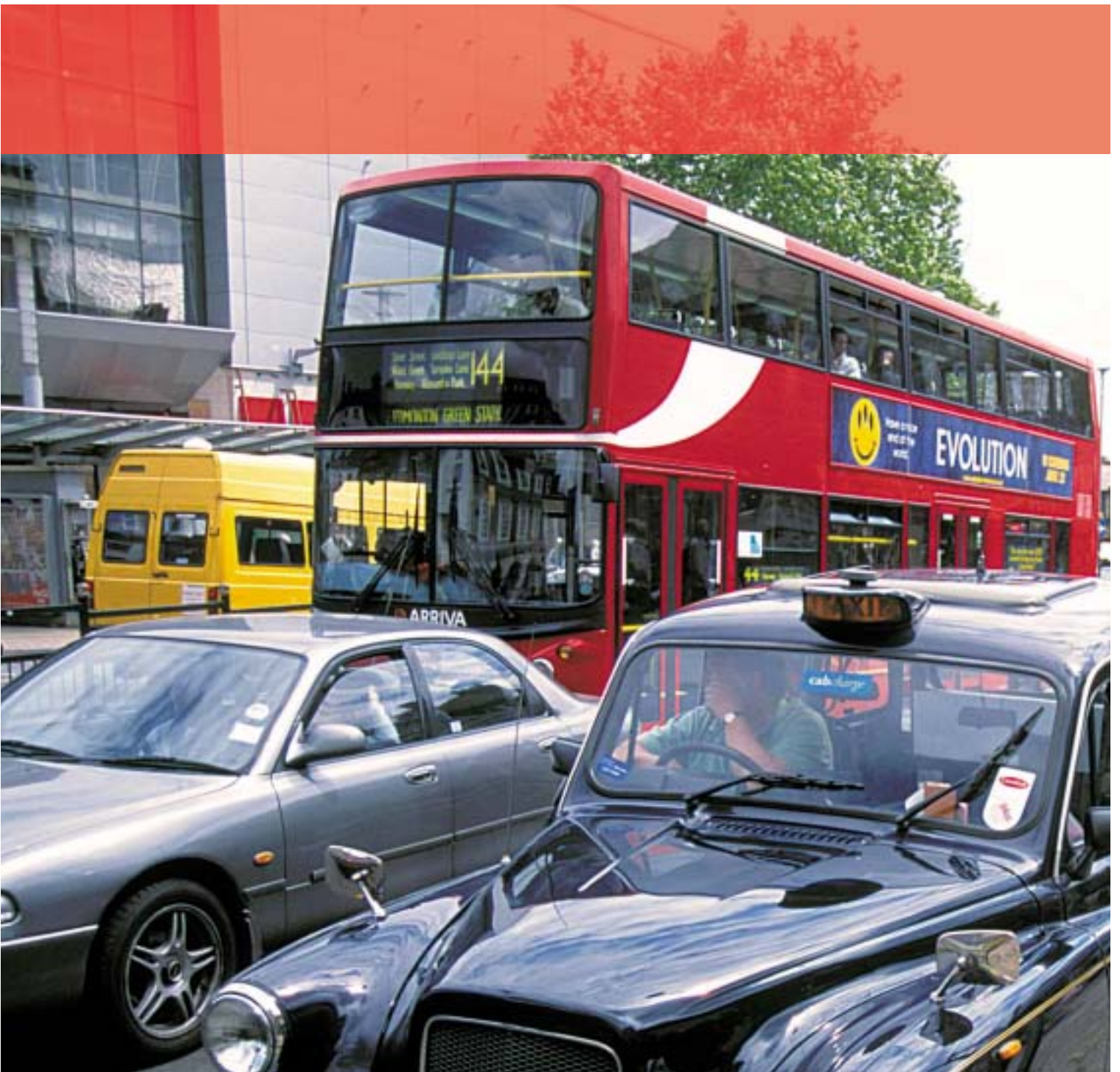


Alternatives to Congestion Charging

Proceedings of a seminar held by the Transport Policy Committee

31 January 2002



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Transport Policy and Spatial Development Policy Committee

This Committee was established by the Assembly on 9 May 2001 with the following membership:

Lynne Featherstone (Chair) - Liberal Democrat
John Biggs (Deputy Chair) - Labour
Angie Bray - Conservative
Roger Evans - Conservative
Sally Hamwee - Liberal Democrat
Samantha Heath - Labour
Meg Hillier - Labour
Jenny Jones - Green
Bob Neill - Conservative

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Reducing Traffic Congestion in London

Foreword



Lynne Featherstone
Chair, Transport Policy & Spatial
Development Policy Committee

In his Transport Strategy the Mayor identifies reducing traffic congestion as one of his ten key transport priorities in order to increase the capacity, efficiency, quality and integration of London's transport system.

Congestion harms our local economies, our local environments, and the quality of Londoners' lives. Few of those with responsibility for transport and spatial planning in London would deny that, at the very least, further increases in traffic congestion have to be avoided and, ideally, that reducing it is the right goal.

The focus of the Mayor's policies is very strongly on central London, where he is now committed to his congestion charging scheme. Whether we agree or disagree with this particular policy, it will have little, if any, direct effect on the rest of London. Yet it is in areas outside central London that traffic is growing fastest, and congestion is becoming increasingly disruptive. Even if congestion charging was to become an appropriate policy across London, it is unlikely to be a realistic option for many years.

We therefore have to consider, develop and implement other policies to address congestion. It is unlikely that any single policy will achieve an adequate reduction. We will need a set of measures which complement each other.

Reflecting its concern about the adequacy of the Mayor's Transport Strategy for improving transport outside central London, the Assembly has recently published a Report on transport in Outer London.¹

As a further contribution to the development of appropriate policies, the Assembly decided to organise a Seminar on 31 January 2002 with the objectives of:

- examining policies which would contribute to reduced congestion in London, other than congestion charging, learning from experience in other cities as well as current research

¹'Transport for All of London' Report of the Public Transport in Outer London Investigative Committee March 2002

- stimulating discussion of options, and, through that, the adoption of those policies best suited to the particular needs and circumstances of the various parts of London.

The Seminar did not set out to address the provision of additional infrastructure or road pricing (whether in the form of congestion charges or workplace parking levies). The Seminar did not seek to take either a "pro" or "anti" stance on road pricing. It focussed on policies which can be applied as a complement or as an alternative to charging. The Seminar was attended by over 100 delegates representing the Boroughs (through both Councillors and officers), the Association of London Government, Transport for London (through both Board members and officers), the London Development Agency, the Metropolitan Police, the Government Office for London, and a number of special interest groups, as well as Assembly members.

The Presentations

We invited six eminent speakers, four from the UK, one from Switzerland and one from Germany, to address the seminar on a range of policy options. We include their papers in this Report.

Professor Peter Jones

We started with an overview of possible measures to tackle congestion, given by Professor Peter Jones of the University of Westminster. He identified a wide range of approaches, other than increasing highway capacity. These include restraining road traffic, through physical, regulatory or price measures, improving the adequacy of possible public transport alternatives, reducing the need to travel, and raising awareness of alternatives. He made the important point that people's perceptions are that to eliminate regular congestion would require a very substantial reduction in traffic, whereas the reality is that a reduction of 10 per cent or 15 per cent can provide very marked improvements.

Peter told us that there is a tendency to focus on the means rather than the ends, whereas the public tends to be much more concerned with the policy objective. Their attitudes to, their willingness to accept, particular measures, is greatly affected by their appreciation of the objective. He concluded that there is considerable potential for the use of awareness-raising measures in London, but to be effective they need to be integrated with other, complementary actions.

Werner Brög

Developing the theme of increasing awareness, Werner Brög, of Socialdata, Munich, described the use of an individualised marketing technique in Perth, Western Australia, as part of a wider TravelSmart policy. This demonstrated that it is possible to reduce car use through simply increasing awareness of the alternatives available for specific journeys. Car driver trips were reduced by 10 per cent, while walking, cycling and public transport use all increased. After-studies have shown that these reductions were still being achieved three years later. While it is a labour intensive approach, the benefits are very substantial, certainly when compared with the costs of providing additional highway capacity to accommodate the growth in car use which would otherwise have occurred.

The reduction in car use represented a change of mode for only two trips a week, yet that is sufficient to achieve the level of reduction which Peter Jones had suggested would result in marked improvements in traffic conditions.

While it might have been thought that it would be short car trips which would be replaced by walk trips, the evidence from Perth was that some car drivers replaced a car trip to a more distant location with a local walk trip. Thus, there was a greater reduction in car miles travelled than in car trips.

Werner explained that a similar approach had also been used in larger cities, with lower levels of car use, but the target of switching two car trips a week to other modes is a reasonable one, even in Zurich where the car share is only 25 per cent. But it is not a "one shot" approach. In Perth, it is being applied across the metropolitan area in stages. He also noted that individualised marketing can be used very effectively to reinforce the effects of a new or improved public transport system, doubling expected ridership.

He made the point that individualised marketing takes citizens seriously. It gives them a chance to participate. It makes very clear that there is a problem which can only be solved together, that they cannot sit there as citizens waiting until the politicians and the planners solve it.

Alastair Duff

The effect of carefully targeted information and public transport services on mode choice for work journeys was also demonstrated by Alastair Duff. Although the car share of work trips to the Heathrow area, with its myriad of employers and complex working hours, had been increasing steadily, measures taken by the Heathrow Area Transport Forum have reduced the car share from 78.0 per cent in 1992 to 71.5 per cent in 1999.

Alastair explained that while marketing is at the heart of any campaign to get people to change their travel behaviour - "marketing, marketing, marketing" - any effective campaign requires true partnership between all parties, partnership which is based on shared objectives, mutual respect, and solid and reliable relationships, and which bridges institutional and jurisdictional barriers.

Professor Mike McDonald

Professor Mike McDonald of the University of Southampton addressed the Seminar on ways in which we can improve the efficiency with which London's streets are used. He explained that traffic control and management, particularly with the deployment of more advanced technologies, offers very cost effective opportunities to increase that efficiency.

He considered that while London has a very good approach to traffic management and control, more could yet be done. However, it is easier to manage traffic on a network which is not saturated (ie, congested) even when it is only just below saturation. As crucial parts of London's network are saturated, an early target is to introduce measures which bring it below saturation.

Intelligent Transport Systems, or telematics, are currently being developed which apply information and communications technology to improve the control and management

of vehicles and transport systems, and provide information to travellers, vehicle operators and system managers. The development and increased deployment of Intelligent Transport Systems will:

- provide better and real time information for individuals and vehicle operators planning and making journeys
- make operation of vehicles in the traffic stream more efficient through products such as adaptive cruise control for maintaining headways, and stop-and-go for automatic progress in queues
- increase the efficiency of urban traffic control systems, integrating public transport priority, traveller and parking information, and selective access controls.

The increasing deployment of these techniques will help achieve improvements in network efficiency. Mike noted that there are other measures, which are facilitated by new technologies, including the concept of car clubs. These are designed to reduce car ownership and car use through avoiding individual ownership, while providing access to a car when required.

Carl Powell

Having made it clear that the City of Westminster is opposed to the Mayor's central London congestion charging scheme, on a number of grounds, Carl Powell, the City's Director of Planning and Transportation, described six sets of measures to reduce traffic congestion. These include better enforcement of parking and traffic measures, reducing the effect of roadworks undertaken by public utilities, demand management, Low Emission Zones and more extensive use of planned park-and-ride schemes.

Ruedi Ott

We concluded with a presentation by Ruedi Ott, Head of Traffic Planning with Zurich City Council. He described how, in 1987, the City Council had set five main transport policy goals:

- to promote public transport
- to reduce motor vehicle traffic
- to channel motor vehicle traffic and restrain traffic in residential areas
- not to increase but rather reduce the number of parking places for commuters
- to guarantee the environment-friendly mobility of cycling and walking.

To help achieve these goals, the Council implemented a set of measures designed to make public transport fast and reliable. Trams and buses were given dedicated lanes and were assured priority at signal controlled intersections. Kerbside parking was removed along streets with major bus and tram services. Automatic vehicle location was installed on trams and buses to provide real time information for both control and passengers. Promoted as a coherent plan, and pursued consistently, these measures proved very effective, encouraging the use of public transport, and cycling and walking as alternatives to the car. Building on these successes, the city Council adopted a new mobility policy in 2001, which consists of five guidelines:

- to optimise and to integrate the transport system, encouraging its use as a multi-modal system
- to develop and to support new innovations, including telematics
- to complete infrastructure, but only to preserve the capacity of the transport network as a whole, or to reduce unacceptable impacts
- to ensure the transparency of transport costs, with users paying the real costs
- to widen the thinking of the citizens and the business world - to establish some form of social contract for a new culture of urban mobility.

Many of the key policy decisions are taken by citizens through local referenda. These have the great advantage that they ensure commitment to the pursuit of measures, once they have been approved.

A Commentary

Individualised marketing is first about raising awareness and then about changing behaviour. The Seminar was certainly highly effective in raising awareness among those present. The challenge now is to achieve change in the behaviour of all those concerned with transport policy and the provision of transport in London, as they address traffic congestion.

There are real concerns that when demand for car travel is suppressed by congestion, any reduction in car use by one part of the community will be offset by increases from another. The point was made that although the use of cars by workers at Heathrow has been reduced, BAA's roads are used extensively by others avoiding congestion on the adjoining network. The reallocation of roadspace freed up by congestion charging and the other measures included in the Mayor's Transport Strategy, has been a real concern of the Assembly, as we have reported in our scrutinies of congestion charging and the Transport Strategy. This dilemma reveals the need for an integrated approach to managing London's transport system, across all the various authorities and agencies with a role to play. As Alastair Duff stressed, partnership is essential.

Although Mike McDonald said that he thought that traffic management and control in London is very good, it was felt that Londoners do not recognise this, and tend to be critical of new schemes. This serves to emphasise the point made by a number of speakers that we need to recognise and publicise successes.

It was also noted that not just in London, but around the world, attitudes to transport policy are based largely on subjective views, conditioned by excuses and prejudice, and these in turn affect those policies. There is a greater need for undisputed fact, for real evidence, and to develop measures in response to real needs rather than perceptions and prejudices.

It is clear that there is a real debate about the sequencing of "sticks" and "carrots", between those measures which seek to force change, such as physical measures, regulations and charging, and those which seek to encourage change, such as improved alternatives, and greater awareness of possible alternatives.

It is probably unrealistic to expect to achieve reductions in traffic and thus congestion in London simply through improved alternatives, and both financial constraints and current administrative and legal procedures will serve to prevent rapid provision of new

alternatives across London. With congestion growing day by day in many parts of London, we must recognise that some sticks may well need to precede the provision of alternatives. But when and where that seems likely to be necessary we must first ensure that:

- we are managing the existing system with a very high degree of efficiency, with- as Carl Powell set out - highly effective enforcement and the minimisation of disruption due to streetworks
- we have pursued rigorously the type of measures aimed at achieving behavioural change which Peter Jones, Werner Brog and Alastair Duff described.

In developing measures to reduce congestion, we must all recognise our wider responsibilities. We must never seek to solve our local problems at the expense of another part of London. Beggar my neighbour policies will only work, in the end, to everyone's detriment.

While we need coherence in our overall approach, we must recognise - and obtain the benefits from - the great diversity we have between the different parts of London. As the Assembly made clear in its scrutiny of the Mayor's Transport Strategy, we must assiduously avoid one size fits all approaches.

We need to seek opportunities to demonstrate the effectiveness of possible measures. Quick wins will do much to assure longer term commitment. Action by Lewisham to provide information to all local households on the public transport travel opportunities opened up by the DLR Lewisham extension is just one example, and their "Leave your car at home once a week" campaign among their own staff shows how government can set an example. We cannot expect others to respond if there is no strong lead.

Although London has a good public transport telephone-based information system, it is not an alternative to individualised marketing. Individualised marketing is directed towards increasing awareness of alternatives, of getting people to the point where they will think about using alternatives to the car as a matter of course, and then to start using information services to plan individual journeys. The way in which the reductions in car use in Perth have been sustained indicates a willingness among local people to accept changes in travel behaviour.

Measures such as individualised marketing must be seen as part of a continuing process for two key reasons. First, resource limitations will make it necessary to spread the initial campaign in London over a number of years. Secondly, the changes in the resident population, as people move into, out of and around London, as well as change their lifestyle, will require constant action.

In Conclusion

One of the great benefits of the Seminar was that it made many of us with responsibilities for transport in London aware of what others have shown is possible, and effective. Zurich demonstrates what can be achieved when there is a strong vision, a clear mandate for the longer term, and effective local autonomy. Perth shows what can be achieved through innovation and integration. Heathrow shows what can be achieved through a combination of determination and partnership. Learning from these examples, I am sure that the Seminar will prove to have been an important step in the

development of policies to reduce traffic congestion, and its adverse impacts, across London.

It is clear that reducing congestion in London requires:

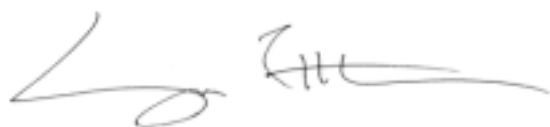
- a coherent vision for all of London, through the shorter term and into the longer term, coupled with strong leadership
- commitment, and consistency of policy
- open-mindedness - a willingness to try new ideas and avoiding "not invented here", "it won't work here", "we've tried that" responses
- a package of measures which complement and reinforce each other, which provide real synergy
- above all, effective partnership, with co-operation between all the authorities, agencies and bodies involved.

There is an urgent need for a funding regime for local transport initiatives which supports longer term vision. Boroughs must have confidence that, when they adopt a policy or plan, the funding will be there to see it through to fruition over however many years that might take.

We need to involve directly the people of London in finding ways to reduce congestion - rather than impose solutions on them - and persuade people that with their support we can achieve even more. That, as I see it, is one of the great merits of the individualised marketing approach; people are empowered to contribute to solutions through personal actions. And when we do things well, we have to ensure that is properly recognised. We need to celebrate our successes, widely.

Reducing traffic congestion in all parts of London is of great importance to all of those who live, work or enjoy themselves in the capital. The Assembly will continue to promote and support the development of sound policies which contribute to such reductions. To that end, and learning from the Seminar, we have formulated a set of recommendations, set out on the next page. I hope that it will not be too long before we will be celebrating the success of a balanced package of congestion reduction measures.

Finally, some thanks. I and my colleagues on the Assembly are most grateful to Professor Jones, Werner Brög, Alastair Duff, Professor McDonald, Carl Powell and Ruedi Ott for their invaluable contributions to the Seminar. We are also grateful and greatly indebted to Martin Richards, our consultant, whose work was central to the Seminar's success and who has so ably edited this Report.



Lynne Featherstone

Chair of the Transport Policy and Spatial Development Policy Committee, London Assembly

Recommendations

In the light of discussions during the Seminar on Reducing Traffic Congestion in London, the Transport Policy and Spatial Development Policy Committee has agreed to the following recommendations:

- 1** The reduction of traffic congestion throughout London, central, inner and outer, must be a primary policy target for the Mayor, Transport for London and the Boroughs. They must all recognise that this can only be achieved through a balanced package of measures, and that in the shorter term those measures will mainly consist of:
 - increasing the efficiency with which our street network is used
 - improving the availability, timeliness and relevance of travel information
 - persuading people and businesses to use their cars, vans and trucks less, through measures such as individualised marketing, School Travel Plans and Area Transport Forums.
- 2** The effective pursuit of these measures will require both leadership and partnership. The leadership must come from the Mayor and his Commissioner for Transport. The partnership must include the Boroughs, employers, schools and the media.
- 3** Transport for London (TfL) organises itself internally, for purposes of both funding and management, according to the different modes of transport. TfL should, however, ensure that the breadth of its expertise and responsibilities are 'joined up' – that they are all coherently used to deliver congestion reduction. TfL's modal structure must not impede effective progress. TfL must also provide assured financial support for congestion reduction initiatives led by others, which are of necessity spread over a number of fiscal years.
- 4** TfL and the Boroughs, working in partnership, should give a high priority to undertaking carefully designed and monitored pilot studies of individualised marketing in two to four localities across London.
- 5** The Assembly should use its powers and resources to encourage all concerned to work together to reduce traffic congestion across London, monitoring progress and seeking to identify and overcome any barriers.

Options for Reducing Traffic Congestion: An Overview



Peter Jones
Professor of Transport Policy and
Behavioural Analysis
Director, Transport Studies, the University
of Westminster

Summary

The paper first addresses the basic mechanisms by which traffic congestion can be reduced. It then focuses on the range of measures available to activate those mechanisms, using examples from around the world. It also considers likely future developments. While focusing primarily on car traffic, some attention is also paid to commercial vehicles.

