most of the suspicion of price-fixing rested upon the small local operators carving up school contracts between them. Nevertheless, there was little evidence of price fixing even in school contracts with just odd cases of a contractor being discovered trying to collude with competitors.

The Rural Bus Subsidy Grant

There was a strong reluctance to bid for RBSG the first time around due to the high degree of financial uncertainty. This has been true especially on net-cost services where operators retain the revenue and estimate this element in calculating the overall level of grant required. There is also some anecdotal evidence to suggest that RBSG tenders cost more as they contain a higher margin for risk. It is not known to what extent this situation will prevail when the RBSG contracts come around for renewal.

There existed a feeling that the milch-cow attitude to RBSG did exist. However, it was felt that it existed primarily in terms of high tender prices. It is too early to say whether or not commercial services are being withdrawn in order to benefit from RBSG money as, until recently, RBSG was specifically forbidden for use on existing services. Nevertheless, RBSG is a factor that needs further investigation once the system and the revisions to the original scheme have had time to bed in.

Conclusions

Deregulation heralded the decline in the level of local authority support for bus services. Operating costs fell substantially in the early years and, in the absence of reductions in other input costs, this fall was attributable largely to a fall in labour costs through changed working practices and wage cuts. However, above inflation fares increases throughout the period may have contributed to the fall in subsidy levels.

Yet, more recently, the tide has turned. As well as the contribution of the foregoing factors, subsidy levels are beginning to rise again. This could be the result of the decline in competition resulting from the re-oligopolisation of the industry; alternatively, it might be that firms could not continue to operate on a day-to-day basis without major capital investment (in other words operating in the long term at short run average costs). Finally, it could be that wage rates needed to be competitive during periods of low unemployment?

The evidence suggests that competition has been found to decline on subsidised services bus contracts but not on school contracts. This may be explained by differences in motivations among the many operators of school contracts, their vehicle investment policy and their labour market conditions. On the other hand, even with the bespoke school contract operators, driver wage rates have had to rise and that cost has been passed on, partly by way of fares, but principally through the level of subsidy paid.

The actual market for subsidised bus services was found to be far from competitive in the general sense of the term. Bus operators were not an homogeneous group and even the larger companies varied in terms of their motivations for tendering for contracts and the tactics they employed both before and after the tendering process.

Finally, the Rural Bus Subsidy Grant appears to attract higher tender prices than the traditional contract prices. This might be explained in terms of the higher start-up costs of many services and the risk element of providing services that are neither commercial nor a lifeline operation virtually guaranteed by the local authority over the longer term. There is also the suspicion that the scheme is being used as a way to make money out of the system by transferring services that were once commercial into the subsidised network. While this is very difficult to prove, the recent changes to the RBSG does make the temptation more, rather than less, likely.

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Driver road rule knowledge & attitudes towards cyclists

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Abstract

Many potential cyclists do not cycle on the road because of safety concerns. Drivers' knowledge of road rules and attitudes towards cyclists on the road were assessed. A telephone survey of 105 randomly selected adults in Sydney, Australia, with a current driver's licence was conducted. Less than half the sample (43%) was aware of recent changes to the Australian road rules. The majority of respondents (76%) reported high perceptions of danger associated with cycling, although respondents who had recently cycled on the road were significantly less likely to report these concerns of danger.

Keywords

Cycling, road rule knowledge, road safety

Background

Road trauma represents a substantial public health problem, with about 600 deaths per year in New South Wales (NSW) (RTA, 2000a). Serious (i.e. hospitalised) injuries from road accidents in NSW occur at the rate of about 30,000 per annum, with the cost of road crashes in Australia in 1996 conservatively estimated at A$15 billion (Bureau of Transport Economics, 2000).

The National Road Safety Strategy 2001–2010 emphasises the need for 'public education campaigns for greater knowledge of, and compliance with, road rules' (Australian Transport Council, 2000a). One of the key responsibilities of the Roads and Traffic Authority (RTA) is to 'Ensure that drivers and motor cyclists are eligible and competent' (RTA, 2000b).

While poor knowledge of road rules is generally considered as one contributing factor to motor vehicle crashes, it has been studied infrequently. No Australian published studies over the last decade describing population levels of road rule knowledge were found in a Medline search. International studies have focused on the road rule knowledge of cyclists, children or parents of young children, but not that of motor vehicle drivers (Langley, Silva, & Williams, 1987; Kimmel & Nagel, 1990; Maring & van Schagen, 1990; Lam, 2001). Results from previous convenience sample surveys in Sydney[1] indicate very poor knowledge of road rules across age and sex groups in the community (Campbell, 2001).

The National Road Safety Action Plan also encourages alternative modes of transport to cars as a strategy to reduce car crashes and for environmental reasons (Australian Transport Council, 2000b). For example, Strategic Objective 8 is 'Encourage alternatives to motor vehicle use' and Action Area 8.2 is to 'Reduce motor vehicle use through the promotion of public transport, walking and cycling'. Perceptions of safety risk are a major reason given by adults for not cycling on roads (Unwin, 1995; Katz, 1998; Wilson, 2000).

There is considerable capacity to increase the population frequency of cycling. Over half (55%) of car trips are less than five kilometres and 33% are less than three kilometres (NSW Department of Transport, 1995), distances considered easily amenable to cycling. Only 1% of Sydney's population cycles each day, despite the total number of bicycles owned by Sydney residents being nearly two million (RTA, 1999a) and the proportion of households with a bicycle having risen from 32% in 1991 to 39% in 1998 (Transport Data Centre, 2000).

The objectives of this study were to:

- identify population levels of correct knowledge of road rules among persons with a driver's licence;
- describe attitudes of persons with a driver's licence towards cyclists; and
- identify the prevalence of regular cycling among adults with a driver's licence and factors associated with regular cycling.

Method

A telephone survey using randomly sampled telephone numbers from the electronic white pages was conducted. Community volunteers from the Marrickville Bicycle User's Group were trained to administer the interview using a standard procedure based on existing telephone survey protocols (for example, standard introduction, logging contact

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[1] Many hundreds of people were interviewed with a simple 5 item questionnaire 'The Road Rule Knowledge Quiz'.

attempts, and interviewer training) (Health Promotion Unit, 2000). This protocol involved each interviewer phoning through a list of randomly selected phone numbers, calling each number up to five times to identify eligible households. An eligible household was one that had a person 17 years or older with a valid NSW Driver's Licence who could speak English well enough to participate in the telephone survey. Where more than one person held a current licence the person to have the last birthday was identified as the respondent. Up to six attempts were made to interview the selected respondent.

Data collected included demographic information, a series of multiple choice knowledge questions based on the RTA publications *Changes to Road Rules in NSW Guide* (RTA, 1999b), *Driver Knowledge Test* (RTA, 2000c) and *Road Users' Handbook* (RTA, 2000d), questions assessing attitudes towards cyclists asked in a previous study (Bell Dignam, 1995), and on-road cycling behaviour. Data were entered onto computer using EpiInfo 6.0 and analysed using SAS for Windows (version 6.12). Analyses were primarily descriptive, using frequency distributions and cross-tabulations. Multiple regression was used to identify factors associated with road rule knowledge and attitudes towards cyclists. Logistic regression models were computed to identify factors associated with cycling on the road in the last 12 months.

Table 1. Frequency of correct responses to multiple choice road rule knowledge questions

Road rule question focus	% Correct
Use of hand held mobile phone while driving (DKT)	88
Vehicles allowed in T3 Transit lane	46
Traffic lights changing from green to amber (DKT)	87
Driving on the wrong side of road to avoid obstruction	54
Who has right of way when two unmarked lanes merge	47
When is parking on the footpath allowed	55
Are cyclists legally entitled to use the roads	87
Are cyclists entitled to use a whole lane	63
Are cyclists and motorcyclists allowed to ride two abreast	19
Cyclists allowed to ride on major highways	63
Cyclists allowed to overtake on the left of cars	31
Cyclists allowed to ride across pedestrian crossings	60
Cyclists allowed to ride along clearway in peak hour	44
Questions directly from RTA Driver Knowledge Test	
Double parking where there is parallel kerbside parking	91
Responsibilities when opening a door on a roadway	92
Approaching a pedestrian crossing	97
Pedestrian rights on the road	87
Giving way to pedestrians when turning at an intersection	94

The questionnaire is available from the corresponding author

Results

Of households reached where eligibility to participate could be ascertained, 105 interviews were conducted. With 95 selected participants declining the interview, the response rate was 53%. There were more female respondents (56%) than male (44%), with 22% of respondents aged 17 to 30 years, 41% between 31 and 50 years and 37% aged over 50 years.

Only 43% of respondents were aware of changes to the Australian Road Rules introduced in December 1999, with one-third (34%) of respondents recalling the RTA leaflet distributed state-wide containing information about the changes. There were no age or sex differences in the proportion of those recalling the changes.

Generally, over 90% of respondents identified the correct answer from five multiple choice questions taken verbatim from the RTA Driver Knowledge Test (see Table 1). However, there was considerable variation in correct responses from other questions based on the road rules. For example, only 19% of respondents knew that cyclists and motorcyclists are legally allowed to ride two abreast, and less than half of respondents knew what vehicles are allowed in a T3 Transit lane (a lane on the roadway designated for use by cars with 3 or more people).

Of a possible 18 knowledge questions the mean number of correct responses was 12.1. Men had a higher mean number of correct responses (12.6) than women (11.7) and this difference was statistically significantly after adjusting for age ($p = 0.03$). There was no association between accurate knowledge of road rules and year when the driver's licence was obtained or recall of recent changes to the road rules.

Only 22% of respondents correctly identified that of the approximately 600 deaths on NSW roads each year fewer than 20 were cyclists (12 were killed in 1999, 7 in 2000) (RTA, 2000a), with younger respondents (18–30 y.o.) least likely to be correct (9%). Those respondents incorrectly identifying the cycling road toll all overestimated the number killed, with 55% thinking more than 50 cyclists are killed annually including a quarter who thought more than 100 cyclists are killed annually. Almost 60% of respondents thought that responsibility for the deaths was shared equally between cyclists and motor vehicle drivers, 27% mainly car drivers and 12% mainly the cyclist[2]. Almost two-thirds (63%) of respondents thought that

[2] The reality is that there is no assumption of fault in Australia. In many cases the cyclist is disregarded with the motorist not even fined. At best it is a case by case basis.

Table 2. % of respondents who agree or strongly agree with statements *

Statement	Bell Dignan (1995)	Present study (2001)
	% Agree or Strongly Agree	
It is very frustrating sharing the road with cyclists.	59	57
Cyclists should not be able to ride on main roads (without cycle tracks) during peak hours	61	51
Many cyclists take no notice of road rules	59	62
Cyclists have just as much right to use the road as motorists	77	75
Most cyclists are aware of other road users and keep out of their way	72	61 *
It is safer for cyclists to keep to the left of the lane	89	83
Drivers are not trained to look out for cyclists	71	63
Cyclists are courteous on the road to motorists	52	34 *
Many cyclists on the road have not learned to ride properly	60	46 *
Motorists need to be educated to give cyclists a fair go on the road	85	81
If cyclists want equal rights on the road, they should pay registration fees or road taxes	46	38
Drivers should change lanes when overtaking cyclists rather than veering around them	76	69

* Significantly different at p<0.05

cyclists take reasonable steps on the road to ride safely and avoid accidents.

Responses to 12 statements about cyclists or cycling (see Table 2) indicate contradictory views of drivers towards cyclists. For example, while 75% of respondents agreed or strongly agreed that cyclists have as much right to use the road as motorists, 51% agreed or strongly agreed with the statement that cyclists should not be able to ride on main roads during peak hours and 57% agreed or strongly agreed that it is frustrating sharing the road with cyclists. Some respondents (38%) agreed or strongly agreed with the statement that if cyclists want equal rights on the road they should pay registration fees or road taxes. These results are very similar to the results of a random sample telephone survey with 304 respondents conducted in 1995 for the RTA (Bell Dignam, 1995). Responses to three of the statements had changed significantly since the 1995 survey. These indicate that the perception of cyclist riding skills had improved, that cyclists were less courteous to motorists, and that cyclists were less aware of other road users and not keeping out of their way.

Based on the (five-point) responses to these statements, a unit-weighted nine-item 'attitude towards cyclist' scale was developed. This scale had a *Cronbach's alpha*[3] of 0.81, indicating high internal consistency. A low score indicated a negative attitude towards cyclists, with a mean of 28.9 and a range of scores from 11 to 45. Using a linear regression model, a negative attitude towards cyclists was significantly associated with lower road rule knowledge (p=0.02) after adjusting for age, sex and cycling status.

About three-quarters (73%) of the 105 respondents had ridden a bike on the road since they were 12 years old (n=77), and of these people 29% had ridden on the road in the last 12 months (n=22). Twelve respondents had ridden a bike on the road in the last month and three in the last week.

In this sample age was not associated with having cycled on the road in the last year, although respondents over 50 years were the least likely to have cycled on the road. Across all ages men (30%) were significantly more likely than women (14%) to have cycled on the road in the last year (p=0.04).

All respondents were asked to imagine they were riding a bicycle on a main road and to what extent they would feel in danger of being hit by a motorist. A quarter (25%) thought 'extremely likely', 20% though 'very likely' and a further 31% thought they would be 'quite likely' to be hit by a motorist (totalling 76%). Cyclists who had ridden on the road in the last 12 months were significantly more likely to report that they were 'not very likely' or 'not at all likely' to feel in danger of being hit by a motorist (46%) compared with non-cyclists or non-recent cyclists (18%) (p<0.01). This association remained significant after adjusting for age and sex.

Respondents who had ridden a bicycle on the road in the last year and had children between 12 and 18 years were three times as likely to have children who ride their bicycles on the road (35%) than parents who had not recently ridden a bike on the road (11%)(p=0.041).

[3] Cronbach's alpha is a summary correlation co-efficient that measures the degree of internal consistency of responses to a series of questions. A Cronbach's alpha >0.8 indicates a high degree of consistency, such that if a respondent agrees with one question then they are highly likely to also agree (or disagree) with certain other questions in the series.

Discussion

These original findings indicate that while knowledge of road rules based on the RTA Driver Knowledge Test is high, there was also considerable variation in knowledge of road rules with more than half the respondents not being aware of recent changes. It may be that correct knowledge scores on the RTA test are not an accurate guide to levels of road rule knowledge in the community.

Lower levels of road rule knowledge were significantly associated with poor attitudes towards cyclists. This has implications for the safety of cyclists if motorists do not know the rules and are not predisposed to be tolerant of cyclists on the roads. Successful campaigns encouraging 'sharing the road' are likely to be helpful to cyclists (Radetti, 2000; Thornton, 2000) but may also need to be supported by campaigns focusing on specific rules. The perception that cyclists are not courteous to motorists and do not follow road rules suggests that cycling safety campaigns for cyclists are also warranted.

The attitudes of motorists does not appear to have changed much in the six years since the attitude statements were asked. Respondent perceptions suggests that there have been improvements in the level of cyclists' skill, and that cyclists were less courteous and less prepared to keep out of motorists' way. Being less prepared to avoid motorists may reflect a greater preparedness of cyclists to assert their legal right to road space.

