

Congestion Charging

What is Congestion Charging?

Road use charging means charging a price for the use of scarce road space. It is a method of charging for the use of the road at the point and time of use to reflect the economic policy objective that vehicles should cover the full costs of their use.

There are two distinct types of road use charging – congestion charging and tolling. Congestion charges are designed to be levied in cities; vehicles are charged as they cross a cordon on the outskirts of the city – or through a series of zones within a city. Singapore and Norway use electronic road pricing for this purpose. However, they could be used anywhere that congestion imposes unacceptable environmental costs eg, (1) at the Barcelona Olympic Games a payment plus restriction of access system was used to relieve traffic congestion, (2) the Lake District National Park could use it in the Summer months. Tolling is generally used on motorways or major highways or bridges and the motive for its use is usually the raising of revenue to finance road infrastructure costs rather than the relief of traffic congestion. A fee is charged for the use of a motorway and charging is usually on a distance basis. Where bridges and tunnels are concerned, tolling is done on a “point” or single charge, basis. Tolling will be covered in a future Network Management note.

Why use Congestion Charging?

The aim of using congestion charging is to charge a price sufficiently high to promote modal shift and achieve transport policy objectives such as reducing congestion and encouraging a shift to public transport. Within this economic rationale sits the principle that the polluter pays. The aim may be to charge the economic price for the road space in order to promote the most efficient use of the facility and parallel facilities. This concept dates from the 1920s and was the basis for the Smeed report on road pricing, published in 1967. It is still cited today as the economic justification for road use charging, and is the basis of the road user charging projects currently being recommended to Local Authorities in the Transport Act (2000)¹ and in the Greater London Authority Act (1999)². A central tenet of congestion charging will be the collection of a considerable amount of revenue – a further important motive for introducing it (see The Hypothecation Issue).



Access control in Singapore. Courtesy Oscar Faber.

By Susan Harvey

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(This Network Management Note is one of a series to be published.)

How do you do it?

Congestion charging can be done by using a:

○ **Cordon-based system**, where a charge is levied either per day or on vehicles every time they cross cordons or charging points. The use of electronic road pricing is advisable as cordon-based charging requires electronic checking of vehicles as they cross cordons or screen lines, and the automatic identification of vehicles which do not have required permits. Such a system is particularly useful where the Local Authority wishes to vary the charge between different times of day (eg, charging more at peak hours).

○ **Area based system**, which takes the form of area or supplementary licences. These allow permit holders to use the road network in the charged area for the period covered by the licence. One advantage of an area licence is that both vehicles driving into the charged area and those making trips wholly within it will be charged. With a simple cordon-based system, trips wholly inside the cordon will not be charged unless a system of screen lines is put in place within the cordon. Area based systems can use a paper licence but they need to be very simple, and will have only a limited capability for varying charges by area, vehicle type or time of day. Another problem is that the licence, once purchased, allows an infinite number of trips to be made at zero extra charge. Thus the direct link between trip-making and the charge is broken.

○ **Continuous charging system** as trialled in Cambridge in the early 1990s. This requires an on-vehicle device, which makes a variable charge according to the speed at which the vehicle is travelling within the city. Many problems were experienced during the trial, including the problem of tampering with the device.

Choosing the right congestion charging system involves consideration of efficiency, enforcement and billing, as well as the relative costs of the systems concerned.

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How can road use charging be enforced?

Any form of road use charging involves a very large number of transactions every day. Detecting offenders is therefore a large-scale operation and normally must be carried out with near to 100% effectiveness and a reasonably high level of penalties, or risk the system losing its credibility. Another method is to set penalties so high that sample enforcement will be adequate – as was envisaged when setting up the early road pricing project in Hong Kong in the 1980s.

Enforcement can be carried out:

- In a zone charging scheme – by the inspection of parked vehicles within the charging area. It may be necessary for the enforcement procedure to include the ability to determine whether the vehicle has moved during the charging period.

- By stopping and checking moving vehicles. Currently, only police have the power to do this; extending this power to non-police traffic wardens and parking attendants would expedite this process considerably.