Mechanisms Reducing traffic congestion involves either increasing capacity or reducing traffic levels during congested periods. The former includes both construction and signal control and traffic management measures. Traffic levels in congested situations can be reduced by displacement (ie, re-timing or re-locating traffic) or by reducing vehicle kilometres.

Measures There are four broad categories of measures to reduce vehicle kilometres:

- providing attractive modal alternatives.
- restraining car use.
- reducing the need to travel.
- encouraging reductions in car use through awareness and marketing initiatives.

Mode switching can be encouraged by improvements to walking and cycling networks, bus services, light and heavy rail systems. Vehicle restraint can be applied through physical/capacity restrictions, regulations or pricing, at the trip ends (eg, parking controls) or in the course of the journey. Travel reduction can be encouraged through tele-services, and planning policies. A variety of awareness and marketing initiatives have been developed to increase the effectiveness of the other policy measures and to encourage a voluntary reduction in car use.

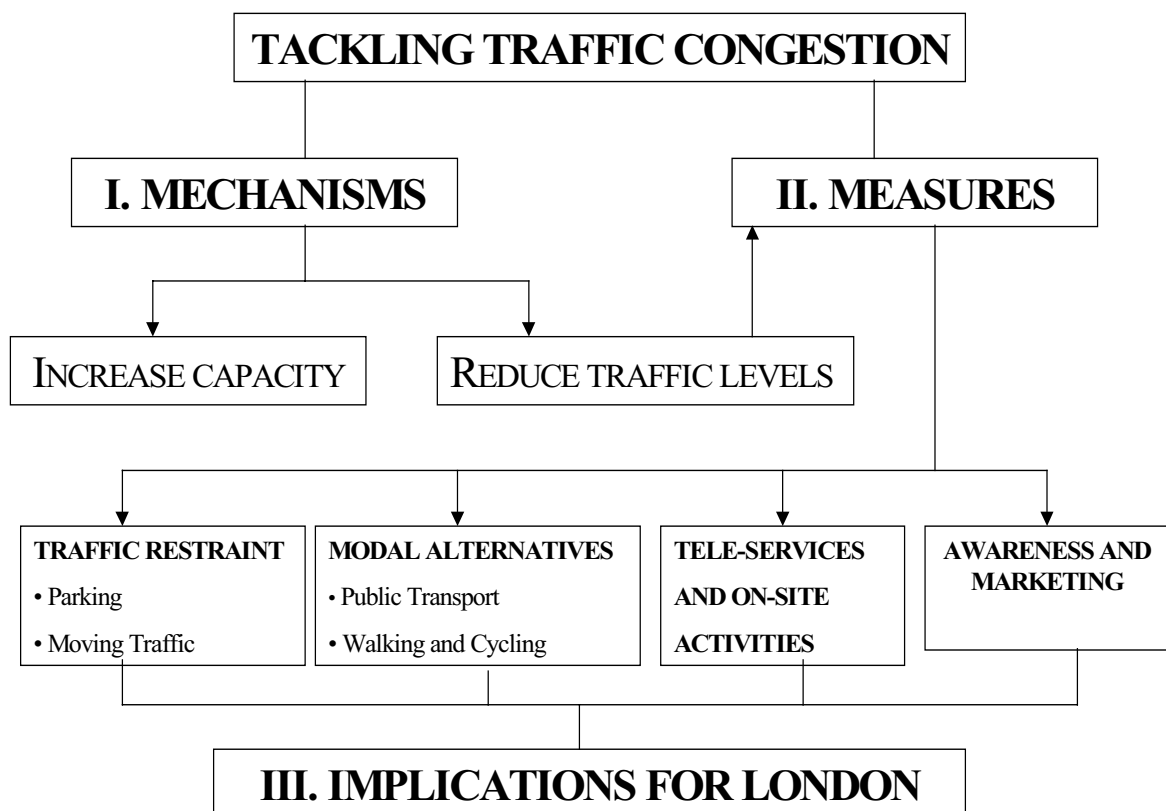
1 Introduction

Traffic congestion has been a feature of urban life since the Roman times, when restrictions were placed on the movement of vehicles at certain times of day. At the

start of the twenty first century, congestion is endemic to urban areas around the world, although the range of measures available to alleviate the problem is now much greater. Drawing on that broad body of knowledge, the paper first considers the nature of traffic congestion and discusses the main **mechanisms** for tackling the problem. It then examines in more detail four groups of policy **measures** that can be used to manage or restrain traffic levels, particularly focusing on non road pricing options. Finally, it briefly considers some of the **implications for London** and the issues that merit further examination. Note that relatively little attention is paid to new developments in information technology, as these are covered in the companion paper by Professor Mike McDonald.

The broad structure of the paper is as set out in Figure 1.

Figure 1 The Structure of the Paper



In reviewing experiences in different countries, two things become apparent. First, that approaches to tackling traffic congestion have varied from one place to another, thereby providing a rich source of experience upon which to draw. Second, however, that in most cases the monitoring of the impacts of the chosen measures has been very limited: it might simply be reported that public transport patronage has increased (without knowing if this has replaced vehicle or walking trips), or that the measure was 'successful'. It is thus often necessary to rely on judgement rather than hard fact when drawing conclusions.

Although the emphasis of the paper is on reducing traffic congestion, many of the measures will also have implications for other policy objectives. Depending on local

circumstances, if measures are introduced to alleviate traffic congestion, then these may be sufficient to meet air quality and noise targets as well.

In large cities, however, this is less likely to be the case, and congestion may be the easiest problem to 'solve'. Typically, a 10%-15% reduction in traffic levels – such as is commonly observed during school holidays – will have a major impact on traffic congestion in areas of London where the network is at capacity. This is much less than the public usually imagines – people often assume that traffic would need to be halved to make a noticeable difference. However, in the worst situations, meeting air quality targets may require a 30% general traffic reduction (unless vehicles can be selectively excluded), and on major arterials significant noise reductions may require closer to a 50% cut in traffic levels. Care also has to be taken when tackling traffic congestion, that any resulting increase in traffic speeds does not lead to a growth in the number or severity of traffic accidents.

2 Broad Mechanisms for Tackling Traffic Congestion

Traffic congestion arises in situations where the volume of traffic exceeds the capacity of the section of road along which it is travelling. This leaves two broad mechanisms by which the problem can be addressed:

- (i) increasing the capacity at the critical points on the road network, or
- (ii) reducing the volume of traffic to match the available capacity.

2.1 Increasing Road Capacity

Road networks comprise a series of links (sections of road) and junctions. There are various means by which capacity on each can be increased.

Link Capacity

Link capacity can be increased by:

- building new sections of road.
- widening an existing road.
- reallocating existing roadspace.
- better management of the street.

While major new road building is not a policy option in London, there may be situations where the provision of an additional link would be beneficial in relieving congestion. In particular, in areas where the road network is relatively sparse and suffers from poor connectivity (e.g. where a river, canal or rail line acts as a barrier); here a bridge or tunnel could create a key new link. Also, where an existing link has a disproportionately limited capacity creating a major bottleneck (e.g. narrow high street); here a by-pass link would both increase capacity and could provide a significant environmental improvement. There are, however, a number of major caveats, discussed below.

Road widening can also assist traffic flow, by increasing lane width or the number of available traffic lanes. However, the scope for road widening is generally very limited in London, given the close proximity of frontages to the existing carriageway. In the past,

road widening was vigorously pursued in some parts of London, but has done little to increase capacity, because of constraints elsewhere in the road network.

General traffic capacity has also been increased in the past by reallocating space within the existing carriageway. In particular, by banning kerbside stopping activity, say during peak periods and thus providing an additional running lane for through traffic. Urban clearways were widely introduced in London in the sixties and seventies, but on a blanket basis that took no account of local network configuration, so were not very efficiently designed. More recently, roadspace reallocation has been applied in a much more systematic way on the Red Route network in London.

Finally, better street management can help to increase traffic capacity, in two ways. First, better enforcement of existing traffic regulations that prohibit kerbside stopping at pinch points and in the vicinity of junctions can assist in increasing traffic flow (as has been evident on parts of the Red Routes in London). Second, improved lane markings and driver discipline can also assist in making better use of available capacity. The beneficial effects of these combined measures have often been observed following the introduction of bus lanes, where better lane discipline and enforcement has resulted in an increase in general traffic flow – even though one of the running lanes has been taken away from general traffic and reserved for bus use.

Junction Capacity

Although link improvements can have a significant impact on reducing traffic congestion in specific situations, in general it is the **junction** capacity that is more critical in dense urban road networks. Again, there are several ways in which junction capacity can be increased – subject to the caveats discussed below:

- new build (underpasses or flyovers).
- increasing the capacity on saturated junction approaches.
- changing the type of junction control.
- refining traffic signal control.

The construction of underpasses or flyovers can create a step change in capacity at critical junctions on a network, but is a very costly solution (both financially and environmentally), and is only likely to be a potential solution in a very limited number of situations. It is less relevant in a context where the road network is viewed as serving a variety of functions, rather than just being a conduit for motor vehicles. The other options listed above are much more practical and relevant in cities such as London, where much smaller increases in capacity are likely to be needed and appropriate to ‘balance’ the network.

Increasing capacity on saturated arms at approaches to critical junctions can be an effective way of reducing delays. This can be done using several of the options discussed under link capacity, from increasing physical lane width or numbers, to traffic regulation (preventing kerbside parking and loading) and effective enforcement, down to better lane markings.

Changes to the method of junction control can also increase capacity significantly, though the most efficient solution depends on the layout of the junction, the volume and composition of the traffic and the pattern of movement across the junction. In most

situations of high traffic flow and conflict, some form of signalised junction control is likely to be most effective; such control is also better at taking into account the needs of other street users (e.g. by including provision for safe, at-surface pedestrian crossing). Further gains in localised network capacity, of the order of 10%-20%, can be achieved by the use of procedures to optimise sets of traffic signal timings. This is discussed in the paper by Professor Mike McDonald.

Some Caveats

Selective increases in road capacity can reduce traffic queues and delays on some parts of the network, and as a consequence reduce traffic exhaust emissions; they can also improve journey time reliability. However, at a network level, the scope for improvement is quite limited, and many previous attempts to increase capacity in London have been largely ineffective. This has been demonstrated in reverse, by taking out some of the capacity increases introduced in previous decades (e.g. using one lane of a short section of dual carriageway for buses, or allowing parking on sections of road previously designated as urban clearways), without having a detrimental effect on traffic flow.

In general, where a network of roads is operating at capacity – as is the case in quite large parts of London at peak periods – then improving an individual link or junction is unlikely to lead to any significant increase in capacity, unless this will alleviate a specific bottleneck that is much more restrictive than the surrounding network.

Two general issues need to be taken into account when contemplating any significant increase in road capacity; these apply at the local and the more strategic level. First, at the site itself there may be issues relating to land take (including the possible demolition of buildings), and the removal of space and capacity for other street activities (e.g. less capacity for pedestrians crossing at traffic signals, or inconvenience for businesses requiring kerbside for loading purposes). There may also be significant local effects arising from increased rates of traffic flow, such as greater street severance or increased accident risk for vulnerable road users.

More strategically, there is considerable evidence that in saturated urban networks with high levels of suppressed demand for road movement, any significant increase in capacity will be taken up by additional traffic attracted on to the network: the well-known “roads generate traffic” argument. An extreme example is provided by the construction of Westway, from White City to Edgware Road. This appears to have resulted in a doubling of the rate of growth in road traffic on that corridor in the decade after it opened, compared to others in that sector of London (SACTRA, 1994). There is also evidence of an ‘elasticity of demand’ effect in studies that have examined the converse situation, where they have found that cutting capacity can lead to some reduction in overall traffic levels in the area (MVA & TSU, 1998).

One interesting research finding in situations where there are congested road corridors and suppressed demand, alongside good quality rail provision, is that there is an equilibrium between travel conditions by road and rail. In other words, the average door-to-door travel times by car and train are the same. This has been verified for travel to Central London and in Paris, and leads to the **‘Downs-Thomson’ Paradox** (Mogridge, 1990). Namely, that the best way to reduce travel times on the road network is to improve door-to-door rail journey times – thereby raising the equilibrium speed.

2.2 Reducing Traffic Volumes

If road capacity cannot be increased – which is the case in large parts of London – then traffic congestion can only be alleviated by reducing the volume of road traffic at critical times and places on the road network. There are two general means by which this can be achieved, through:

- (i) displacement of road traffic.
- (ii) reduction in overall traffic volumes.

Traffic Displacement

In the case of traffic displacement, the overall volume of road traffic is unchanged (looking at the urban network as a whole, on a 24 hour basis), but some of it shifts to parts of the network that has spare capacity. This can happen in two ways, by:

- using the same roads but at other times of day (time-displacement).
- using other parts of the road network (space-displacement).

Time displacement already happens in large cities, such as London, where ‘peak spreading’ is a common phenomenon. Peak hours have become peak periods, and in Central London the network is now at capacity for around 12 hours each weekday. Long-term measurements have shown that on radials in Inner London, peak period flows have remained largely unchanged for over twenty years, and the inter-peak period is filling and approaching peak period levels on some routes. In outer London, traffic growth is in general still occurring both at peak and off-peak periods.

One of the consequences of providing a large increase in road capacity can be to reverse this process, causing a ‘reversion to the peak’ effect. One such well documented case is on the M10 ring road around Amsterdam, where a new tunnel provided a major increase in capacity across the North Sea Canal (Loos and Bovy, 1991). Quite quickly, peak traffic levels grew by 10%, while ‘shoulder’ traffic levels declined; 30% of drivers changed their departure time.

Space displacement is also a common occurrence in London and other urban areas, in the form of ‘rat running’ through residential areas to avoid congested points on the strategic road network. This is a widespread phenomenon. National statistics have shown since the eighties that the rate of traffic growth on minor urban roads has been much faster than on the main roads – in rural areas the converse is the case.

Rat running is relatively easy to counter through appropriate policy measures, and these are outlined in Section 3 of this paper.

Traffic Reduction

At the network level, traffic volumes are measured in terms of vehicle miles/kilometres of travel. This can vary in response either to a change in the average length of a vehicle trip on the network, or to a change in the total number of vehicle trips. In other words, a 10% increase in vehicle kilometres could be due either to an average 10% increase in trip length, or to a 10% increase in vehicle trips at the current average length – or some combination of the two.

Thus, total traffic levels can be reduced in one of two ways, by:

- reducing average vehicle trip length, or
- reducing the total number of vehicle trips.

Reductions in vehicle **trip length** can be achieved by means of one of three main mechanisms²:

- increasing the number or attractiveness of destinations closer to home (or other primary trip-generating locations such as workplaces).
- increasing the 'costs' of travel by motor vehicle.
- encouraging more efficient travel patterns through 'trip chaining'.

To varying degrees, these are applicable both to car and commercial vehicle travel.

Planning policies that encourage higher density and mixed use development will in time increase the number of possible destinations for a given trip purpose within a certain distance of the home or workplace. This, in turn, should help to reduce average vehicle trip lengths. Such a move would be further strengthened by policies that encouraged people to patronise local businesses. Currently, a number of national government policies are having the opposite effect and are increasing average trip lengths; in particular, centralisation of hospital facilities and greater parental choice over school location.

Drivers can also be encouraged to reduce their average trip length as a result of increases in the 'costs' of travel. Here we include both money and time costs. Although intuitively this seems a plausible mechanism, in practice the evidence of effectiveness is weak. Nationally, the sharp increases in vehicle fuel excise duty in recent years have not led to a perceptible drop in average annual car mileage – fuel consumption appears to be much more sensitive to price than does car mileage.

In the longer term, travel seems to be more sensitive to time costs than money costs – in part because, while annual incomes tend to rise over time, personal time availability is fixed at 24 hours per day. Despite the national ten-fold increase in car traffic in the last 40 years, it is perhaps surprising to find that:

- the average number of trips per person per day has hardly changed, and
- the average daily travel time budget has also remained largely stable.

How can this be squared with the observation that people are travelling a lot 'more'? Mainly by the fact that (i) the average speed of travel has increased, as people switch to car from the slower door-to-door alternative modes (walking, cycling and bus) and – at least on inter-urban roads – that (ii) the average vehicle speeds themselves have increased (e.g. through the construction of motorways). Nationally, about a third of the growth in car traffic can be attributed to an increase in trip length, largely associated with this rise in inter-urban speeds. Thus, trip lengths are likely to be sensitive to any

² The policies that help to achieve the first two of these mechanisms can in some cases also encourage modal shift; whereas increases in trip chaining can make it more difficult to use public transport as an alternative (though not cycling or walking).

network-wide reduction in average vehicle speeds – such as might be brought about by the extensive introduction of 20mph zones.

Trip-chaining represents the third means by which trip lengths can be reduced. Note that it is not so much that individual trip lengths are reduced (though some may be), but rather that daily mileage in aggregate is cut back, while the same destinations are visited by car. It is thus a hybrid of trip length and trip number reduction. Here drivers organise their journeys in a more efficient way, by visiting two or more destinations on the same outing from home, rather than making a separate trip to each. In simple terms, by linking two destinations on the same journey, one trip can be saved (e.g. going from: home->work->shop->home, instead of: home->work->home, then home->shop->home). The reduction in overall trip length across the set of activities will clearly depend on the relative locations of the various destinations.

The business travel market has addressed the equivalent problem for decades, with many academic papers being written on the ‘travelling salesman’ problem.

There are also several mechanisms for achieving a reduction in vehicle **trip numbers**. These fall under two broad categories:

- switching of vehicle driver trips to other modes, or
- reducing the overall number of trips made.

In this case, the mechanisms apply almost exclusively to reducing car vehicle trips and are not so applicable to commercial travel, at least in urban areas. There may also be important secondary effects, discussed below.

Modal shift has been a cornerstone of urban transport policy for decades, though the evidence of the effectiveness of some of the measures used is often limited (see Section 3). In general, the aim is to change the relative attractiveness of car and alternative travel modes. This can be achieved in one of two ways:

- improving the modal alternatives (in particular: bus, rail, walking, cycling).
- increasing the cost or difficulty of car travel.

Section 3 covers the kinds of policy measures that can help to achieve a modal shift in some detail, so they are not considered further here. As noted earlier, planning policies that increase the density of activities will help to reduce trip lengths and so make walking and cycling more competitive.

Trip reduction can also be brought about using two different types of mechanism:

- improving on-site services, so that more activities can be accessed at the one place (either physically or virtually), thereby reducing the need to travel.
- increasing the cost or difficulty of car travel.

Again, on-site and tele-services are discussed in greater detail in Section 3, and are not considered further here.

It is also important to note that, of all the mechanisms that have been identified to reduce traffic volumes in this Section – whether by reducing trip lengths or the overall

numbers of vehicle trips – the ones with the most widespread impact involve increasing the costs of travel, in some form or another. These are not the focus of this paper, but cannot be ignored.

Secondary Effects

One of the lessons that has been painfully learnt by city administrations around the world is that people respond in complex ways to new policy initiatives – especially those designed to restrict or modify behaviour in some way. Travellers, in particular, are very resourceful at adapting their behaviour and this needs to be taken into account when devising transport policy measures.

In Singapore, for example, when congestion charging was first introduced in the mid-seventies, it was assumed that by directly targeting morning in-bound travel to the city centre, there would be a corresponding reduction in evening traffic levels, without the need to extend the charging period beyond mid-morning. In practice, while morning peak flows inside the charged area fell sharply, there was no corresponding reduction in evening peak flows. People adopted a range of avoidance mechanisms: some came into the city centre ahead of the charging period, having breakfast in a local café before going to work; others (on business or shopping trips) came in later in the day to avoid the charge; and people who diverted around the city centre in the morning crossed through it on their return journey in the evening.

There are also other examples of behavioural adjustment that need to be borne in mind when planning the introduction of new policy measures in London. In particular:

- improved network conditions will generate extra traffic, in a large city like London. This applies not only to new road capacity – the ‘roads generate traffic’ argument discussed in Section 2.1.3 – but also to major new public transport infrastructure. In both Munich and Zurich, for example, the construction of mini-Crossrail schemes has led to a large increase in cross city-centre rail traffic and in Zurich this has led to plans for a second tunnel (see paper by Ruedi Ott).
- success in encouraging travellers to switch to destinations closer to home, thereby reducing average trip length, may lead to an increase in trip frequency. This is consistent with the ‘constant travel time budget’ hypothesis and has been observed empirically. For example, students living close to college are observed to return home during the day, whereas those living further out come in for the whole day. At a more macro level, one effect of the M25 has been to increase the frequency of social visits across London.
- encouraging a driver to switch from car to an alternative mode potentially leaves that car free to be used by another household member during the day. In some situations, this has resulted in an increase in peak public transport use (as a commuter switches from car), but reduced off-peak use as other non-employed household members switch to car. The overall net effect may be very little reduction in car use. In this respect, Park and Ride is an effective policy, in that the car is only being driven for part of the trip, but its partial use prevents the car being used by another person during the day.