The results also indicate that there is a high perception of danger associated with cycling on the road. Three-quarters of respondents thought they were likely to be hit by a motorist, and there was a dramatic over-estimation of the fatalities associated with cycling. This perception seems exaggerated, with cyclists with recent on-road experience reporting significantly lower levels of perceived danger. Programs that encourage non-cyclists to try cycling may reduce perceptions of danger which is a major barrier to regular cycling (Katz, 1998). Strategies encouraging parents to cycle may have additional positive benefits if their children are also more likely to cycle.

A weakness of the study was the relatively low response rate, primarily due to the volunteer nature of the interviewers and the generally lower response rates for telephone surveys obtained in metropolitan areas. Although some of the interviewers had previous telephone survey experience, the Sydney region is heavily surveyed by commercial market research companies and the general survey participation rate is consistently lower (about 60%) compared with rural areas (Public Health Division, 2001). The relatively small sample size also reduces the power of the multivariate analyses, however, the statistically significant results that were found are likely to be meaningful findings.

The low frequency of on-road cycling is consistent with other data (Transport Data Centre, 2000) that less than 1% of the population cycles to work daily. Clearly there is room to increase the level of regular cycling in the population and achieve the considerable environmental and personal health benefits of cycling (Unwin,1995; Roberts *et al.,* 1996). Incorporating incidental physical activity which results from regular lifestyle behaviours has been found to be more cost-effective than physical activity achieved through structured exercise programs (Sevick *et al.*, 2000).

Conclusion

The majority of adults in NSW have a driver's licence. Eighty percent of bicycle users aged 17 years and over have a driver's licence, a rate similar to the total population of driving age (87.4%) based on the number of licences held and the age distribution of NSW residents (RTA, 2000b). Improving road rule knowledge could lead to improved road and cycling safety and may contribute to increased cycling.

Indeed, it is an important responsibility for public authorities who regulate motor vehicles to ensure that drivers clearly know the rules they must abide by. Regular testing of road rules is warranted, possibly at the point of licence renewal. A single driving knowledge test when a licence is first granted is inadequate. A driver's licence is a privilege and as such, it is reasonable to expect that road rule knowledge be maintained. This is particularly important when poor road rule knowledge is associated with negative attitudes towards vulnerable road users.

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Household-focused travel behaviour change initiatives – Critical new tools in Travel Demand Management

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Abstract

Two *travel behaviour change* approaches, which focus on the provision of information to households about how they can use private motor vehicles less and more efficiently, have shown promising results in Australia. These approaches are described and the results summarised.

Reductions in car use of around 14% have been measured, with associated increases in public transport patronage, walking and cycling. The approaches serve to increase awareness of the societal reasons for reducing car use, and also assist people to change their own travel behaviour in ways that provide individual benefits.

Keywords

Individual marketing, IndiMark™, Perth, Travel behaviour change, Travel Blending®, Travel demand management, Travel diaries, TravelSmart™, Australia.

Introduction

Travel Demand Management (TDM) concerns measures designed to reduce the amount of travel by private motor vehicles. The range of TDM possibilities has been growing rapidly as the sustainable transport agenda has strengthened.

Over the last few years new approaches have been introduced which focus on the provision of information to individuals within their households about how, in their particular circumstances, they can use private motor vehicles less and more efficiently. These interventions seek to achieve behavioural changes by the provision of information to the individual traveller without necessarily involving changes to infrastructure or services.

Two such approaches are being applied in Australia with promising results. They have been developed by two firms of international transport consultants using expertise that has been developed by key individuals over the past 15 years. Travel Blending® was conceived as an innovative campaign to reduce air pollution in Sydney prior to the 2000 Olympic Games by the New South Wales motoring organisation the NRMA (National Roads and Motorists' Association), and was developed by Steer Davies Gleave in association with Monash University (Ampt, 1997). In Australia it has been applied to several thousand households in Adelaide and Brisbane, with other applications in Leeds, Nottingham, New Jersey and Santiago.

IndiMark™, short for 'Individual Marketing', was developed and tested in Europe in the 1990s by SocialData in the 'Switching to Public Transport' project run by the International Association of Public Transport, (UITP–INPHORMM, 1998). The majority of the over fifty applications to date have been in German, Austrian, Swiss and Swedish towns involving numbers of participants ranging from 2,000 to 75,000. These applications were directed at increasing the use of public transport. In Australia IndiMark has been applied throughout the council area of South Perth (35,000 population) as part of Western Australia's TravelSmart™ program and is also being applied in Brisbane.

A feature of the Perth application has been the extension of the IndiMark intent from that of achieving a mode shift to public transport, to that of achieving mode shifts to walking and cycling as well.

Each approach has been described separately by its proponents (Rose & Ampt, 2001; Brög, Erl, Funke & James, 1999). In this article the two approaches are reviewed in parallel. It is based on a review of the two approaches by the author as an input to the Australian National Greenhouse Strategy (Perkins & Giannakodakis, 2001).

Basic Concepts

The Travel Blending® and IndiMark™ approaches have the following features in common:

- They seek to fill the gap between raising people's awareness of the need to change and people actually changing their travel behaviour.
- They involve a degree of dialogue and information exchange with individuals and households.
- They are based on the concept that small changes in individual and household behaviour can produce a significant aggregate reduction in the adverse consequences of motor travel.

IndiMark™

IndiMark has the primary aim of increasing the amount of activities which are accessed by Environmentally Friendly Modes, walking, cycling and public transport, while decreasing the amount of private motor vehicle travel.

IndiMark is explicitly a marketing approach aimed at producing sustainable shifts in use of transport modes on a large scale. For instance, use in Europe has on occasion been as a marketing tool for bus companies to increase patronage. The market is segmented into regular users of Environmentally Friendly Modes, people with an interest in making mode changes and those without any interest. It is argued that the market segmentation produces a more effective outcome (effort is not wasted on the unresponsive, while regular users are recognised and encouraged).

Table 1. A summary of the IndiMark™ method

Contact	All households are contacted by mail and phone to determine if they are regular/extensive users of Environmentally Friendly Modes (R), are not at all interested in changing (N), or are interested (I).
Motivation	Problems and requests from the R and I groups are responded to.
Information	Information (timetables, maps etc.) are posted to the R and I participants. The R and I participants select the information they want, then it is posted or hand delivered to them within a couple of days.
Convincing	Consultation phone calls and home visits on request are made, with selected households in group I receiving tickets to use on public transport for a limited period.

Source: Derived from Brög & Schadler, 1998

Its use in Perth has been firmly embedded in a city-wide travel demand strategy. As such, it is being linked into the development of local government action plans to construct supporting infrastructure (e.g. bus shelters, cycleways), changes to town planning schemes and local change programs like TravelSmart to School.

Travel Blending®

Travel Blending is based on the hypothesis that if people have an understanding of the aim of reducing the adverse impact of private motor vehicle use in relation to their own lives, they will be in a position to make the changes that best suit their own circumstances.

Philosophically, Travel Blending has been cited as an example of a new approach in the application of transport policy based on concepts of information sharing and more explicit citizen participation (Rooney, 1998). Rooney embedded the Travel Blending approach in the theory of self-organising systems (Portugali, 1997) which holds that '*you cannot direct a living (self-organising) system, you can only disturb it*' (Rooney, 1998). This translates into an approach favouring interventions which, rather than directing people to achieve a particular outcome, provide people with the information from which they will choose their own responses: '*With information freely available, it is more likely that a workable solution will emerge, one that has broader support in the community*' (Rooney, 1998).

Travel Blending is designed to encourage participants to:

- Think about activities and travel in advance (in what order should activities be done, who should do them, where should they be done).
- Blend their travel by *blending modes*, *blending activities* (doing as many things as possible in the same place or on the same journey), or *blending over time* (making small sustainable changes on a weekly basis) (Ampt, 1997).

The approach aims to '*provide people with an achievable goal rather than a set of general possibilities*' (Ampt & Rooney, 1998).

The method of Travel Blending involves participants completing seven day travel diaries to gain an understanding of their personal and household travel patterns. The diaries are analysed and the participants are provided with suggestions on how they individually and as a household might reduce their motor vehicle travel and increase the overall efficiency of their travel. These suggestions are supported by customised information (bus timetables, maps, cycle hire, guides to local services, etc.) which will assist participants in implementing the suggestions. Participants are encouraged to complete a second seven day travel diary approximately a month after starting to make the changes so that changes can be measured and further feedback can be provided.

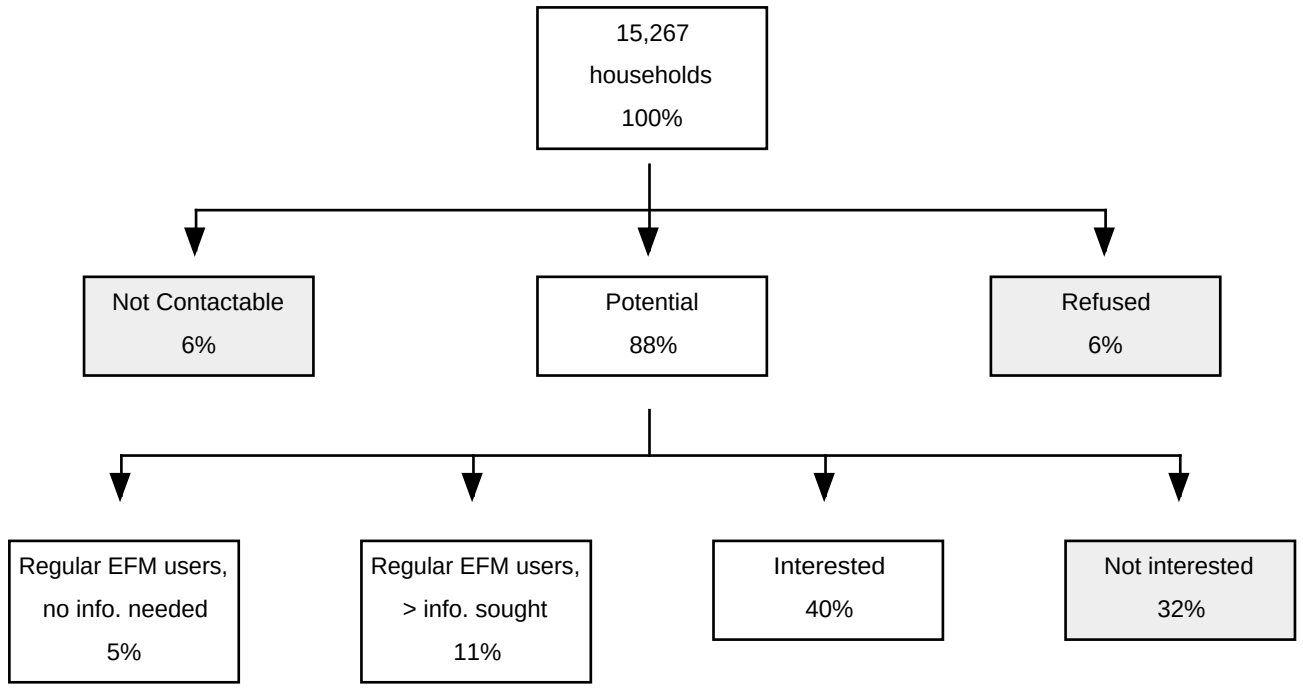
Differences in Approaches

IndiMark is individualised in terms of contact with individuals, but less so with respect to the information provided. Travel Blending provides travel suggestions specific to the individuals within each household based on analysis of the 'before' travel diary.

IndiMark is focused on mode changes. Travel Blending encourages more efficient use of cars through more planning of travel and trip chaining, as well as mode changes.

IndiMark focuses on the proportion of respondents who express an interest in making some change, as identified in the initial phone contact. Travel Blending captures those who are prepared to participate in completing the travel diaries. Feedback

Figure 1. Take-up Rates for IndiMark™, South Perth



Source: Derived from James & Brog, April, 2000

from participants suggests that not all participants recognise the potential for changing travel behaviour in their household, so the Travel Blending participant group does not exactly correspond with the 'interested' group in IndiMark.

IndiMark incorporates those who are judged to be regular users of Environmentally Friendly Modes. Travel Blending does not include those households without a car.

Delivery

IndiMark was offered to all contactable households in the South Perth local government area. The pilot study involved a sample of some 400 households from across South Perth. The Western Australian Transport Department intends to continue the program on an area by area basis.

Travel Blending was tested in Australia using workplace and school environments as the conduits to household members. Hence, a sample of some 350 households was enrolled via the Transport SA workplace, two other firms and a high school.

Travel Blending has subsequently been applied in suburbs in Adelaide and Brisbane. With its application to geographical areas, the concept was expanded to maximise participation and build on the synergies of involving everyone in a neighbourhood. This approach has been named 'Living Neighbourhood®' and involves integrating the roll-out of the Travel Blending tool with community development initiatives such as a directory of local businesses and services to encourage the localisation of trips, 'green prescriptions' issued by local doctors to encourage walking, and the development of a school curriculum subject around the Travel Blending project. So, within the Living Neighbourhood, people who work, attend school or participate in community activities in the neighbourhood are offered the Travel Blending program as well as residents.

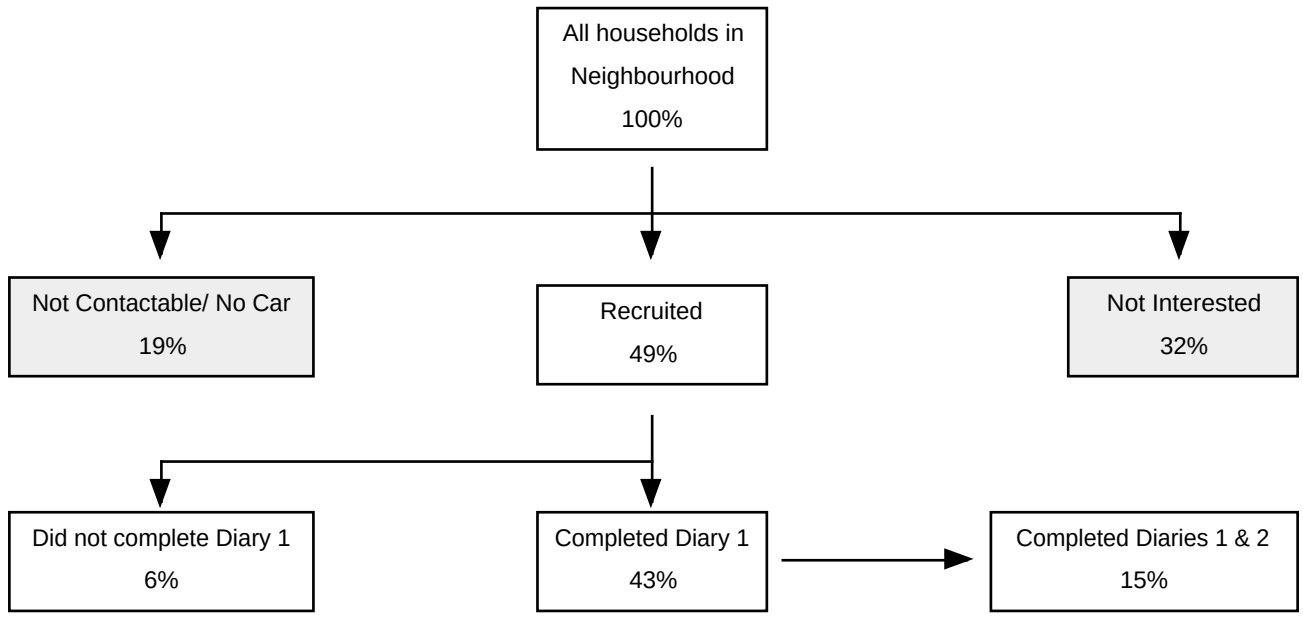
Take-up Rates

Figures 1 and 2 chart the take-up rates for IndiMark and Travel Blending within the targeted populations. In South Perth an involvement of around 56% of households was achieved. Five percent of households were classed as regular users of Environmentally Friendly Modes not requiring further information. Eleven percent were classed as regular users who requested further information. Forty percent were not regular Environmentally Friendly Mode users, but sought additional information.

