Cross Thames Travel Study
Issues and analysis of possible options

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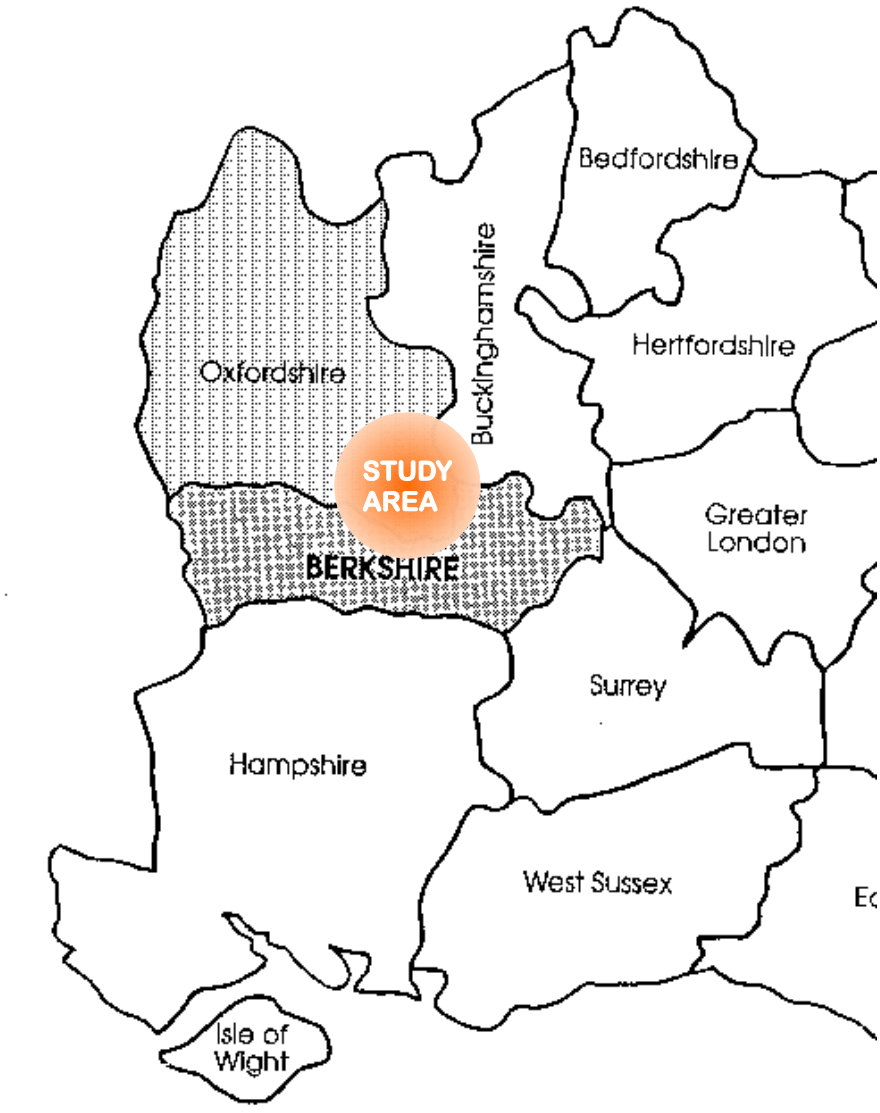
1.0 Introduction

.1 The Cross-Thames Travel Study

.1 This project is concerned with issues of travel between Oxfordshire and Berkshire.
Maps 1 & 2
The local authorities representing these areas are seeking imaginative but realistic transport strategies to alleviate congestion and environmental degradation but at the same time maintain economic growth.

.2 The Cross-Thames Travel Study, referred below as the 'Study', is being undertaken by TRL
(Transport Research Laboratory) following submission of a tender for the work.



Map 1

.2 Background to Study

.1 A significant length of the boundary separating the two counties of Berkshire and Oxfordshire is formed by the River Thames and hence cross border travel is influenced by this physical feature. This is particularly the case with road transport where historical crossing points determine the current pattern of distribution of traffic between counties. *Map 3*

.2 The major conurbation of Reading[1] lies close to the county boundary and its northern 'built up' component of Caversham virtually abuts the predominately rural area of South Oxfordshire.

.3 Notwithstanding the presence of the river Thames, substantial physical interaction between the two areas takes place.
This interaction in the form of road transport focuses on the two bridges serving central Reading and Sonning Bridge. The latter serves as cross boundary route between South Oxfordshire and the eastern/south eastern Reading area plus an alternative route around Reading for those travelling from Caversham, especially during peak periods. However other roadways and boundary crossings are affected as traffic seeks to access or circumnavigate the Reading urban areas.

.4 Although there is considerable and increasing road traffic between the two areas, as each area lies within separate counties, little or no administrative interaction has taken place[2] - and certainly, the key strategic measures such as those laid down in the County or Unitary 'Structure Plans' do not interface or integrate access county borders. These strategic plans may well include the seeking of transport measures suitable only to that particular administrative area.

.5 In fact Berkshire County Council adopted proposals to construct a new bridge - The 'Third Bridge', to the east of Reading in 1986, following a transportation study of the area and public consultation. It was one of a number of highway schemes designed to deal with traffic on radial routes into Reading.
Oxfordshire County Council objected to the proposal on the grounds of increasing traffic and development pressure in the south of the county.