3. Policy Measures for Reducing Car Use³

There are four broad groups of policy measures that can be applied to reduce car use:

- (i) measures that directly restrain road traffic.
- (ii) improvements to modal alternatives.
- (iii) tele-services and on-site services.
- (iv) awareness raising and marketing initiatives.

Each is considered in turn, first outlining the broad principle and then giving some practical examples of their implementation. Note, however, that:

- there is much more experience of implementing certain of these measures than others, and some are the subject of other papers presented during this seminar, so the depth of coverage is variable.
- relatively few implementations have been comprehensively and thoroughly monitored, particularly outside the UK, so the evidence in many cases is weak.

3.1 Restraint of Road Traffic

Restraint policies can make use of one of three types of measure that impact in different ways on car drivers:

- physical capacity constraints.
- regulatory controls.
- pricing measures.

In addition, car restraint can be targeted at two different aspects of the journey:

- the trip end - when the vehicle is parked.
- during the course of travel – while the car is travelling through the road network.

Trip End Restraint

Here restraint is directed at limiting the provision of parking spaces, usually at the non-home end of the trip but also occasionally at the residential end. Parking restraint can be applied using the three types of control outlined above.

Physical: by limiting the **number** of spaces available, both on-street and off-street. Depending on the policy objectives (e.g. to discourage car commuters), some spaces may only be provided at certain times of day (e.g. car park opened after 10am).

Regulation: the use of spaces can be regulated in terms of **who** can use them, and for what **time period**. Regulatory controls apply particularly to on-street parking and can designate spaces for various groups, usually through the provision of permits, including:

- residents.

³ While the emphasis is on measures to reduce car use, reference will be made to effects on freight and service traffic where this is appropriate.

- disabled drivers.
- businesses.
- doctors.

In addition, **time period** can be regulated in two senses:

- the **times** of day at which spaces are available for use – which, apart from any restraint requirement, may also be affected by the need to reserve that part of the carriageway for other users at certain times of day (e.g. peak period bus lane).
- the maximum **duration** for which any parking act is permitted (usually linked with a minimum period before return is permitted).

While the emphasis in this Section is on car restraint, kerbside controls can also apply to other categories of vehicles. For example, space may be reserved for loading/unloading, although it may only be permitted at certain times of day, and is usually restricted in duration.

Pricing: car use may be reduced as a consequence of the price charged for parking. On-street charges are usually set to achieve a balance between demand and supply, so that 10%-15% of spaces are unoccupied at any one time – thereby reducing the need to search for a space. But the equilibrium price depends on the overall number of spaces available.

In practice, these three types of control are commonly used in combination, particularly with on-street parking. For example, spaces that are charged for also usually have a maximum parking duration.

Residential parking: in inner city areas, the physical lack of residential parking space may discourage car ownership, particularly multi-car ownership – though it may also encourage the out migration of wealthier households. This might be a contributory factor in explaining the relatively low increase in car ownership in Inner London in recent decades.

There is stronger evidence to suggest that the problems of finding an on-street residential space in the vicinity of home discourages drivers from using their car, and that some trips that would normally be made by car are instead made on foot or by cycle, or using public transport.

Effectiveness

While parking controls can be very effective at limiting certain categories of car use, there are several potential problems:

- conflicts with other policy objectives: there may be worries that if restrictive parking controls are applied in an area then car-borne trade will go elsewhere, where parking is plentiful and free (e.g. at out of town centres). In some cases this has resulted in town centres allocating more of the available spaces for short-term shopper parking, but this increase in turnover per space has implications for emissions.
- lack of impact on through traffic: a large proportion of traffic in a central city area (typically 30% or more) may be through traffic – that is entirely unaffected by the controls. Indeed, if parking controls are successful in substantially reducing car traffic terminating in the area, then this could ‘suck in’ additional through traffic.

- limited ability to control the full range of parking in an area: many categories of road user are exempted from, or are able to avoid, local parking controls. For example, many employees and customers are provided with free parking by employers and businesses (often well over half of the non-residential parking spaces are privately owned and so are presently unaffected by public parking policies) and residents pay very low annual charges.

Moving traffic restraint

Physical restrictions on the capacity of links, junctions and local (usually residential) networks can be achieved in a number of ways, through:

- road closures.
- traffic ‘mazes’ in residential areas: using banned turns, short sections of one-way street in alternate directions, etc. to ensure an indirect routing through the local network.
- traffic ‘cells’ in city/town centres: dividing the area into a number of cells that can only be accessed by general traffic from a surrounding ring road, which has to be used to travel from one cell to another; cyclists and public transport vehicles can pass directly between cells.
- traffic calming schemes (e.g. using speed humps or tables, chicanes, mini-roundabouts, etc.); speed ‘cushions’ may be used to reduce the impact on buses and other wide wheel-base vehicles.
- traffic ‘collars’ (i.e. by narrowing/reducing the number of traffic lanes, or by altering signal settings to reduce capacity); sections of cycle and bus lane may be provided to enable these vehicles to by-pass the bottleneck and jump any build-up of traffic upstream of the restriction.

Regulation involves the introduction of controls that limit access to designated links or a whole area, based on some characteristic of the vehicle or the driver. Possibilities include regulation by:

- type of **vehicle**: including width or height restriction, exemption for certain classes of vehicle (e.g. buses, low emission vehicles); or by licence plate number – the Athens ‘odd/even’ licence plate scheme limits access on alternate weekdays to vehicles with licence plates ending in odd and even numbers.
- type of vehicle **occupant**: exemptions may be provided for residents, disabled drivers, local businesses, etc.
- **purpose** of the journey. For example, the use of a route may be restricted in the UK to vehicles ‘loading’ or requiring ‘access’ to the designated area.

Pricing schemes can be designed primarily to control the overall level of traffic in an area (e.g. in Singapore) or as a revenue raising measure (as in Norway). There are many options for determining the basis for charging drivers, including:

- point charges, at junctions or links (e.g. tunnel or bridge tolls).
- cordon/boundary charges (as proposed in Edinburgh).
- area charges (as proposed in London).

- length-based charges using time or distance (time-based charges are not permitted in the UK, because of potential effects on driving behaviour and safety).
- externality-based charging (e.g. proposal for real-time 'congestion' charging in Cambridge; could also vary charge according to emissions).

Charges can also be varied by time of day/day of week, with exemptions or reduced charges for certain categories or vehicle or person (using similar classifications to those discussed under regulation).

Effectiveness

Physical measures have been shown to be successful in reducing traffic volumes in the local area. Some can 'meter' the volume of traffic passing through an area, others force a re-routing (e.g. traffic cells), or can discourage through traffic by making the route less attractive (e.g. mazes and traffic calming). Traffic cells, for example, can reduce city centre traffic within the affected streets by over 50%.

However, there may be undesirable network and local side effects:

- traffic will often be displaced to other parts of the network; if these other sections have substantial spare capacity this may be beneficial, but otherwise congestion and air pollution may just be moved from one area to another.
- designing routes that are tortuous may reduce traffic speeds and improve road safety, but if there is more acceleration/deceleration this can lead to increases in noise and air pollution and total vehicle mileage may increase substantially.
- some schemes may become less effective or appropriate if general traffic levels increase substantially in the area.

Restriction through **regulation** has the advantage over physical measures that it can be more selectively targeted at certain groups and modified more easily, and can be applied only at certain times of day. As a consequence, it tends to gain higher levels of local public support than other types of measure (especially where local residents are exempt!). In the seventies and eighties many Italian cities introduced access restrictions in their central areas – but with widespread exemptions for local residents and businesses, plus buses and lorries. Typically, overall traffic levels dropped by 10% and car traffic by about 15%-20%.

Until recently, a major problem with regulatory measures was the difficulty of enforcement; for example, the manual access permit scheme in central Milan needed 100 police officers to enforce it. Now, however, the widespread use of camera technology and the ability to issue electronic access permits means that some of these measures are likely to become more cost effective in the future (see Miles *et al*, 1998). A recent study in La Ribera, a small inner city area in Barcelona, found that the introduction of a resident-only car zone with barriers controlled by cards, reduced car traffic in the area by nearly 80%. Over 70% of residents supported the scheme.

Another limitation with regulatory measures is that they often only limit a **proportion** of traffic, so that any overall growth in traffic is not capped. For example, the odd/even licence plate scheme in Athens becomes less effective as the total car stock increases, and in the UK the number of Orange/Blue Badge holders is rising as more older people have access to a car. By contrast, physical limitations can impose absolute limits, as can restraint through pricing.

There is some practical evidence that road **pricing** can be effective in reducing car use. The Singapore city centre scheme introduced in the mid-seventies halved car traffic in the area. Many other cities – including London – have carried out stated preference studies and modelling studies that have also shown significant potential traffic reductions inside the charged area. In policy terms, pricing has the key advantage that it could be used to ‘cap’ overall traffic levels in an area – in the same way that parking prices are set to achieve an equilibrium between demand and supply. It would also generate substantial income for improvements to non-car modes.

3.2 Improving modal alternatives

Usually the most popular solution among the public to traffic problems in London and other large cities is to improve modal alternatives, particularly public transport services. People argue that safe and attractive alternatives to private car use need to be provided if significant numbers of drivers are going to change their travel behaviour.

Rail Based Systems

Rail-based systems are perceived to provide particularly attractive alternatives to the car, both in objective terms and subjectively (some car drivers view rail as a much higher status mode than bus). As previously noted, for travel to central London there appears to be an equilibrium door-to-door speed between car and rail-based journeys.

There are many features that influence the attractiveness of rail services, including access to the network (i.e. distance to the station), frequency, speed, reliability, fares, crowding, comfort, information, security, etc. While line speed is important, it is door-to-door times that mainly count for trips within urban areas. This has led many city authorities to look closely at tram systems in recent years: their shorter distances between stops than heavy rail and ease of access at street level can more than compensate for lower line speeds – provided that there is sufficient segregation from general traffic to ensure service reliability. These systems need to be complemented by urban bus services and with regional rail networks.

So far UK experience with new tram/light rail systems has been mixed. Typically, however, 20%-30% of passengers previously travelled by car, and in Manchester a 5% reduction in car traffic was observed on parallel radial corridors in peak periods. In Strasbourg the construction of a new tramway, plus improved bus services, increased public transport patronage by 32% in three years, and there was a 17% drop in car traffic to the city centre (where more space was allocated to alternative modes). In other European cities there is no direct evidence of a drop in car traffic following the introduction of new rail capacity – partly due to lack of detailed studies – but in many cities it appears that decades of growth in traffic levels has been arrested: rail has captured the growth in travel demand once the road network is at capacity.

Cities such as Munich and Zurich have developed their own Cross-Rail equivalent, linking up suburban rail services in a new tunnel under the city centre. In general, the result has been a sustained growth in passenger number using the services, to the point where the tunnel sections become a significant restraint on future growth: scope for capacity increase or additional tunnels should be built in from the start.

Bus-Based Systems

Similar considerations apply when developing attractive bus-based systems as in the case of rail. In general, buses are able to get closer to a wider range of trip origins and destinations, but offer a less reliable service and a less comfortable ride. Many services also suffer from an 'image' problem – though much less so in London – and tourists often find service patterns confusing, preferring to use rail. Where high-profile, high-quality services are provided, however (e.g. Leeds Busway), then local increases in patronage can be significant.

However, generally speaking, the effects of bus service improvements have been poorly monitored. While most companies can provide data on increased boarding numbers, little is known about where the increased patronage has come from – in particular, about levels of abstraction from car.

One exception was a bus corridor improvement in Copenhagen, involving bus stop improvements, provision of real-time information, new bus and cycle lanes (taking capacity away from private cars) and signalised priority. The effect was to reduce the modal share of car trips from 52% to 48%, but bus use went up from only 2.8% to 3.5%: in this case, the greater beneficiary was cycling (up from 33.6% to 36.9%).

Blackledge (1998) reports on the findings from a number of European Commission funded demonstration projects, several of which included bus improvements. He concludes that they have resulted in an average increase in bus patronage of 4.8% (maximum +10%), and an average reduction in car use of -0.5% (maximum -2%).

Cycling Provision

As many commentators have observed, cycling rates are very low in the UK compared to most other countries in north-west Europe. Taking capital cities, around 20% of trips in Copenhagen are made by cycle, and Helsinki plans to double cycle use, from 6% to 12% in ten years. In 1991, only about 2% of trips by London residents were made by cycle.

There is now quite an extensive body of advice, from several countries, on how to provide attractive cycle facilities, including cycle networks and the provision of safe parking and special changing/showering facilities. Many professionals adopt a cautious approach to encouraging cycling, on the grounds that it is an unsafe form of travel. Safety improves as the number of cyclists increases, but even under current UK conditions, a British Medical Association study (BMA, 1997) found that the health benefits (reduced risk of heart attack, general increase in fitness, etc) more than offset the accident risk.

Provision for Walking

Most European cities have developed pedestrianised areas, to varying degrees, and – despite initial hostility from traders – they have usually been very effective in increasing usage of the local streets, thereby enhancing the vitality and viability of the local area.

However, in general it would be fair to characterise walking as the 'Cinderella' mode of transport. In all the European cities with comprehensive data, the share of trips on foot has been in gradual decline for several decades. This can be attributed to a number of causes: increased car ownership (in the UK, cars are being used for a growing proportion

of trips under one mile), longer distances between destinations as cities spread, increasing traffic dominance and growing concerns about personal security.

Several cities are starting to address the problem, by providing safer, more direct and more attractive pedestrian routes, with greater priority at traffic signals and improved lighting and CCTV camera provision. Street maintenance is also an important contributory factor, with even paving stones reducing accidents and making it easier for those with wheeled luggage and shopping bags, and the removal of graffiti and abandoned cars reducing personal safety concerns.

Car 'Sharing'

Here a potential confusion of terminology arises. In most of the rest of Europe, the term 'car sharing' refers to the shared ownership of a motor vehicle, not to giving other people a lift during a particular journey.

Instead of personally owning a car, groups of people (typically, residents in an area) join a club that purchases or leases a number of cars for general use. Members pay an annual fee plus a per kilometre charge. While the approach is best developed in urban areas in Germany and Switzerland, schemes are now under way in several places in the UK, including Camden, Bristol and Edinburgh.

Studies in Germany have found that one car club vehicle replaces between five and ten privately owner cars – thereby reducing considerably the need for local on-street parking provision – and that overall household car use may reduce by half. Most of this reduction is taken up by other modes (walking, cycling or using public transport).

Some General Considerations

In judging the extent to which the provision of improved alternative modes will reduce car use, a number of factors need to be borne in mind:

- the availability data on travel impacts is often very limited and incomplete: lack of evidence (e.g. in the case of bus improvements) does not necessarily mean lack of effectiveness.
- travel impacts often build up over a number of years. Studies have shown – both in relation to rail and bus service improvements – that it is often newcomers to an area that are more likely to take advantage of improvements than residents who have established travel patterns. Hence, as population turnover builds up, so do patronage levels.

3.3 Tele-Services and On-Site Services

Both measures offer the potential to reduce the need to travel, in order to access a range of goods and services.

Tele-Services

The telephone provided the opportunity a century ago to talk to another person without being physically in the same place, and advances in wide-band communication technology and associated software and hardware are now making it possible to carry out a much wider range of activities remotely. Tele-banking and tele-booking offer a growing range of services (from booking flights to cinema tickets) and are becoming

commonplace, as is the ability to remotely access video entertainment and information sources via the web. Tele-working is also growing in importance, along with tele-conferencing which is increasingly substituting for some longer distance travel.

Most of these tele-activities are direct substitutes for travel (e.g. for a visit to a local bank or a business meeting), but there are potential indirect effects. There is considerable debate as to whether easier personal communication and remote information gathering stimulates the desire to meet and experience places at first hand. Certainly, web-based airline booking has helped to cut costs and increase ease of information access – and so has indirectly stimulated demand.

Uncertainties also exist in relation to the net effect of tele-commuting. While daily trips to the office may be reduced, some of these benefits may be offset by:

- an increase in the average distance between home and workplace: trips may be fewer, but longer.
- some of the time saved by not commuting on a daily basis may be used in other out-of-home activities and hence associated non-work travel.
- a car no longer used by an employee for daily commuting may be used by another household member.
- working at home increases in-home energy consumption (electrical equipment, heating, lighting, air conditioning) that may off-set other energy savings.

One of the most contentious areas is in relation to the impacts of tele-shopping. While this reduces the need for a physical trip to the shop – or makes it easier to travel by a non-car mode – there is still a requirement to transport goods to the home. The retailer may be able to schedule this efficiently by making a series of deliveries in an area (depending on the tightness of the delivery time ‘window’, number of competing suppliers, etc.). But the vans used are generally much larger, more intrusive (physically, and in terms of noise and air pollution), and are less fuel efficient than the cars they replace. One study in a small market town suggested that there could be a net saving of up to 70% in vehicle mileage, but this reduces to about a 30% reduction in fuel consumption. The figures in a large city could look very different, given greater competition and the need for repeat deliveries if people are out.

On-Site Services

It is self-evident that, the more services provided at or in the vicinity of a site, the less the need to travel between sites to access goods and services. In recent decades, however, the trend has been in the reverse direction.

Several studies looking at the travel impacts of an office relocation, for example, have shown that moving to a purpose-built site away from shopping areas increases lunch-time car traffic. Similarly, the greater emphasis on ‘out-sourcing’ of maintenance and repairs (e.g. contracting a company to provide and maintain office plants, or bring in food supplies) has contributed to the significant growth in van traffic in places such as London.

Recent planning policies designed to encourage mixed use development and to locate new developments within existing areas and at points with good public transport access should assist in reducing the need to travel. One recent example that has encouraged

travel efficiency has been the growth of smaller retail food stores at public transport interchanges (Hammersmith, Liverpool Street, etc.), which has enabled people to shop without increasing their travel time or distance.

However, there may be important negative effects for freight deliveries. Planning policies that encourage mixed use and higher density developments may shorten car trips and enable the occupants to switch to other modes, but on the freight side they are likely just to lead to an intensity of distribution activity in an area.

3.4 Awareness Raising and Marketing

The assumption has often been made in the past that, if transport systems are improved, people will automatically be attracted to use them. In practice there is a lot of inertia in travel behaviour and a lot of ignorance about the availability of alternatives to the car – including simple questions of how to access a system or purchase a ticket. London has traditionally provided quite comprehensive information about its bus and underground services, but in a passive rather than a pro-active manner: the potential customer has to make the effort to obtain the information.

In the last decade, there has been a growing interest in developing co-ordinated, multi-modal awareness and marketing campaigns, that seek to change perceptions and attitudes to car use. They aim to encourage people to use alternatives to the car where practical⁴, both for personal reasons (less stress, save money, get healthier, etc.), and for wider community reasons (improve air quality, reduce accident risk, etc.).

The potential for modest reductions in car use is there: national surveys have found that most drivers accept that around 10%-20% of their car trips could be made by alternative modes. Surveys of parents who chauffeur their children to school in the UK suggest that around a half would prefer not to have to do so. While this is partly down to lack of provision of suitable alternatives, it is also a question of awareness and willingness to change.

Experience from recent work in the UK and other countries has highlighted the need to develop a comprehensive strategic communications strategy over several years, if real progress is to be made. However, the target groups and messages need to be clearly defined.

The aim is to take people through a series of stages of change, sometimes characterised as 'The Five A's':

- **Awareness** that traffic levels and car use pose a problem, both individually and to the local community as a whole (air pollution, obesity, etc.)
- **Acceptance** by individuals that they are part of the problem and that by changing their behaviour it will make a difference – to them and collectively
- **Attitude** shift, whereby other modes are seen as potential alternatives to car use, for selected trips

⁴ The emphasis is very much on making small changes, focusing on trips where this is feasible: if everyone did not take their car to work for one day each week, for example, total commuting traffic would drop by 20%. The emphasis is not on asking people to give up their use of the car entirely – as it is sometimes portrayed in the media.

- **Action:** experimentation with alternatives to the car for selected trips
- **Assimilation:** adopting this modified travel pattern as part of daily behaviour.

As the strategy shifts its focus from awareness raising through attitude shift to action, there is a need to employ different types of communication technique and to move from the general (newspaper advertising, posters, etc.) through more targeted approaches (e.g. via schools or workplaces) finally to a customised, 'dialogue marketing' approach. Opinion surveys in London show that there is already a high level of awareness of the problems associated with car use (particularly in inner London and around the strategic centres), so here it is likely to be more appropriate to focus effort on more pro-active marketing initiatives.