In Dulwich-Rose Park the take-up rate was 49% (excluding residents without a car who would in IndiMark terminology be classed as regular Environmentally Friendly Mode users).

Hence, take-up rates have been similar for both approaches. However, where Travel Blending has been applied within an organisational setting (particularly schools), take-up rates have been higher.

Figure 2. Take-up rates for Travel Blending® by residents of the Adelaide suburbs of Dulwich-Rose Park



Source: Derived from Steer Davies Gleave, 1999

When Travel Blending was applied in an outer suburban area with higher proportions of elderly people, single working people (who were out of the house for much of the time and difficult to contact), and a lower household income profile, the take-up rate was lower at 29%. The 'not contactable / no car' group comprised a much higher 36%.

Results

The changes in travel behaviour are measurable very soon after the intervention, and for both techniques they have been impressive.

The changes in trips per household by mode and the reductions in car travel distance are charted for both techniques in Figures 3 and 4.

Figure 3 shows the changes resulting from Travel Blending projects. These are percentage changes achieved by the participating households.

Figure 4 shows the changes resulting from the IndiMark project in South Perth. Here the changes are recorded as percentages of all South Perth households.

The most consistent, and in many ways the most important, feature of both techniques is the reduction in car travel achieved. In South Perth an estimated 14% reduction in car trips and car kilometres travelled for the whole population was achieved by the participating households. In the Travel Blending projects reductions in car trips of 10% to 15% of the trips by participating households were achieved, with corresponding reductions in car kilometres travelled of 9% to 30%.

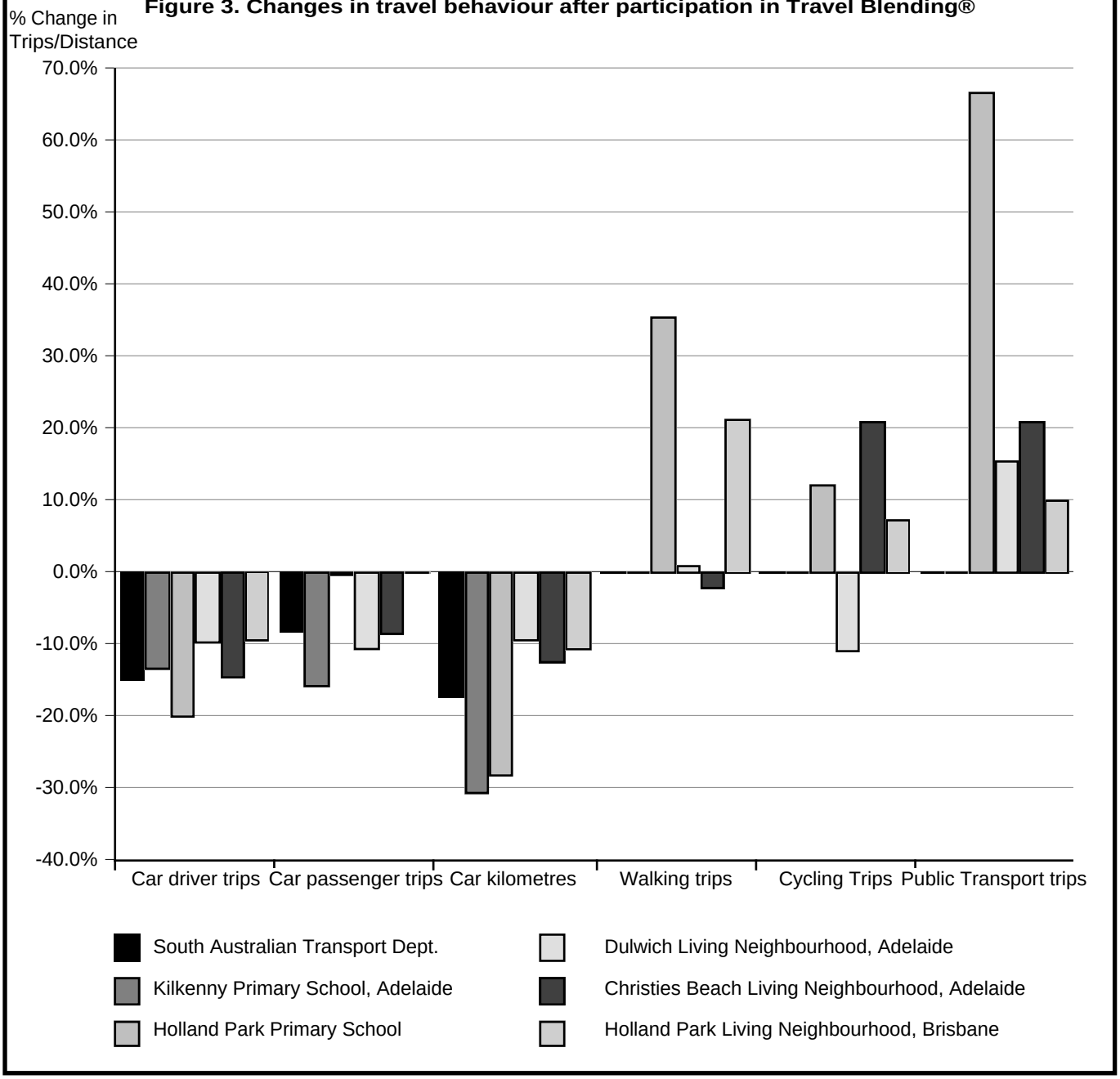
The importance of the reduction in car travel can be appreciated in the context of current Australian passenger travel behaviour. In Adelaide, for instance, average car ownership rates are 1.29 vehicles per household in inner suburbs and 1.58 in outer suburbs (ABS, 1996). 81% of all trips are by private motor vehicle, compared with 12.6% walking trips, 1.2% cycling trips and 4.6% public transport trips (PPK, 2001). Hence, a technique that produced shifts to environmentally friendly modes *without* significantly reducing car travel would be more limited in achieving sustainable transport goals.

It is the reduction in car travel that produces the major part of greenhouse abatement. The reductions in greenhouse gas and other emissions tend to broadly reflect the reductions in car kilometres travelled.

The IndiMark results suggest that the reduction in car travel was achieved by a combination of mode shift and higher car occupancy rates (reflected in the increased car passenger trips), without an appreciable reduction in the total number of trips.

Travel Blending projects have produced a reduction in car trips and variable increases in walking, cycling and public transport patronage. There has been a reduction in total trips, and generally a decrease in car passenger trips as well, indicating that car occupancy rates have not increased. The changes resulting from Travel Blending suggest that the primary responses of households were to chain car trips and conduct their travel activities more efficiently.

Figure 3. Changes in travel behaviour after participation in Travel Blending®



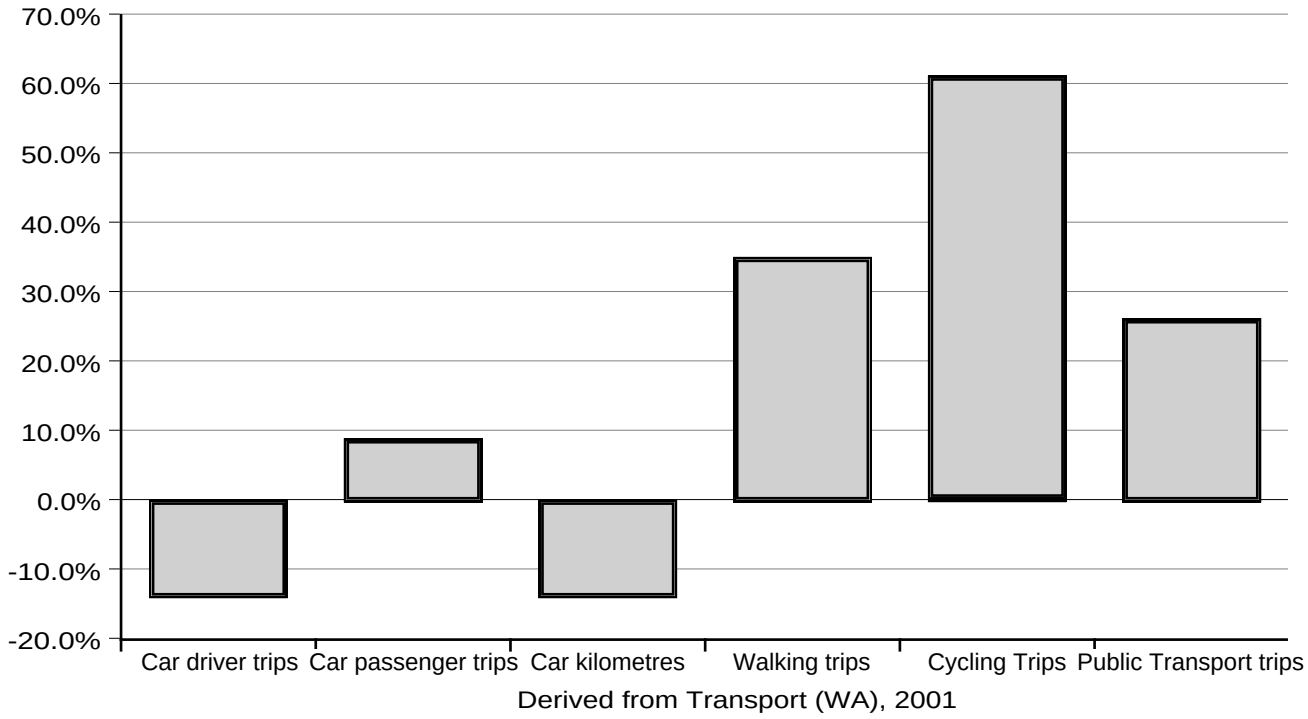
Both techniques appear to produce effects that are consistent with their intent. IndiMark has produced significant mode switches that, coupled with higher car occupancy rates, have reduced car travel substantially. Travel Blending has produced generally less significant and more variable mode shifts, but more efficient use of household cars. This suggests a degree of malleability in people's responses. Householders have delivered similar car travel reductions but through different mechanisms. There is thus the potential to gain further car travel savings if the current approaches can be modified to achieve mode shifts in the manner of IndiMark and trip chaining and improved trip planning in the manner of Travel Blending.

Benefits & Costs

Benefit-Cost analysis has been applied to both techniques, and the results from analyses of the pilot projects have been published (Ker & James, 1999, for IndiMark; and Tisato & Robinson, 1999, for Travel Blending).

Ker and James noted that there has not been a case of the re-application of IndiMark, therefore three rates of decline in the behavioural change were tested. The base case assumed a reduction to 15% effectiveness by year 10. Tisato and Robinson adopted four scenarios, in which the most optimistic involved a permanent maintenance of the behavioural change while the most pessimistic required annual awareness campaigns and a 5 yearly re-application of Travel Blending with

Figure 4. Changes in travel behaviour in South Perth



updated kits. They also introduced an option that accounted for the financial benefits of less traffic on the road network.

The results presented for the South Perth Pilot Project were varied according to the assumed sustainability of the intervention, the need for additional bus services, the benefits of reduced pollution and the value of time.

The results for Travel Blending are shown in Table 2. A 40% take-up rate was assumed, which is realistic provided that the 49% take-up rate for Dulwich-Rose Park (refer Figure 2) rather than the 29% take-up rate in the Christies Beach suburb proves to be the norm.

The median results from Ker and James' analysis gave benefit-cost ratios of 15 for the base case, and 17.4 when benefits of increased health and fitness were factored in.

A benefit-cost ratio greater than 1 means that there are more benefits than costs. In assessing modern transport infrastructure projects, where government budgets are constrained, projects generally need to achieve a benefit-cost ratio of 3 to 4. The above benefit-cost analyses show that under the most pessimistic scenarios IndiMark and Travel Blending better these ratios, and under medium expectations, considerably exceed them.

The benefit-cost ratios depend on the sustainability of the behaviour changes. Follow-up surveys were conducted on participants and control groups in the South Perth pilot project after one year and two years to test the sustainability of the change. The results were encouraging, with the aggregate behavioural changes being sustained and slightly improved on.

The cost per household if travel behaviour change techniques were applied on a large scale has been estimated as approximately US$50 (National Transport Secretariat, 2001). A travel behaviour change program capable of delivering an across-the-board 10% reduction in passenger car kilometres applied to the 410,000 households in Adelaide over, say 5 years, would cost approximately US$4 million per annum. For those with more concern about congestion and travel times than sustainable transport, the advantages of 10% less traffic generated would be considerable[1]. For those concerned about reducing the adverse environmental and social impacts of transport the benefits would be multiplied. An annual expenditure of US$4 million compares favourably with typical annual expenditure on new urban roads and urban road and intersection capacity enhancements in South Australia of around US$25 million (South Australian Government, 2001).

[1] There is of course a rebound effect whereby less traffic reduces congestion and encourages more vehicle travel. An integrated sustainable transport strategy would take the opportunity of reduced car traffic to redefine road space in favour of environmentally friendly modes.

Table 2. Benefit-Cost Ratios for Travel Blending® extrapolated to the whole of Adelaide based on the results of the 1997/98 Adelaide Pilot Project

Benefit-Cost Ratio over 30 years at 40% take-up rate	Changes Sustained without further intervention	Changes maintained by annual awareness & education campaigns	Annual awareness campaigns & 5 yearly interventions required to sustain change
Without network benefits	17	12	5
With network benefits	29	20	8

Source: Tisato & Robinson, 1999

Why Change Travel Behaviour ?

It is evident that the reasons why *participants* change their travel behaviours differ from those that governments have for introducing travel behaviour change programs. In Sydney reducing car pollution prior to the Olympics was the driving force behind the development of Travel Blending. In Adelaide, and subsequently for State transport agencies in Australia, the prime objective has been greenhouse gas abatement. For Brisbane City Council the attraction was a travel demand management tool that could be combined with local area community development. Responses from participants who reduced car travel have tended to emphasise different benefits, particularly gains in time from better organisation of household travel. Cost savings from less fuel consumption, and in a few cases, the sale of the second family car, have also been cited as benefits. Other benefits have included the 'discovery' of local facilities not previously used, social benefits to family cohesion of planning travel as a family, and the perceived personal and health benefits of walking or cycling more.

Clearly, it is important to understand what individuals gain from involvement in travel behaviour change programs. At the same time it is clear that as people's awareness of the issues increases, part of the motivation is their contribution to a better society.