.6 The current Berkshire Structure Plan (1991-2006)[3] includes proposals for a Sonning Bypass, which is a reference to the 'third bridge' project. The Oxfordshire Structure Plan 2011 "strongly opposes" the 'third bridge' project.[4]

.7 Although the formal position is stated in the respective Structure Plans the local authorities have agreed that a review of the implications arising from the various proposals is necessary.

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[1] Reading has a base population of approx. one hundred and fifty thousand. Reading is also a part of a more extensive agglomeration comprising 'Greater Reading' plus Wokingham and Bracknell.
[2] Notwithstanding the provision within the Planning Acts which allows joint formation of Plans
[3] Berkshire Structure Plan remains extant notwithstanding the dissolution of the county and formation of six unitaries
[4] under Policy T12 - The County Council will oppose highway proposals that could lead to increased use of county roads (with reference in the text to the third bridge)

2.0 State of Travel Study to date

.1 Report of Surveys

The 'Study' has carried out a traffic survey and the Travel Survey Report describes existing travel conditions in the study area and the specific travel surveys carried out in march 1999.

The need for the specific surveys was considered necessary given the existing traffic data available. The surveys record travel at nine crossing points of the Thames located in the study area of private motor vehicles, public transport, cyclists and pedestrians. The aim of the surveys was not only to gain information on origin, destination and purpose of journeys but also survey the choice of travel available and travel behaviour.

The surveys bring up to date and confirm the traffic loads on four principle crossings and reveal that both Caversham and Reading Bridges carry mainly local traffic, Sonning serves as a by-pass for Reading, with traffic travelling to and from East Reading and Henley Bridge serving as a through route between South Oxfordshire and areas west of London.

.2 Report of Issues

Following analysis of the surveys, issues were identified and an 'ISSUES REPORT' was published in Oct 1999

This report reviews the background of the Study to date, states National, Regional and Local Policies, refers to Travel Surveys and Public Consultations. Issues deriving from these elements are reviewed and some conclusions drawn. The latter draws attention to Policies (whether National or Local) currently in place and identifies Primary and Subsidiary issues *(refer Appendix 1.0 -Transport Issues).*

.3 Initial strategy Options and Measures Paper

An overview of the Study was presented to Members and Officers of the commissioning Authorities during November 1999 and which referred to initial 'Strategy Options and Measures'- *(refer Appendix 2.0 -Strategy Options).*

.4 Strategy Options

The options (as under 2.3 above) have been developed and are currently on public exhibition within the area of the 'Study'; and public comment is sought.

The strategy exhibited place less emphasis on infrastructure options (new river crossings) and tends to focus on improvements and additions to public transport coupled with traffic management measures.

3.0 Analysis of options

.1 General

The recommended options are presented as 'packages' and include both infrastructure developments (by-pass bridges) and Demand Management Measures.
However as the analysis of national policies suggests, low priority is to be given to providing additional road space.
Given the scale and fundamental nature of the traffic issues in the study area, the provision of additional road infrastructure would appear to be nil.
However restrictions on car use, either by not increasing road capacity or by applying restraint measures, are not politically popular - both by the general public and business interests.
For government policies to be realised, the demand management measures affecting private car use and proposals for alternative communication and travel modes are required to return a net gain to the economy of the area and seen to be effective by the populace as a whole.

.2 Infrastructure

Bypass bridges
Three possible sites are proposed, but it is assumed that if a further river crossing is to be constructed, then one preferred site would be selected. From the traffic surveys any 'third' Thames bridge would be located between Caversham and East Reading - very much as in the original Berkshire Structure Plan (date), but whether this bridge should be a road bridge or dedicated to a mass transit system is another matter.
The results of modelling the infrastructure options have not been made fully available as yet, however initial results indicate that for Henley a bypass would remove through traffic from the town (approx. 50% of total) but would increase traffic generally in the surrounding area and would tend to reduce traffic on the M4 motorway.
A bypass for Sonning and a closure to motorised traffic of the existing bridge would relieve Sonning of congestion, increase traffic in Henley, Caversham and Reading Central with a decrease in South Reading and on the M4 motorway.
A bridge at Reading - as an extension of the A329(M) would make no difference to traffic in Henley, relieve Sonning, make a small increase in traffic in Caversham and Reading and more Traffic in South Oxfordshire particularly the A4074. Traffic would reduce on the M4 and A4 roadways.
The option of constructing a river crossing dedicated to mass transit between Caversham and Reading is an option not modelled.

Additions to the road network via by-passes, including new river crossings, require to be justified in terms of investment, not only in a the purely commercial sense but also, as a 'public good'[5], in terms of economic and social benefit returned.
The wide ranging and long term effects of major infrastructure developments require comprehensive appraisal techniques. One technique is 'Cost / Benefit Analysis' (CBA), which has been employed to assist public authorities to not only assess financial returns but also returns of a social nature.
A difficulty arises when a project gives social benefit to one party but at the expense of another. Therefore any development which causes one party expense conflicts with the welfare economics concept of pareto[6] optimisation. CBA attempts to circumvent the Pareto problem by 'hypothetical' compensation; the approach being that, if those adversely affected by the project are compensated, then no party is worse off and there is a residual

[5] refer Glossary for definition
[6] A Pareto optimum occurs when it is impossible to make anyone better off without making someone worse off.

gain to some and the Pareto criterion is retained. Therefore an additional investment will be economically justified as long as the discounted value of incremental social benefits exceed incidental costs. A key element is to determine the money valuation of an externality and hence its compensation level.