There is increasing evidence that a targeted, pro-active approach can be very cost effective. Trials in Germany have shown that dialogue marketing can double the patronage of a new transport service, and that costs can be recouped within one or two years through increased ridership. Studies comparing the use of 'Individualised Marketing' against standard information provision or the issuing of test tickets has shown the former to be a much more effective means of reducing car use and increasing public transport patronage (Brog and Schadler, 1999).

The companion paper by Werner Brog and Helen Gray-Smith demonstrates the benefits that have resulted from applying a similar approach on a large scale in several residential areas of Perth. Interestingly, the reduction in car mileage exceeded the reduction in car trips, as some people switched to a closer destination at the same time as switching from car to another mode. For a general review of a wide range of 'personalised journey planning techniques', see the recent report published by DTLR (2002).

4 Some Implications for London

This brief overview has shown that there is a wide range of measures that are now available to tackle traffic congestion, some of which have not yet been extensively applied in London. While considerable effort in the past has gone into traffic management (and London is a world leader in some aspects of signalised control), there is further scope for applying physical and regulatory control measures – in the latter case assisted by the rapid advances in automatic enforcement technologies. The introduction of 'low emission zones' could have a significant impact on local air quality and could help to stimulate wider technological advances and changes in transport operations. There is also scope for extending parking controls to other parts of London, and applying more sophisticated controls in some of the existing areas.

In terms of modal alternatives, more could be done to develop attractive facilities for walking and cycling. Cycling use is well below that in most other north-west European cities and there is much useful experience that can be drawn on from the rest of Europe to assist in increasing modal share. But in the case of walking, London will need to pioneer new approaches if significant increases in modal share are to be achieved – no other city has been able to increase walking except in localised areas. Finally, there appear to be exciting opportunities in the area of awareness and marketing initiatives, particularly if introduced in conjunction with service improvements such as the London Bus Initiative.

It is also evident that appropriate solutions will vary across different parts of London: central, inner and outer. While some may question the validity of measures that in

general have been successful in much smaller cities than London, in fact London is in the main a collection of strategic and local centres, each of which has many counterparts elsewhere in Europe.

Finally, it is important to recognise that:

- significant change will only come about through the introduction of co-ordinated and comprehensive packages of complementary measures, and that
- consistent policies have to steadily implemented on the ground over several decades, if real changes in behaviour are to be achieved and sustained.

In situations when such an approach has been adopted, the effects can be quite dramatic, as shown in Table 1. Against a background of increasing incomes and rising car ownership, car use among residents in the cities shown over a period of one or two decades has either remained stable or actually declined. Public transport use – and in several cases cycling – has increased. As previously noted, in all cases the modal share of walking has declined.

Several authors have attempted to give a broad overview of the introduction of various sustainable transport policies and their impacts in a range of European cities. Pharoah and Apel (1995), for example, cover ten cities – including London – while the contributors to Tolley (1997) describe various types of policy measures across Europe. Marshall and Banister (2000) focus in more detail on a number of case studies implementing specific policy initiatives in four cities.

Table 1: Changes in Modal Share Among Residents of Selected Cities Over Time⁵

	Amsterdam		Bremen		Munich		Stuttgart		Vienna	
	1982	1992	1982	1996	1982	1995	1976	1996	1971	1991
Walk	27	25	25	20	29	23	34	27	31	22
Cycle	20	15	20	22	10	14	2	6		4
Car Driver	31	30	30	30	30	30	35	35	39	37
Car Pass.			10	9	8	8	13	8		
Public Trpt.	22	30	14	18	22	25	16	24	30	37

⁵ The figures may not always sum to 100% due to the exclusion of motorcycle trips.

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The Perth Experience Reducing the Use of Cars - the Homeopathic Way



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Summary

The traditional approach to achieving modal change has been through the provision of transport services and infrastructure, pricing, and longer term land use policies. Although improvements in the transport system are necessary for increased use, they are of limited value if people are unaware of the system improvements.

We all perceive the world subjectively – subjective views of the world are built up in our minds. These subjective views are incomplete and distorted, but they are nevertheless what determine behaviour. This does not mean that the individual does not behave rationally, but that the rationality is subjective. In order to influence behaviour (with respect to modal choice) there are both “measures in the system” (hard policies) and “measures in the mind” (soft policies).

Socialdata has been involved in the research of travel behaviour in many countries. Its main task is in research and marketing in the field of mobility behaviour and, in particular, in the combination of research and implementation. Research has shown that “soft policies” can activate large potentials, on the same scale as system measures.

There are problems world-wide with traffic congestion, together with its effects on health and the environment. Reducing the use of cars in the homeopathic way requires

treating the problem naturally, rather than relying on large-scale infrastructural changes. By approaching the problem together as a community, and by providing motivation and information through personal contact, individuals are empowered to make their own travel choices.

Nearly everyone makes at least two trips a week by car that could be undertaken by a more environmentally friendly mode - two trips means the trip to the destination and the return trip. So if everyone could change to using public transport, walking or cycling just once a week instead of using the car, this would have a great effect.

Socialdata pioneered Individualised Marketing in the late 1980s. It is a voluntary travel behaviour change programme based on a personalised, customised, marketing approach. It has proven to be highly successful in achieving shifts in mode from the car to environmentally friendly modes; shifts that are proving to be sustained in the longer term.

1 Perth, Western Australia

By world standards, car use in the Perth metropolitan area, Western Australia, is high, with about 80% of all personal trips currently undertaken as either a car driver or a passenger. Since 1986, the number of car trips as driver has increased alarmingly, and many would think the task of changing travel behaviour in such a car-dominated city as Perth would be difficult, if not impossible.

The municipality of South Perth comprises seven suburbs in close proximity to Perth City Centre, with a population of around 35,000. It provides a wide variety of travel options to residents and visitors, through an extensive network of cycleways, walkways, bus routes and a ferry service.

1.1 Existing Behaviour Trends

A comparison of travel survey results of South Perth residents on an average day in 1986 and 1997 reveals the changes in main mode share over time in the travel behaviour of local residents (Figure 1). What is interesting, is that the amount of travel has remained virtually the same, only the way people travel has changed.

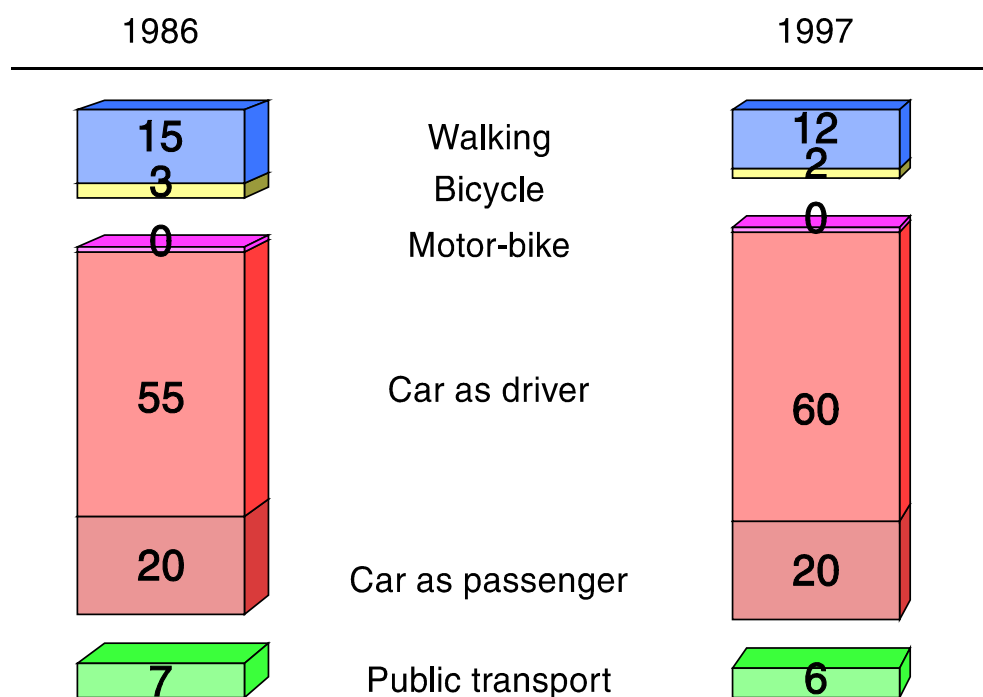
The share of all environmentally friendly modes has decreased, walking from 15% to 12%; bicycle from 3% to 2%; public transport from 7% to 6%. These trips have been switched to the car as driver, the share of which has increased by five percentage points (from 55% to 60%) over the eleven years. The use of car as passenger has remained constant (20%).

1.2 Potential for Change

Further in-depth research was carried out from the 1997 travel survey to obtain the reasons for an individual's mode choice for each trip. This analysis was supported by follow-up interviews, identifying the awareness, perception and choice barriers currently preventing individuals from using real alternatives. These analyses make it possible to differentiate clearly between people's subjective and objective situations and, with this information, to determine the opportunities for travel behaviour change to environmentally friendly modes.

In South Perth, 80% of trips are made by motorised private modes and 20% by environmentally friendly modes. 15% of the trips undertaken by private car use the car because there are constraints to using alternatives (Figure 2). As these constraints could be because the car is used for business reasons, or to carry heavy parcels, these trips have limited potential for change. A further 31% of trips would require system improvements, such as the provision of an adequate bus connection or improved walking and cycling facilities, before a switch could be made.

Figure 1 Mode Choice in South Perth



However, for about one third of the trips (34%) there are only subjective reasons against the use of alternative modes. For these trips, if a behavioural approach to mode change is applied, changes are possible without the need for system improvements, pricing or changes in land use policy. This group has the greatest potential for change and is the focus for the travel behaviour change programme.

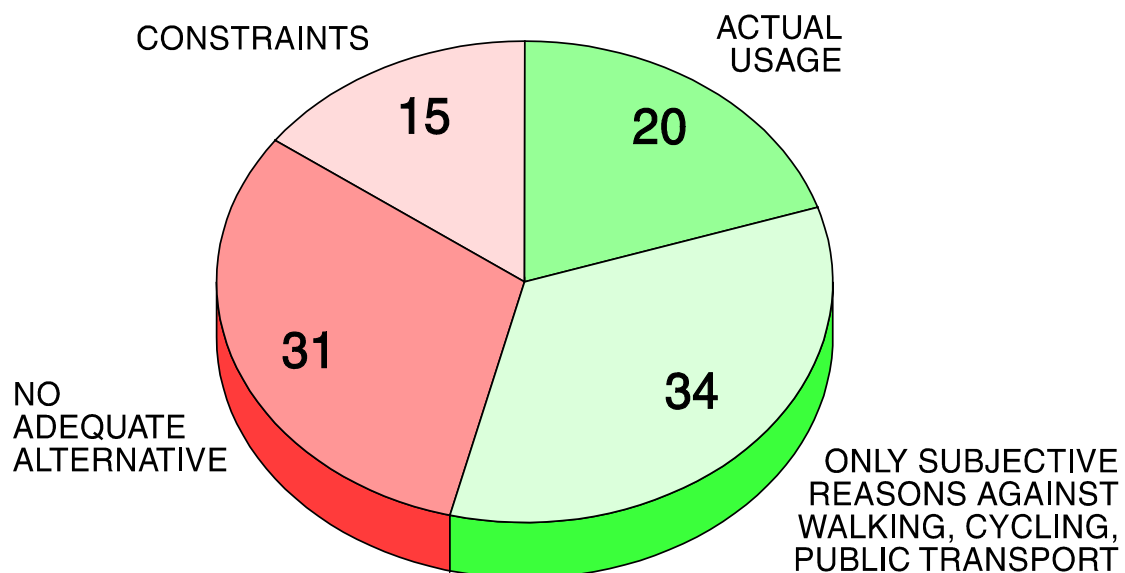
This programme would require no system improvements; the implementation of a travel behaviour programme to inform, motivate and encourage people to use environmentally friendly modes - including the 20% of trips that already use alternative modes, so that they are not lost to motorised travel.

2 Individualised Marketing - The Basic Principles

Using the "soft policy" approach, measures to activate these opportunities for change must be professionally adapted to the specific needs of the alternative modes as well as to the potential customers. It might be thought that all the necessary information about alternative modes - such as walking, cycling and public transport - is readily available. But all empirical surveys show that this information does not reach the respective target groups. Even with more sophisticated marketing methods, the

(potential) customer is still required to enquire for information (e.g. customer information centres).

Figure 2 Opportunity for Modal Change, South Perth



Priority has to be given to distributing information effectively. If the concept of customer orientation is taken seriously, information has to be "brought" to the customer instead of expecting him/her to get it from the provider.

In the 1990s *Socialdata* undertook a series of projects of an experimental nature, in order to prove the effectiveness of so-called "soft policies" for public transport. The starting point of these experiments was the recognition that much opposition to the use public transport is due to a lack of information and motivation.

Potential users of public transport were contacted directly, to motivate them to think about their travel behaviour. They were then thoroughly informed about the availability of public transport to meet their specific needs. As an added incentive, selected test candidates were given a special ticket to use the public transport system free of charge for one month.

The first experiment was carried out in 1991 in the German city of Kassel. This was extremely successful: the use of public transport for the test group nearly doubled, with constant mobility indicators. A similarly encouraging result came from a second experiment in Nuremberg in 1993. These results remained nearly constant for almost four years (without further measures). Both experiments showed that the largest percentage of new trips was won in off-peak traffic periods (the field with the largest potential).

2.1 The "Switching to Public Transport" Project

These findings led to an international demonstration project called "Switching to Public Transport", initiated by the UITP (International Union of Public Transport) - an operators' association, with scientific leadership from *Socialdata*. About 45 projects in 13 European nations were carried out (Figure 3) and these projects were hugely successful (Laconte and Brög 1998, Brög, 2000).

This demonstration of Individualised Marketing showed that personalised encouragement, motivation and information could lead to considerable increases in public transport use, that the approach could be applied on a large scale and that it was relevant for many, very different, countries.

3 The South Perth Pilot Study

In Western Australia, the Department of Transport has developed TravelSmart®, an integrated transport approach to encourage people to be less reliant on car usage by providing improved services and infrastructure, land use planning, and through travel behaviour change programmes. TravelSmart® is a world-first initiative to help preserve Western Australia's environment and quality of life. It is about empowering people, by providing them with localised information, advice and encouragement about alternative modes of transport, and leaving the choice to them. Individualised Marketing is part of this integrated approach (Department of Transport, 1999. Department of Transport, 2001. www.Travelsmart.transport.wa.gov.au). In 1997, *Socialdata Australia* was contracted by the Department of Transport to provide an Individualised Marketing (IndiMark®) pilot study in the City of South Perth. The pilot study consisted of applying the IndiMark® system, with 'before' and 'after' studies to evaluate changes in travel behaviour. Further evaluations were carried out at a later date to determine whether the changes were sustained (Goulas, 2001).

The first "after study", conducted immediately following the campaign, in November 1997, showed that Individualised Marketing is an effective tool to increase the use of alternative modes and to reduce the share of motorised private transport: car use. Car as driver trips went down by 10%, and at the same time walking increased by 16%, cycling by 91% and public transport by 21% (Figure 4).

A second evaluation in February 2000 found that these figures for mode choice remained constant over more than two years. Walking trips were constant at 14% of all trips, the same as in 1997 following IndiMark®, compared to 12% before. Cycling doubled from 2% to 4% and then remained at this level. The car-as-driver share decreased from 60% to 54% immediately following the IndiMark® campaign and then remained at this level. The car-as-passenger and public transport mode shares also changed following IndiMark® in 1997, and have remained constant to February 2000.

Thus, it is evident that Individualised Marketing has long-lasting effects on mode choice even two and a half years after the campaign. The changes in mode choice proved to be sustained.

Figure 3 The UITP "Switching to Public Transport" Project

- Individualised Marketing -

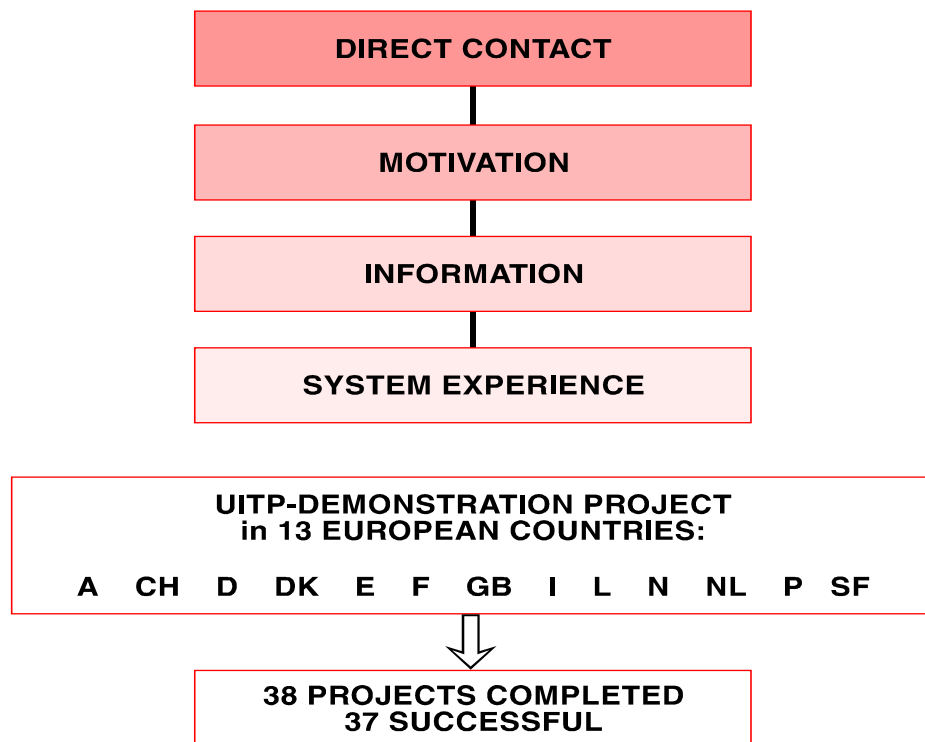
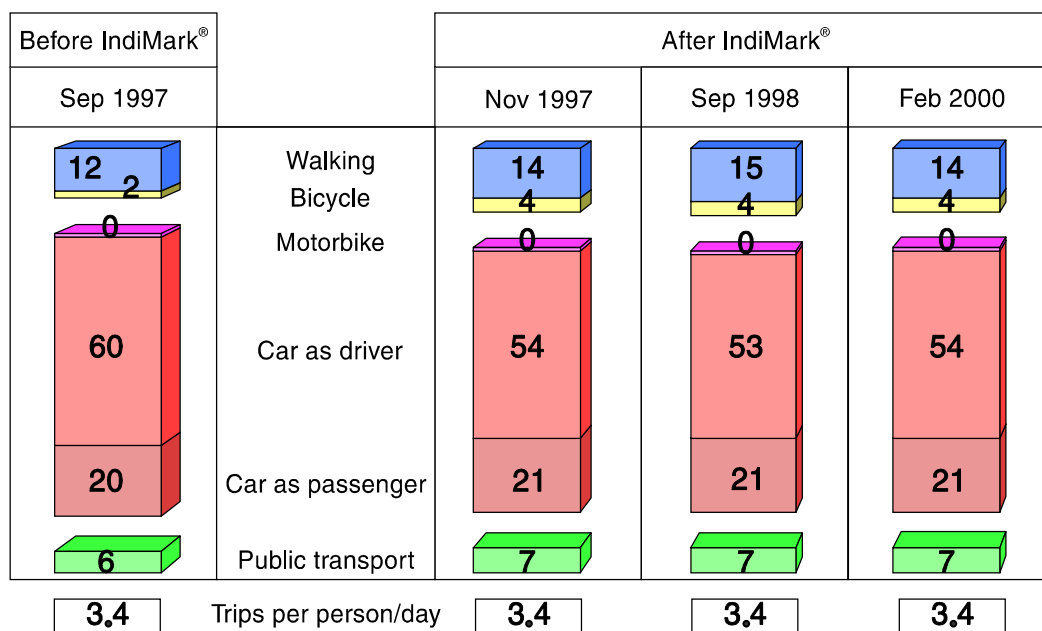


Figure 4 Mode Choice in South Perth Before and After the IndiMark Pilot Project



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3.1 Cost Effectiveness

From the pilot study results, an extensive cost/benefit analysis was carried out by Ker and James (1999) to calculate the cost-effectiveness of the Individualised Marketing campaign. This showed that for every dollar invested in IndiMark®, there was a cost benefit of \$13 (Figure 5).

Figure 5 The South Perth Pilot: Cost-Benefit Analysis

Costs	\$ 1.3 Mio
Benefit	\$ 16.8 Mio

Cost-Benefit-Ratio	1 : 13
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4 The South Perth Large Scale Demonstration Project

In general, Individualised Marketing means establishing a dialogue through an individualised, direct contact approach via a detailed step-by-step procedure. Through these stages there is a communication process based on personal contact, providing information and further support on an individual basis. This personal contact can motivate people to think more effectively about their daily travel, providing them with information if requested, and supporting their need to try out the alternatives if required.