Evaluation

An advantage of travel behaviour change programs is the relative ease of evaluation. Measurable changes take place within the first few weeks of the project within discrete populations (whether suburbs or organisations). The South Perth project has so far been the most thoroughly evaluated with 'before' and 'after' one day travel diary surveys of participating and non-participating households, and separate auditing of increases in local bus patronage. Evaluation methodologies are being investigated with a view to obtaining statistically reliable data on the quantifiable changes in travel behaviour and also on the quality of life changes that participants perceive.

Both of the techniques applied in Australia have been varied and improved with each new application, in response to lessons learnt. For instance, the Travel Blending diaries are designed as learning aids and form the basis for providing the customised feedback to families on how they may alter their travel patterns. They have also been used to measure the travel changes by comparison of the 'before' and 'after' diaries. Many participants find the completion of the second diary to be too onerous, so only around one third of participants fill in both diaries. A separate sample survey is required to measure the change in travel patterns, thus removing biases and also obviating the need to use the second diary for measurement purposes, so that it can be offered more as an option than an integral part of the package.

Conclusions

A challenge to transport agencies is to incorporate travel behaviour change initiatives into the bigger picture of travel demand management. The application of a travel behaviour change project without other reinforcing travel demand management activities would ultimately dissipate the gains. It would, for instance, produce the rebound effect back to car use due to less traffic congestion, but it would also increase the dissonance in public policy between the predict and provide philosophy, which is still strong in Australian transport policy, and the demand management philosophy. Household-focused travel behaviour change emphasises individual responsibility. The efforts of individuals and families to change their travel behaviour should be facilitated by the transport system, and not have to occur in spite of the system.

What the stand-alone application of travel behaviour change does suggest is that there is '*considerable slack in the existing system*' (Rooney, 1999). If reductions in car travel of around 14% can be achieved purely through the improved flow of information, without any significant supporting infrastructure or service improvements[2], then the potential of integrated travel demand management approaches should be considerably greater.

[2] There were some bus service and infrastructure improvements in South Perth, and a range of transport and community-related improvements in the Living Neighbourhoods, but these were minor reinforcing measures from a transport perspective, rather than major transport service or infrastructure upgrades.

The area-based application of household-focused travel behaviour change programs offers particular possibilities for integration. For instance, the progressive introduction of a travel behaviour change program in an urban transport corridor could be accompanied by traffic management schemes, improvements in public transport services, revised TDM-oriented local planning codes, TDM initiatives at major trip attractors, improvements to walking and cycling infrastructure and facilities, and so on.

The IndiMark™ and Travel Blending® techniques have bridged an important gap between problem awareness and behavioural change in relation to travel. By targeting individuals within households, the behaviour change interventions cover all travel activity (not just journeys to work or school) and encompass household decision-making processes where many travel decisions are made. As such there are good reasons for travel behaviour change to become a standard part of more comprehensive travel demand management programs, with the principles inherent in the current techniques being adapted to a wide range of circumstances.

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Disclaimer

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U.K. Regional Air Services Consultations: a summary of & commentary on the RASCO Reference Case

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Abstract

In July 2002 the U.K. Department for Transport released its consultations on Regional Air Services, as a precursor to issuing a White Paper designed to provide a policy framework for the next thirty years of U.K. aviation. Key among the scenarios is the RASCO Reference Case, which assumes a near-tripling of U.K. demand over 2000 – 2030 to about 500 mppa. This paper summarises the characteristics and impacts of the reference scenario, collated from the seven regional studies, and shows a clear disjunction between a commonly accepted noise threshold and the implications of Reference Case demand forecasts. Even under the politically challenging assumption of significant technological improvement by aircraft (–14 dB(A) on present 'Chapter 3' standards), enforcement of a rule of no additional daytime residential exposure to > 57 dB(A) Leq would prevent the expansion necessary to meet reference case demand at Heathrow, Stansted, Luton and Birmingham, with lesser problems at Liverpool John Lennon and Newcastle airports. There is a need for legally-binding, long-term agreements between airports and regulators, designed to phase incremental reductions in the size of populations exposed to annoying levels of aircraft noise (> 57 dB(A) Leq).

Keywords

airports, aviation, forecasting, land use planning, noise pollution

Introduction

In July 2002, the Department for Transport (DfT) released what are almost certainly the most important aviation policy documents of recent history: its consultations on Regional Air Services (see http://www.airconsult.gov.uk). In its 1998 White Paper on transportation, the U.K. Government announced that it would prepare an airports policy for the next 30 years. In December 2000 it issued a consultative document for this purpose (DETR, 2000a). The July 2002 consultation details specific regional options for where and how airport growth might be accommodated. These are based on two series of studies. The Part 1 series of Regional Air Services (RAS) studies covered the U.K. regions (i.e. outside the Southeast and East). Part 2 of the RAS programme, known as RASCO, entailed the auditing and co-ordination of the separate regional studies and their integration with a number of associated strategic studies (DfT, 2002g). The consultation period ends in the spring of 2003, following which the Government's recommendations will be made known in its White Paper on the Future of Aviation.

After setting a context of global and U.K. air traffic growth trends, this paper summarises and discusses the characteristics and local impacts of the RASCO reference scenario, collated from the seven regional studies. The paper highlights the implications for residential noise exposure and makes broad, associated policy recommendations. Its main purpose is to assist the deliberations of others forming their own views and responses to U.K. aviation policy as it develops.

Global air traffic growth

U.K. plans for aviation expansion parallel global trends – or, at least, trends in industrialised North America, Europe and latterly Southeast Asia. Since 1960, passenger traffic (expressed as revenue passenger-kilometres) has grown at nearly 9% per annum, 2.4 times the global average Gross Domestic Product growth rate (IPCC, 1999). Today there are over 18,000 commercial aircraft in service, around 1300 airlines (Endres, 2001 in Pastowski, 2003), over 1192 airports open to international aviation and world-wide over three billion passenger kilometres were flown in 1999 (ICAO, 1999 & 2000 in Pastowski, *op. cit.*). Global passenger transport activity by air has reached roughly 50 times the volume it had 50 years ago (Ausubel *et al.*, 1998 in Pastowski, *op. cit.*). Notwithstanding the effects of 11th September 2001 for aviation, together with the ongoing restructuring of the industry, the demand for fast and reliable air transport is likely to continue under prevailing market conditions. Although the rate of growth of passenger

Box 1. A brief introduction to aircraft noise measurement

By presenting a condensed summary of the forecast consequences of the mid-range scenario for U.K. aviation expansion, this paper is intended show that the scale of impacts warrants national, secure and long term legal agreements for citizens on aviation-related noise. While Directive 2002/30/EC (European Commission, 2002a) sets a framework for airport noise mitigation, it fails to establish any noise limits for citizens. Critically, setting challenging long-term targets on noise would provide support for nascent technological advances: see Mackenzie (2002) for an overview of current R&D initiatives. The following brief introduction to aircraft noise measurement provides some background to the paper's focus on the forecast 57 dB(A) Leq contour. The views of the World Health Organisation (WHO) are emphasised for their relative impartiality.

Sound level meters respond to sound in a similar way to the human ear. They usually register the root mean square of the sound pressure level in decibels and may use an A-weighting filter system to give units dB(A). This filter takes account of the way in which human beings hear high and low tones to differing extents (Mato & Mufuruki, 1999). The decibel (dB) unit for acoustic measurement is scaled logarithmically in relation to human hearing capacity. The human auditory threshold is defined as 0 dB (100 times greater than human auditory threshold), and the pain threshold as approximately 130 dB (1013 times greater than human auditory threshold). Busy street traffic at 70 dB is 10 times the sound pressure level (loudness) of a typical conversation at 60 dB.

The human ear and hence the decibel scale performs non-additively when there is more than one sound in the environment at a time. If this were not the case we would be deafened by several people talking at once nearby. The largest decibel increase that can result from the combination of two typical sounds is 3 dB (Berglund, *et al.,* 1999, appendix 5). Thus a doubling in air traffic movements would not lead to a doubling in total aircraft noise, despite the potential for increased annoyance from over-flights. While the view taken here is that the WHO (2001) guideline for community annoyance should be legally adopted as a long term target (i.e. 50–55 dB(A) averaged over 16 hours in an outside location), without aircraft becoming substantially quieter, this would likely imply substantially lower air traffic movements than the U.K. government's threshold of 57 dB(A).

LAeq,T (which is the same as *Leq,T* measured in dB(A), often written simply as *Leq* or *Leq*, is the average (integrated) energy equivalent of A-weighted sound over a time period T. WHO recommend that LAeq,T should be used to measure continuing sounds such as road traffic noise, or types of more-or-less continuous sounds such as industrial noise (Berglund, *et al.,* 1999, viii). Leq noise *contours* join points of equal monitored or forecast averaged sound energy. It is these contours that the RASCO studies have forecast. For noise involving distinct events, such as aircraft or railway noise, measures of individual events such as *LA max* or the A-weighted Sound Event (Exposure) Level (SEL) *should also* be obtained *(ibid)*. LA max is the peak sound level reached during a measurement period. The Sound Event (Exposure) Level is effectively a 1 second Leq. It accounts for the intensity and duration of the noise event and is used to compare different transient events for their total noise energy content (Porter *et al.,* 1999).

While WHO acknowledge that the above measures may ignore the complexity of individual noise perception, they take the view that the measures have the practical advantages of economy and standardisation *(ibid).* Nevertheless, WHO acknowledge the existence of many other measures for evaluating the long-term average sound pressure levels from aircraft near airports (Ford, 1987; House, 1987 in Berglund *et al.,* 1999, section 2.7.2). These include different frequency weightings, different summations of levels and numbers of events, and time of day weightings. Indeed, the European harmonised noise indicator *Lden* that must be applied in noise mapping of urban areas and major noise sources by 18th July 2004, under Directive 2002/49/EC (European Commission, 2002b), is an *LAeq,T* indicator with different weightings for noise occurring at different times of day (**d**ay, **e**vening and **n**ight). For accessible discussions of airport-community relations with respect to noise, and the health impacts of aviation, see Thomas & Lever (2003) and Hume & Watson (2003) respectively.

traffic has slowed to about 5% in 1997 as the industry is maturing in some parts of the world, growth rates of 5% per annum are expected to continue for the next 10 to 15 years (IPCC, 1999).

U.K. air traffic growth trends & forecasts

In 2001, almost 50% of the U.K. population made at least one journey by air and the U.K. accounts for over 40% of all air travel between Europe and the USA. One fifth of all international air passengers begin or end their flight in the U.K. Over 180,000 people in the U.K. are directly employed by the aviation industry, with indirect employment perhaps up to three times this number (DfT, 2002a, 7–8). The Department for Transport anticipates a near-trebling of air passengers by 2030. Current demand is some 180 million air passengers, while the mid point forecast of national demand for 2030 is 500 mppa (DfT, 2000f, p.17). Summary mid-range forecasts of passenger numbers and percentage increase on 2002 are for 2010 – 276 m, a 43% increase; for 2015 – 333 m, a 185% increase; for 2020 – 401 m, a 223% increase and for 2030 – 500 m, a 278% increase. Regarding freight, U.K. air freight doubled between 1989 and 1999 and is forecast to grow even more

Table 1. A summary of RASCO Reference Case scenarios for 2030 relative to c. 2000 for major airports in UK regions

Region	Additional Infrastructure	Terminal Passenger Increase (mppa)	ATM Increase (Annual 000s)	Employment Increase (000s) [1] [2]	Noise exposure > 57 dba Leq (Additional 000s of people) [3]	Land take (ha of Green Belt or high grade agricultural land)
South East	Heathrow: 1 new runway	52 (81%)	195 (42%)	49 (72%)	25 (8%)	228
	Stansted: terminal expansion plus 2 new runways	110 (917%)	613 (461%)	83 (830%)	22 (367%)	1200 plus significant architectural losses
	Luton: (a) runway realignment or (b) replacement & lengthening	23 (383%)	167 (309%)	12 (133%)	(a): 6 (75%) (b): 11 (137%)	100
North of England	Manchester: mixed mode after 2015 [4]	41 (227%)	187 (105%)	North West: 41 (240%)	21 (48%) to 0 (1%) [5]	Unspecified
	Liverpool John Lennon: runway extension	6 (334%)	83 (259%)	North East: 8 (155%)	6 (238%) to 3 (108%)	High bio-diversity sites at risk to west
	Newcastle: runway extension	6 (186%)	37 (84%)	Yorks & Humber: 8 (262%)	3.5 (292%) to 3 (108%)	Newcastle: 203 ha allocated
Midlands	Birmingham: 1 new wide-spaced runway [6]	28 (380%)	143 (128%) [7]	14 (154%)	144 (423%) to 83 (244%)	450 - 600
Wales	Cardiff International: terminal & stand expansion from 2015	3 (213%)	25 (125%)	3 (387%)	1 (900%) to 0 [8]	0
Scotland [9]	Edinburgh: 1 new runway	14 (262%)	144 (162%)	23 (222%)	0 (-5%) [10]	> 200
	Glasgow: terminal & apron expansion	9 (133%)	71 (79%)	19 (126%)	17 (68%)	minor
South West	Bristol: runway extension, 1 new parallel taxiway & second terminal	13 (448%)	63 (180%)	7 (64%)	1 (20%) [11]	None [12]
Northern Ireland [13]	Belfast International: terminal expansion or addition; new stands & apron [14]	7 (216%)	72 (167%) [15]	8 (126%)	0 [16]	None specified

Notes (all figures are rounded to the nearest 1,000,000 or 1,000 as appropriate)

1. The employment figure typically constitutes direct plus indirect & induced jobs. For indirect jobs, DfT have applied varying multipliers, similar to a 1.3 multiplier to the direct jobs total, & for induced jobs a 0.3 multiplier. Indirect jobs are those directly dependent on airport expenditure; induced jobs are those supported by the expenditure of direct & indirect airport employees. DfT note that assumptions over productivity growth are very significant & can be more important than the choice of growth scenario for the employment forecast. For example, for Scotland, 'the difference between 0% & 2.5% productivity growth under the RASCO Reference Case scenario is 40,000 jobs; the difference between the RASCO Reference Case & the UK Wide Constrained case is only 30,000 jobs.' (DfT, 2002i, p.127). In Table 1 a 1% productivity growth assumption is used throughout for consistency, though this is most appropriate to areas with higher unemployment rates & hence with lower incentives for investment in automation (e.g. of airport services such as baggage handling & catering).

2. For the SE & Scotland, employment forecasts are relative to 1998 (DfT, 2002g, p.56; 2002l, p. 126).

rapidly over the next 10 years (p.45). It currently represents 20% by value of all visible U.K. trade. DfT forecasts show freight traffic in the Southeast increasing from 1.8 million tonnes today to 6-8 m tonnes by 2030. Night time movements may increase from 13,000 today to 40,000 at the four main Southeast airports *(ibid.)*.