With the contemporary perception of damage to the environment and exploitation of common resources in the pursuit of economic development, consideration of the valuation of the externalities[7] causing these effects are being considered in greater depth.

Various methods and concepts have been explored, including: 'total economic value', 'travel cost method', 'hedonic pricing' and 'contingent valuation method'[8]

CBA can embrace elements of economic efficiency, such as travel time changes, changes in vehicle type and operating costs, cost and impacts of accident rates, capital and maintenance costs, changes in pollution[9] levels and modifications to the physical environment.

CBA was utilised for major infrastructure projects during the 1960s and 1970s and although appearing a rational approach to infrastructure assessment, suffered because of the difficulty in placing a defined quantitative value on particular costs or benefits being considered.

The DETR uses a method known as COBA to evaluate new major road schemes. In basic terms it compares the cost of a new road project with the benefits which can be derived by road users *(refer Fig A.)* The advantages of a new road facility are seen in journey time savings, vehicle operating cost savings and accident cost savings. In regard to expenditure, capital and maintenance costs are considered.. The assessment techniques are complex, but notwithstanding, the method is criticised because it only looks at the project from the perspective of the users. Consideration of impact on the physical environment has until recently been lacking,[10] but evenso no monetary values are accorded to externalities. Also the indirect effects (possible positive externalities), of a project particularly on regional development benefits are not taken account of in the model.

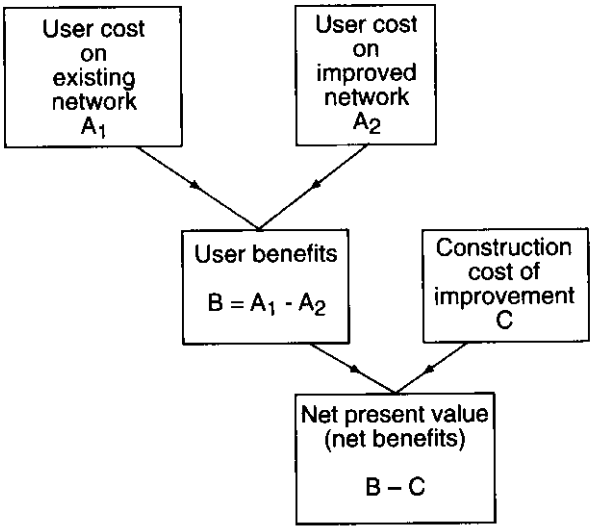

Fig A - The COBA method

[7] refer Glossary for definition of externalities

[8] refer Glossary for definitions

[9] Pollution (e.g. atmospheric & noise), certain accidents and impacts on the physical environmental are considered 'externalities', but attempts are made to 'internalize' them into the equation by giving them a monetary value.

[10] in spite of EC Directive 85/337/EEC

A simpler technique known as a 'Planning Balance Sheet' has found favour with planners as it only approximates costs and benefits of a project, but takes a broader view, plus its process is seen to be more transparent to the lay public.

In respect to the infrastructure options arising from the Cross Thames Travel Study, some preliminary results of modelling have been released but there is no indication of a cost/benefit analysis being carried out or planned.
The modelling of the various proposed road infrastructure options have shown that all have a negative effect in regards to reducing congestion. It would therefore appear that the new infrastructure option is not even a viable transport option, even before being judged in terms of its environmental impact

.3 Public Transport

The meaning of 'public' transport in this proposed option is the provision of mass or group transport of people and not the provision of a transport service by the public sector. Therefore provision of mass transit (which is seen as more resource efficient than travel by private car) can be provided via the market. This method of provision is assisted by the 1985 Transport Act allowing privatisation of bus services and subsequent legislation (1993 Railways Act) allowing the privatisation of British Rail.
Public transport has seen a relative decline in use over the last forty years, but the UK with a public transport share of 13% of overall transport provision compares with the rest of Europe. However there has been an absolute decline in volume[11] of bus travel and although rail volume has remained stable there has been a relative fall when seen in overall travel volume.
The current concern over environment issues, both at a global and local level, have stimulated renewed interest in public transport.
Although major rail infrastructure and regeneration projects have been and are being undertaken - particularly in connexion with European regional policies, relatively little development has taken place in the UK at the local level - either in urban or rural areas.
The Cross Thames Study raises classic issues of public transport provision for both urban and rural[12] areas.
The proposed option is to provide an integrated system embracing enhanced rural and urban bus service, enhanced rail services, new mass transit facilities and the private car. *(refer Maps 5 & 6)*
Although public transport is to be 'integrated' and notwithstanding the DETR definition of a rural area, the area of South Oxfordshire to the north of Reading contrasts with Reading Borough and its suburbs.
Evidence[13] suggests that dedicated municipal bus services perform better than 'area' services, the latter having to cross subsidise rural services contained within the general area.
Also given the strength of the logic of the 'price' mechanism, the market might be seen as the provider of public transport, however since privatisation bus services in aggregate have declined, which further stimulate a change to car mode (White).
Privatisation generates competition between services and so does not encourage integration concepts such as through or joint ticketing. Information, publicity and promotion of services are often lacking, in short competitive behaviour does not necessarily produce the optimal network.