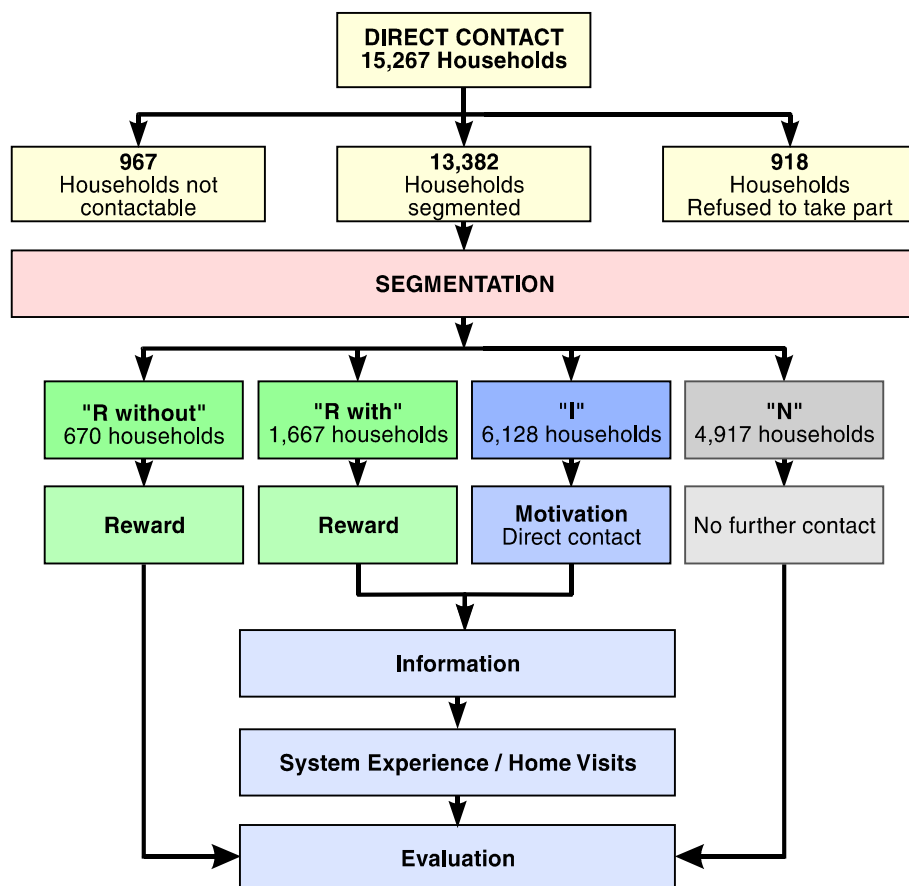
The first phase of IndiMark® is to personally contact all households in a given area.

In South Perth there were 15,267 households; some households (967) were not contactable and 918 households preferred not to take part. The 13,382 households who were successfully contacted were classified into three main groups "I", "R", and "N" (Figure 6).

- Group "I", (interested/interesting households) are households that are not using environmentally friendly modes regularly, but who are interested in doing so. This group is more likely to change and to continue to use environmentally friendly modes with personal contact, motivation and information. There were 6,128 households in this group in South Perth, and they received the most attention.

- Group "R Without" (at least one member of the household is a regular user of an alternative mode, without a need for further information). These 670 households were rewarded with a small gift.
- Group "R With" (at least one member of the household is a regular user of environmentally friendly modes, with information needs). These 1,667 households received a gift, and their requested information.
- Group "N" (not interested / not interesting households) are excluded. In South Perth there were 4,917 households who did not wish to participate or there was no possibility for them to use environmentally friendly modes. This group received no further contact, as it is highly unlikely that any of these households would be able to change their current travel behaviour.
- Group "I" received further motivation, information and the opportunity to receive home visits by specialist staff. For public transport, for example, a household not using buses or trains regularly, may receive a free "test ticket" for a month, to become more familiar with the system.

Figure 6 Market Segmentation - The South Perth Large Scale Project



During the course of the IndiMark® campaign: contact with individual households was made through over 3,000 home visits, 29,000 telephone calls and 37,000 letters (Figure 7). Around 6,000 packages of information were individually collated, packaged and hand delivered to households in South Perth - totalling about 9,000 kilograms. Random

sample surveys of the population were conducted before and after the Individualised Marketing programme to measure its effect. In the 'before' survey, the mode share was 12% of trips by walking, 2% by bicycle, less than 0.5% by motorbike, 60% as car-as-driver, 20% as car as passenger and 6% by public transport. The second column (Year) refers to the number of trips per person per year undertaken by the different modes.

Figure 7 The South Perth Large Scale Project - Contact Record

ca. 37,000	letters
ca. 29,000	phone calls
ca. 42,000	items marketing / information material
3,200	personalised timetables (to 1,200 households)
ca. 6,000	individualised packages
616	home visits by Perth Bus staff
760	with test tickets
2,601	personal home contacts by Socialdata (cycling and / or walking)
ca. 9,000	kilogram total weight

The programme achieved a 14% reduction in car trips, (Changes, Relative) with these trips changing to: walking (up 35%), cycling (up 61%), public transport use (up 17%) and car sharing (up 9%) (Figure 8). The results from the 'after' survey are expressed across the whole population, **not** just those taking part (Figure 6).

People spent more time exercising through walking and cycling, and overall they made more trips within the City of South Perth than before.

The 14% reduction in main mode share of car-as-driver trips has restored travel patterns to lower car dependence than the 1986 levels of 55%.

Independent bus counts were undertaken as a further measure to evaluate the effectiveness of the programme IndiMark® in February to May 2000. Between March 1999 and 2000, there was a 25% increase in public transport trips that started in South Perth (Figure 9).

Figure 8 The South Perth Large Scale Project - Evaluation

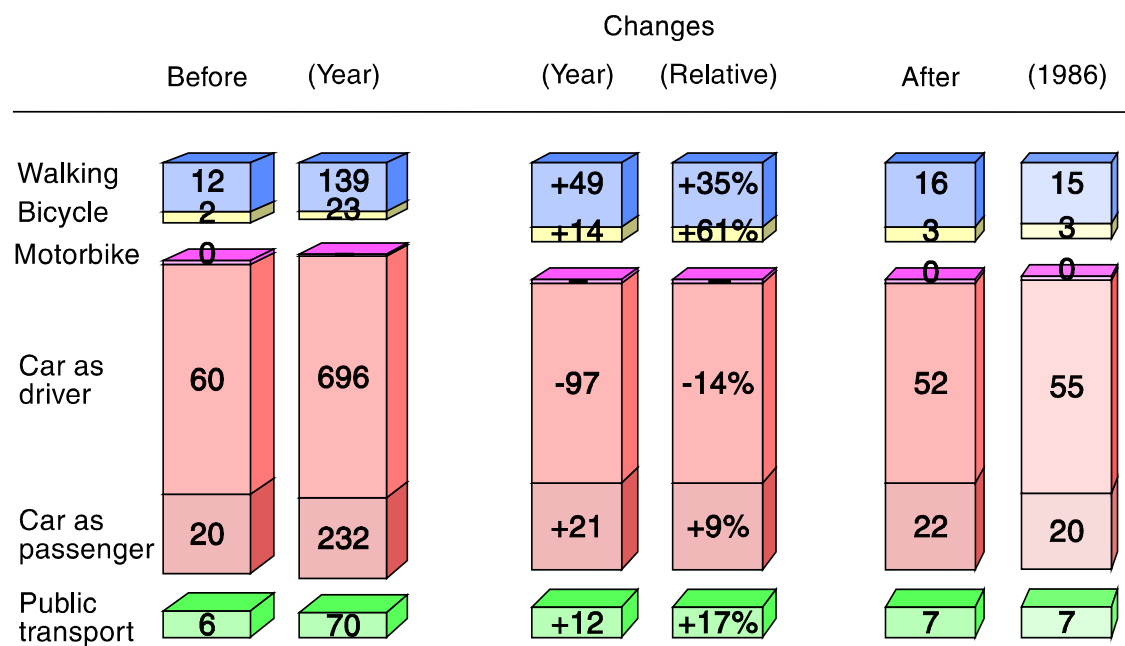
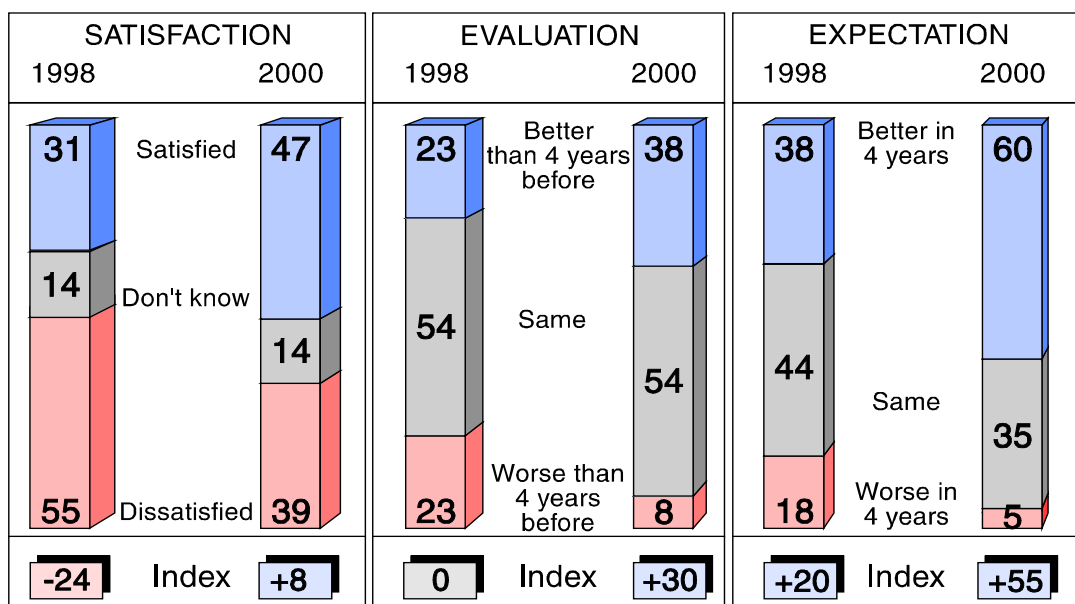


Figure 9 The South Perth Large Scale Project - Changes in Public Transport Use

Month	1999 - 2000	2000 - 2001
Mar	+25 %	+6 %
Apr	+17 %	-12 %
May	+31 %	+4 %
Jun	+42 %	+3 %
Jul	+26 %	
Aug	+34 %	
Sept	+27 %	
Oct	+25 %	
Nov	+20 %	
Dec	+14 %	
Jan 2000	+25 %	
Feb	+5 %	
Total	+25 %	(+1 %)

The results from March 1999 to June 2001 show an overall increase (+1%), which indicates that the effect of IndiMark® is sustained. During this period in South Perth, there were no system improvements to the public transport system, only IndiMark®. Yet, despite this, the results clearly show that residents were more satisfied with public transport in 2000 than in 1998 (Figure 10). In 1998, less than a third of South Perth residents were satisfied with public transport, whereas following IndiMark®, nearly half were satisfied. They also had high expectations that public transport would be better in 4 years time.

Figure 10 The South Perth Large Scale Project - Changes Satisfaction with Bus Services



5 Large – Scale Applications

Individualised Marketing has been used to promote public transport in 15 countries, and about 60 pilot projects and nearly 100 large-scale applications (involving nearly 1.5 million people) have been conducted (Figure 11). The South Perth project was the first large-scale application to include walking and cycling, as well as public transport.

Figure 11 IndiMark Large Scale Application Projects

	Projects:	Target persons:
Germany West	35	651,973
Germany East	20	444,998
Sweden	23	151,044
Austria	9	135,793
Switzerland	3	12,049
Australia	1	35,000

6

Traffic congestion is a real problem. Reducing the number of personal trips made by car will help preserve our quality of life and our environment. To achieve real change, a natural way is necessary. Our approach is to work with the community and to motivate them to consider alternative ways of travelling.

If the aim of fostering the use of environmentally friendly modes is to be taken really seriously, a “soft policy” approach must be used. People should receive information, which enables them to improve their perception and to motivate them, to empower them to make their own decisions, rather than telling them what they should do.

Through direct contact in an on-going communication process, people can be motivated more effectively to think about their daily travel. This personalised approach means that the information needs of people can be identified and provided in a very specific way. They receive only that information which they really need instead of a low-level “flood of material”. Providing information tailored to individual situations is far more convenient and motivating, than having to filter through and select from multiple possibilities.

Everyone has trips that can be changed. So it is not just a matter of making car trips more efficient. For example, providing improved transport infrastructure will not necessarily encourage people to change their mode choice, only to use the system more efficiently. The decisive factor in improving the transport situation and everyday mobility is to change to alternate modes. It is important for people to identify trips

where alternate modes can be used, without having to make huge lifestyle changes – small changes across the population result in large changes overall. If it is possible in a car-dominated city such as Perth, it is certainly possible for London.

Figure 12 Changing Travel Behaviour the Homeopathic Way



7 Current Projects

IndiMark® for all environmentally friendly modes is currently being applied in pilots in Brisbane (Australia), Frome and Gloucester (UK), Athis-Mons and Montreuil/Bagnolet (Paris region) and in a pilot/large scale application in Viernheim (Germany).

Two large-scale projects are also underway in Göteborg Sweden, and in the Town of Cambridge in Western Australia.

Figure 13 IndiMark Projects to Watch

D	Viernheim	Pilot	Evaluated
AUS	Brisbane	Pilot	Evaluated
UK	Frome	Pilot	Completed
UK	Gloucester	Pilot	Completed
F	Athis-Mons	Pilot	Started
F	Montreuil/Bagnolet	Pilot	Started

D	Viernheim	Large Scale	Completed
S	Göteborg	Large Scale	Started
AUS	Cambridge	Large Scale	Started

Socialdata is currently conducting pilot studies in several countries and results of these will be available in the near future.

8 Conclusion

The application of the large scale Individualised Marketing in South Perth exceeded the projections that, based on the pilot study conducted in 1997, were thought possible. Following IndiMark®, car as driver trips went down by 14%. At the same time, walking increased by 35%, cycling by 61% and public transport by 17%. These results show that this form of voluntary travel behaviour change is an effective tool for promoting sustainable ways of travelling. It also showed that only small changes were required. Switching two trips a week (for example, walking to the local shops and back) instead of using a car, would achieve these significant effects. If this can be achieved in Western Australia, it can be achieved in London.

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Further information: TravelSmart web site: [www. Travelsmart.transport.wa.gov.au](http://www.Travelsmart.transport.wa.gov.au)

The Heathrow Experience: Mode Shift Through Effective Partnerships



Alastair Duff
Chairman, Heathrow Area Transport Forum

Summary

The paper illustrates the important role that effective transport partnerships can play in harnessing joint effort towards common goals across a wide variety of agencies by means of area-focussed Transport Forums. Three key objectives for Transport Forums are to:

- agree short and long term targets
- devise a strategy to achieve them
- oversee and monitor implementation.

Specific strategies for a Transport Forum should include:

- setting targets for increased use of public transport
- providing customer-focussed facilities that encourage use of public transport
- reducing single-car occupancy
- encouraging operators to provide more services through innovative financing and development schemes
- developing an inter-modal approach that integrates all forms of transport
- establishing effective partnerships with all interested parties.

The Strategy should focus on:

- building partnerships with key regional and local organisations
- understanding customer needs
- working with stakeholders
- delivering customer-focussed, quality-driven services.

The work of the Heathrow Area Transport Forum demonstrates how mode-shift can be achieved through meeting user requirements. Key learning points will be identified.

1 Introduction

The purpose of this Paper is to explain how Heathrow set out to develop its potential as a transport interchange, the partnership approach used to bring together the wide range of interested organisations, the issues faced and the successes achieved. The measure of success achieved by the Heathrow Area Transport forum is indicated in two ways. Firstly, the 10 Year Transport Plan, which notes that *Airports are important transport hubs within their regions...they need to be better integrated into the wider transport network to maintain and improve access...the largest airports have the potential to become important surface transport hubs in their own right, not just as destination points, but as interchanges between car, bus, coach and rail.* And the White Paper on Transport, which indicated that from this Forum experience the benefits for other airports in establishing their own forums would enable them to reach their full potential as transport hubs.

2 Background

Airports like Heathrow, by the nature of their activity, require good surface access links in order to ensure that air passengers can make their connections, and employees are in place to handle aircraft, traffic services and air passengers. Unfortunately, existing urban transportation planning takes little note of their specific needs and the development of an inter-modal strategy on surface access for airports, aimed at creating an integrated hub, had to be developed. The concentration of a wide variety of businesses on and around an airport should offer opportunities for the providers of bus, coach and rail services to enhance their operations. However, these opportunities are not always apparent to them, due either to a lack of data regarding the potential market, inappropriate assumptions about the airport's needs or a lack of consensus amongst the wide range of agencies associated with the delivery of public transport improvements.

Partnerships are vital to making progress but how to create an effective one? In 1995, BAA Heathrow set out with the specific objective of establishing a Transport Forum that would bring together all the key players in London and the South-East. This would allow a regular dialogue with local authorities, transport authorities and operators, business and environmental interests in order to find ways in which surface access, both to the airport and within the surrounding area, could be improved, whilst also identifying other options such as car-sharing and cycling which would also reduce car dependence. This should be seen in the context of the present (2002) figures of 64 million air passengers and 68,000 staff employed by 435 companies on airport. It should also be noted that Heathrow is the busiest bus/coach hub in the UK and has 5 railway stations on airport.

3 The Heathrow Area Transport Forum Structure and Operation

The Heathrow Area Transport Forum now comprises over 80 organisations. Managed through a Steering Group are a number of Working Groups covering bus route development, rail planning, air quality, telematics, demand management corridors, travel planning, cycling/greenways and freight quality partnerships. The Steering Group includes Transport for London, SEEDA, SEERA, SRA, Highways Agency, BA, BAA, Stockley Park Consortium, Thames Valley Economic Partnership, the London Boroughs of Hounslow and Hillingdon, Surrey and South Bucks County Councils, Spelthorne and Slough.

The three key objectives for the Forum are –

- to agree short and long term targets.
- to devise a strategy to achieve them.
- to oversee and monitor implementation of the strategy.

The Forum decided that its core strategies should be:

- setting a target for increased use of public transport by air passengers.
- providing customer-focussed facilities that encourage use of public transport.
- reducing single-car occupancy by staff.
- ensuring that operators are encouraged to provide more services through innovative financing and development schemes.
- developing an inter-modal approach that integrates all forms of transport.
- establishing effective partnerships with local planning authorities, transport authorities and operators, the local business community and others, to develop area-wide, cost-effective and mutually beneficial strategies that will exploit the full potential of public transport, on the premise of the airport as an integrating hub.

It was felt necessary to redefine the perception of Heathrow as being “only an airport.” We now define it as “a place where networks meet, integrating very different scales of distance and modes of transport, from walking to flying.” Six key points then emerge about this type of interchange. It:

- is a major focal point, playing a fundamental territorial role in its environment.
- relieves practical interchange problems and offers an image of quality.
- is a service-orientated space, where travellers can make the most of their journey through facilities that complement the transport function.
- is developed through partnership between the various agencies and providers.
- operates co-operatively between the service providers to provide high levels of customer satisfaction.
- is innovative, looking to integrate organisational, economic, technological and service elements.

After extensive discussions, and a lot of hard work by all parties, in 1999 a 5 Year Airport Surface Access Strategy was approved by the Forum and agreed with the 12 Borough, District, Unitary and County Authorities involved, setting out commitments, objectives and targets. This has been incorporated into their Local Transport Plans. Heathrow's surface access needs, and its role in transport development, is now part of the regional and local transport planning process. An Annual Review of progress is issued.

The Forum's access development strategy has focused on:

- building partnerships with key regional and local organisations.

- understanding customer needs.
- understanding key regional movement patterns and issues.
- working with stakeholders to identify holistic strategies within which the Forum strategy can sit.
- working with all parties to ensure the delivery of successful quality transport services.
- improving key interchange points on and around the airport.

4 Local Transport in West London

Looking at the detail of Outer West London, the need is for a mix of services. Passengers want services that link the main areas of employment activity to key interchanges, enabling them to travel for work or leisure easily, quickly and efficiently. There is a need for smaller services, which penetrate areas, where to run frequent services would not be sustainable, but where a less frequent service would still be used. There is no point in providing high frequency services, if the key areas of activity or housing are not penetrated. There is a need for innovation by providing new services such as demand responsive or express links.