One of the Government's stated reasons for permitting this level of growth in the Southeast is fear of losing air traffic and routes to continental hubs, and hence damaging the prospects of retaining a London hub (DfT, 2002a, p.6). The large number of transfer passengers at hub airports (forming one quarter of Heathrow's total passenger number in 2000) (*ibid,* p.9) enables economies of scale through reduction of marginal costs relative to alternative routing arrangements. However, given the level of demand in the Southeast of England, the Government's implied concern over a substantial loss of *existing* (rather than new) business from Heathrow is questionable. DfT tell us that in 2000, 53% of air passengers to or from the U.K. started or finished their journeys (i.e. had journey origins or ultimate destinations) in London, the Southeast or East (ibid, pp.12-13). Most of these 95 million people wanted to land at or take off from a London airport and it can be reasonably assumed that this pattern of demand will continue to exist regardless of whether or not London's aviation capacity is expanded. Indeed, if London demand can be assumed to remain strong, the main threat to Heathrow's hub status may be less its congestion and more the development of Stansted.

Notes to Table 1 continued

3. 57dba Leq is a long term average of sound levels & has been chosen here from DfT's three noise exposure levels (the others being >63 dba Leq & >69 dba Leq) because DfT (2002a) cites it as the level of 'onset of significant annoyance'. The World Health Organisation recommends a limit of 55 dba LAeq (averaged over a 16 hour period) as a level of 'serious annoyance' for people outdoors in the daytime & evening (Berglund, 1999). WHO night time limits are stricter.
4. Mixed mode: an arrangement with landings & take-offs on the same runway.
5. Where a range is given in this column, for all regions, the first figure assumes a -8dba reduction on Chapter 3 standards per aircraft using present technology, & the second figure assumes a –14dba improvement using improved technology (DfT, 2002h, p.126).
6. Of the options for Birmingham airport, only a wide spaced runway would accommodate RRC passenger demand forecasts up to (and beyond) 2030 (DfT, 2002b), though the existing single runway would not reach capacity until the early to mid 2020s. The option of a new Midlands airport between Coventry & Rugby is not listed as it is not a necessary condition of meeting RASCO-level demand. (Moreover, DfT consider it economically viable only if no or at most one new runway is built in the SE, & Birmingham airport closes [DfT, 2002d]. These seem unlikely conditions, though the new airport would have the advantage of removing 80,000 people from Birmingham's > 57 dba Leq contour. An additional runway for East Midlands Airport (EMA) is not listed as this, too, is not necessary to meet the RASCO demand forecast for EMA.
7. ATM forecast based on figures in Table 3.3 of DTLR (2000).
8. Following DfT (2002e), the noise exposure estimate for the High Growth scenario is used here because this most accurately reflects the ATM under the base case that the RASCO scenario is intended to represent.
9. Similarly, (DfT, 2002i) for Scotland, the Alternative Scottish Base Case is used for passenger, ATM & employment estimates, as this is most likely to represent the base case that the RASCO scenario is intended to represent (ibid). As no options for an additional runway at Glasgow are forecast to be economically viable by 2030 (DfT, 2002i, p.176), they are not listed here. The Edinburgh runway options would not be viable until 2023 (ibid).
10. This decrease in exposed population is forecast to increase only marginally with an extra runway (DfT, 2002i, p. 131).
11. It is worth noting that the forecast increase in noise exposure for Bournemouth (Leq >57) is relatively substantial, at 4,800 people (380%) under a present technology (-8dba) assumption (2,100, 233%) for the improved technology assumption (-14dba).
12. But Bournemouth is identified as having several high wildlife value sites at potential risk from increased activity.
13. For Northern Ireland, DfT (2002k, p.54) considered that the standard RASCO Reference Case would underestimate demand. This scenario has therefore been replaced with a (high growth) UK Unconstrained (UKU) forecast based on the RAS Base Case & a modification of the RASCO Facilitating Growth Scenario to account for the low cost sector.
14. The runway at Belfast City & runways at Belfast International are sufficient to cater for demand under all scenarios (2002k, p.63). Limited terminal expansion would be necessary at City.
15. This is stated as passenger-related ATM (2002k, p.67). Although DfT (ibid, p.61) state that 'Belfast International is expected to see significant levels of freight, rising from 31,000 tonnes in 2000 to 172,000 tonnes in 2030 under both modelled scenarios', a separate figure for freight ATM is not provided.
16. Additional population exposure at Belfast International is minimal under both -8dba & -14dba assumptions. However, at Belfast City the population exposure increase is more significant, being forecast to range from +10,000 to +7,000 people under the reference case for the two respective technology improvement assumptions.

Local consequences of expansion

For consistency in forecasting, the RAS studies use the same set of four scenarios. The *RASCO Reference Case* assumes regional growth plus significant new runway capacity (about 300 mppa) provided over the next 30 years at London airports. The *Southeast Constrained Scenario* permits regional growth in line with forecast demand, but constrains London capacity at about 150 mppa (compared to 114 mppa in the Southeast in 2000 [CAA, in DfT, 2000g, p.36]). The *U.K. Wide Constrained Scenario* limits growth throughout the U.K. to that with current planning permission or support. The *Facilitating Growth Scenario* assumes that demand is encouraged to grow and is provided with the necessary capacity. Although Government decision-making is still at a nominally consultative stage, it would be reasonable to assume that the *RASCO Reference Case* is currently near to the Government's preferred scenario. The RASCO Case assumes an expansion of infrastructure to cater for the DfT's forecast tripling of demand over 2000 – 2030, with about 300 mppa of the 500 mppa passenger total travelling to or from the Southeast.

Tables 1 and 2, with notes, summarise some of consequences of the RASCO reference scenario. For brevity, only the larger airports in each region are listed. Omission of smaller airports should not be taken as implying an under-rating of their local positive and negative impacts. Percentage increases, which are perhaps the simplest way of conveying change, have been calculated for the tables below where necessary, and numbers are rounded to the nearest whole million or thousand as appropriate.

While the figures in Tables 1 and 2 and associated notes should be self-evident, some additional comments are necessary. In terms of noise exposure, the 57 dB(A) contour is used here as a key measure, as this is the commonly accepted standard for the onset of 'significant community annoyance' (DfT, 2002h, p.122). Noise limits based upon averaged sound energy emitted by aircraft over a specified time period (e.g. expressed as a 16 hour day Leq) are a common environmental control at airports (Thomas & Lever, 2003). Manchester Airport, for example, has a legal

Table 2 Exposure to > 57 dba Leq noise and EU Nitrogen dioxide limit exceedance c.2000 & 2030 at UK airports under the RASCO Reference Case Scenario or equivalent

Larger airports requiring new infrastructure to meet RASCO Reference Case Demand [1]	Current number of residents exposed to excess NO2	Future (2030) number of residents exposed to excess NO2	Current number of residents exposed to > 57 dba Leq	Future (2030) number of residents exposed to > 57 dba Leq	
				-8 dba	-14 dba
Heathrow	Not specified	33000 [3]	307000	332000 [4]	Not specified
Manchester	0 [2]	None specified	43400 [5]	64300	52600
Stansted	0	<300	6000	24000	Not specified
Birmingham	0	20	33700	178000	117400
Glasgow	0	0	25000	41900	28700
Luton	0	0-50	8000	6,000 – 14,000 [8]	0 – 150
Edinburgh	0	0	4400	4200	3900
Newcastle	0	0	1200	4700 [7]	3800
Belfast International	0	0	600 [9]	900	700
Bristol	0	0 [6]	1000	2000	1300
Liverpool John Lennon	0	0	2600	8800	6700
Cardiff International	0	0	100	100	100

Notes
1. The new infrastructure options are as stated in Table 1.
2. Based on Manchester Airport's detailed modelling (DfT, 2002b, p.122). For regional airports, Underwood et al. (2001, p.iv) also state 'for non-roadside receptors, no off-airport exceedances of the current objectives for NO2 and PM10 are predicted around any of the airports in 2005 and 2010. Similarly there are no predicted exceedances of the current objective for the 99.8th percentile of 1-hour mean NO2 concentrations (200mg/m3) at representative terminal locations at any of the study airports in any of the future cases considered in 2005 and 2010.'
3. This could fall to some 5,000 people with 'determined action by the aviation industry to reduce harmful emissions' (DfT, 2002a, p.24). DfT (ibid, p.24) state: 'The Government could only decide in favour of a third runway at Heathrow if there was a robust strategy for ensuring that the UK could meet its international obligations'. Yet, even the Maximum Use (no new runway) scenario is forecast to lead to NO2 exceedances for 14,000 people by 2015 (DfT, 2002g, p.55).
4. Corresponding figures for other noise levels are: >60 dba Leq: 154,000; >63 dba Leq: 73,000; >66 dba Leq: 26,000. Note that DfT's noise forecasts for the SE (DfT, 2002g) do not supply –14 dba estimates. It is assumed here that the forecasts provided are based on the –8 dba assumption. As with all of the –8 dba forecasts, these should be overestimates if ICAO's recent –10 dba requirement by 2006 is met.
5. Population exposure for the 63 dBA Leq contour is 8,000 and for 69 dBA Leq is 1,000 people (DfT, 2000b, p.121).
6 Bristol's air quality should be kept under review in the light of tighter EU limits and if a runway extension is proposed (DfT, 2002l, p.113).
7. Newcastle Airport's detailed modelling suggests 3000 people (DfT, 2002b, p.124.
8. Worst case forecasts, based on the assumption of no new capacity being built in the SE (DfT, 2002a, p.78).
9. Note that despite fewer passengers and ATM, Belfast City airport's urban location led to a residential population of 4,000 exposed to > 57 dba Leq in 1999; in 2030 its –8 dba forecast is 13,700, and its –14 dba is 11,400 exposed people.

requirement not to increase the extent of its daytime 1992 60 Leq contour until 2011.

Use of a > 57 dB(A) Leq noise exposure contour as a key decision-making criterion, however, would lead to some unpalatable implications for the Government, particularly in conjunction with some of the other consequences of expansion. Firstly in the Southeast, Heathrow already causes officially defined noise annoyance (> 57 dB(A) Leq) to a very large population of 300,000 people. While a new runway would increase this noise exposure by 'only' 8%, the most optimistic aircraft technology assumptions would still leave 5,000 residents exposed to levels of Nitrogen dioxide which breach EU limits (DETR, 2000b). When serious concerns over the underlying aquifer, excess water demand and consequences for nearby water-courses are added to this (DfT, 2002g, p.53), the environmental case against a third runway looks strong. This case would be further (though unnecessarily) strengthened by a decision to significantly develop Stansted, which could in time take the bulk of new Southeast traffic. Regarding Stansted, two new runways would lead to significant new urbanisation (an additional 144,000 jobs) in a region that is not in particular need of development, and it is not at all clear that the fears for Heathrow's hub status are sufficiently grounded to

justify this.

Secondly, the noise impacts of a new wide-spaced runway at Birmingham airport, necessary to meet the RASCO level demand, are high at 144,000 to 83,000 additional people (> 57 dB(A) Leq contour), depending on technology assumptions. While the Midlands region in general would benefit from an additional 14,000 jobs, these would come at the cost of more than a 200-400% increase in the population exposed to 'annoying' noise. Thirdly, in the North of England, additional air traffic in the RASCO scenario would bring *relatively* low numbers of additional people under the > 57 dB(A) Leq contour *if* the –14 dB(A) assumption can be realised. Even then, Manchester Airport would continue to expose the current substantial number of over 43,000 people to > 57 dB(A) Leq. Fourthly, and in contrast, airport developments up to RASCO demand levels in Scotland (with the notable exception of noise exposure at Glasgow airport), the South West and Northern Ireland would have *relatively* low environmental impacts.

Table 3. Exposure to > 60 dba Leq noise c.2000 & 2030 at selected U.K. airports under the RASCO Reference Case Scenario*

Larger airports requiring new infrastructure to meet RASCO Reference Case Demand [1]	Current number of residents exposed to > 60 dba Leq	Future (2030) number of residents exposed to > 60 dba Leq with a –8 dba assumption
Heathrow	291,000	263,000
Stansted	3,800	30,000
Birmingham [2]	5,600	72,700
Luton	6,200	9,600 – 4,100 [3]

Notes
* Only for airports for which the necessary information is available in the RAS consultation
1. Infrastructure as detailed in Table 1
2. Modelled noise increments at Birmingham were > 57, > 63 & > 69 dba Leq
3. The second figure is a forecast with a –14 dba assumption

On the basis of the RAS consultation results, even under the politically challenging assumption of significant technological improvement by aircraft (–14 dB(A) on present 'Chapter 3' standards), enforcing a rule of no additional daytime residential exposure to > 57 dB(A) Leq would prevent the infrastructure expansion necessary to meet reference case demand at Heathrow, Stansted, Luton and Birmingham, with lesser problems at Liverpool John Lennon and Newcastle airports. With a threshold of > 60 dB(A) Leq (30% more averaged sound energy), however, the noise-based case against expansion at these airports is less clear-cut. Table 3 shows that the population exposed to > 60 dB(A) Leq would increase over 7 times around Stansted and by a worrying 13 times at Birmingham. Yet exposure around Luton airport could decrease under technologically improved conditions and should decrease under standard technological conditions at Heathrow.

Use of environmental limits in airports policy

While the RAS consultations state that the Government is committed to ensuring that the long term development of aviation is sustainable, this is meant in terms of striking a balance between the social and economic benefits of air travel and the environmental effects of any developments, rather than any necessary commitment to environmental limits. Commentators will have their own and differing views on how to balance the tradeoffs involved. Here, the position taken is that there should be a presumption against exceeding environmental quality thresholds, in this context particularly for noise (typically using > 57 dB(A) Leq as a threshold) and air / water quality (using EU and Environment Agency limit values), plus a presumption against built development on land of high grade agricultural or biodiversity value.

Yet it would be unrealistic to expect aviation to immediately contract to meet difficult environmental targets. A more plausible approach would be legally-binding noise contraction commitments between airports and a regulator (though in the U.K. there is a regulatory vacuum on airport-related noise). Generally, for airports with residential populations within the > 57 dB(A) Leq contour, these agreements would be designed to steadily reduce increments of the exposed population over agreed time periods. This would also require the commitment of airlines and aircraft manufacturers. Yet environmental policy, economic activity, technology and public opinion exist in a dynamic and mutually influencing system. A policy of phased enforcement of environmental limits would drive concomitant economic and technological change, particularly (and perhaps necessarily) if enforced over a high traffic region such as the EU. Lack of enforcement has led to the present situation of over 400,000 people in the U.K. exposed to levels of 'annoying' aircraft noise. Notwithstanding differing perceptions of aircraft noise, this is a very substantial level of excess exposure. Flexibility on the particular noise threshold chosen could in principle be made for regions with populations in urgent need of development or undercapitalised air fleets.

Conclusion

This paper has summarised the main implications of RASCO reference case demand as set out in the U.K. Regional Air Services consultations and has shown a clear disjunction between a commonly accepted noise threshold and the implications of U.K. Government demand forecasts for air travel. Hypothetical enforcement of a rule of no additional daytime residential exposure to > 57 dB(A) Leq would prevent the expansion necessary to meet reference case demand at Heathrow, Stansted, Luton and Birmingham, with lesser problems at Liverpool John Lennon and Newcastle airports. There is a need for legally-binding, long-term agreements between airports and regulators, designed to phase (where necessary) incremental reductions in the size of populations exposed to annoying levels of aircraft noise (> 57 dB(A) Leq). Enforcement of such residential exposure standards, preferably at EU level and with flexibility for special cases, will be necessary to at least mitigate the impacts of forecast growth in the U.K.