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[11] Each new car reduces local bus trips by between 2-300p.a. - Public Transport P White
[12] There are various definitions for rural areas - one common standard is an area containing a population less than 10,000; but the DETR definition is a population below 50,000.
[13] Public Transport: White

Following deregulation comprehensive network planning has been largely abandoned. Individual operators make their own service changes and arrangements and although their might be innovations, acute instability in the provision is furthered by the short (six week) period in which franchises are allowed for change or withdrawal of services.

Network planning and its economics

Planning a public transport system, whether to serve a rural or urban area should begin with considering the land use pattern, with density of housing being of key importance. From this physical base, existing journey types, destination and duration can be recorded and some attempt at future forecasting made. Rail infrastructure requires to be planned fifteen to twenty years ahead and will itself influence land use planning.

However the flexibility to adapt to change is an advantage when planning a bus service, the basic infrastructure is in place, modifications to the infrastructure can be moderate and non intrusive plus the capital cost of vehicles is less and can be more flexibly allocated than rail rolling stock (or even tracked light rapid transit - LRT).

Bus services, especially those serving a sparse population (rural) or suburban areas with high car ownership will tend to be used by the poorer or older sectors of society. This is an image which detracts from bus use (Transport 2000). Urban bus services especially serving metropolitan areas and where a strong tradition of bus provision still prevails (e.g. Reading) and rail services do not suffer to the same extent, which are seen to be favoured more by the 'middle classes'.[14]

Elasticity of demand

Rail and LRT use is relatively price inelastic. Changing fare levels attract few motorists, in-elasticities (e.g. -0.2 to -0.5) being such that negative fares would be required to obtain any significant modal shift from car to buses. Rail is slightly more elastic especially on shorter journeys, but modal shift is related more to improvements of comfort and especially time savings and frequency. Values are high on interchange and delay time. Evidence (APAS) suggests that most public transport journeys arising as a result of 'instruments' are not due to modal shift from the car, but are due to increased journeys by existing public transport users.

Subsidy regime

On many passenger transport services there is little prospect that fares can be set at levels which will generate large volumes of business and provide a commercial rate of return to the operator. Rural services tend to fall into this category.

The concept of subsidy or revenue support, is that it can help to reduce the prices paid by passengers and boost patronage of the services offered. This will have the indirect effect of generating broader social benefits such as reducing traffic congestion and pollution and benefiting the less well off.

When a subsidy is applied to a transport operation it acts to shift the supply curve down and to the right *(Fig. B)* Now the service can be offered to the public at a reduced price, where the downward sloping demand curve intersects the new supply curve a new equilibrium is established with the quantity increased and the price reduced.

Subsidies in the UK tend to be used to cover shortfalls in operational costs rather than the provision of cheaper fares, other than in respect to particular groups such as pensioners, disabled or un-employed. Also in some metropolitan areas where the service is

[14] even if Mrs Thatcher never travelled by train

commercially viable a subsidy will be applied to reduce fare levels to encourage modal shift. In this case positive externalities are being encouraged in the form of released road space, reduced congestion and its accompanying pollution. Subsidised transport might also be considered in assisting regeneration and influencing land use patterns.

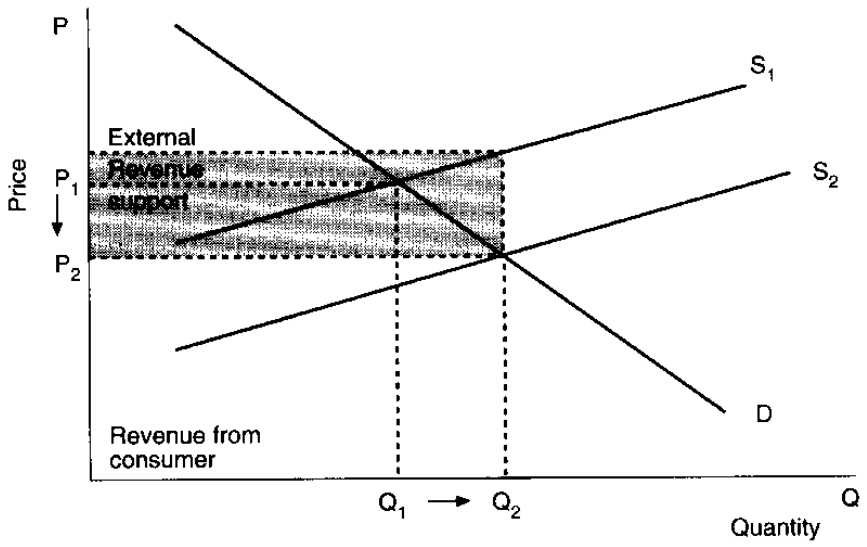


Fig B. The effects of transport subsidy - from Bamford

In a perfectly competitive system there would be no justification for subsidy (intervention), but in a situation where *marginal cost pricing* (e.g. road pricing) is not universally applied, subsidies are seen as a second best pragmatic alternative (Glaister).
This theoretical economic argument, together with the views that blanket subsidies are difficult to direct to those who need them, that subsidies breed inefficiency in operations and that managers have no incentive to keep costs down, have had a significant influence on recent UK transport policies.

