



Avon traffic restraint study

Peter Dunn

Ove Arup and Partners

Abstract:

The Department of Transport in the UK, now the Department of Environment Transport and the Regions (DETR) have been investigating various ways to reduce reliance on the private car, referred to as Traffic Restraint, in London and elsewhere. This involves schemes that increase the cost of driving in congested conditions. Following extensive studies in London, Bristol was chosen as a case study to assess the impact of congestion charging in a smaller centre in more detail.

As it is now accepted in the UK, that road capacity in cities cannot be expanded to meet demand, it is necessary to manage that demand. A demand management strategy has three elements, firstly to discourage car usage, secondly to encourage use of other modes, and thirdly to minimise the need to travel at all. It is important to recognise that the three methods are complementary. This paper examines methods to discourage car usage, acknowledging that greater use of alternative modes is also required.

Bristol as with most other cities of its size in the UK, relies heavily on the private motor vehicle to meet its transport needs. Growth in car ownership and use, and more dispersed, low density development have combined to produce steadily increasing traffic congestion. Public awareness of the transport problem is continually growing, particularly relating to the environmental effects, and the sustainable development debate.

The aim of the study, jointly funded by the DETR and Bristol City Council, was to research the options for charging for road use as a means of achieving the various objectives set out in the Avon Transport Plan.

This paper will describe the results of the study, how they may affect transport policy in the UK, which is relevant to transport policy issues in Australasia.

Contact author:

Peter Dunn
Senior Transport Planner
Ove Arup and Partners
PO Box 2503
Auckland
NEW ZEALAND

Telephone: +64 9 309 4713

Fax: +64 9 307 3917

Introduction

Public awareness of the transport problem is continually growing, particularly relating to environmental effects, and the sustainable development debate. It has been accepted that road capacity in large cities cannot be expanded to meet demand, and that other measures must be investigated to reduce car travel but at the same time maintain acceptable levels of accessibility.

Some Australasian cities have investigated and implemented strategies for reducing traffic congestion in city centres. These have generally included measures that have localised effects such as reducing road capacity and restricting parking. In Europe, due to the size of population and dense development and a community that can no longer sustain the cost of providing road infrastructure, stronger measures are being investigated.

In September 1997 Ove Arup & Partners completed a comprehensive study to develop feasible traffic restraint options for Bristol. The study concentrated on road pricing as a mechanism, as a separate study was conducted investigating parking restraint measures.

This paper describes the study process and outcomes, and how they may affect transport policy in the UK.

Study Background

A demand management strategy basically has three elements, firstly to discourage car usage, secondly to encourage use of other modes, and thirdly to minimize the need to travel at all. While it is important to recognise that the three methods are complementary, this study dealt mainly with methods to discourage car usage, acknowledging that greater use of alternative modes is also required.

The Department of Transport (now the Department of the Environment Transport and the Regions - DEIR), have been investigating various ways to reduce reliance on the private car, referred to as Traffic Restraint, in London and elsewhere. This has involved schemes that increase the cost of driving in congested conditions. Several regional centres, of which Bristol was one, were selected as case studies to establish in more detail the likely impact of traffic restraint schemes, and ways in which they could feasibly be implemented. This study was jointly funded by the former Avon County Council (now the Bristol City Council) and the DEIR.

Bristol is located in the west of England, with a regional population of approximately 750,000. As with most other cities of its size in the UK, Bristol relies heavily on the private motor vehicle to meet its transport needs. Growth in car ownership and use, and more dispersed, low density development have combined to produce steadily increasing traffic congestion.

Bristol has experienced traffic growth similar to the UK national average over the past 12 years and car travel is predicted to increase by more than a third by 2013. Avon County Council produced a 20 year Transport Plan in 1995, based on the findings of the Bristol Integrated Transport and Environmental Study (BRITES). This clearly identified the key

transport objectives, and targets for the County, and identified a range of strategic measures to achieve them.

One of the prime objectives of the study was to research the options for charging for road use as a means of achieving the objectives of the Avon Transport Plan. A parallel study for the DETR, analysing the effects of parking restraint strategies, was carried out by the MVA Consultancy, who also developed TRAM (Traffic Restraint Analysis Model), the main analytical tool used in both studies. Following the road pricing analysis, scenarios were developed with combinations of road pricing, fuel price increases and parking restraint.