- Through the use of fixed or video cameras to photograph the number plates of offenders as they pass

a “charging point” without a smartcard or tag. Cameras need to establish the following: the date and time of the photograph, the car’s number plate, a view of the car’s windscreen to establish that it was not carrying a valid permit, and confirmation that the photograph was taken in the charged area. A new form of video enforcement has been developed whereby all vehicles driving in the area have to register and their number plates are recorded on a computerised database. As they pass through cordons, or charging points in a tolling system, the vehicle is automatically photographed and its number checked against the database. If the check is unsuccessful, the motorist is given the opportunity to pay the charge before midnight on the same day. Other variations on electronic checking are being developed.

Local Authorities considering the installation of a charging scheme must ensure that they have sufficient financial resources to allocate to the establishing of near 100% effective enforcement. They should also investigate and test available electronic methods of enforcement.

Levels of charge, exemptions and technology

Levels of charge

These will be determined by the purpose of the road use charging as outlined above. Charges may be levied at all times or some periods might not be charged – weekends, evenings and early mornings and possibly daytime non-peak periods. This enhances the ability to shift demand away from peak periods.

When any road use charge scheme is put forward, a case will be made for certain vehicles to be given **exemption**, or a zero charge. The categories put forward are normally emergency vehicle – police, fire and ambulance – disabled vehicle users and public transport vehicles including taxis, particularly if one objective of the scheme is to encourage the use of public transport. Other categories of transport which may be excluded are deliveries, undertakers, doctors, carers and voluntary organisations. The treatment of residents of the charging zone needs consideration; to give a full exemption to all residents may prove too costly. For example a recent report³ on the potential for congestion charging in London estimated that whereas car trips by central London residents were around 50–60,000 a day (5–6.5% of total trips), residents of Inner London made about one million trips a day out of a total of 7.3 million trips (%); thus, to give them uncharged car use would impact heavily on traffic levels and congestion.

Technology

Assuming that electronics is to be used, albeit after a trial “paper” period, the driver can be pre- or post-charged. Pre-charging would probably be done by the issue (or sale at a subsidised price) of an in-vehicle charging unit, which would be mounted on the dashboard. This would hold a smartcard, which the driver would top up with “electronic money” at a machine situated on the forecourt of his local garage or filling station, or at other convenient sites. The smartcard would be automatically debited by the in-vehicle unit after receiving a signal from a roadside beacon as the vehicle passes into the charged area or onto the tolled motorway. Electronic tags valid for one day could be sold to visitors to the area. These would be mounted on the windscreen of the vehicle: the roadside beacon would read them and record that they were valid for the day. Post charging would be done by the vehicle displaying an electronic tag inside the windscreen. Each passage into the charged area would be recorded by the beacon, and the vehicle owner would be sent an invoice at the end of each month.

The above analysis assumes the installation of beacons – either infrared or microwave – at the roadside. Recently, however, an alternative approach has been developed. This is known as Vehicle Position Systems (VPS) which is based on an in-vehicle positioning system, usually the US Global Positioning System, (GPS), which locates the vehicle within the charge areas. Within the vehicle, the in-vehicle unit also contains details of the appropriate charge structure and is able to determine when the charges should be applied. Normally this would be at specific locations which are called “virtual gantries”, (see diagram opposite).

Electronic fee collection using the VPS method was trialled in Hong Kong during 1997–99 and was the method recommended to the Hong Kong Government at the end of the three-year trial. The main advantage of this method is that it does away with the need for expensive infrastructure.



Screen from the Mannesman’s ROBIN system using GPS to define virtual road-charging payment locations. *Courtesy Oscar Faber.*



Smartcard and roadside automatic debiting equipment. *Courtesy Oscar Faber.*

Whatever the method used, an effective **billing system**, (in the sense of the processing of millions of electronic debiting transactions daily) will have to be installed, involving the services of major IT service providers. The Department of the Environment Transport and the Regions is keen that this should not involve a “re-invention of the wheel” by each Local Authority as it installs congestion charging.