Studies at the wider European level (APAS) suggest that 'user side' subsidy is found to be more effective than 'provider side' subsidy. Costs of providing the subsidy necessary for free fare transit are high relative to benefits, patronage is increased but mainly because of latent trips induced, the traffic and mode split are negligible.
A review involving eleven countries concluded that a 1% increase in subsidy caused an increase of patronage of between 0.2 & 0.4%. This would tend to suggest that in some circumstances the response to price change is so inelastic that 'negative' fares should be charged!
This logic re-inforces the principle of road pricing and the user paying the full cost of using the facility i.e. the cost of dealing with the negative externalities such as dealing with pollutants, accidents and impedance of other users: *the marginal social cost* should equal the *marginal private cost.*

.4 Demand Management Measures

"The private car liberates but it also destroys. We are nourishing at immense cost a monster of great potential destructiveness and yet we love him dearly"
Colin Buchanan 1963

Global, European and National strategies and policies are focused on reducing 'global warming'. This is the principle driving theme of the 'sustainability' concept.
Global warming results from increasing levels of carbon dioxide in the atmosphere and in the UK approximately one third of carbon dioxide produced arises from the transport sector.
The UK has committed to restrain carbon dioxide emissions,[15] and to this end seeks to reduce travel by the private motor-car.

Notwithstanding the global need to restrain carbon emissions, all transport modes cause externalities and within the road sector these externalities, particularly those produced by the private car (e.g. noise, pollution, accidents) are not seen to be charged and compensated for. In economic terms the private cost of travelling by car is below the social cost. *(refer Fig C)*

The estimated external and social costs of road transport in Great Britain (£ billion a year, 1994 prices)

Air pollution	2.0–5.2
Climatic change	1.5–3.1
Noise and vibration	1.0–4.6
Total external costs	4.5–12.9
Road accidents	5.4
Social costs of road transport	9.9–18.3

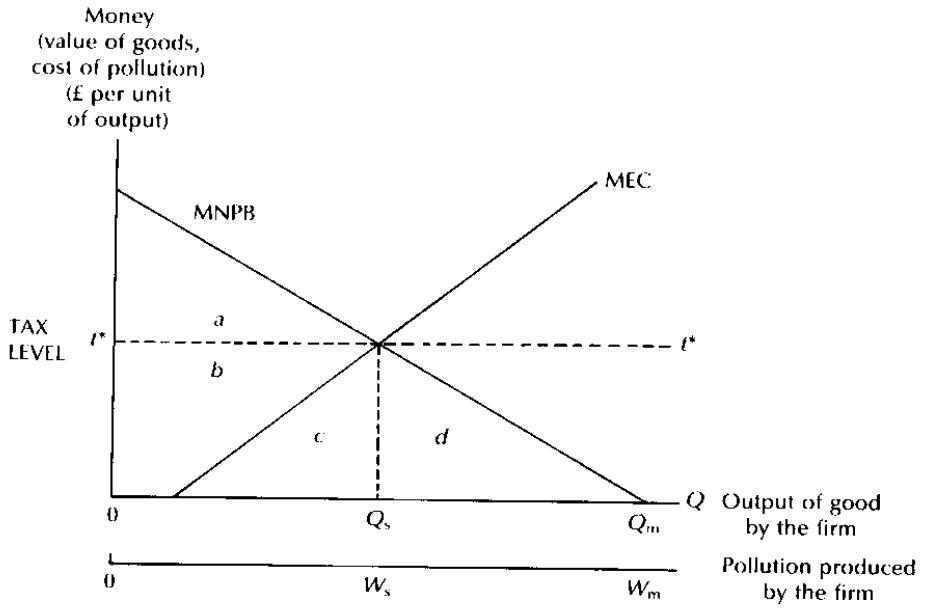
Note: The estimates of external costs are very difficult to estimate with precision, hence the range of values shown. They do, though, provide a broad indication of the scale of harm caused by road transport. The costs of congestion are not included.

Fig C (after Bamford)

It is now seen that from an environmental and an economic standpoint that 'external' effects need to be controlled. The theory of the market indicates that the externalities should be 'internalised' by giving monetary values to the externalities and adding them to the private costs of consumption to the extent that these costs equate with the social costs and market equilibrium is attained.
However optimising externalities depends to some extent from the perspective viewed. R Coase[16] (whose theorem gives force to valuation of externalities and who has proposed the greater allocation of property rights - and the trading of these rights) questions whether

[15] The UK has committed itself to containing CO2 and other 'greenhouse' gases to 1990 levels by the year 2000. Following the Kyoto conference on climate change (1997) there is a requirement to reduce emissions to 12.5% below 1990 levels by the year 2008. A domestic target is also set which aims at a reduction to 20% of 1990 levels by 2010.
[16] who produced Coase theorem, which states that: The socially efficient level of charge would be one that was equal to the marginal external cost

those who suffer from externalities should be protected or those who benefit from externalities should be compensated for not causing them.
Although from an economic efficiency point of view, which path to take may not be clear, a moral view tends to pre-dominate in western society that those who pollute should pay i.e. compensate for damage incurred. The origins of this concept stem from work by Pigou[17] who in considering the adoption of emission charges advocated that authorities take responsibility for the environment and charge users of this environment (cf current terminology 'commons') for that use. The charge is now referred to as a Pigovian tax, which works on the principle that beyond the point of equilibrium of *marginal environmental cost(* MEC) and *marginal net private benefit* (MNPB) the tax is greater than the return from any additional output beyond this point. *(refer Fig D.)*. However the concept still rests on the valuation of the externality (pollutant) which remains difficult to assess *(refer 3.2 above in regard to valuing externalities).* It is also argued (Bowers) that a Pigovian tax corrects the externality but does not result in an efficiency gain for society, it is argued that in Pareto optimum terms although the polluted make a gain, the polluter is made worse off and has not been compensated for the loss.