The study process is outlined in Figure 1.

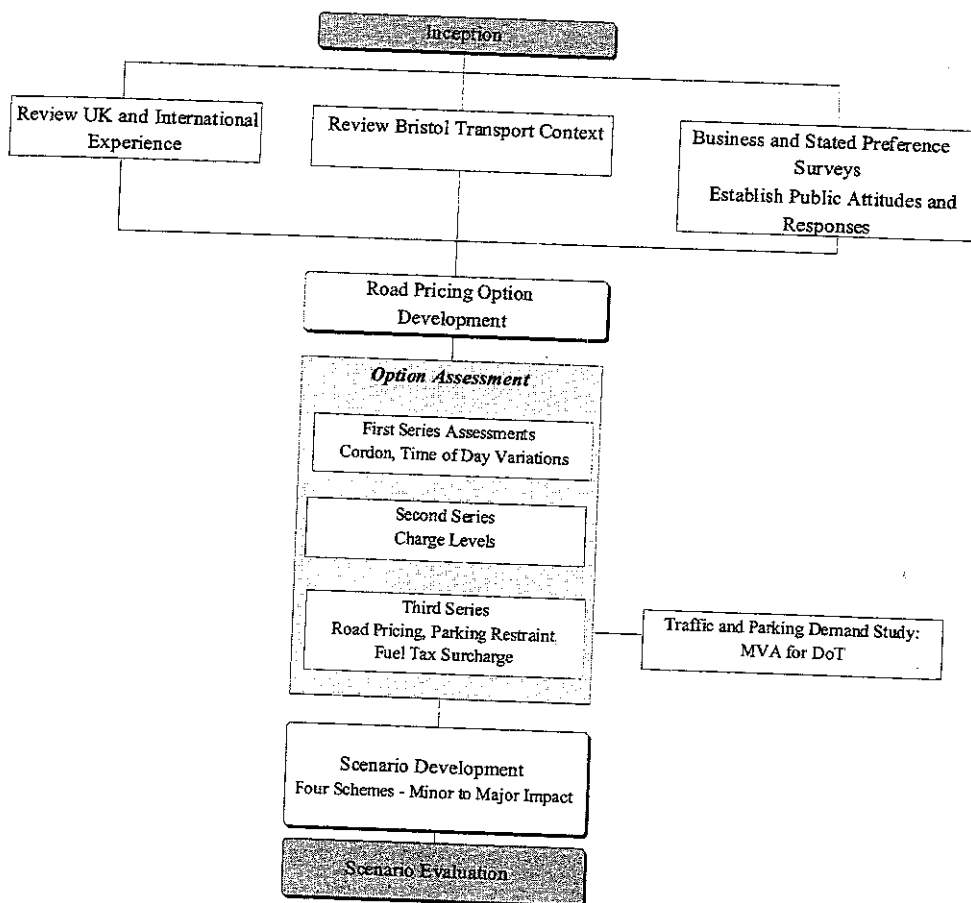


Figure 1 Study Process

Transport Objectives

The objectives and targets are described in the Avon Area Transport Plan under the following headings:

Accessibility and Movement: a transport system which provides a greater range of transport choices, good accessibility for all to employment, health, educational, shopping, social and leisure facilities, and provides for the efficient movement of people and goods;

Economic Development: a transport system, which supports environmentally sustainable economic development and urban regeneration;

Environment: a transport system which is sustainable in terms of its impact on the environment and natural resources, and serves, rather than dominates, the built environment and local communities. It should provide opportunities for net environmental improvement;

Safety: a transport system that provides the highest achievable level of safety for each and every user;

Security: a transport system which is, and perceived as being secure for all who wish to travel.

This provided the framework by which the traffic restraint measures were assessed.

Past Experience

Traffic Restraint

There are many examples in Europe of different forms of traffic restraint in town centres. Measures include pedestrianisation of streets, parking restrictions, bus lanes etc. In terms of reducing car travel these have had varying degrees of success; in York, for example, such measures resulted in traffic being displaced from the centre on to the Inner Ring Road rather than switching to public transport.