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Had enough of Auto-dominance yet?

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Abstract

With future urban growth, we are facing a serious problem of even greater congestion, with all its unpleasant side-effects than at present. Solutions based on 19th century transit systems, such as light rail, have not proved effective in shifting commuters from automobiles – rather they have moved passengers from existing modes, such as buses. It is time to look carefully at cutting edge alternatives which can offer a high speed, clean, efficient and seamless journey.

Keywords

Buses, light rail, Seattle, transit

Introduction

Despite good intentions, recent huge investments in conventional public transit such as light rail and bus services have been shown to be quite ineffective in dealing with current, let alone, future congestion, pollution and safety problems. A recent study from Harvard University has reviewed a dozen new light rail systems in U.S.A. It concluded that none of them were successful, none of them even came close to achieving the riderships they had promised, three-quarters of the customers were former bus riders, and many of the bus companies then went out of business. Furthermore, none of these expensive light-rail systems has had any measurable effect upon traffic congestion, pollution and safety. And, Seattle's controversial light rail plan is now estimated to cost more than $150 million per mile, take most of 10 years to construct and is not expected to even make a dent in future congestion.

Yet conventional light rail continues to be viewed as the 'only way out' by those who are unaware that a different and better urban transportation future is possible. Calls for greatly increased investments in 'public transit' are popular with both environmentalists and politicians. While many agree that more money should be spent on alternatives to the auto, it is abundantly clear that investing more money in conventional light rail will not do anything significant to reduce congestion and auto-dominance in the future.

Current forecasts indicate that the population of the Willamette Valley, Oregon, will increase by about 2 million between now and 2050. If current or increased levels of auto ownership are maintained during this 50 year period and road-building and maintenance does not keep pace with this growth, it is very likely that our cities will be overwhelmed by autos long before we arrive at 2050.

Is there truly no way out? Or, are their some little-known transit alternatives that might help us to achieve a more livable and a less auto-dominated future?

Fortunately, there are. A diverse group of people around the world are working diligently on a variety of solutions that they believe could produce a better future, one that would provide a reasonably high level of personal mobility without requiring us to suffer the negative attributes of auto-dominance.

Some alternatives to more & more autos

There are three major urban transportation concepts that are being investigated around the world today. One is called Personal Rapid Transit (PRT), a second is called Group Rapid Transit (GRT) and the third is called Dualmode Transportation. All differ from conventional rail transit in that they use small electric vehicles, provide frequent direct service, cost much less and provide auto-like personal mobility.

Personal Rapid Transit

The PRT concept calls for small automated vehicles that are operated on elevated, exclusive guideways. A large number of stations would be provided so that patrons could access the system with a short walk and then have a non-stop, stressless and view-rich ride to the station nearest their desired destination. A PRT system would be available all of the time, would be electrically-powered and essentially pollution and noise free. The service provided would approximate that of a private auto in terms of travel time and surpass it in terms of safety, reduced stress and adverse environmental impacts.

Group Rapid Transit

GRT is a term that refers to a service very much like PRT, except that the vehicles are larger as are the guideways and stations. Some have off-line stations which makes non-stop service possible but some do not and have to stop at each station. Stations would be fewer in number but service would be quite frequent.

GRT systems are likely to be more expensive than PRT systems but may provide more capacity although at a somewhat slower average speed.

Dualmode Transportation

Dualmode transportation differs from PRT and GRT as its vehicles can be operated on both the conventional street system, similar to an auto but can also travel on an automated guideway under computer control. Clearly, such a system can provide door-to-door service which neither a PRT nor GRT system can do. Otherwise, the concepts are similar in most respects. Both need elevated guideways while a dualmode system needs far fewer miles of guideway and far fewer stations than PRT or GRT. Travel on the automated part of the system would be hands-off, visually exciting and probably somewhat faster than comparable PRT and GRT networks.

Don't get too hopeful. None of these systems, if implemented, could be expected to replace the auto and leave the conventional roadway system empty and unused. But, depending on how intelligently they are deployed, they do offer a significant potential for reducing auto dependence without significantly reducing our cherished high levels of personal mobility. Their main advantage is that they 'fit' the very diffuse travel patterns that are characteristic of the 21st century American city – which conventional radial rail systems simply cannot do.

Moreover, neither would these alternative systems require the huge costs and disruption that have been experienced in tearing up and tunnelling under our cities to build conventional rail systems. In fact, all of these systems would be much easier to 'fit' into existing urban areas, with minimal construction impacts and disruption to business and living patterns.

Seven examples of emerging innovative transit systems

Only very brief descriptions are provided here. More details and numerous illustrations are available at the websites for each technology.

There are three Personal Rapid Transit systems under development at the present time. One is called TAXI 2000, based in Minnesota. Development of a second, called Ultra Light Rail (ULTra) is underway in the U.K. A third, called SkyTran, is being developed by a company based in the U.S.A.

The TAXI 2000 concept is very well-developed and is now a leading contender for a downtown circulator application in Cincinnati, called SkyLoop. If all goes well, it will be the first PRT application in the U.S.A. TAXI 2000 is now a global leader in PRT technology.

The ULTra concept has been developed at the University of Bristol in the U.K and is now being actively pursued by a private spin-off company. It is similar in its service attributes to TAXI 2000 but features a larger vehicle and a different type of automated guideway. Its first application is likely to be in Europe.

SkyTran is quite different from TAXI 2000 and ULTra. It would provide a small (2-person), very fast vehicle, suspended from a very slim guideway. Using magnetic levitation for propulsion and suspension, it would provide low cost and very fast service throughout a metropolitan area.

Austrans is a Group Rapid Transit technology now being pursued in Australia. Its small, lightweight vehicles provide 8 seats and use steel wheels on steel rails. It is particularly well-suited to travel within urban areas and can be fitted into existing urban environments quite easily.

Another GRT system is called CyberTran. It is a passenger and light cargo transportation system that would use large numbers of small (6–20 passengers), light weight (10,000 lb. loaded), electrically powered, computer controlled (no driver) vehicles operating on rails mounted on an elevated or ground-level exclusive guideway. It would provide speeds that range from tourist (20–40 mph), to urban (40–75 mph), to high speed (75–150 mph).

The leading Dualmode Transportation concepts are being developed in Denmark and Texas. The Danish system is called RUF (rapid, urban, flexible) and it represents a blend of rail and roadway attributes. It features small, electric individual vehicles and a larger 10-passenger electric vehicle for group travel. Both vehicles can be operated on the conventional roadway system and can also travel on a special RUF monorail under full computer control. Door-to-door travel is featured and it is essentially environmentally benign.

MegaRail is currently the leading U.S. dualmode concept and is being developed in Texas. It differs from RUF in substantial ways but would provide the same kind of service attributes. A PRT version, called MicroRail and a heavy cargo version are also being developed. Prototypes are now under construction and will be available for inspection during 2001.

Implementation opportunities & problems

To repeat an important and often misunderstood point, none of these systems can be expected to displace totally the greener and more efficient autos that automakers will be producing in the future. However, if they can be sufficiently developed, survive rigorous testing programs and become market-ready at a competitive price, they should find quite a large number of ready and willing public and private customers. Clearly, there are both technical and non-technical challenges yet to be overcome.

Perhaps the greatest technical challenge that they all face is the development of a highly reliable

software package that is needed to control a large number of vehicles that would operate in a fully-automated mode. Such software packages have been developed and tested in limited ways but none have yet been subjected to tests that involve large numbers of the general public, some of whom behave in unexpected ways at times. Yet, large-scale PRT simulations have been conducted that offer evidence that such systems can be expected to perform effectively on large urban networks involving thousands of vehicles and hundreds of stations. Clearly, small networks should be constructed first and tested with riders from the general public to verify these promising computer-based simulation results. Dualmode transportation systems face similar problems and have yet to be tested as extensively as PRT and GRT systems using computer-based simulation models.

Another problem has to do with the common reaction that these systems are not 'mass transit' systems and therefore don't have the capacity needed to carry large numbers of people from place to place. But, studies have shown that these system do have the capacity needed to meet the requirements of the great majority of potential urban applications in the U.S.A. Still, most people simply don't believe such results because they don't understand that the capacity requirements in most urban and intra-urban applications are far lower than they imagine and that the larger capacities provided by conventional transit systems are simply not needed to serve the vast majority of the very diverse travel movements we currently can observe in our cities.

The capacity of a PRT system, for example, has to be measured by its ability to move a large number of people over a network between a large number of stations – with only a minimal wait time at the station. One has to rely on a computer-based simulation model to make such a calculation because one can't do it in their heads or by resorting to 'common sense' notions. A recent large-scale PRT simulation of this type was done for the entire city of Gothenburg, Sweden, and it found no serious capacity problems in the city-wide PRT network.

An example of a non-technical problem that all elevated technologies have to face has to do with the visual intrusion of elevated guideways in various urban settings. Many static illustrations and computer-generated animations of 'what it would look like' in various urban locations have been created. Still, there is considerable uncertainty about how the public will react to the prospect of these structures being placed in their communities. Reactions are likely to be highly variable and often quite unique to a particular location and set of community traditions and values. Useful studies of various ways of mitigating the visual intrusion of elevated guideways have been conducted in Sweden and many other countries. The main trade-off involved is between visual intrusion and the greatly improved safety offered by these new technologies.

Other technical, non-technical and public policy issues can be examined by looking at the Frequently Asked Questions sections of the websites for each technology. Most of these are quite extensive, having been developed over several years of vigorous web-based and personal discussions among advocates and their protagonists.

How might they be used in Oregon's Willamette Valley?

Since most of the population growth is expected to occur in the Willamette Valley in the future, how might these technologies by used to help maintain high levels of personal mobility and land use objectives while reducing auto-dependence? Here are some application ideas.

Personal Rapid Transit and Group Rapid Transit systems can be most helpful initially in providing circulator service in high density, badly congested activity centres and overcoming barriers to movement such as freeways, rivers and other obstacles. SkyTran could be used to connect population centres to more distant locations such as a remote airport located between Portland and Seattle or to provide fast travel to various locations on the Oregon coast and other popular recreation sites. Austrans could be used to connect various locations in the suburban areas, serving intermediate all-day travel volumes. CyberTran would be an ideal replacement for Amtrak service in the Valley, proving much faster and more frequent service at a much lower cost.

Dualmode Transportation systems could provide for fast, safe travel throughout the entire valley for a fraction of the cost of conventional rail and highway systems. And, do so with little or no negative impact on the environment. Station locations would have to be carefully selected so as to help maintain land use goals rather than undermine them. Some of the abandoned or little-used rail lines in the valley might provide the needed right-of-way, bringing them back into productive use.

What can be done now?

How can interested residents of Oregon encourage the evolution of these and other transportation alternatives and help reduce the prospect of living with the continued dominance of the auto? Several activities can be suggested. One would be to request that the Legislature direct the Oregon Department of Transportation to conduct continuing assessment studies of the most promising alternatives and help educate people about them.

A more useful aim would be for the state to fund an incubator facility that could assist various inventors to develop and test their technologies to make them market-ready. Or, Oregon could join with Washington or California to establish and fund such a facility. Such an incubator already exists in California but it is currently focused only on the development of cleaner and more efficient autos.

Concurrently, studies need to be conducted to determine how various technologies might 'fit in' most effectively with the current highway, rail transit and land use systems in Oregon. Probable land use impacts would have to be carefully considered as a careless application of any new transportation technology could encourage sprawl and have adverse effects on the maintenance of urban growth boundaries and other land use goals. In fact, the proper use of appropriate non-auto technologies could greatly assist in the achievement of land use goals and actually help maintain and preserve many of the environmental amenities so valued by Oregon's residents.

It will take some determined effort to find attractive and cost-effective ways to avoid building more highways and conventional rail transit routes. But, at least there are some attractive possibilities on the horizon that one can use to stimulate innovative thinking about the urban and intercity transportation problems of the future. If enough people get interested and active, perhaps Oregon could become a national leader in encouraging them and even foster some new local transportation industries in the process.

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Personal Rapid Transit Technologies

TAXI 2000 http://www.taxi2000.com

ULTra http://www.atsltd.co.uk

SkyTran http://www.skytran.net

Group Rapid Transit Technologies

Austrans http://www.aebishop.com

CyberTrans http://www.cybertran.com

Dualmode Transportation Technologies

RUF http://www.ruf.dk

MegaRail http://www.megarail.com

Descriptions of more than 50 innovative transportation technologies from around the world can be found at http://faculty.washington.edu/jbs/itrans

Emerging Innovative Transit Systems: A sceptical view

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Abstract

This is a response to 'Had Enough of Auto-Dominance Yet?' by Jerry Schneider who advocates the use of new high-tech modes of transport. The origin of these modes appear to lie in the simplistic notions that there can be the prospect of transferring onto them a significant proportion of journeys currently made by car and that, from an environmental and ecological perspective, as they are 'public' transport, they are unquestionably 'good'.

Keywords

cars, progress, mass transit, public transport

As the 20th century progressed down the road towards delivering people's aspiration for ever-improving levels of motorised mobility, so too did identification of a range of problems that come in its wake. Not least of these was the fact that the three prerequisites of optional car use – adequate age, income and of course ability to pass the driving test – could never be met by the majority of the population. Sadly, this was not acknowledged as sufficient justification for *not* attempting to maximise the number of people who could benefit.

In any case, it soon became apparent that there are limits to the number of adults who can travel further and faster when they wish, and to do so in the type of comfort, personal environment and relative safety that the car makes possible. It was seen that, other than in the very small number of new settlements that could be largely planned for its unrestricted use, other ways would need to be found to fulfil this aspiration.

This realisation has led to research into and developments of other motorised transport systems the role of which is no longer, as in the past, simply to provide a reasonable public service for those without access to a car. It is aimed at *improving* on the car's characteristics, the intention being to attract people out of their cars. The longer the journey that has to be made, the easier it is for high speed rail to offer that alternative. But far more of the transport problem is urban in origin. It stems from the multiplication of the more common journeys that people choose to make in their daily lives which require covering relatively short distances and which contribute disproportionately to congestion, danger and pollution.

It is against this background that recent 'brochure-attractive' developments, in the form of *Personal Rapid Transit* (typically 2-person), *Group Rapid Transit* (typically 8-person) – both consisting of computer-controlled automated vehicles running on elevated guideways – and *Dualmode Transportation Systems* which can also run at street level, have been proposed in recent years. Their proponents believe that these systems could play a major role in providing a high level of motorised mobility without the penalties that mass car use incurs.

Their origin appears to lie in the simplistic notions first, that there can be the prospect of transferring onto them a significant proportion of journeys currently made by car and that, second, from an environmental and ecological perspective, as they are 'public' transport, they are unquestionably 'good'. This is highly misleading for a number of reasons.