The firm maximizes profit by producing all units of output which have MNPB > 0, i.e. by expanding output to Q_m. However, the social optimum is achieved by stopping production of all units where MEC > MNPB, i.e. by restricting output to Q_s. Imposing tax level t^* upon the firm causes it to stop producing all units where $t^* >$ MNPB, i.e. the firm restricts output to Q_s, the socially optimum level of output. This, in turn, reduces pollution emissions from W_m to W_s.

Fig D The optimal (Pigovian) pollution tax ppearec after Pearce & Turner

[17] A.Pigou, proposed taxes on emissions in The Economics of Welfare 1920

However pollution taxes have advantages over a regulatory approach of setting emission quotas and standards with accompanying penalties for non compliance, the argument being that usually the standard set, is not related to the value of the output giving rise to the pollution and if it is set above the equilibrium MNPB=MEC the standard allows additional pollution; if set lower than the equilibrium, efficiency is reduced by unnecessary reduction in performance. Leaving aside the logic of the argument, given the accepted difficulty in establishing the values of externalities, whether for setting tax or standards, many 'environmentalists'[18] are tempted to wonder how much of this is economic game playing - where can these models be seen operating, even at an approximate level, in the world economy?

Control of demand for private car use is seen as a method of reducing congestion, the latter giving rise to a number of adverse environmental impacts, besides having direct commercial consequences in itself. The CBI (Confederation of British Industry) estimated (1989) that the cost to industry of congestion amounted to fifteen billion pounds a year, two thirds of which is related to the south-east of England. This estimate had risen to nineteen billion, an increase of four billion in eight years. The fact that congestion does not literally 'clear' via the action of the market seems to indicate that the economy can tolerate high levels of resource wastage - estimated at approximately ten pounds per week per household.

Congestion is seen as an example of market failure, again because social efficiency has not been attained. It is seen as an externality which can be 'internalised' by using the price mechanism.

.1 Congestion charges - road pricing

Congestion is an example of an externality where someone on consumption of a utility impedes another seeking the same utility[19]. On the economic basis of marginal cost pricing, when a consumer impedes another the cost of that impedance should be compensated for. In the case of road congestion one road user should compensate the other for the congestion caused. *Ceteris paribus*, the cost per kilometre to each vehicle is made up of two components: a time cost and money cost, costs will respond elastically to increases in vehicles and these costs will be mainly in terms of time. It is concluded (Glaister) that the cost incurred by the individual vehicle kilometre will fall short of the total cost it imposes on society

The external costs of congestion are invariably negative: the marginal social benefit is less than the marginal private benefit. This can be seen in (Fig E) where DD is the demand curve for travel.

[18] cf. H Daly - Steady state economics

[19] It could be argued that congestion brings an element of rivalry to roadways which are generally considered to be a non-rival quasi public good

The vehicle miles demanded are Q_1, when the price to motorists is P_1, (this is the cost of using the vehicle per mile). The social optimum is at E_1 where price = marginal social benefit, the difference between Q_1 and Q_2 shows the over consumption.
The additional monetary costs of congestion can be seen in a simple example.[20]

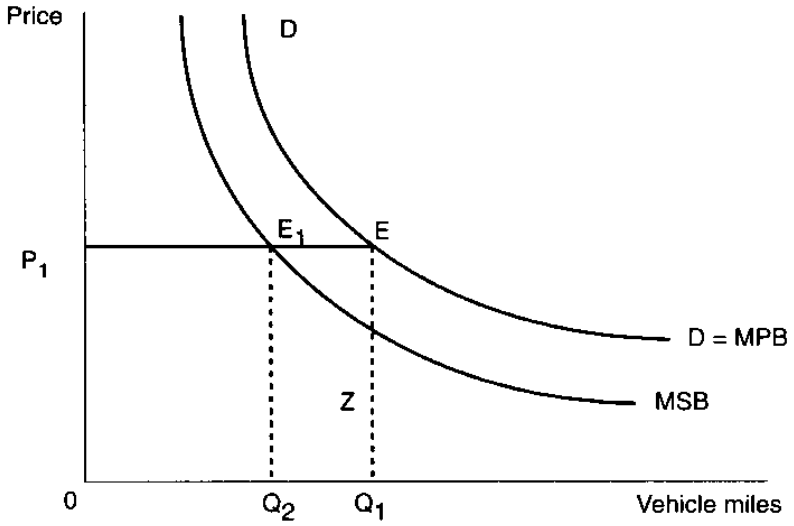


Fig E The external costs of traffic congestion after Bamford

Again notwithstanding the economic logic the measurement of congestion costs are complicated and includes valuation of motorists time, increased fuel and other running costs, reduced vehicle productivity (especially goods vehicles) plus additional costs to public transport services - there are also accentuated pollution costs.
However it can be seen that the private motorist is not covering the full cost of using a car and the principle of 'road pricing' is that users should pay for the costs imposed on others *(refer above - the polluter pays)*. This can be carried out by direct or indirect means. Direct charging is via tolls or smart cards, tolls are generally applied to trunk roads and motorways and smart cards used to control access to urban areas. Indirect charges can be levied on vehicle ownership (increased licence fees) or levied on vehicle use (e.g. fuel tax, specific area or distance licences).