Road Pricing

The practical experience of road pricing as a mechanism for traffic restraint is rather limited. The most well known example is in Singapore, which operates an Area Licensing Scheme, and has successfully reduced traffic congestion in the central area. Complementary measures such as parking restraint, improved public transport and bypass roads have significantly contributed to this. The Area Licensing Scheme is currently being upgraded to a fully automated electronic system.

Three cordon pricing schemes operate in the Norwegian cities of Oslo, Trondheim and Bergen. However, they have been applied mainly in major radial corridors, rather than the

area as a whole. The main objective of those schemes is to raise revenue for transport infrastructure, which has generally resulted in the accelerated implementation of environmentally sensitive highway improvements.

Some Italian cities have restricted access to historic parts of the city centre to residents and permit holders. These are, in effect, supplementary license schemes with strict qualifying conditions, and are enforced using a paper permit displayed in the windscreen. It is intended to introduce an electronic system in Rome that would charge business permit holders on the basis of time spent in the zone.

A concession has been let for an urban motorway project in Melbourne, City Link, which requires a free flow tolling system for recovery of revenue to fund the construction. The concessionaires are satisfied that a viable scheme, with associated enforcement procedures, can be implemented on this project.

Road Pricing Schemes

Time and distance based charging systems were rejected as feasible schemes based on current technology advice and the results of past studies. Both time and distance based systems encourage the driver to minimize their travel time and distance respectively, leading to potential for rat running and speeding.

Consultation with the industry indicated that the technology is likely to be available to provide an environmentally acceptable and operationally efficient system of free flow tolling on urban streets. Therefore, it was concluded that technology alone was not likely to constrain the introduction of a road pricing scheme.

A review of the development of relevant technologies worldwide, showed that charges could be levied electronically at tolling points without slowing traffic using infrastructure that would be acceptable in the urban street environment. This would allow a scheme where charges are levied for crossing cordons. Toll cordons were selected for further investigation.

Surveys

An important element of the study was to examine motorist's possible response and the community's attitude to the introduction of traffic restraint measures. In-depth interviews were conducted with 200 businesses and structured questionnaires administered to 420 motorists to obtain their attitudes to transport problems and policies, such as traffic restraint, and to public transport improvements. The possible response of motorists to such measures was extracted from the stated preference element of the motorist survey. For the purposes of the survey a charge of £2 per day could only be tested.

There was a concern that road pricing implemented in Bristol only would put it at a commercial disadvantage compared to other nearby centres. The business reactions were interesting, because most respondents, when considering the effects on their own business, expected to adapt without much difficulty. It was concluded that road pricing alone at the

level of charge explored in the interviews (maximum £2 per day) would not cause businesses to relocate, but could affect the decisions of those businesses considering relocation for other reasons. The research with businesses showed that road pricing could have a significant effect on business location if applied only to the city centre. However, we found no evidence to indicate that road pricing would result in migration of businesses from the Bristol area. It was not within the scope of the study to assess the effects on businesses from outside the area that might be considering relocation to Bristol.

Most people interviewed believed that the build up of traffic in Bristol over the past 5 years was a problem, highlighting air quality as a major concern. There was a general willingness to pay for air quality improvement. There was also an agreement that action needed to be taken, as problems were increasing. Both businesses and motorists clearly indicated that public transport improvements would have to be in place before road pricing was introduced.

Road Pricing Options

Figure 2 illustrates the various pricing cordons tested. Firstly, a series of 3 orbital cordons were tested, which would impose charges on vehicles driving towards the centre of Bristol in the morning peak period. The central cordon, which included the Central Business Area, was bounded by an Inner Circuit Road, while the inner cordon also included the inner residential areas such as Clifton and Redlands. The outer cordon follows the M5 and M4 motorways, the existing and proposed Avon Ring Road and the River Avon from Cumberland Basin to the M5. All main roads crossing the outer cordon would have park and ride sites to provide drivers with the option to use public transport and not be charged. As the suburbs of Bristol sprawl to the north, a further partial cordon was defined running east to west from Shirehampton to Hambrook. A further series of radial cordons were identified which divide the city into 19 zones.

Initial assessments were carried out with charges applied on some or all cordons, inbound or two way, at various price levels levied during peak periods only or over the day.