1. A realistic matching of the *door-to-door* convenience and comfort of the car is not often possible. In common with public transport generally, these systems tend to have a linear form that does not fit locations either of high population density or of low density with its dispersed patterns of points of arrival and departure that the car has so singularly encouraged. Their application would be limited to areas entailing some walk to the 'station', a wait for the vehicle, and then some walk to the destination. Just considering the element of travel time, speeds in them would have to be very high to begin to compete with the car.
2. All the systems are costly to develop and put in place for public use. Not only does their construction depend on public subsidy but also the fares to ride on them. But why should these funds be used to lower the costs of travel on them? Is the explanation that, without subsidy, people would otherwise use their car? If so, it does not stand up to scrutiny: much recent evidence from the U.K. and the U.S.A. reveals low use of new high quality public transport systems by people who had previously made the equivalent journey by car – in spite of the considerable direct and indirect subsidy of travel on them. For instance, on the new Manchester Metro, the Sheffield Supertram and the Croydon Tramlink, the proportion is only about one in five.

3. There can be no assurance that technology will be able to ensure a totally reliable service when it is called upon to cover 'thousands of vehicles and hundreds of stations'. But even a slight failure or breakdown in the system would severely disrupt a large number of people's lives. Associated with this too is the problem of vandalism as the vehicles and stations will open up widespread opportunities for people with a grudge against society which can find its outlet in damage that is costly to rectify. Considerable surveillance would be needed to minimise this risk.
4. There is the issue of visual intrusion as all the systems require an infrastructure elevated to clear high vehicles travelling at road level. Their proponents describe the prospective ride on them in the vehicles to be used as 'view-rich'. It seems unlikely that this would be a description that would be selected by those living or working in buildings facing them.
5. Lifts or escalators to take passengers up to and down from the 'stations' would not be a viable proposition as they would be too costly. Those with difficulty in getting around and climbing long flights of steps at either end of their journey – and on the return journey – would therefore be precluded from using the systems.
6. As with improved road capacity to meet the predicted increase in demand for private transport use, high quality systems would encourage the adoption of longer and therefore more energy-intensive patterns of activity. The consequences of this need to be considered in relation to climate change. It is now becoming widely recognised that, to combat climate change, *dramatic* reductions in our use of fossil fuels must be made. Whilst the proponents of these systems would no doubt argue that as they would run directly on electricity or indirectly on it from batteries, renewable energy or nuclear sources could be used. This is regrettably an unrealistic scenario since it is inconceivable that, even with a vast programme of construction, such a solution could be on offer within the relatively short time scale foreseen for these systems being operational.

Unless these fairly wide-ranging concerns about such systems can be adequately allayed, there would appear to be insufficient justification for supporting further development of these costly, albeit innovative, approaches to dealing with the urban transport crisis.

A challenge for the imagination: How will ubiquitous wireless change cars?

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Abstract

Personal transportation has not been touched nearly as much by the information revolution as other sectors. The Wireless Internet on one side, and global warming and congestion on the other, will accelerate change. Will car-to-car communication make roads sufficiently safer and more efficient to extend the reign of the private car? Car sharing appears positioned to benefit more, but replacing fixed public transit with intelligent jitneys is most likely to offer order-of-magnitude improvement.

Keywords

Cars, communication, information technology, internet, technology

Enlisting information in the fight against pollution, congestion & global warming

Why are cars so inefficient? A major reason is that they move more metal than people. The difference between a soccer mom in a Lincoln Navigator or four football players in a Toyota Echo is only a matter of how much the car outweighs the passengers: a factor of fifty or three.

Is moving people even the right measure? Should you count people-miles or pizza-miles if you drive five miles to pick one up at Pizza Hut? Person-miles or kid-miles when mom drives her toddler to school and deadheads back home?

The place to start in solving the 'car problem' is to examine the problems that the car solves in the first place. Why are we so addicted to them? Having figured that out, we will have to present consumers with an attractive alternative. Most people's consciences are attuned to the virtues of walking, bicycling and public transit. They drive because convenience trumps virtue.

Information technology may change the game. Computer 'mileage' has grown a million fold during the 30 years it has taken to double automobile mileage. And, while auto mileage improvements have recently stalled, computer power, storage capacity, and communications speed still follow Moore's Law, doubling every 18 months.

Information and communication have radically changed the way we write, calculate, present ideas to one another, shop, manufacture, and transport goods. All of our jobs, even down to the least skilled, seem to involve computers. The interesting question is why information technology has not had a bigger impact on homes and on personal transportation.

On the one hand we have a huge fleet of rolling assets that are demonstrably inefficient in their role of getting people where they are going, and on the other a rapidly improving technology that has brought dramatic efficiencies to other areas of human endeavour. How information can improve the car situation should be an interesting question.

Information improves driving today

Information and communications technology already improve traffic. For example:

- Rush hour traffic updates help drivers avoid snarls. In Montgomery County, Maryland you can look at the roads on the Internet to see if the coast is clear before leaving home.
- Cell phones help us make more intelligent use of our cars. 'Honey, please pick up Jimmy from Scott's on your way home;' 'I'm near your neighbourhood – guide me in;' 'Jenny, don't bother to come today – Donna just called in sick.'
- Traffic engineers use cameras and buried induction coils to monitor traffic and tune the traffic lights. Transponders and radios ease individual drivers through tollbooths. Traffic signals change in response to radio signals to let emergency vehicles pass.
- Telematics systems provide maps, directions, calls for help and concierge services.

Car sharing makes good use of information technology to make reservations, identify the driver and handle billing. The efficiency is not in the vehicle itself but in relieving people of the need to own a car. Without the sunk cost of a car and garage, each trip offers a free decision whether to walk, bike, take public transit or use a shared car. Just having fewer cars in the city, even if they were driven the same number of miles, would result in a significant reduction

Table 1. Advantages of Cars In General

Advantage	*Discussion*
Operational convenience	You are the master. The car does what you want.
Freedom of movement	A car has more scope of movement than any other mode of transport. Roads go wherever there are people. Cars go wherever roads go beyond. In contrast, public transit sticks to predefined routes and right-of-ways; boats need water; airplanes need airports; and cyclists and pedestrians are limited by muscle-power.
Protection from the elements	Cars provide protection from home garage to office garage. Nothing else can.
Ease	All alternatives except bikes require walking, and cycling is work.
Cleanliness	Cars keep our clothes clean and our bodies free from sweat.
Speed	Provided the roads aren't jammed, a car is usually the fastest mode of transport for trips up to a few hundred miles.
Comfort	The driver buys an appropriate level of luxury and has control over entertainment and air conditioning,
Safety	Public transportation has an edge once a passenger is on board, but that safety is more than offset by the risks getting there. It is 30 times safer in a car than walking or biking.
Carrying capacity	Cars carry everything we need. Everything else involves walking, and most people don't want to carry more than about twenty pounds.
Reliability and Control	People have an irrational fear of things beyond their control, like tube strikes and terrorists. We trust our cars because we own and know them.
Operating Environment	Production model cars operate in every temperature range in which humans can live, from Siberia to the Sahara. Mass production off-road models handle snow, ice, mud and moderately flooded roads.

in creating space to park them and of course the cost of manufacturing them.

At the end of the day drivers still lack the information that would be most useful. Defensive driving is a must: the operative assumption is that other drivers don't see you and don't know what they are doing. Drivers don't know when cars up ahead are braking, whether the other driver will let them merge, or whether to switch lanes because the guy ahead of them will turn left in the next block. Knowledge of the other guys' intentions would cut down vastly on frustration and accidents. Decreasing doubt and uncertainty would make room for more cars on the roads.

In Praise of Cars

It takes only a glance at a list of top-selling cars to see where our values are. Hondas and Toyotas reflect economy. Vans reflect our family values. SUVs reflect (accurately or not!) an interest in safety and ultimate mobility. The markets for fast and attention-getting cars are only niches. Most cars' attractions are primarily practical. Unless economic factors force us to give them up, any replacement will need to offer most of the advantages as a car. Table 1 catalogues the automobile's many attractive features, and Table 2 lists the added advantages of owning or leasing over taxis, rented and shared cars.

The problem with every other means of conveyance is that they are not cars. Summing it up, in addition to lacking style and comfort:

- Bicycles and walking are slow. They make you work, they expose you to the weather, and they limit the amount you can carry with you.
- Taxis are expensive, not always available, and require advance planning.
- Collective transportation systems such as trains, buses and aeroplanes travel on fixed routes and schedules. A passenger has to get to a designated place at a designated time. They tend to be less convenient for carrying baggage and parcels, less private, less comfortable, and usually slower than driving.

As long as cars offer such an overwhelming list of advantages and remain affordable, they are likely to dominate personal transportation. The concern that they are a disaster in terms of natural and human ecology will not sway many people to abandon them. The question, then, is how to blunt the advantages of the car over other forms of transportation or somehow redeem the car itself. Information technology has a role to play.

The Wireless Internet is made for transportation

Almost half of Americans have access to the Internet. Half have cell phones. Sales of handheld devices are outstripping that of PCs. The so-called third generation or '3G Wireless' which is being rolled out in Japan marries all three. At least in metropolitan areas it will be possible in a few years for people, cars, buses and metro trains to be in constant Internet communication.

Some places in Europe already use cell phones like credit cards. It makes sense. The service provider is

Table 2. Advantages of Having Your Own Car

Advantage	*Discussion*
Availability	The car in the driveway or garage is ready to go immediately at any time. Even in snow with a 4x4.
Zero planning required	A car in the garage satisfies almost all transportation needs.
Financing convenience	Simple, predictable transactions cover car payments, insurance payments, gas and repairs.
Cost	Cars account for only about 10% of a household budget, fuel less than 1% for middle class families.
Prestige	Cars serve the same social purpose as horses and buggies a century ago.
Amenities	The owner outfits a car with a library of CDs and tapes, cell phone, email and other electronic connections.
Anonymity and privacy	Cars physically isolate us from our fellow human beings. We have some of the freedoms of home: to scratch, loosen our belts, put on makeup, or carry on a private conversation by cell phone. Every alternative to the car throws us together with strangers.

already letting the subscriber use the phone on credit, trusting that the bill will be paid at the end of the month. Why charge other things to the same bill? It only costs a little bit more to build a second transmitter so the phone can make a Wireless LAN connection with a merchant's machine. Add some sort of authentication, maybe a PIN number and voice recognition, and you have a system that is easier to use and more secure than credit cards.

Cell phones are beginning to meet the U.S. government mandate to know their geographic coordinates. Some will do it by incorporating Global Positioning System chips in the phones, others by triangulation among cell towers.

Taken all together, it will soon be within the power of anybody who can afford a cell phone to tell the world, in real time, where they are and where they want to go. They can use the same cell phone to pay for their transportation in amounts ranging from bus fare to airfare. Cellular technology is so inexpensive that government could mandate that manufacturers include it in cars, just like seat belts and 5 mph bumpers. It stands to reason that these capabilities will have an effect on the way we travel.

Teamwork among privately owned cars?

On the roads it's every man for himself. We don't know or care where the other drivers are going. Many drivers easily ignore rules of courtesy with people we don't look in they eye, don't know and will never see again.

If we want it, communications technologies should make it possible for cars to maintain full time contact with each other via some combination of the Wireless Internet and wireless LAN technologies like 802.11 or Ultra Wideband. They can also be in touch with central systems that perform such tasks as monitoring road conditions, managing traffic lights, routing emergency vehicles and maybe monitoring the availability of parking in various garages.

The more interesting question is how we will use ubiquitous communications. Do we want computers to drive our cars? Do we want drivers to be able to talk to each other by radio? The answers are an easy 'No' and 'No'. The airlines and the Federal Aviation Administration have constantly shied away from automating flight, and there are a whole lot fewer obstacles in the air than on the ground. And one can only imagine the road rage if drivers heard what we already say about each other!

An alternative path would make the car's telematics system a middleman; have drivers converse with their cars and cars talk to one another. Modern navigation systems let a driver tell the car the destination and the car use generated speech to tell the driver when to turn. The driver is still responsible. Once we put all cars in communication it will be possible for the car to advise the driver when to slow down for a red light he won't make, when a driver up ahead is braking hard and when to pull over for an emergency vehicle. The car would inform the driver, but the driver would still have to act, just as a pilot has to physically respond when an aircraft warning system warns 'Pull Up!' to avoid a collision.

We can already tell our destinations to onboard navigation systems. Would it be too far-fetched to assume that cars could advise drivers as to the optimal time to change lanes, to suggest that the driver let another car merge, or even help traffic signals decide when to switch in real time?

Mercedes already uses radar to keep an appropriate distance between cars. Keeping cars in constant wireless communication could extend the safety web to everybody on the highway. We might in time trust the system enough that we can stop buying rolling fortresses. More to the point, it might embolden pedestrians and cyclists. A large part of the reason they suffer so many times more injuries per mile than

Box 1. How communications-based approaches compare with other solutions to the 'car problem'

Advance	*Potential improvement in urban roadway usage*	*Liabilities*	*Doesn't very well address*
Car-share	2 fold (increases public transit usage)	Walk to the car	Low Density Neighborhoods
		Advance planning	
Jitney	5 fold plus: average number of riders	Time to pick up other riders	Luggage
		Lack of personal space	
Full-time communication links in cars	1.5— 2-fold: increases capacity in cars per hour	Give up privacy	Parking
		Cost of telematics systems & in-vehicles devices	
Hydrogen powered cars	Little to none	High costs of manufacture	Roadway congestion
		Fuel distribution infrastructure	
Metro & Light Rail	Severalfold	Lots of walking	
		High infrastructure cost	Low Density neighbourhoods

motorists is that motorists just don't see them. What a boon if the car itself told its driver to watch out for the bike!

A ubiquitous communications system can – better to say will, because parts of it seem inevitable – have ominous privacy implications. 'Black boxes' like those on aircraft may record vehicle communications and actions. It would be a big help to police in reconstructing accidents. It would also inform them every time the driver was speeding, ran a light, rolled through a stop sign or whatever. Communications would make it possible to track any vehicle any time.

In fact such tracking is possible already using cameras, transponders and inductance coils already in-place. Singapore charges for the use of downtown streets. Tracking will be useful in immigration control and homeland defence systems. The chief implication of putting cars in constant communication is that it will make surveillance much easier. The tradeoff is that two-way communications can improve traffic more than the passive systems now being put in place.

If cars co-operated with each other and police could ensure that people adhered to traffic laws, there would be room for more cars on the road. Life would be easier for pedestrians and bikes, and getting people out of cars might take some pressure off the roads. Cars that actively kept drivers out of accidents could be both lighter and safer.

Would the improvements be enough? How many more cars could pass over the roadway network if they were closer together? How much more efficient can lighter cars become? At the end of the day the outcome could be like the results with the Corporate Average Fuel Economy (CAFE) law. Yes, individual cars now get better mileage, but gasoline consumption has still risen because we drive more. Roads become ever more crowded because right-of-way acquisition and road building have not kept pace with increased traffic, in the U.S. or any place in the world. On top of the significant privacy issues, technology feasibility and cost, putting cars in communication would not appear to offer the order-of-magnitude improvement needed to hold the threats of pollution and global warming at bay while we develop alternatives to fossil fuels. And fuels aside, it is unlikely that the congestion problem will be solved as long as the density of vehicles on the road remains limited by human vision, hearing and reaction times.

Improved information will help Carshare programs

Carshare members (as opposed to bikers, pedestrians or users of public transit) automatically enjoy all the advantages listed in Table 1. Better information should help offset some of the convenience benefits of outright ownership of a car.