If road space is assumed to be in unlimited supply and that it is provided free consumers will demand Q_0 *(Fig F)* at zero price - this is market equilibrium, but the assumption of unlimited road-space is unrealistic and any road has a capacity, which can be shown at Q_2. The marginal private cost curve (showing the supply of road space for users) can be drawn upwards from this point, giving an equilibrium at E' where MPC = MSB and where motorists are paying the full private costs of using their vehicles. The marginal social cost curve is added (to reflect external costs) from Q_2 to cross the road demand curve (MSB) above E' at a point E".

[20] Suppose one thousand cars travel along a congested road at 10 miles per hour and assume the cost per car for the journey is £2. If a further car joins the flow the speed will fall below 10 miles per hour and the cost per vehicle on the congested road rises say to £2.01. The private cost rise per individual vehicle might only be 1p, but the external cost imposed is substantial (1000 x 1p - ten pounds). The marginal social cost for one vehicle added to the traffic flow is therefore £12.01 Example extracted and simplified from Bamford

This latter equilibrium point (E") shows a lower quantity of road-space provided for a higher price, this higher price reflecting the cost of the externalities.

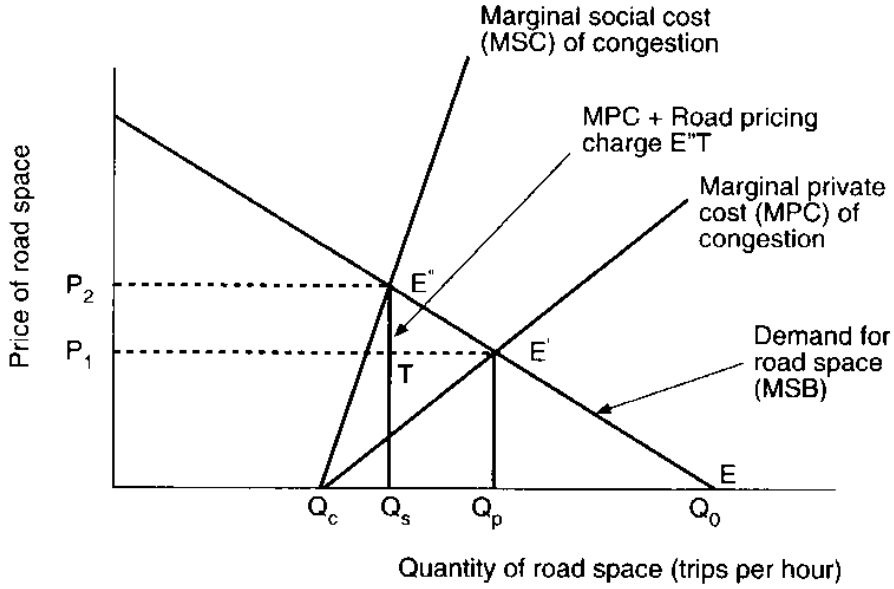


Fig. F The effects of road pricing, after Bamford

Again the valuation of externalities makes the application of the theory problematic, however road pricing does offer the advantages that it provides a market based solution to congestion and results in falls in traffic, also revenue gained can be 'hypothecated'[21] to support public transport developments.
An objection to road charging is that it is socially divisive and all at a particular time and place, will pay the same charge regardless of income. This objection could to some extent be removed by 'smart' discriminating charging technology. However the main objection comes from the car lobby which already feels that not an adequate proportion of road tax[22] and fuel duty are spent on road developments at present and would not sanction further taxation, whether hypothecated or not.

Tolling is a component of road pricing congestion and is seen as a tool to control congestion in the built up areas containing the Thames bridges under study. The aim is to re-direct 'through' or 'transit' motorised traffic to the trunk road 'box'[23] and encourage modal shift of a proportion of this traffic to public transport. It is not stated but within the Study to date, it is assumed that tolls will be of the 'smart' variety, in that they seek to restrain certain traffic (heavy goods in transit and through private vehicles). Private vehicles in transit relate closely to morning and evening peak and identified as commuting traffic. Traffic which is seen to be capable of mode change to mass transit. Traffic terminating in the area of the bridges would be subject to lower or no tariffs.

[21] refer Glossary
[22] The UK has road taxes at over 300% of expenditure on roads, compared with over 400% in the Netherlands and 60% in the USA
[23] Trunk road 'box' formed by A34, M40, M4 and A404

.2 Parking charges

A general parking policy based on charging can be effective and preferable to road pricing if the traffic required to be controlled is terminating in the area. However it does have limitations, it has no impact on through traffic (where road pricing would) and by providing a facility at optimal capacity may encourage traffic into town centres. Reading in particular has a high level of private off street parking *(12,000 according to RUAP),* this situation has been noted by the Cross Thames Study.
Reading Borough seeks to reduce its central public car parking provision to seven thousand spaces and to control private non-residential parking by planning control (for any new spaces). However the borough can do little prior to possible central government legislation[24] allowing the enforcement of a 'Special Parking Area' in the town centre, which would permit the levying of workplace parking charges.