It was concluded that a peak-charging scheme could significantly contribute to the objective of reducing car travel to the centre of Bristol during peak periods. However, it would have only a limited impact on the other transport objectives. With respect to reducing car travel, it was shown that only a third of the traffic reduction in the peak period is likely to be caused by a switch to public transport, or other non-car modes, with the remainder shifting to other time periods. Therefore, the impact in achieving the regional transport environmental objectives would be limited. On the other hand, an all day charging scheme could produce a reduction in traffic levels that would contribute substantially to achieving the objectives of the Avon Area Transport Plan.

In predicting behaviour in 2016 it has been assumed that GDP and personal incomes will be higher in real terms than today. The figures quoted in this paper represent income and price levels at the model base year of 1991, and therefore approximate to current values.



Figure 2 Avon Traffic Restraint Study – Road Pricing Cordons

It was concluded that a charge of between £1.20 and £1.90 per cordon per day would be necessary to contribute significantly to transport and environmental objectives. This is a higher charge than tested in the surveys, and represents for example a cost for a car trip from outside the M4 to the city centre of £4.80 for a £1.20 cordon charge, while a journey from the inner suburb of Clifton would cost £1.20. For most long distance trips the assessment showed that people would transfer to public transport. There is also likely to be some redistribution of travel patterns, which the IRAM model cannot fully account for, as it does not model all possible variations in behaviour. This was accepted as a model limitation and was taken into account in the conclusions of the study.

If an orbital or cellular cordon charging system was to be applied all day, at £1.20 or £1.90 per cordon crossing, car travel could be reduced by 14% to 20% as shown in Figure 3. There is evidence however that the long-term response to increased motoring costs could be higher than can be predicted from the forecasting process used. This would be caused by changes in residential or work location because of the increased travel costs. The traffic reduction could therefore be greater than the model predicts.

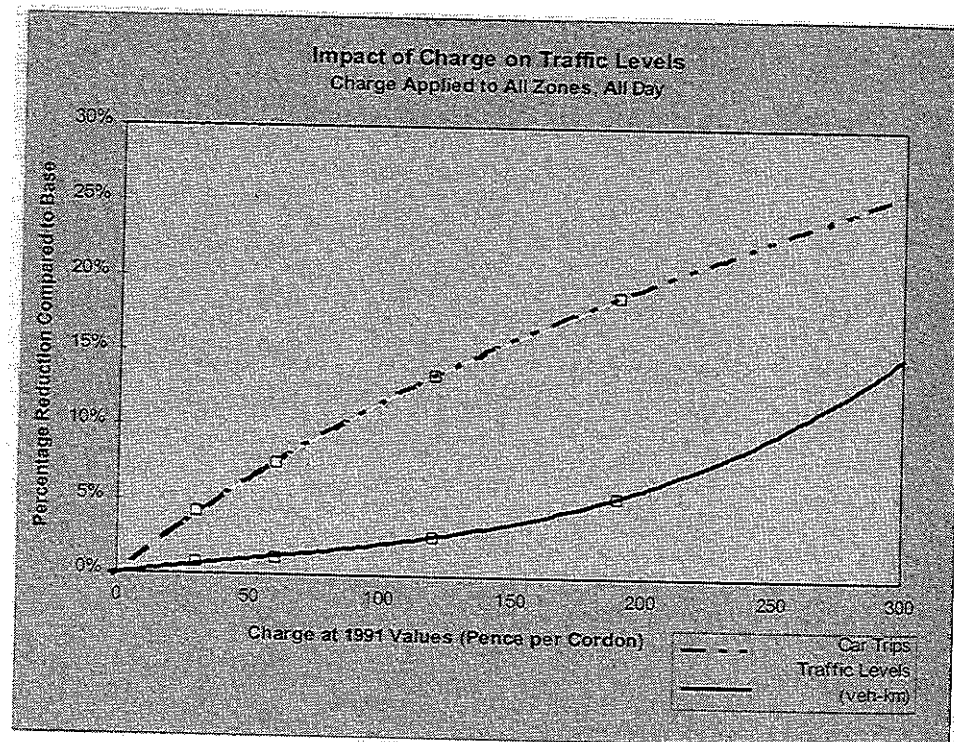


Figure 3 Impact of Charge on Traffic Levels

Because of the relatively low sensitivity of demand to road pricing, the revenue available is potentially extremely high. Even if the deterrence effect is much higher than that predicted by the model, there are still potentially very large positive revenue streams.