Many of the routes of the present London bus network are the same, or variations of, routes that have been operating for 40 to 50 years. But that does not mean that they now match the needs of those living in West London as the needs of these people have changed. In many cases the key employment centres, such as Heathrow, have changed significantly in terms of demography and operating patterns. And the numerous major/medium trading estates in West London have found themselves poorly served, if at all, by public transport and getting such transport is hard. It is arguable that the bus service tendering regime has not been designed to be flexible and is not tuned to local need; although the tendering process has served London well over the years a "one size fits all" approach tends to stifle innovation.

The major barriers to using bus services in West London are reliability, journey time, quality & compatibility. There is a wide range of differing needs across West London which at present are not met by the bus network, since the network is planned around major flows. The social stigma of using the bus, which has grown up over the last 20 years, has further alienated the benefits of the bus network in the eyes of potential users. Yet where an adequate link is provided that meets the needs of a core group of users, as with the Southall – Heathrow Southside link, (where London Buses was unable to justify the provision of a link as the flows did not justify a 15 minute service) a commercial operator has stepped in to provide a link (with Forum financial support) which, although very limited, still provides a public transport option for over 2,000 passenger journeys a week, journeys that would otherwise be made by car.

The Forum has pursued a policy of bus service support through the use of focused pump priming rather than total control. By working in partnership with the bus industry it has encouraged them to develop new services by taking part of the risk, and once established the Forum's role in the project drops back to marketing support. There are clearly cases where operators will try innovative services and the Forum approach means that, for a relatively small investment, major initiatives can be put in place. BAA financial support also means that, through the Forum, it is often possible to lever in additional funding from other parties.

5 The 1992 Starting Point

At regular intervals the CAA carries out major passenger and employee surveys which provide, amongst other data, information as to how they access the airport. From the 1992 survey, Table 1, it can be seen that car use was continuing its relentless climb, bus use and cycling were declining and walking non-existent.

The initial activity was to acquire as much data as possible so as to understand the network and user behaviour; this occupied between 1992 and 1994. Simply not enough understood about how people travelled, what their desires were, what the network could do and what the capacity was. There was the need to spend time and money to understand this. By 1999 the Forum was able to use the Surface Access Monitoring System; a very large database developed by BAA Heathrow into which is poured all relevant data. Using GIS mapping principles it is possible to get down to postcode level. This enables the Forum to more quickly estimate the potential of any given proposal in terms of ridership.

At the same time, a number of focus groups were carried out to identify airport staff attitudes and propensity to change mode. Unsurprisingly, it was found that they regarded public transport as being unreliable, unsafe, uncomfortable, infrequent and expensive. Much of this was of course untrue but such was the perception. However, 37% said that they would use it if it was more reliable, 24% if the timings were more flexible and 36% if it offered good access from home. On this basis, the Forum set out to improve service schedules and frequency, primarily on bus but also on the Underground.

Two issues quickly emerged. Firstly, a jurisdictional barrier which the Forum was ideally suited to resolve. Because of the boundaries between the Greater London Area and the Home Counties, and between the counties themselves, no one transport authority was responsible for the provision of all-round public transport planning to Heathrow. The Forum proved to be an ideal mechanism to resolve this, aided by Heathrow's legal role as both a Traffic authority and a Bus/Coach Licensing Authority. Secondly, that there was actually quite a good bus network in place but it was based on the supposition that the airport worked like an industrial estate; five days a week from 0700 to 1800. Of course, Heathrow is a 24 hour, 7 day a week operation, with around 75% of its staff working shift. The challenge was to change the network to meet user needs.

Table 1 Employee Mode Shares, 1975 to 1992

Employee Modal Split			
	1975	1986	1992
	%	%	%
Car	71.2	75.7	78.0
Car-share	7.6	5.3	4.0
Underground	1.2	3.8	6.0
Bus	12.8	11.0	6.0
Motorcycle	3.1	1.8	2.0
Bicycle	1.7	0.1	1.0
Walk	1.3	0.6	-
Rail	-	-	-
Taxi	-	0.7	1.0
Air	-	-	1.0

6 Heathrow Area Transport Forum Initiatives

A number of Forum initiatives have been launched:

- Starting with the 285 service to Richmond in 1995 a programme of selective and focused financial investment was undertaken on core services to improve frequency and capacity. The 285 results were so encouraging that the Forum was able to attract funding for, amongst others, the 140, 105 and the very successful A10 Uxbridge to Heathrow semi-express route. But the tender conditions must include quality standards. Where it does not, as with the re-tender on the 285 to Richmond, the benefits painfully gained withered rapidly on the vine and had to be rescued in co-operation with the operator. All bus routes into Heathrow received significant marketing investment through leaflets, radio advertising and route specific mail-shots.
- Ticketing is crucial to success. Starting in 1997 for Heathrow staff, the Airports Travelcard is now a co-operative effort involving 42 bus, coach and rail operators, available to over 100,000 staff at Heathrow, Gatwick and Stansted. It offers remarkable value for money in terms of discounted fares, enables interchangeability between operators without the need to buy an additional ticket and encourages a shift away from car use. This is not subsidised by the Forum nor does

it require the Forum to apportion fares, and has achieved its success through the willing participation of the service providers via the Forum Bus Working Group.

- A key factor in improving access is ensuring the ability of mass transport to compete in terms of speed with the private car, in other words providing priority systems. The first priority bus lane on a motorway in Britain was on the M4 Spur leading to Heathrow, planned, built and paid for by BAA. Working through the Heathrow Transport Forum, we were able to create an effective partnership with the Highways Agency to construct this innovative solution, which now saves a guaranteed 10 minutes in the peak hours for the 7 million passengers who come to Heathrow by coach. A new initiative is the shortly to be constructed bus slip off the Bath Road at the airport's East Entrance.
- A survey was conducted on behalf of the Forum into on-airport travel habits and it was found that 15%-18% of staff were driving to work because they needed to go to other sites during the day. A further survey mapped the routes being used and cross-referred them to the existing bus network. Two initiatives resulted:
 - a) firstly, the Bus Working Group examined the schedules and it was found that with some tweaking the vast majority of on-airport connections could be made with only one change of bus, principally at Hatton Cross. Furthermore, the densest demand lay along existing direct routes. The necessary schedule amendments were introduced with the co-operation of the bus operators.
 - b) secondly, following detailed discussions with London Transport and an agreed payment, a Free Travel Zone was introduced, whereby all red bus services on the airport and along the adjacent Bath Road section would be free to all users.
- Accurate and easily available travel information is essential if car users are to be persuaded to try mass transport. On behalf of the Forum, BAA Heathrow has developed the largest interactive travel database in Europe, which brings together 15 existing journey planners, including TfL, National Express and Railtrack. This provides journey information for up to three connections on bus, coach and rail services within a 50 mile radius of the airport. Due to go live in March 2002, it will be available to Forum members via an Intranet connection. An Internet version is also being developed.
- Heathrow has 435 companies based on site, as well as many others located in the surrounding area. Via the Forum's Travel Planning Group active promotion of travel plans, working with key companies, is now underway. Car-sharing, or pooling, is a major element in this and since its re-launch in April 2001 the Heathrow Car Share Scheme is now the largest in the UK, with over 1100 registered sharers.
- Many schemes that come before the Forum only need relatively modest financing to be successful. But where to find the money? The Forum is able to bid for finance from the Heathrow Transport Fund, derived from the surcharge on public and staff airport car parking. This Fund is hypothecated to improving local transport needs. It paid for the M4 Spur bus lane, supports many bus routes into the airport and contributed £1m to the Feltham railhead improvement scheme.

7 Results to date

In terms of cross-boundary operations from Heathrow, the Forum plays a pivotal role in the development and promotion of such services, and will continue to do so. The results of the last 6 years show that the Forum partnership approach has provided a mechanism to bridge jurisdictional and legal boundaries in order to enable a focused approach to be taken towards increasing bus and rail use and reducing car dependency. In particular it has shown that the highly focussed, route by route funding process has been able to reverse the trend of the last twenty years. Table 2 below shows that bus use has recovered, as have, to a smaller extent, cycling and walking. The improved scheduling of the Underground has increased rider-ship a little and the use of Heathrow express by staff is encouraging. There is clearly much work still to do but at least all the indicators are moving in the right direction.

Table 2 Employee Mode Shares, 1975 to 1999

Employee Modal Split				
	1975	1986	1992	1999
	%	%	%	%
Car	71.2	75.7	78.0	71.5
Car-share	7.6	5.3	4.0	4.0
Underground	1.2	3.8	6.0	6.3
Bus	12.8	11.0	6.0	11.7
Motorcycle	3.1	1.8	2.0	2.1
Bicycle	1.7	0.1	1.0	1.3
Walk	1.3	0.6	-	0.6
Rail	-	-	-	0.8
Taxi	-	0.7	1.0	0.8
Air	-	-	1.0	0.9

8 Conclusions

The experience of the Heathrow Transport Forum has confirmed other surveys that indicate the core passenger needs are reliability, frequency and predictable journey times. By providing these, as well as innovative ticketing and accessible information, it is possible to persuade and encourage car users to give public transport a go, and then retain them. Quality must be an integral part of the product offered to the public,

including higher levels of staff training. With bus, for example, the aim has been to promote bus travel as the first choice for all, not the home for those with no choice.

A key theme in the work of the Forum has been the importance of marketing. Not only marketing the improved services themselves, though that is vital, but equally the marketing of progress towards better services, the need for change and the whole concept of travel planning. A number of learning points can be established. There is a need to:

- establish solid and reliable relationships with all parties.
- be highly interactive.
- bridge institutional and jurisdictional barriers.
- develop quality-based, customer-focussed improvements.
- celebrate successes.
- get early quick wins.
- understand the data thoroughly.
- learn from beacons of good practice.
- avoid the law of unintended consequences.
- set clear and achievable targets.

The conclusion is that no one organisation can increase the use of public transport and reduce car dependency on its own. The area-wide perspective, the inclusive approach towards tackling these challenging issues, the opportunities for attracting additional funding, the ability to target corridors most likely to see high levels of mode-shift; all these make the Transport Forum an attractive addition to transport planning in the 21st Century.

Improving the Efficiency with which Streets are Used



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Summary

A range of techniques is available to make better use of roadspace against clear policy objectives. These include reducing congestion for all road users, selective priority for particular vehicle types or users, priority for non-motorised vehicles and the fostering of initiatives such as car sharing. As traditional traffic management techniques (eg, turning controls, on-street parking and stopping restrictions, and access control) are applied comprehensively in London, opportunities to improve capacity by further applications are very limited. London has also been in the forefront in the application of on-line traffic control. However, delays could be reduced through better management in over-saturated conditions (eg, detailed operational changes at key locations, and increased access control through “gating” strategies). However, it is unlikely that these would provide reductions in delay of more than 10%.

Intelligent Transport Systems (ITS), ie, new technologies of traffic detection, communication and control, include integrated urban traffic management systems and a wide range of new vehicle technologies. Some vehicle-based technologies will mature rapidly. An example, “stop and go”, which automatically moves a vehicle forward in a queue, will be available in about two years. This will change drivers’ perceptions of queues, the formation of queues and related traffic operations. Other technologies, such as integrated location and communication devices (e.g. GPS in mobile telephones) will allow a wide range of new on-line transport services to be developed to provide flexibility for people and goods in a flexible and efficient way. The presentation will describe the range of ITS systems and services and indicate how they will impact on the efficiency of an urban road network. It will conclude that although ITS of itself will not solve our urban congestion problems, it will provide opportunities for new and more efficient solutions to meet clearly defined policy objectives.

1 Introduction

Traffic congestion may be reduced by either increasing the practical capacity of a road network or by managing demand so that fewer vehicles use key parts of the network at key times. Demand may be managed by causing behavioural changes through fiscal, physical, and/or by other means. Approaches may be focused on achieving

environmental and social benefits as well as savings in congestion. In the specific case of road user charging, hypothecation of the net revenues to support public transport services may be a key advantage. Generally, applications of demand management indicate that clear benefits are needed to ensure user acceptance.

The capacity of a road network can be increased either by new construction and/or by making better use of existing roadspace. The scope for new construction in most urban areas, including London, is very limited, but small physical changes at key locations may be worthwhile in reducing congestion. However, whilst such construction may be very cost effective and should be encouraged, it will be likely to have only a small impact on overall levels of congestion in a city such as London. Indeed, such construction may be only environmentally and socially acceptable when linked to other policy objectives of supporting public transport or improving a local environment.

A range of techniques is available to make better use of roadspace against clear policy objectives. Such objectives may include reducing congestion for all road users, the introduction of selective priority for particular vehicle types or road users, priority for non-motorised vehicular activities, or the encouragement of new transport initiatives such as car sharing.

This paper will consider the opportunities of improving the efficiency of the road network in London. A review of traditional approaches and techniques will be made, followed by the potential for evolving Intelligent Transport Systems (ITS) to contribute to a solution.

2 Traffic Management

Traditional traffic management measures for use in urban areas include:

- **Turning Controls, one way streets, etc.** Many urban traffic problems are caused by right turning vehicles having to wait to cross an opposing flow of traffic. The problems can be reduced by having one-way streets where the opposing traffic is removed or by limiting the intersections where right turns can occur. More complex approaches may be adopted to avoid a right turn at a key junction. Such approaches can be very worthwhile in reducing congestion, adding to the efficiency with which signal control and bus priority can operate more efficiently. However, traffic speeds may increase locally, making conditions more difficult for pedestrians and cyclists.
- **Parking, waiting, loading controls, etc.** Vehicles parked and stopped on the highway reduce roadspace and hence capacity. They also detract from the urban environment and can make vulnerable road users less safe. A coherent approach to parking management has been adopted in London, with limits on off-street parking and tight controls of on-street parking. However, the generally full use of kerbside parking on residential streets accepts high levels of car ownership and the resultant traffic impacts. Controls on major traffic routes are strong, but short stops are difficult to control and cumulatively can result in a severe loss of capacity.
- **Priorities.** Priority may be given to vehicle types, road users groups, and residents. Priorities may vary by route, time of day, and will relate to stopping and parking as well as movement. In London, bus priority is very well developed with world leading on-line signal control prioritisation systems. Red routes maintain capacity for key traffic movements, and residents are protected by speed reducing measures and

access controls. Enforcement of priorities is a key issue, buses are frequently trapped in congestion in too many situations, pedestrians have difficulty in crossing roads in many areas, and commercial and living environments are too often dominated, and affected, by traffic. However, clarification of priority objectives with improved application and enforcement is unlikely to lead to substantial improvements because of the limited capacity available for vehicles elsewhere. For example, pedestrians may be given much greater priority in crossing a road which bisects a local shopping area, but this will be likely to only slow vehicles without easing congestion.

- **Speed Controls.** Speed reduction improves safety and the environment. Physical measures to reduce speed, such as chicanes and speed humps, are substantially applied in parts of London and enforcement cameras are effective elsewhere. Speed controls in an urban environment have a negligible effect on capacity.
- **Intersection Controls.** In an urban network, capacity and levels of congestion are largely controlled by intersections. In any network a relatively small proportion of intersections govern the capacity of the whole. However, improvements to such key intersections will simply lead to the emergence of other intersections as those which limit capacity. Intersections may be controlled by movement priority i.e. roundabouts, by time priority i.e. traffic signals, or some combination of both. In London most major intersections are signal controlled, as these enable clear priorities to be given to specific movements and vehicle types, buses and pedestrians in particular. In general, intersections in London are well designed and managed, but capacity may be effected by waiting/loading vehicles and a lack of road user discipline. Also, whilst there are clear opportunities to improve intersection capacities, such improvements are unlikely to result in a substantial reduction in congestion.

Overall, traffic in London is well managed. Nonetheless, improvements may be made and, whilst such improvements are likely to be extremely cost effective, they are unlikely to make a step change in levels of congestion, even at a local area level.

3 Integrated Urban Traffic Management

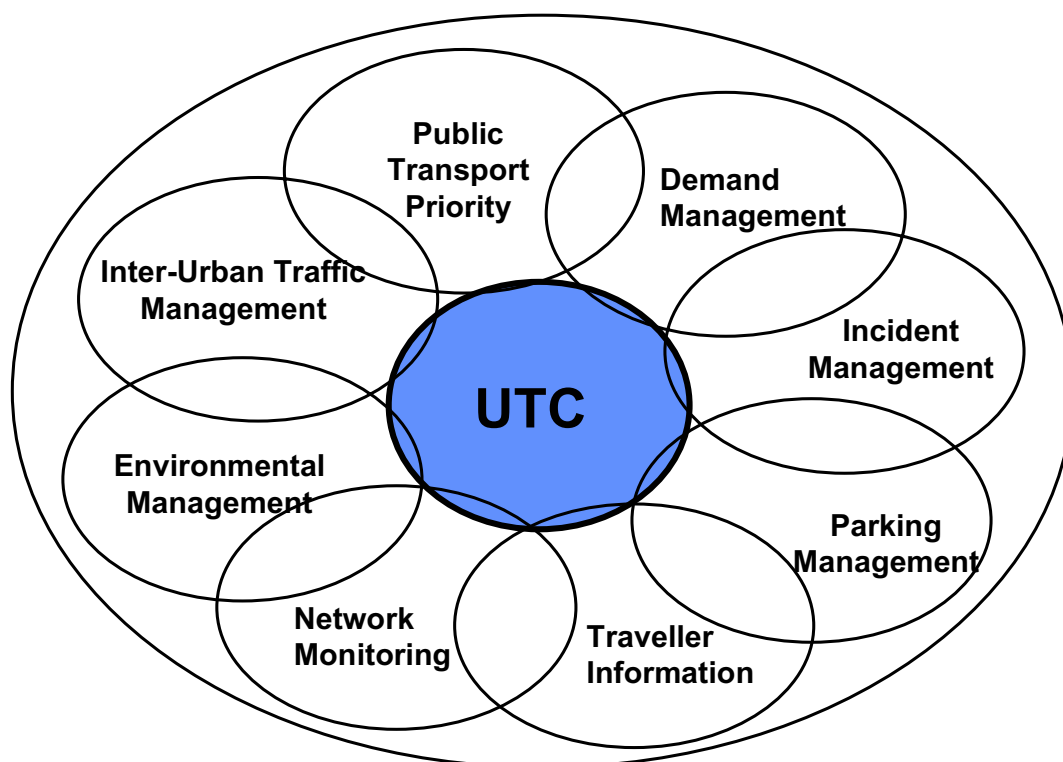
3.1 General

Integrated Urban Traffic Management (IUTM) refers to a range of measures and techniques which relate to Urban Traffic Control (UTC) as shown in Figure 1.

3.2 Urban Traffic Control (UTC)

Traffic signals may operate at each intersection independently i.e. isolated control, or be linked as part of a co-ordinated system i.e. UTC. Traffic signals are linked in a co-ordinated way where it is warranted by traffic interactions. However, isolated control can be more responsive to traffic and pedestrian demands than co-ordinated control where signal timing are constrained by the needs of co-ordination. At its simplest, both isolated and linked signal systems may be considered to operate on fixed time plans based on historic data or be traffic responsive. As well as safety, objectives will relate to minimising journey time, providing priority, and managing queueing.

Figure 1 Integrated Urban Traffic Management

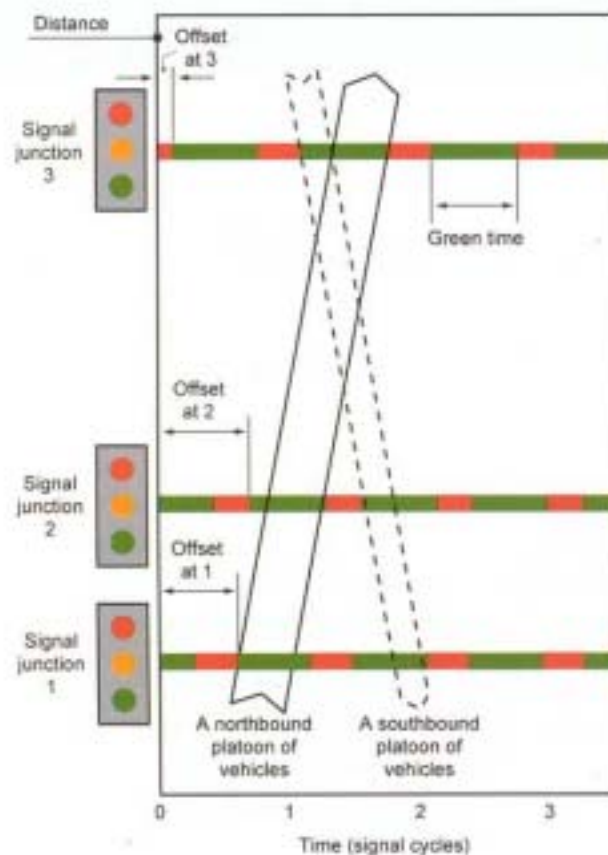


Capacity and delay at any signal controlled intersection are governed by the rate of discharge of a queue, i.e. the saturation flow, and the amount of time when traffic does not flow, i.e. the lost time between conflicting movements. In general, lost time can be reduced by bringing the stop lines closer together i.e. a smaller junction and/or by having fewer changes of priority. The traffic signals in London are generally well designed and there is little room for improvement in either of these factors, particularly in peak conditions.