The biggest convenience factor Carshare has to overcome is that a personal car waits at home. Carshare will offer a credible alternative when users, wherever they are, can request a car on short notice from a garage within walking distance via the Wireless Internet. Once drivers can be confident that cars will be available to meet their needs the other factors can enter the decision. Is the cost of owning, garaging and maintaining a car worth the benefits in terms of prestige, comfort and customisation?

Carshare systems such as zipcar.com and flexcar.com have the sort of communitarian flavour that organic food and coffee boutiques had twenty years ago. Their success has attracted bigger capital. Hertz' pioneering venture in the San Francisco Bay Area offers Smart-car sized Th!nk City electric vehicles up through standard cars. If the model succeeds, you can imaging they might customise the car

through touches like downloading your favourite music and adjusting the seats, mirrors and climate control to your preferences before you picked it up. Big operators are also able to do what U-Haul did for trailers, pull together a nationwide chain and standardise operations so the public feels comfortable with the system wherever they go.

Going my way? Intelligent jitneys

Since most of what gets freighted around is metal, not people, the obvious order-of-magnitude improvement to be made in personal transportation is carrying more people per vehicle. The energy consumed per person-mile is surprisingly consistent among cars, planes and transit buses: 3000 – 4000 BTUs. Only inter-city buses and trains, at less than 1000 BTU per passenger-mile, are significantly more economical. By way of comparison, rail freight is much more efficient. If trains could pack people like pigs they would use 30 BTU / passenger mile.

The economy of public transit lies in the observation that lots of people travel approximately the same routes. A shared vehicle is the most efficient way to move them. Passengers sacrifice for the sake of system efficiency. They lose the time it takes to pick up and drop off other people, the time it takes to walk to and from public transit, and the time they spend waiting between vehicles for the efficiency of the system. They give up most of the Table 1 advantages of cars and the Table 2 luxuries of actually owning one. What they get is a utilitarian transportation: cheap and reliable, but slow, inconvenient and often uncomfortable. They also don't have to fight traffic or park.

The car remains the gold standard. Public transportation is a necessity for people who can't afford a car and an option for those for whom driving and parking are even more of a hassle. There is a small coterie of egalitarians, environmentalists and car-haters who put up with it because they believe in public transit. It will have to come a lot closer to matching the convenience of cars before the broad middle class chooses it voluntarily.

Enter the Wireless Internet, able to collect precise data as to who needs to go where and when. Transit systems now collect such data so they can tell the passenger how to fit his plans to the transit system: the fixed time and location to board the system. Why not mould the transit system to the needs of the passenger? Don't make him go to the bus, bring the bus to him! How crazy is the idea, really?

In a metropolitan area a great many people make more or less overlapping trips. How many are there? Assume a metropolitan area of 3 million people with a 60 mile diameter, each making two trips daily between 6:00 am and 10:00 pm. That would come to 30,000 people getting in their cars every 10 minutes. If their timing, origins and destinations were totally random that would equate to a van load of people, 11 of them, travelling between each pair of mile-square patches of the metropolis. Our movements are far from random. Most trips are fairly local and they are clustered at certain hours of the day. It would be easy to fill many vans for point-to-point trips if a computer knew who wanted to travel.

A jitney operation might fill the bill. It would take:

- A computer system with a database of information previously entered by frequent jitney users: names, credit billing information and the origins and destinations of their most frequent trips.
- A request system able to accept travel requests via phone, Internet or Wireless Internet. Most request transactions would be simple because the system would know who the passenger was by the cell phone, where they were by GPS, and would let them speak the name of a preregistered destination.
- A fleet of jitneys constantly moving throughout the city. They would be small enough to travel down side streets to offer doorstep service. They would recognise passengers by the cell phones or smart cards that handled billing.
- A dispatching system capable of matching passengers to vehicles and rerouting vehicles to meet real time demand. The system would have to provide a guaranteed level of service, maybe different levels at different prices.

Jitneys could approximate the convenience of cars. They would eliminate the walks to and from public transit. They could tell passengers when the jitney would arrive and how long the trip would take, offering to call a cab when they could not satisfy the customer's needs. Picking up and dropping off in small areas, with a long, fully loaded trip in the middle would be economical and fairly fast.

Privately operated jitneys could cater to middle class needs and desires. Assuming that passengers would be willing to pay rates comparable to operating and parking a car, it should be possible to outfit fairly comfortable vehicles. They might include individual screens and headphones like airliners, so travellers could be entertained en route. They might include PC docking stations with (Wireless Internet again) online capability. If passengers could make good use of the their time in transit it might not bother them that the trip took a bit longer than driving.

One place to start would be in suburbs that are too sparsely populated for public transit; jitneys might be a good way to bring people in to metro stations. Another good bet would be for suburb-to-suburb commutes. Speeding along HOV lanes could buy back

some of the time spent giving doorstep service. Jitneys have an advantage in that they could be introduced incrementally, starting in areas in which public transit is uneconomical and encroaching on fixed routes as their usage grows. Less-than-truckload hauliers and paratransit operators already have prototypes of the most essential building block, the real-time dispatching system. The remaining capital expenses would grow in proportion to system size.

Conclusion

There is a major discrepancy between the Internet-time improvements in computers and communications and the glacial improvements in mechanical and roadway systems. Timeframes for road building projects run into decades. The implicit assumptions in road projects are that cars will remain more or less like today, that we will have fuel for them, that the total highway system can accommodate the growth in demand, and that nothing like the Kyoto accords will radically curtail our driving. A straight-line extrapolation into the future might prove valid, and certainly no single alternative looks any more probable. However, given the many things that make the straight-line assumptions unlikely, it would be wise to examine the alternatives.

Frederick Smith's FedEx used information (and aeroplanes) to radically change the parcel delivery business. Amazon used the Internet to radically change the book business. Oracle, SAP and the supply chain management companies changed the way companies buy, manufacture, ship and sell. It is not unreasonable to expect that entrepreneurs will see opportunities to apply information technology to personal transportation. Widespread adoption of any of the Carshare, jitneys or car-to-car communications concepts would have a significant impact on our roadway needs. Communications and information are vastly cheaper and more environmentally friendly than any kind of vehicle. They have to be included in any long-term plan.

Another deluded car fanatic. Reply to ‘A challenge for the imagination: How will ubiquitous wireless change cars?’

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Abstract

This is a response to ‘A challenge for the imagination: How will ubiquitous wireless change cars?’ The paper is fundamentally flawed by two key delusions: all car transport problems can be solved – without reducing the ‘right’ of motorists to carry on as usual – by applying high-powered electronic technologies, and that motorists are being restricted, when in fact they are not. This latter delusion is profoundly dangerous.

Keywords

cars, cyclists, human rights, pedestrians, technology

Introduction:

I was surprised to be asked to comment on this piece, as it seems the notes of a first year undergraduate rather than a serious contribution of the type we are normally used to reading in the pages of WTPP.

Nevertheless, it expresses some commonly held views. These views are basically as follows: There are some problems associated with the current transport system. We can solve these problems (which are not very clearly articulated) by either restricting car use or by using technologies (‘The question, then, is how to blunt the advantages of the car over other forms of transportation or somehow redeem the car itself’). Not surprisingly, the quest for the technological fix wins out.

I argue that the writer is doubly deluded on fundamental issues. Parts of his recommended scenario for the future are sensible and probably necessary elements of any sustainable transport policy. However, unless the twin delusions are dealt with, his project will be just another motorist excuse. It will be unlikely that it is taken up and will be a failure either in its own terms or those of a suitable transport policy’s requirements, or both.

Two delusions

Seibert’s premise is that there are some problems associated with car transport. These can be solved without any fundamental reduction in the ‘right’ of motorists to carry on as usual, with the exception of having to use high-powered electronic technologies which may involve a surveillance element. (Delusion One).

Associated with this is the idea that we all know about these problems and are willing to something about them (‘Most people’s consciences are attuned to the virtues of walking, bicycling and public transit.’). The motorist wishes to solve these problems, and is oppressed by various schemes to solve them by programmes which may restrict him / her from doing what (s)he wants to. (Delusion Two).

Let us briefly inspect these beliefs.

Delusion One

I do not believe that allowing a continued growth of car ownership and use can solve the problems mentioned.

Previously I have argued, along with other relevant points, that at present the vast majority of people in the world do not own cars(Davis, 1992; 2002). Over the last 50 years, while the number of cars has increased approximately 10 fold, the number of people has doubled. In fact the number of people in the world who do not own cars has increased from 2.5 billion to 5 billion.

In a report for an OECD Working Party on Pollution Prevention and Control, Adams (2000) considers the prospects. The UN medium projection for the world population in 2025 – the kind of timescale I suggest we should be considering – is 8.5 billion. The U.S.A. in 1993 had a motor vehicle ownership level of approximately 0.75 per person, and this has increased since then. If we take just that 1993 level as indicative of what a human being had a ‘right’ to, we are considering a level of car ownership in 25 years time of some 6.4 billion motor vehicles, compared to c. 500 million now, i.e. a 12-fold increase.

There are ways in which those with some time on their hands may like to amuse themselves while speculating on this scenario. Allowing for London parking standards of 3 metres length per car, 6.4 billion cars – and many of the motor vehicles would be larger and longer than cars that could park in such spaces –

would take up some 40 million kilometres when parked. If stationary they could be accommodated on a motorway stretched around the equator (sea included) if it were 1000 lanes wide (Adams, *op. cit.* pp. 109–110).

There are rather more serious considerations. It is likely that changes in fuel technology will lead to less damaging effects in terms of noxious and greenhouse gas emissions from typical cars in the future. However, even if they were significantly reduced, with the kind of growth considered above the adverse effects on humanity would be disastrous for millions of people.

Even with such new fuels, increases in motor vehicle usage would create more problems than stabilisation or reduction in amounts of car usage, as at least some problems are likely to continue while oil and other fossil fuels continue to be employed. To take just one element frequently missed out on in consideration of greenhouse gas emissions: what needs to be counted is not just the emissions from a moving vehicle, but the emissions from its production, transport and disposal – not to mention the construction of infrastructure such as car parks and highways required to contain them

In fact Adams does not consider these two most widely cited problems. Just some of the others he does are:

- Social polarisation: The significant minority of those without access to cars (about one in five households in Britain in present, although the vast majority in the world are likely to remain carless for the near future even under present trends) are disadvantaged with respect to those with access to cars. Increased car dependence brings with it lifestyles where non-car use becomes increasingly unattractive.
- Land use: Increased sprawl of cities and increased difficulty for non-car users as journeys become too difficult to make by the alternatives.
- Community relationships: the conviviality of local communities is undermined.
- Promotion of geographical uniformity and loss of cultural diversity.
- Loss of safety for non-car modes such as walking and cycling and loss of health for the car dependent. Shifting from the healthy and environmentally more benign modes of cycling and walking produces health problems – obesity, heart disease, stroke, depression and stress. In the normal public health accounting terms these account for far more life-years lost than 'Road Traffic Accidents' (for example, see Davis, 1997).

All of these disbenefits are entwined in the web of car dependency, and not just car dependency, but ***increasing*** car dependency. Ameliorative efforts, such as the initiative to 'get people out of cars on to public transport' are at best of minimal, and often expensive, assistance. To illustrate this example further, the increased use of rail over the last few years in Britain has not reduced car usage, but very often slotted neatly into car dependent lifestyles as increased urban sprawl lengthens commuting and other journeys, only part of which are travelled by train. Bus travel is often inappropriate as an alternative precisely because car dependency fits with land use patterns where bus use is inappropriate. Alternatives of public transport, in short, only function as a sustainable solution if measures are taken to discipline car usage in the first place.

Similarly with Seibert's electronic 'fix', the above problems are either not discussed or temporarily evaded. Of course, smart technologies ***can*** have some part to play in controlling some of the problems of mass motorisation **(**Road Danger Reduction Forum, 2001). Black boxes recording crash details for insurance and potentially criminal investigation are already widespread in some motor vehicles in some countries. But the benefits, which would accrue to people like me walking or cycling, are not mentioned.

This brings us on to another problem which will not be dealt with by electronic fixes of the Seibert variety. In his tables listing the benefits of car use, there is absolutely no allowance for admitting that the status quo may be inequitable or plain wrong. For example: 'Cost: Cars account for only about 10% of a household budget, fuel less than 1% for middle class families' (Seibert, Table 2). In the USA they may, but not in the developing world. More important, the low cost is there because motorists do not have to pay for what economists call 'external costs'. Any fool can say something is cheap because he does not have to pay for it.

To take just on more example: 'Reliability and Control: People have an irrational fear of things beyond their control, like tube strikes and terrorists. We trust our cars because we own and know them' (Seibert, Table 1). Maybe it is the job of the analyst to see this as a problem, rather than a fact of life which we should sacrifice the planet and civilised values upon.

Delusion Two

Perusing the arguments 'In Praise of Cars' can be a bizarre experience. One can only grasp the logic by entering the world of Delusion Two, a self-pitying universe where motorists are misunderstood victims. 'Most people's consciences are attuned to the virtues of walking, bicycling and public transit', according to Seibert. Are they?

In Britain, the current Deputy Prime Minister famously stated: *'I will have failed if in five years time there are not many more people using public*

transport and far fewer journeys by car. It is a tall order but I urge you to hold me to it' – and with car usage increasing, there is not the slightest prospect of being 'held to' his promise. What has happened is the fear among motorists that real steps would be taken to control the problems they create – while car ownership and use has increased. In other words, we have the prospect of both an exacerbation of many of the problems of motorisation while simultaneously motorists are being told that they are a problem which should be controlled. One must not be surprised if, in such a Government sponsored climate of fear and ignorance, delusion is commonplace.

This delusion: that motorists are being restricted, when in fact they are not, is profoundly dangerous. It lies behind prejudice against cyclists, a failure to appreciate the need for increased taxation on car use, and continuing failures to grapple with the problems of mass car use, or even define them properly.

We all know what the advantages, as perceived by anybody who wants to own or use a car, are. Even if genuine controls were brought in on car ownership and use, people would still be using them in their millions. We do not need defences of them.

Conclusion

We are often told that new fuels will deal with the problems of greenhouse gas emissions from the transport sector. As argued above, I do not think this is actually so. However, insofar as greater fuel efficiency and alternative fuels will alleviate the problem – and I am all in favour of that – we have to be aware that alleviation is all we are talking about. We also have to be aware of the other problems involved in mass car use. And then we have to appreciate that appropriate change will have to take place at governmental level if the alleviation which is possible can take place anyway.

I do not argue against smart, wireless, or any other technology in transport. But to use it properly, we have to define what the problem is and then we will be in a position to use it accordingly. To take one example, in London every year a handful of cyclists are hospitalised as motorists flout the Highway Code by opening their car doors without looking behind them. If motorists do not wish to be troubled by having to do what they are supposed to, but prefer to rely on a smart technology to stop car doors flying into the faces of cyclists, then that is fine by me. But it is those kinds of problems which have to be addressed, not ones to squeeze more juice out of the system.

Finally, from wrongly opened car doors to global warming, the advocates of motorist privilege really do need to understand what their obligations are. They need to know that the real steps to having those obligations fulfilled are not being taken. And that, with or without wireless technology, they should be.

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