Traffic Restraint Options

Testing of combined road pricing, fuel price increases and parking restraint scenarios highlighted the effects of these restraint measures individually and in combination

The effects of parking restraint alone are similar to a central area road pricing scheme and depend on the extent to which parking supply and the pricing regime (which are interlinked) increase the price of commuting to the city centre. Parking restraint can, however, only be applied in areas where the supply and price of parking can be controlled. In Bristol this meant the Central Area. Parking restraint is, therefore, a weak instrument for discriminating between City Centre and out-of-town development, as it will normally favour the out-of-town developer.

Real increases in fuel prices in accordance with current Government policy have a significantly different effect to road pricing or parking restraint. They penalise the long-distance commuters more than those who make short journeys to work and have a much greater effect on reducing traffic levels over a large area than either road pricing or parking restraint. They reinforce city centres and reduce demand for travel in cities such as Bristol with a high dependence on car travel to the city centre. This accords with government planning policy in the UK.

Road pricing, parking restraint and fuel price increases all require action by central government in the UK. To attain both local and central government support requires an assessment of the equity issues, at both local and national level, as these are important to achieving political consensus.

Assessment of Feasible Scenarios

Following the preliminary analysis, four scenarios were developed to illustrate the effect of traffic restraint measures that were found to be worth pursuing. The scenarios were applied to the long term Avon Area Transport Plan and the impacts were assessed both qualitatively and quantitatively against the stated targets and objectives of the plan broadly outlined in this paper, and more specific economic, financial, and social criteria. The following elements were dealt with at the level of detail the scope of the study allowed:

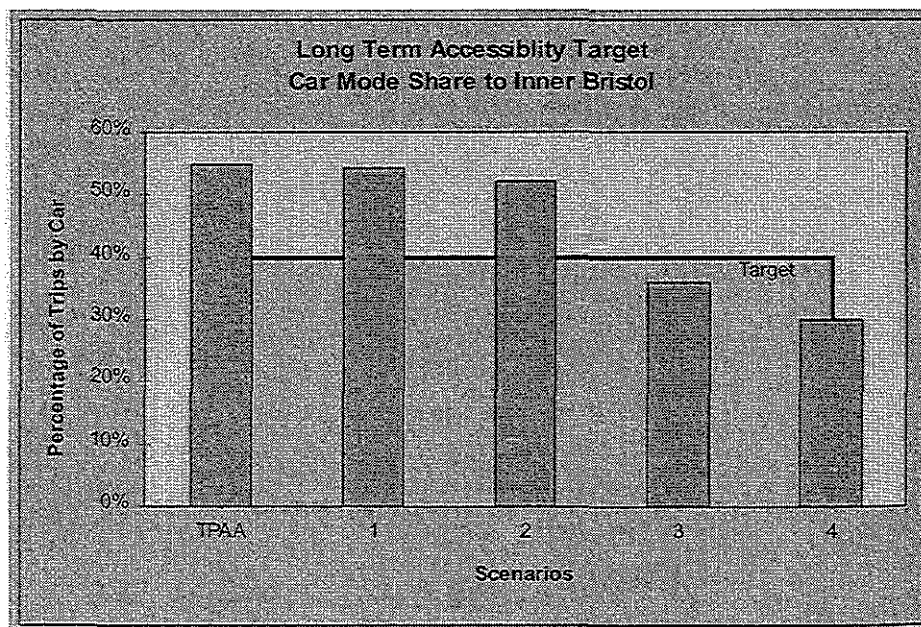
- Implementation and Operation;
- Land Use Effects;
- Social Aspects;
- Accessibility and Movement;
- Environmental;
- Economic Development;
- Safety;
- Security;
- Financial and Economic.

Table 1 lists the four scenarios that were assessed.