The linking of traffic signals can bring additional benefits; the basic concept is shown in Figure 2. A variety of methods exist, the simplest being fixed time plans which change by time of day or predefined traffic conditions. The TRANSYT programme is the most widely used method of determining such plans. These use historic data off-line to calculate green times, the allocation of green times to movements and the time offset between adjacent signals. TRANSYT has been shown to provide benefits of some 10% saving in journey time over isolated operation. It is a particularly useful approach for generating "green waves", i.e. priority movement in a single direction along an arterial. However, fixed time plan systems don't adapt to the variations in demand which occur in practice, and they can "age" quite quickly with changes in traffic levels or direction of movement.

A range of on-line UTC systems have been developed which change signal timing in response to on-line demand. These range from versions of TRANSYT which update automatically, to fully responsive systems such as SCOOT, UTOPIA, PROLYN, MOTION, OPAC, SCATS. Some systems are centralised, such as SCOOT, whilst others, such as UTOPIA, are more decentralised.

Figure 2 Basic Principles of Linked Traffic Signals



SCOOT is widely used in the U.K. (including London) and overseas, whilst UTOPIA has more recently been developed in Italy. These two systems have been the subject of substantial evaluations and both have shown benefits of the order of 20% saving in journey time.

A basic concept of co-ordination is that green times occur so that arriving flows are subject to minimum delays. This is not easy to achieve on a network with many conflicting movements. Maximum benefits occur when a network is not over-congested with substantial queueing blocking the movement of arriving vehicles. "Gating" strategies can be useful to manage demand at a local level, i.e. when traffic entering part of a network is queued at "gates", beyond which traffic is relatively free flowing. There are probably few areas in London where "gating" is a practical possibility because of the problems of queue location.

3.3 Integrated Systems

UTC systems are widely used in cities throughout the world to manage traffic more efficiently. However, the hardware and software involved have increasingly been enhanced to offer on-line management of:

- Public transport priority
- Demand through gating
- Incidents

- Parking
- Traveller Information
- Environment.

They can also provide comprehensive monitoring facilities.

There is evidence that application of all the above systems can be very cost effective, but, of themselves, they will not lead to a step change in congestion levels. For example, in a recent survey, only 8% of drivers who noted parking guidance Variable Message Signs changed their car park destination as a result of the information. Traffic information signs in London resulted in a very low percentage of drivers diverting, perhaps because the opportunities to meaningfully divert were limited by generally high levels of congestion.

4 Intelligent Transport Systems

Intelligent Transport Systems (ITS) is the generic name of future transport related systems and services which are enabled or enhanced by the use of new technologies. These may be grouped as:

- **Traveller Information.** Systems which collect and interpret travel information and provide it before and/or during a trip, can encourage travellers to re-time their trip, select an alternative mode, route or destination. Typically, information may be accessed by telephone, over the internet, or through variable message signs, in-vehicle systems, and personal hand-held devices. Public and private service providers are increasingly involved in travel information.
- **Driver Support Systems.** Vehicle manufacturers are developing a range of products to make driving safer and more comfortable. These include Adaptive Cruise Control (ACC), which has recently become available, where a driver sets a speed and a time headway to a vehicle in front which the vehicle then automatically follows. Others include Stop-and-Go for automatic forward movement in a queue, and collision avoidance where radar and other sensors warn a driver of a potential collision. On-line information systems generally require vehicle location (Global Positioning System). Vehicle-to-vehicle and vehicle-to-roadside communications enable a wide range of functionalities.
- **Network Management Systems.** These build on IUTM, with increased applications and more competent cost effective solutions.
- **E-commerce.** This is a very wide area of applications which can range from trip substitution (i.e. virtual mobility) through to the on-line ordering and delivery of goods.

It is very clear that ITS systems will not solve congestion of themselves. However, they provide opportunities to develop and apply radical new ways of meeting mobility objectives. A key lies in the utilisation of cheap and easy to use location and communication equipment, and a re-thinking of how roadspace should be used and managed. This may be best illustrated by an example:

“A traveller sets out on a journey to work from a suburban London home. His low energy car produces little atmospheric pollution or noise and has many driver support systems for comfort and safety. He parks

in a pre-booked space in a Park & Ride before entering a congested route. He is taken to the correct bus stop by an automated shuttle. A low/zero pollution bus takes him close to his destination on a high priority route. Because it is a nice day he walks the remaining half mile to work. At lunchtime he has an appointment with his dentist about 2 miles from his office. Close to the time he wants to leave, he uses his portable voice actuated communications/location system to order a 'taxi'. He uses a transport service provider with which he is registered and is offered a range of options. He chooses a cheap option as he has a little time to spare, and shares the vehicle with two other passengers and a parcel for delivery. His vehicle uses priority facilities throughout its journey. He is given a guaranteed arrival time to meet the needs of his appointment and his position is tracked to ensure that this is achieved. He is at the dentist longer than expected and returns to his office in a taxi with only one other person for part of the journey. During the afternoon he places his weekly food order with a supermarket for collection at the car park. It is raining when he leaves his office and he uses one of the small autonomous public transport vehicles to take him from the office to the stop for his shuttle bus to the Park & Ride site. He is able to time his departure from the office by considering on-line transport information available on his location/communication system and choose between the bus and a light rail alternative. When he arrives at the Park & Ride site, he contacts the supermarket who track his passage through the car park and have his goods waiting to be placed in the boot of his car for the journey home as he passes a collection point."

This scenario may appear rather far fetched, but all of the technologies are currently available in test form at least. However, much research and trials would be needed before considering it a practical possibility for London. Nonetheless, long term futures offering mobility without congestion should not be forgotten. Also, it must be noted that such a future scenario, and steps towards it, require the restriction of roadspace to private car users in some form.

5 Conclusions

- Traffic management in London is of a generally, but not uniformly, high standard. Further well thought out traffic management measures will always provide good value for money in meeting transport objectives, although their effects on overall levels of congestion will be minimal.
- Traffic control measures, particularly those incorporating public transport priority, are particularly well understood and applied in London. Their extension can always be cost effective and supportive of policy objectives, and should therefore be pursued. However, it is unlikely that they will make a major impact on congestion.
- New technology will necessitate change. For example, on-line driver information may encourage the use of environmentally sensitive routes and Stop-and-Go technology may influence the way in which traffic signals should be set. However, it is probably the hand held device which incorporates location and communication technologies which can lead to radical new services, new concepts of vehicle ownership and use, and associated fundamental changes in use of roadspace. But, the many experiments and trials in this area have yet to demonstrate the feasibility of such an approach. Also, it can only work in an environment in which demand is

managed, either by physical measures or pricing, and where a wide range of conventional and demand driven public transport services are seen by users to be adequate.

- Policies using new technology could offer urban futures where there are high levels of mobility without congestion and environmental pollution, and where personal safety and security are assured. However, this is some time in the future, the development path is unclear, and more studies are needed. For the foreseeable future, demand must be managed by fiscal or physical measures. Available traffic engineering measures will not, of themselves, provide a solution, and work best in a traffic environment which is not over-saturated.

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Alternatives to Congestion Charging for Central London



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Summary

This paper outlines the reasons for the City Council's objections to the Mayor's proposals for congestion charging in central London.

It goes on to set out an alternative strategy, which consists of a combination of measures designed to tackle the three objectives of reducing central area congestion, improving air quality and raising money for further investment in transport facilities.

Regardless of whether congestion charging is introduced there is a consensus that public transport needs to be improved. In the short term this can only be achieved through improved bus services, but in the longer term significant improvements are needed to rail services, including improving the existing networks and introducing new facilities such as CrossRail, CrossRail2 (formerly the Chelsea – Hackney line), the London Tram and other similar facilities.

Further key alternative measures that the City Council wishes to see are improved compliance with parking regulations, more action against moving traffic offences, more control over the activities of the utilities, a range of further demand management measures and the introduction of further measures to improve air quality.

1 The City Council's Opposition to the Mayor's Proposals

The City Council is opposed to the Mayor's proposals to introduce congestion charging in central London. Its position is set out in the latest version of its Unitary Development Plan.

The principal remaining concerns are that the boundary of the congestion charging zone cuts through established residential and business communities, and the effects the scheme will have on these communities. Some examples of the effects are

- Businesses within the zone will have to cover the costs of receiving deliveries, that those outside will not. This will particularly affect small business such as

newsagents, and customers who currently visit businesses within the area by car may go elsewhere if they are faced with a further £5 charge to make their journey.

- Residents who live just outside the zone will have to pay £5 to get into it. Whilst Westminster does not encourage parents to take their children to school by car, it does not believe that the way to discourage this practice is to charge £25 a week, which is completely over the top.

The potential traffic problems on the Inner Ring Road and on other orbital roads immediately outside it, which may arise as drivers seek to skirt around the zone, are fairly well documented. The City Council believes there are better ways to tackle congestion in central London, which would address these concerns. These are outlined in Sections 2, "Public Transport", and 4, "Six Alternative Measures".

2 Public Transport

There is a wide-ranging consensus that public transport is in dire need of significant, sustained investment across all modes, whether or not congestion charging is introduced. But the need becomes even more urgent with congestion charging ahead. The City Council has no confidence that public transport can be sufficiently improved by February 2003 to enable it to cater properly for current demand, let alone the extra pressures that will be placed upon it by congestion charging.

Investment in the existing Underground system has faced delay after delay and there is little prospect of significant improvements in the short-term. Investment in new lines has faced similar delays. The earliest that CrossRail Line 1 is expected to open is now 2011, with CrossRail Line 2 (Chelsea-Hackney) following by 2016 at the earliest. Thameslink 2000 did not happen in 2000!

It is essential that adequate increases in public transport capacity and reliability are provided in advance or at the same time as the introduction of congestion charging in central London. If we accept, as I think we all do, that the railways will not be able to cope with the extra passengers that wish to use public transport to avoid the £5 congestion charge, we must therefore pin our hopes on buses.

3 What are the Mayor's Objectives?

It is important to understand what the Mayor is trying to achieve in considering whether congestion charging is appropriate and if not, what alternative measures need to be put in place.

3.1 Reducing Congestion

The Mayor has set a target of reducing traffic in central London by 10 – 15%. Clearly it is likely that congestion charging in central London will contribute to reaching this target – at least as far as traffic within the charging zone is concerned. But, whether this target will be met is debatable, particularly given the large number of vehicles that are exempt from the charges. Much of the current traffic in central London is made up of vehicles that will be exempt from the charges or will receive a 100% discount, such as buses, taxis, coaches, motorcycles, etc. or of vehicles that have little option but to continue to enter central London and bear the charge, such as delivery vehicles. There is relatively little traffic left from which it will be possible to get an overall reduction of 10-15%.

Even if traffic is reduced by 10%, it is debatable whether this will reduce congestion significantly. If you could, literally, take 10-15% of the traffic away, no doubt there would be a corresponding reduction in congestion. But the large number of bus lanes that the Mayor intends to implement (because he cannot rely on rail improvements), along with schemes that take away roadspace (like the "World Squares for All" proposals) will squeeze the remaining traffic into less space. So, a reduction in traffic does not necessarily mean that the vehicles which remain in the system will individually experience less "congestion" or shorter journey times.

3.2 Improving Air Quality

Most of the most polluting vehicles will either be exempt or receive a 100% discount from the charges, for example buses, coaches, taxis, etc. or they will have little option but to continue to drive in central London and pay the charge, e.g. delivery vehicles. A 10-15% reduction in traffic, even if achievable, is therefore only likely to lead to an insignificant improvement in air quality.

3.3 Raising Money for Investment

This should not be the prime motivation for the scheme. If it is, it really is simply a tax on the motorist. Even so, it was sold to the public on the basis that it would raise £200M a year for expenditure on transport – but this figure has since been revised down to some £130M.

4 Six Alternative Measures

The City Council's alternative strategy to congestion charging is made up of the following six key measures:

- better, decriminalised parking enforcement on the TLRN.
- better enforcement of moving traffic offences.
- full lane rental for utilities.
- a range of demand management measures.
- Low Emission Zone.
- Park and Ride.

The alternative strategy was derived from work that the City Council has undertaken in conjunction with the consultants, Peter Brett Associates.

4.1 Better, Decriminalised Parking Enforcement on the TLRN

The January 2002 issue of *Parking Review* reports the widely held view that regulation of the Red Routes by the Police and Traffic Wardens has not been as effective as local authority enforcement of the decriminalised non-Red Routes. The City Council's own surveys showed that between 1989 (Police enforcement) and 1994 (Council enforcement) the amount of time residents' parking bays were occupied illegally went down from 30 minutes to 10 minutes per day. They also showed that as the City Council's Parking Attendants cleared metered parking bays of those who had been

parking illegally, meter occupancy dropped from an average of 90% to 65%, making it easier for those who are looking for a place to legitimately park to find an empty space.

Parking Review also states that the Police are moving 160 Traffic Wardens away from parking enforcement to new security patrol units. It is also reported that Commissioner Sir John Stevens has said that this move will result in a drop in Red Route, bus lane and speeding enforcement. This may lead to an increase in traffic congestion and an increase in accidents, which can also increase delays and congestion.

Decriminalisation would also mean the income from enforcement could be ploughed back into transport, instead of finding its way to a central Home Office pot. Strangely, on another page of the same publication, it is reported that Transport for London wants to “recriminalise” some central London roads. A move which, based on current experience, is likely to have the opposite effect to what is required!

4.2 Better Enforcement of Moving Traffic Offences

This is required for a number of reasons including:

- **Safety** – many accidents are caused by drivers speeding, drinking and driving, ignoring bans on right-turns, no-entries, etc. Improved enforcement would reduce the number of offences and thereby reduce the number of accidents.
- **Associated delays** – accidents also cause delays. Those accidents which involve serious injuries and/or fatalities can result in whole roads being blocked (whilst the emergency services attend), resulting in huge delays. Delays are also caused while drivers stop to exchange details following a damage-only incident and this can take out a traffic lane, which, even if it is only for a short time, can have serious knock-on consequences.
- **Other obstructions** – for example bus lanes are often blocked by traffic, which seriously hampers public transport, or vehicles stray onto yellow box markings and impede other traffic.
- **Promotes a compliance culture** – the more enforcement there is, the more drivers are likely to comply with the regulations.
- **Income could be hypothecated** – at present the money that is levied on drivers in the form of fines or fixed penalties for moving traffic offences is passed into a central Home Office pot. It should be hypothecated into a specific transport enforcement fund for London which could fund increasingly improved enforcement.

Local authorities implement traffic management schemes for a wide variety of reasons, but their attempts are often thwarted by the lack of enforcement. For example, banned right turns are often put in place to address an accident problem, or to reduce delays caused by vehicles waiting in the middle of a road to turn right, but these are less effective without enforcement.

But authorities also shy away from introducing some traffic management measures because the Police tell us that they are particularly difficult to enforce – such as banned left-turns and point no-entries.

The City Council has introduced several coach bans in residential areas. Whilst there is a degree of self-enforcement – the number of coaches in these areas has dropped – the

City Council still has to deal with a large number of complaints about vehicles flouting the bans, which would be better dealt with by improved Police enforcement.

4.3 Full Lane Rental for Utilities

There are some 12,000 highway openings by the Utilities in Westminster every year, which equates to 200 road works sites in Westminster in any one week. These obstruct the flow of traffic.

If the Utilities were charged from day one it would encourage them to undertake their works as quickly as possible. Thus, even if there were still 12,000 openings a year in Westminster, there would be significantly fewer on our streets at any given time. But such a scheme may also encourage the Utilities to think twice before opening the highway and lead to a reduction in the 12,000 figure. The charge would need to be set at a level which would act as a realistic incentive to finish the works as soon as possible, which should make the scheme at least self-financing. Any surplus should be ploughed back into improving London's transport, including highway maintenance.

4.4 A Range of Demand Management Measures

Whilst there is already a range of demand management measures in place in central London the City Council firmly believes that there are further measures that should be tried, before the congestion charging experiment is introduced, and that the measures that are already in place should be more widespread.

Parking controls do not affect through traffic but can act as a very effective deterrent to those with a destination in a particular area. Westminster currently charges up to £4 an hour for on-street parking in the central area, which is usually limited to a maximum stay of two hours as well. There is still scope to extend controlled parking into further areas of central London and to review the regulations and charges.

But too many London employees are able to access free parking facilities in private non-residential (PNR) car parks. This is being tackled in central London by the imposition of very strict maximum parking standards in new commercial developments (1 space per 1,500 sq. m.), but reducing the amount of parking only on redevelopment is a slow and painful way of achieving that reduction. There is also still much scope to apply stricter standards outside central London.

Further incentives, such as Uniform Business Rate tax breaks, are required to encourage the use of existing parking spaces for other uses. Many office developments were built prior to the introduction of the parking standards referred to above and were therefore provided with large car parks. These car parks often remain to this day even after refurbishment or even redevelopment above basement level. The City Council encourages a change of use in such situations, but has had little success. Perhaps a financial benefit would encourage landowners to make better use of such space.

Other measures that are still in their infancy in most areas include green travel plans, home working, internet shopping with home delivery, and car-sharing. Even a review of traffic signs might reduce the amount of traffic circulating because the drivers are lost.

Individually these measures are likely to have a relatively insignificant effect. However, taken together and consistently applied their effect could be significant.

4.5 A Low Emission Zone

Congestion Charging does not tackle the significant problems experienced in central London with Air Quality. The City Council has seen fit to designate the whole of Westminster as an Air Quality Management Area because of the existing and forecast air quality problems over the whole area.

However, as already noted, most of the most polluting vehicles will either be exempt or receive a 100% discount from the Mayor's charges, for example buses, coaches, taxis, etc. or they will have little option but to continue to drive in central London and pay the charge, e.g. delivery vehicles. Congestion charging is therefore only likely to lead to an insignificant improvement in air quality.

A better scheme would be to introduce a Low Emission Zone, which only vehicles that met certain, strictly enforced standards could enter. The larger the Zone, the more effective the scheme would be. We are not saying that buses, taxis and/or lorries should not be allowed into central London, only that, if they want to enter central London they should meet exacting standards on emissions that are certainly much tighter than the standards required to pass the current MOT test.

4.6 Park-and-Ride

Park-and-ride already occurs in the form of rail-heading, where drivers seek to drive as far as they can and then park at or near outlying rail stations and catch a train into central London. This is often seen, quite rightly, as a problem for the local authorities where the stations are located. Residents of the areas around the station understandably consider the daytime parking of commuters cars as an imposition and in many areas controlled parking zones have been introduced to address it. This process is continuing, and is already pushing drivers further out from central London, but in a largely unplanned manner where local authorities are reacting to the problems rather than being able to tackle the issue positively.

The City Council is not advocating simply shifting the traffic and parking problems of central London to outer areas, but is simply suggesting that there may be locations in outer London and beyond where parking facilities could be provided at or near to outlying stations (or even stations newly-created specifically for the purpose), where they would not be seen as such an imposition on residents, whilst reducing the total mileage driven. The number of drivers who drive from outside London to central London every day is likely to be relatively small (estimates from the 1991 London Area Transport Survey suggest that somewhere between 7,500 – 8,000 drove from outside London into Westminster every day), but further study is required to assess whether there are positive ways of encouraging rail-heading.

The Mayor and Transport for London need to tackle this as the strategic issue that it is. It is not for Westminster City Council to suggest locations where such facilities might be created, but it is worth noting the overall benefits that might accrue if drives could be persuaded to change mode further out of London.

The Strategic Rail Authority needs to be involved for the longer term improvement of the rail network to support "Park and Ride" initiatives especially in those areas close to the Greater London Boundary where bus services are poor. This requires the Mayor to work with the neighbouring Counties and Unitary local authorities.

5 Where Next?

The City Council is opposed to the Mayor's proposals to introduce congestion charging in central London and feels they should be abandoned. Even if the Mayor cannot be persuaded to abandon the proposals, we believe he should commission studies of the full facts on the alternative proposals, before dismissing them in favour of forcing congestion charging through. If he will not agree to this, the congestion charging proposals should at least be tested in public at a public inquiry where all opinions can be aired and a comparison made between congestion charging and the alternative approach.