Looking at the experience of other countries as to the large volume of transactions required for any kind of automatic debiting, there would probably be a requirement for two or three large centres covering the whole of the UK. These would integrate payments made via smartcards, post-billing systems for congestion charging, through ticketing – and also motorway tolling, if and when it is installed in the UK.

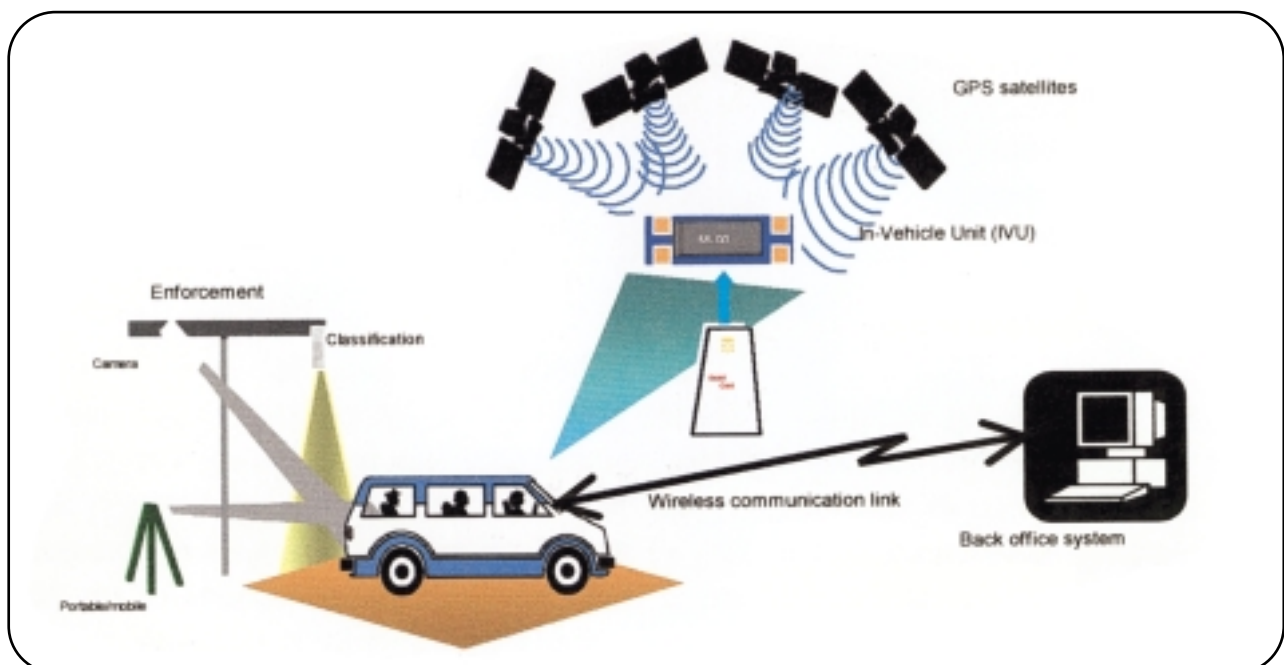
What are the main objections?

Among regular objections raised against road user charging are the following: that it is simply another tax on the motorist, that because it is a flat rate charge it discriminates against lower income groups and that electronic road pricing is an invasion of privacy. A further objection is that the technology is not

sufficiently fully developed and will not work properly. When proposing a scheme, it is important to emphasize to both local councillors and the media:

- That road use charging involves levying a charge for the use of the road so as to allocate a scarce resource fairly. It is not a tax. The real cost of using the roads in a congested city (which includes the external costs to the community in terms of air and noise pollution, damage to historic buildings etc) is much higher on an annual basis than the payments made by the motorist in motor vehicle licence and fuel taxes. The important issue is to charge the vehicle at point of use so that the driver assesses the value of that marginal journey to him - whether it is being made for business or leisure purposes.

- That road use charging, if levied for the purpose of relieving traffic congestion, and if not levied on buses, will free up road-space for buses and improve their reliability, thus benefiting all bus users including those from the lower income groups who tend to travel by public transport. If combined with a policy of installing bus-only lanes, road user charging will be highly effective in this way. The funding of bus lanes or service improvements from hypothecated revenues represents a further



Road user charging using VPS. *Courtesy Ian Catling Consultancy.*

way in which public transport users will benefit from congestion charging.