Table 1 Traffic Restraint Scenarios

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Road Pricing	Yes	Yes	Yes	Yes
Cordons	3	All zones	All zones	All zones
Time Period	AM peak	AM peak	All day	All day
Direction	Inbound	Two-way	Two-way	Two-way
Charge per Cordon	£1.20	£1.20	£1.20	£1.90
Parking Restraint	None	None	Do-maximum	Do-maximum
Fuel Surcharge	None	Low	Low	High

As an example, one of the accessibility targets was the reduction of car travel to the city centre to below 40% of the total trips. The impact of the four traffic restraint scenarios on the other measures in the Transport Plan for the Avon Area is shown in **Figure 4**.



Note: TPAA – Transport Plan Avon Area

Figure 4 Long Term Accessibility Target

Figure 4 shows that only scenarios 3 and 4 achieve that long-term accessibility objective.

Study Findings

Road Pricing

It was shown the road pricing could produce very high revenues, and significantly contribute to the objectives and targets as outlined in the Avon Area Transport Plan. For road pricing to be acceptable very significant public transport improvements will be required as a precondition. Subject to central Government decisions on the use of proceeds from such schemes, the revenue streams could, in principle, allow such improvements to be financed.

Whilst there may be concern over the impact on the personal finances of those at the margins of car ownership, it should be recognised that the quality of public transport available will be much greater which will also benefit existing public transport users. Access to employment opportunities will, therefore, be much less dependent on car ownership. Those who have to devote a high proportion of income to motor expenditure in order to obtain employment would have a public transport alternative that could allow them to avoid car ownership and thus provide a higher disposable income. Those excluded from car ownership will also gain significantly in terms of access to employment and social facilities.

Parking Restraint

Parking charges were found to influence mode share in a similar way to road pricing in areas where restraint is applied. They can also produce high revenues. It is, however, a less flexible policy instrument, as it is far more difficult to apply restraint in areas outside the city centre, and has no impact on through traffic. In the Bristol context, it would be much more difficult to apply restraint to the developing area on the northern fringe to balance the impacts between the city centre and out-of-town development.

Fuel Surcharges

The previous UK Government adopted a policy of increasing fuel duty by 5% per annum in real terms. The Chancellor announced in his July 1997 budget his intention to implement even stiffer increases. In this study, the effects of maintaining a 5% increase up to 2016 was tested, assuming the increase is passed on in petrol prices. Fuel surcharges have an impact on car usage in general and a greater impact on air quality than other restraint instruments. In administrative terms, there is no local control as collection of revenues is on a national basis. However the revenue is very cheap to collect. There is no guarantee that the financing of local transport improvements would be possible unless central government was prepared to hypothecate such revenues for the purpose. There is also a national concern about the impact on rural areas. In the Bristol context, the greatest impact would be on those who commute from villages outside the city, who impose a greater economic and environmental cost than those who live closer to their work. This is most likely to favour inner-city regeneration as opposed to out-of-town development in

accordance with government policy. In terms of competition between towns and cities for employment and retail business, similar impacts would be expected everywhere, whereas local restraint policies could result in a competitive disadvantage for Bristol businesses.

Study Recommendations

In order to achieve both the local effects on urban congestion and the more global reductions in emissions sought in the Transport Plan the best practical strategy is to support present national policy on fuel prices in combination with road pricing in congested areas. The study concluded that if Bristol City Council wish to proceed on this basis then the first stage would be to define a scheme for consultation. This should include the levels of charge, time of operation, cordon structure and an analysis of the programme for implementation of both the road pricing scheme and the related public transport improvements. The scheme would also need to indicate how various categories of user, including buses, taxis, orange badge holders etc, are to be accommodated within the scheme. This will allow respondents to the consultation to understand what is being proposed.

Since the completion of the study Bristol City Council have responded to the Government's consultation on Integrated Transport policy saying that they want a bill introduced to include discretionary powers to introduce road pricing. There has been a meeting between politicians from Bristol, Leicester and Edinburgh to discuss how the cities can introduce road pricing. More research is currently being undertaken by DEIR into the administration and enforcement of both paper and electronic based road pricing systems. Both Bristol and Leicester have undertaken revealed preference experiments on road pricing. Volunteer commuters were allocated funds via an IVU, from which the toll charge would be deducted when they crossed a cordon. If they chose to use public transport they retained the value in the IVU. While the Leicester experiment involved fixed price cordon tolls, Bristol was relating the toll to actual pollution levels via a VMS.

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