The Zurich Experience



Ruedi Ott
Head of Traffic Planning
Zurich City Council

Summary

In response to growing air and noise pollution, Zurich Town Council resolved in 1987 to strengthen its commitment to five transport policy goals:

- to promote public transport.
- to reduce motor vehicle traffic.
- to channel motor vehicle traffic and to restrain traffic in residential areas.
- not to increase but rather reduce the number of parking places for commuters.
- to guarantee the environment-friendly mobility of cycling and walking.

The City's transport policy based on these goals has been an important contribution to Zurich being at the top of the Mercer world-wide quality of living survey for some 215 cities, in 2000.

In May 2001, the Council approved a new mobility policy, intended to maintain its successful transport policy, while also recognising the need for sustainability. The policy is based on five guidelines:

- to optimise and integrate the transport system, with active mobility management to make the existing transport network more efficient, with close connections between the different modes, encouraging multi-modal use.
- to develop and to support new innovations, such as telematics applications, car sharing, city logistics, collect-call taxis.
- to complete infrastructure, but only to preserve the capacity of the transport network as a whole, or to reduce excessive impacts on citizens.
- to ensure full transparency of transport costs, with participants paying the real costs.

- to widen the thinking of the people and the business world for a new urban mobility.

1 Introduction

Zurich has been commended for its approach to transport, and its transport policy has undoubtedly contributed to the city's recognition as providing the best quality of life among cities around the world.

Unlike many major European cities, Zurich does not have a metro - although it does have a well developed suburban rail system serving the metropolitan area. Following rejection by citizens of a planned metro system, the City has successfully promoted the use of public transport, cycling and walking, while controlling traffic and parking.

2 Zurich in its Region

Although the City of Zurich has a population of 360,000 and 330,000 jobs, it is the centre of a conurbation with a population of close to 1 million. There are 171 municipalities within the Canton of Zurich.

The Cantonal Public Transport Act of 1988 and the relevant Transport Supply Order calls for the provision of good public transport services for all continuously built-up areas with at least 300 inhabitants, jobs or trainees/students. "Good" means that there must be a bus or tram stop in a catchment area within a distance of 400 m, or a train stop within a distance of 750 m, with at least one service per hour.

The Zurich region is served by the S-Bahn, a 400 km suburban rail network, which was completed in May 1990 with the opening of a new tunnel under the old city centre and the Zürichberg, with a four track through station underground. The S-Bahn provides a fixed interval timetable and has a tariff agreement with free transfer between the region's other transport operators, who were brought together under the Zurich Transport Authority (ZVV) in 1990. The Authority's network comprises 262 lines with a total length of 2,300 km serving the whole of the Canton of Zurich. It includes railways, trams and buses, as well as cable cars, riverboats and ferries.

Public transport use increased by 22% in the first year after completion of the S-Bahn, and by 40% over the first ten years.

3 The City's Transport Policy

Two major projects in the City of Zurich for underground metro systems were rejected in referenda, the first in 1962 and the second in 1973. The second rejection decision, which was taken by the City Council, was to be a mandate to develop the existing tram, trolley bus and bus system to meet travel needs within the city.

In 1973, a 'peoples' initiative' was launched with the aim of providing SFr200 million for projects to speed up public transport. This initiative was approved in a referendum in 1977. Not only did this ensure resources but, and more significantly, a majority of the population expressly approved a transport policy which gave priority to trams and buses.

Building on this, in 1979 the City Council issued a directive that in any conflict involving the various modes, precedence had to be given to public transport.

In 1987 the City Council established five main goals for its transport policy:

- to promote public transport.
- to reduce motor vehicle traffic.
- to channel motor vehicle traffic and restrain traffic in residential areas.
- not to increase but rather reduce the number of parking places for commuters.
- to guarantee the environment-friendly mobility of cycling and walking.

A study had shown that the public transport system was considered to be slow due to three main kinds of obstruction:

- vehicles turning left or running between the tramlines because of parked vehicles.
- conventional traffic lights with long waiting times.
- minor collisions.

To overcome these, and to make the "Zurich Line" fast and reliable, a "speed-up" programme was initiated with three objectives:

- to ensure that public transport vehicles are not obstructed by other vehicles between intersections, by creating dedicated tracks and separate bus lanes, and abolishing on-street parking along roads with trams and major bus lines.
- to provide maximum priority for public transport vehicles at signal controlled intersections, with a dynamic control system including direct actuation by trams and buses.
- to provide a computerised public transport control system, with automatic vehicle location for all vehicles and in-cab information displays.

3.1 Traffic Control

Implementation of the traffic control system, SESAM, has provided the required priority for public transport vehicles at traffic signals. A fundamental principle of the system is that trams and buses do not need a long green light but do need a green light when they are approaching an intersection. The system works by means of transmitters in the vehicle and induction loops in the carriageway. The signal control system, which is quite separate from the operational public transport control system, can be used by every tram and bus, independently of its timetable.

The advantages of this control system are:

- trams and buses obtain a green light when they really need it.
- if there is a series of traffic signals, the traffic computer usually actuates green for public transport vehicles all the way through the series.
- when traffic signals are located directly after stops, the tram or bus is identified on arrival at the stop. After 10 to 15 seconds the green light goes on and stays on until the departure signal is given as the vehicle passes.

The traffic signal controlled junctions are grouped into small cells, with the aim of maximising efficiency within each cell, with queuing areas for traffic between the cells. Rather than detecting queues, the system counts vehicles and regulates entry according to local street capacity. Traffic signals at junctions are programmed to give absolute priority to trams and buses, and also to ensure that some capacity is given to pedestrians and cyclists; e.g. if an approaching tram is detected, a short green phase will be given to the crossing flow, both to clear it ahead of the tram and to enable passengers to reach the stop safely.

In handling other traffic, Zurich's traffic control system differs from conventional approaches. The City is divided into a large number of units, each consisting of three to ten sets of traffic lights. These units are formed dynamically depending on the direction of traffic and are co-ordinated with traffic volume. For example, during the morning peak, the units located on the outskirts restrict the inbound traffic, so that it can be handled by those located nearer the City centre. Traffic is not restricted at actual gates, but by making the appropriate reduction in the capacity of the entire unit. An artificial kind of congestion thus arises, although it is spread in such a way over a number of traffic lights that it does not seem to be a deliberate limitation of traffic. Unlike a queue at a single traffic light, users accept this type of capacity reduction.

3.2 The Public Transport Vehicle Control System

The public transport vehicle control system locates vehicles to within 10 m, and provides real time information to all tram and bus drivers on any timetable changes and traffic disturbances. It enables actions to be taken to reduce the impacts of any incidents, thereby increasing punctuality and regularity. The system also provides data on regular problem points in the network, identifying needs - and supporting the case - for improvements.

Each tram and bus stop has a customised timetable, showing the departure time of all vehicles on each route at the stop, and the running times to places down the route. 80 % of all the vehicles operate within a 30 to 40 second deviation from the timetable, which is thought to be the world's best reliability level.

3.3 Public Transport - and Transport Policy

In the mid 1980s, the City's public transport operators (VBZ) published a plan that included three key measures:

- 1 there should be a connection with the S-Bahn for all inhabitants of the City. That required some infrastructure improvements and creating new or longer bus routes.
- 2 basic regular services were to be provided for all inhabitants, with new services for areas with poor connections: The more important basic services were defined as:
 - people should be within less than 300 m or at most 5 min by foot, of the nearest stop.
 - tram and bus services should operate from 6 am until midnight, with a maximum headway of 30 min. In fact, during the day, most tram and bus services run every 6 to 8 min, and night-buses have run at weekends since 1993.

- 3 services should be market-oriented. Capacity should be increased through the use of more spacious trams and articulated buses, headways should be shorter, and routes should be revised to reduce journey times and to avoid connections or detours via the City centre.

With around 300 million passengers a year, public transport predominates in Zurich's traffic. The aim is not only to maintain but also to improve this market position. Marketing, which promotes a self-confident style with slogans such as "We are number one", "We are the key to the quality of your life ", contributes just as much to the success of public transport as infrastructure improvements and fares policies. The Rainbow Card – the Zurich environmental season ticket – is a kind of club membership card for public transport users. The price of public transport is included in the price of tickets for major sporting and cultural events and the transport operators co-sponsor events, and organise activities in conjunction with trade and industry.

3.4 Traffic

The improvement of public transport, at considerable financial cost, was not an end in itself. It was explicitly intended to meet new mobility needs and handle a substantial proportion of travel previously made by car in a way more compatible with the environment and the City.

However, all too often, the car still has so many advantages for the individual that it is seen as more attractive than the tram or bus, even when – as in Zurich – the quality of public transport is very good and its capacity high. Zurich has therefore come to the inescapable conclusion that promoting ecological transport modes, and in particular public transport, is not sufficient.

In addition to encouraging public transport, cycling and walking, the possibilities and attractiveness of using the car for travel to and in towns have to be actively, but selectively, reduced.

For many years Zurich has refrained from developing the main road network in order to prevent traffic from increasing and having an undesirable effect on the modal split. This principle was challenged with the opening of two national road segments, the northern bypass and the Milchbuck tunnel. However, the opening of these new roads was complemented by new measures to reduce traffic on the local road network. These included reducing the number of lanes and shortening green times at signal controlled intersections.

The traffic capacity of the City's road network has also been reduced at some locations by reallocating roadspace to cycle tracks and providing additional pedestrian crossings, and night-time use of motorway access roads through residential areas has been banned. Following approval by the Federal Government in 1989, the many technical and police measures to restrain traffic in residential areas were supplemented by the introduction of extensive 30 km/h speed limit zones.

3.5 Parking

Extensive parking controls, both on- and off-street, have also been introduced as a key element of the City's transport policy.

The most important aspects of the policy are those which deal with parking on private property. The Parking Ordinance regulates, in particular, the number of mandatory parking spaces in new and converted buildings as well as the maximum permissible number of extra parking spaces. In addition, areas with good to very good public transport services have been singled out for parking reductions. The designation of these areas is also related to clean air requirements.

In the City centre, the number of parking places for visitors and customers is limited to the level in 1990. This means that when a new public parking garage opens, a matching number of on-street parking places must be eliminated.

While measures relating to on-street parking only play a minor role in quantitative terms, in qualitative terms priority can be given to special user categories, in particular to local residents, and, in the City centre, to visitors and customers. However, measures against illegal parking are crucial, as the success or failure of all parking regulations in public areas depends on their effectiveness.

In certain areas, where there is a lack of spare highway capacity, there is a need for more serious parking-restrictions or new approaches. To address these needs, a new "access contingent" model, which gives more flexibility to owners in the use of their parking lots, is being implemented. This replaces the concept of fixing a number of parking places by specifying the number of in and out movements by car per day, with a daily average limit over a six month-period; movements in excess of this limit will lead to action against the landowner. The contracts are signed, but as yet there is no direct experience with this new model.

3.6 The Effects

Zurich's transport policies have proved highly successful. Personal mobility is guaranteed; most people use environment-friendly transport modes as public transport, walking or cycling. Traffic conditions for motor vehicles are less congested than most other comparable European cities.

Overall, the measures have made a major contribution to the City's quality of life. Together with Vancouver, Zurich was rated top of the 2000 Mercer worldwide quality of living survey, covering some 215 cities.

The main reasons for Zurich's success include:

- making public transport faster, and keeping it attractive.
- traffic management by means of a dynamic control system.
- effective planning and control of parking, on- and off-street.
- good living conditions, through traffic calming in residential areas with City-wide 30km/h speed-limits and directing traffic onto the main road network, but without increasing its capacity, as well as parking restrictions for non-residents.
- good conditions for walking and cycling. Indeed, every public transport passenger is also a pedestrian, so the waiting areas at stops and the routes to them must be attractive. If people no longer wish to leave their homes on foot, whether because of unattractive footpaths, pointless detours, pollution caused by emissions, security problems or because they feel that, as pedestrians, they are not treated as participants in traffic in their own right, it will not be possible to promote the use of

public transport instead of the car. People can also rent a bike for free for the whole day. With more than 300 bikes at six stations, this facility has now run for its eighth summer season. The costs are met by advertisements on the bikes.

- soft policies for sustainable mobility management. Information, such as the "Zurich mobil" package for new residents (which includes facts about "mobility", the car-sharing-concept, as well as the combination of a season ticket for public transport and cheap access to a rental car), advisory boards, public awareness and education, new offers in the mobility behaviour etc play a key role.
- project management staff from all City Council departments ensure that all measures are implemented in the same direction. Even the smallest decision – irrespective of whether it concerns public transport, private car transport, parking policy, etc. – must be taken in the light of the overall plan. After about 30 years of intensive activity, the mobility policy of Zurich shapes the thinking and action of all those working in local government.

Advancing, pragmatically, by small or large steps, the City's staff has assembled the many components to form a whole. For example, the decisive factor to get the present high standard of public transport system is to be found not so much in individual large projects as in the sum of all the steps taken, particularly the small ones.

4 The Future

The times and the goals are changing. In the 1950s and 1960s, new infrastructure and extensions were the goals. In the 1970s and 1980, the focus was to slow traffic down, especially in the cause of environmental protection. In the 1990s, the main concern was the economical use of public funds, which had become severely constrained.

Now, in the early part of the new millennium, the focus is on consolidation and sustainability, with three key topics, environment, economy and society, and with transport planning playing a key role within a co-ordinated overall urban policy.

Zurich must retain its attractiveness. The key factors for this are a high quality of life, a competition-proofed economy and protection of the environment. The needs of today are to be fulfilled in such a way that future generations will still have all the opportunities. Projects must therefore be economically advantageous, ecologically beneficial and socially equitable.

In May 2001, the City Council of Zurich adopted a new mobility policy, designed to maintain the successful transport policy of the last decades while working towards sustainability.

The new mobility policy has two main tasks:

- making future sustainable development possible
- offsetting damage caused by earlier development.

To achieve these, five guidelines have been set:

- to optimise and to combine the transport system. Active mobility management is to make the existing transport network more efficient, and the different modes of transport are to connect more closely to ensure efficient multi-modal use.

- to develop and to support new innovations. These will include new communication systems, such as the internet as a means for replacing physical by virtual mobility, and telematics applications for objective oriented mobility management. In addition to transport technology development, it will also be necessary to seek, test and promote other forms of mobility management, such as car-sharing, city logistics, collect-call taxis etc. The conditions of all forms of multi-modal transport must be improved in order to allow the considerable potential of the intelligent fulfilment of mobility needs to be fully exploited.
- to complete infrastructure, but only when it preserves the capacity of the transport network as a whole, or where unacceptable impacts on citizens, such as noise and pollution, can be overcome. New infrastructure must be accompanied by additional supporting measures to avoid negative effects.
- true costs: There must be transparency in transport costs, to increase awareness and to ensure that users are paying the real costs.
- to broaden the thinking of the people and the business community about a new urban mobility. It is the intention to establish a kind of social contract with the people of Zurich about this new culture of urban mobility.

These new guidelines take the place of the five goals set in 1987. The principles are now on a higher strategic level and therefore open for new challenges in urban transport planning.

This overall mobility strategy will be complemented at an operating level with 17 sub-strategies covering combined transport/intermodality, mobility management/telematics, mobility consulting services, public transport, walking, cycling, arterial roads, by-passes, residential-areas, public spaces, parking, shopping and leisure traffic, freight traffic, new development areas, city core, Cantonal and regional cooperation, and financing.

Inside the city, as well as just beyond its border, there are new development areas, usually former industrial areas, with the potential for thousands of new jobs and housing. However, the existing road network does not have sufficient capacity to accommodate additional traffic, and there is no room for new roads. "Business as usual" is not sufficient. New approaches are needed. These will include:

- further investment in public transport, leading new land use developments. The City is planning to construct three new tramlines of some 15 kilometres within the next ten years and, in the Glattal, about 17 kilometres of a new suburban LRT are planned to connect Zurich with the neighbouring communities and their development areas (with potential for at least 25,000 people and 90,000 new jobs).
- an attractive open space, and a permeability for pedestrians and cyclists as high as possible, in the new development areas.
- strong parking-restrictions in certain areas, or the implementation of the new access contingent model.

Last but not least, less than 12 years after the opening of the S-Bahn, there was a second referendum about increasing the capacity in Zurich's central station, this time mainly for the national railways. On 23 Sept. 2001 the voters of the Canton of Zurich approved (with 82% in favour – which, for the Swiss democracy, is an extremely high portion of "yes" votes) a second through-station located underground followed by a

second tunnel to Oerlikon in the North, to be in service in 2012. This new 4.8 km long tunnel will cost some. SFr 1.5 billion, of which the Canton will pay 40% with SBB, the Federal Railways, paying the balance.

5 In Conclusion

In Zurich, promoting public transport is not a question of paying lip service. We do it with all our hearts, investing in infrastructure as well as in softer measures such as traffic management, mobility management and public relations. And we avoid polarisation between public and motorised private transport. The way to the future is through integrated mobility management. The evidence is clearly that these policies have strong support among the citizens of Zurich.

Annex

Biographies of the Speakers

Professor Peter Jones

Peter Jones is Professor of Transport Policy and Behavioural Analysis at the University of Westminster and Director of its Transport Studies Group. In his research he has specialised in understanding relationships between transport policies, public attitudes and travel behaviour, and has been engaged in studies in several countries around the world. He has acted as a specialist advisor to the European Commission, the House of Commons Transport Select Committee, the DTLR and various UK local authorities. He is currently a member of the Assurance Panel for the World Business Council for Sustainable Development's global study into Sustainable Mobility.

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Werner Brög is the managing director of Socialdata, Institute for Transport and Infrastructure Research, in Munich, Germany. The main emphasis of his work is on research in methodology to collect valid data on mobility behaviour, application of policy-orientated decision-making models ("Situational Approach") and development and application of strategies to promote behavioural changes (e.g. use of public transport) by "Individualised Marketing". He works for ministries, public bodies and transport authorities in Germany, various European countries, Australia and USA. In 1996/97 he led a European demonstration project called "Switching to Public Transport" (in co-operation with the UITP) in more than 40 cities in 13 European countries.

Helen Grey-Smith is the Project Co-ordinator for Socialdata Australia. She has a background in art, teaching, small business management and environment education. Helen was actively involved in environmental issues in Western Australia in the 1970s, and in Canberra from mid 1980s. She worked with community and school groups on re-vegetation projects, helped promote community landcare in the Canberra area, and was a Director of Greening Australia. Her current role involves managing the field work for travel surveys and IndiMark® delivery in Western Australia and Queensland.

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Alastair Duff

Alastair Duff joined BAA having read Law at London. At Heathrow, he has been General Manager Terminal 4, General Manager Heathrow Express and General Manager Ground Operations. His last post was as General Manager Transport Strategy, where he was responsible for developing surface access strategies for Heathrow that would increase the use of public transport by air passengers and staff whilst reducing car dependency. He is now an independent consultant advising organisations on transport strategy, telematic applications and commuter travel planning. He is Transport Strategy Adviser to BAA. He also chairs the Heathrow Area Transport Forum Steering Group, the West London Transport Group and the Association for Commuter Transport.

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Mike McDonald has been Director of the Transportation Research Group at the University of Southampton since 1982 and was Head of the Department of Civil and Environmental Engineering from 1996 to 1999. Research for which he has been responsible covers many aspects of transport planning, traffic engineering and control, application of new technology, safety, highway design, economic appraisal and evaluation. He has been significantly involved with the EC Transport Telematics programmes, and has been a member of several professional and government committees and advisory bodies including the Technology Foresight Programme. He is presently leader of the EC ROSETTA project to determine future research directions.

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Carl Powell is an American by birth and has lived and worked in the UK for over 30 years. Prior to Westminster he was from the Rotch Group, a private investment institution, where he was Chief Executive Officer for Corporate Resources. Initially qualifying as a surveyor, he has worked in both the private and public sectors spending time in the NHS and 15 years with London boroughs. He has had a wide experience in a wide range of technical and corporate services.

Carl Powell has been Director of Planning and Transportation at Westminster City Council since 6 September 1999.

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Ruedi Ott

Ruedi Ott trained as a civil engineer and traffic engineer at the Swiss Federal Institute of Technology of Zurich, graduating in 1973. He has worked in the Traffic Planning Section of Zurich City Council since 1974, and has been Head of the section for over 20 years. Mr Ott is a member of the Governing Body of the Swiss Association of Traffic Engineers, responsible for research, and represents the City of Zurich as a permanent guest in the Traffic Planning Committee of *Deutscher Städtetag*, the association of all cities in Germany. He is also a member of the National Research for Roads and Traffic Committee of the Federal Department of Environment, Transport, Energy and Communications.

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- scrutinies are conducted with objectivity and independence;
- scrutinies examine all aspects of the Mayor's strategies;
- scrutinies consult widely, having regard to issues of timeliness and cost;
- scrutinies are conducted in a constructive and positive manner;
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