○ That the use of the smartcard, which allows drivers to be debited anonymously, rather than being sent a monthly account (for bosses or partners to see) which details where the vehicle has been at a particular time on a particular date means that privacy need no longer be invaded.

○ That it is essential to ensure that the technology used for enforcing the charge in highly congested road space reaches the 99.99% accuracy required to ensure that very few vehicles evade the charge. However, considerable resources are now being put into testing this as part of the Department of the Environment, Transport and the Regions (DETR)'s road user charging trials in Leeds and Edinburgh.

What is the alternative?

A recent report⁴ from the Commission for Integrated Transport (CfIT) – the Government's advisory body on the Integrated Transport Policy - forecasts a 65% increase in traffic congestion in cities by 2010 if no action is taken (see Table 1).

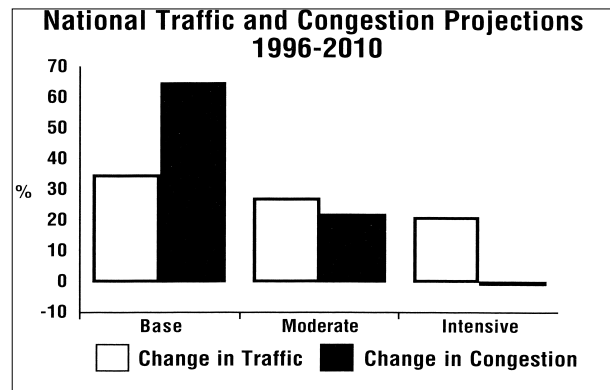
If moderate measures are introduced (including road use charges of £1.20 per trip in major conurbations and workplace parking levies of £1000 in the same areas) this is reduced to a 22% increase. If "intensive" measures are taken (a higher congestion charge of £2.50 per trip, a workplace parking levy of £2000 plus a motorway toll of four pence per kilometre congested parts of the network) the prediction changes to a one percent reduction in congestion.

Road use charging is not the only possible measure, as the CfIT points out. There are alternative policies - the workplace parking levy, as described in the Government paper *Breaking the Logjam*⁵, used on its own – a measure that many city authorities will find attractive – is one. Another option is to concentrate on improvements in the quantity and quality of bus travel. This can be done by providing more buses, instituting bus lanes, taking part in the DETR's Bus Quality Partnerships schemes and by following London Transport's excellent example of installing on-line information for passengers at bus stops (the Countdown project).

Alternatively, access to the city can be controlled by network restrictions, gates and priority controls and other traffic management measures such as the installation of "Intelligent Traffic Lights", for example the Split Cycle Offset Optimisation Technique (SCOOT) – which can also be specially adjusted to give priority to buses. All of these initiatives are consistent with road use charging and may, in fact, only be capable of realisation with the funds generated through a charging regime. As the Government has been urging for many years, ideally a package of measures should be used to relieve traffic congestion – without undue reliance on a particular measure.



Waterproofing housing for transponder mounted on motorbike from CEC-SEEL trial in Singapore. *Courtesy Oscar Faber.*



National Traffic and congestion projections. *Courtesy CfIT and Barry Cook/Local Transport Today.*

The hypothecation issue

When even a preliminary consideration of a road use charging scheme is undertaken, a major issue as far as the public are concerned is how the funds collected will be spent. If the proposal is that the money raised will be spent on improving public transport, there is always much greater support for the project.

Conversely, if the funds are to go to Central Government, or be used to replace previous funding from Central Government, the percentage of the population in favour falls considerably. It is essential that the use to be made of the funds is made clear to the public, including the media.

References

- 1 Transport Bill (1999).
- 2 Greater London Authority Bill (1998).
- 3 Road User Charging in London (1999) CMTE& London First (Prepared by Halcrow Fox).
- 4 Commission for Integrated Transport report (December 1999).
- 5 Breaking the Logjam (DETR – 1999).

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