Work place parking charges

This concept is based on charging companies, situated in areas prone to damage and congestion caused by motor vehicles, for the private parking the companies set aside for their employees. Difficulties arise in setting the level of charge and to whom it should apply. Charge levels could be set on 'willingness to pay' setting the optimal (market) price[25], but this would penalise the poorer/lower paid employee. Alternatives can be based on income levels (a percentage of salary deducted for parking) making charges more equitable, but not necessarily economically efficient.

Where car parking charges are introduced at the workplace for solo drivers but not car 'poolers'/sharers then significant changes occur. However the changes (cf. study in Los Angeles[26]) may not result in a modal shift to public transport but a change to more car sharing, with a decrease use in public transport. However where parking charges have been introduced per employee (cf. Ottawa) there has been a reduction in solo driving with most trips transferring to public transport. The parking charging policies for these two cities appear to reflect their physical structure and accompanying public transport infrastructure. Regardless of particular charging methods the availability of free private parking at an employees place of work is an important factor influencing the (non) use of public transport.

However restriction of company parking provision either by physical planning controls or workplace charging will require to be integrated with other measures (improved public transport and other wider parking restrictions) to prevent the transfer of the problem elsewhere, such as to residential streets and non-controlled carparks (public or private) dedicated to particular users (sports clubs, libraries, doctors surgeries, shops and supermarkets etc)

.3 Car restraint and environmental measures

Restricted and banned access

The exclusion of motor vehicles from urban areas tends to be applied to historic centres and is often put in pace in conjunction with making alternative road space (whether existing or new) available (e.g. Firenze and Rheinfelden). A main problem within the 'Study' area, is Henley on Thames, where attempts to restrict access either by re-routing (on existing roads), engaging in a 'woonerf' system or by partial pedestrianisation has been thwarted by a strong car lobby in the surrounding hinterland and the high percentage (almost 50%) of through traffic. The townspeople, notwithstanding the damage this traffic

[24] A new deal for everyone -Govt. White Paper (1998) refers to the taxation of work-place car parks.
[25] after Button - Transport Economics
[26] solo drivers dropped from 42% to 8% and car sharing increased from 17% to 58%

inflicts on their town, for some perverse reason feel sympathy for those (except heavy goods lorries) in transit through the town.
Any restricted access requires to be part of an overall strategy which includes alternative provision for motor traffic, park and ride/walk/boat and public transport enhancements.

Traffic calming / speed limits
These measures are essential adjuncts to restricted or banned access, as they look to control traffic attempting to avoid the banned area by taking 'long' cuts and causing 'rat' runs through peripheral residential areas. Not only does this restraint give a perception of safety but by reducing automobile speed provides an actual safety improvement.
Although no change of mode can be identified in respect to environmental measures of car restraint (APAS) the general effect is complementary with other measures and additive especially over time.

.4 Park & Ride
The private car can be used as a feeder to public transport and can be appropriate where populations densities are low and public transport services poor. The idea of driving to a transport interchange (generally rail) is not uncommon and appears to strike a balance between appropriate forms of transport especially for those living in rural areas and working in dense cities. (White suggests that significant park and ride is not expected in urban areas below a pop. of fifty thousand).
However park and ride is a component of the Reading transport strategy (RUAP) and (in the form of park and walk) has been proposed for Henley on Thames; and the 'Study' suggests a strategy of further park and ride sites, particularly to the north of Reading (Caversham) on the boundary between urban and rural areas.

However although allowing the restriction of car access to town centres, the facility conflicts with the provision and enhancement of public transport (particularly rural bus services) and in the longer term gives support to dispersed housing development. Park and ride requires very careful assessment prior to implementation and if implemented should be a short term measure seen to placate the car lobby rather than improve mass transit and reduce carbon emissions.

.4 Conclusions

The solution within the 'Study' area is seen to rest with the extensively enhanced provision of mass transit, especially for commuters. The option of additional road infrastructure in the form of a by-pass to avoid and/or alleviate congestion although tendered as an option is rejected as impracticable in terms of cost, environmental implications and on the basis of computer modelling which shows that this type of provision does not solve the problem in this case.

The provision of mass/public transport has to be made in the light of a predominantly car based transport system, a major city intent on economic expansion but with a remote employee base, the presence of a substantial rural area plus significant across district long distance commuting.

Demand management measures, of any significance, can not be introduced without accompanying enhancements to public transport.

This combination of the two elements (mass transit and demand management) requires a strategy set within a chronological framework. This framework is lacking in the current strategy, but is essential to gain public acceptance, allow for increasing levels of additional and alternative fixed and mobile capital to be attained. A chronological framework will also permit the transport system to adapt to changing land use; land use patterns which have been influenced by the transportation strategy and its political origins.

The political base of any strategy requires that the relevant public authorities and other interests within designated area, form a transport executive to manage the project. The skill will rest with maintaining or adapting this executive over time and through periods of unsympathetic political administrations.