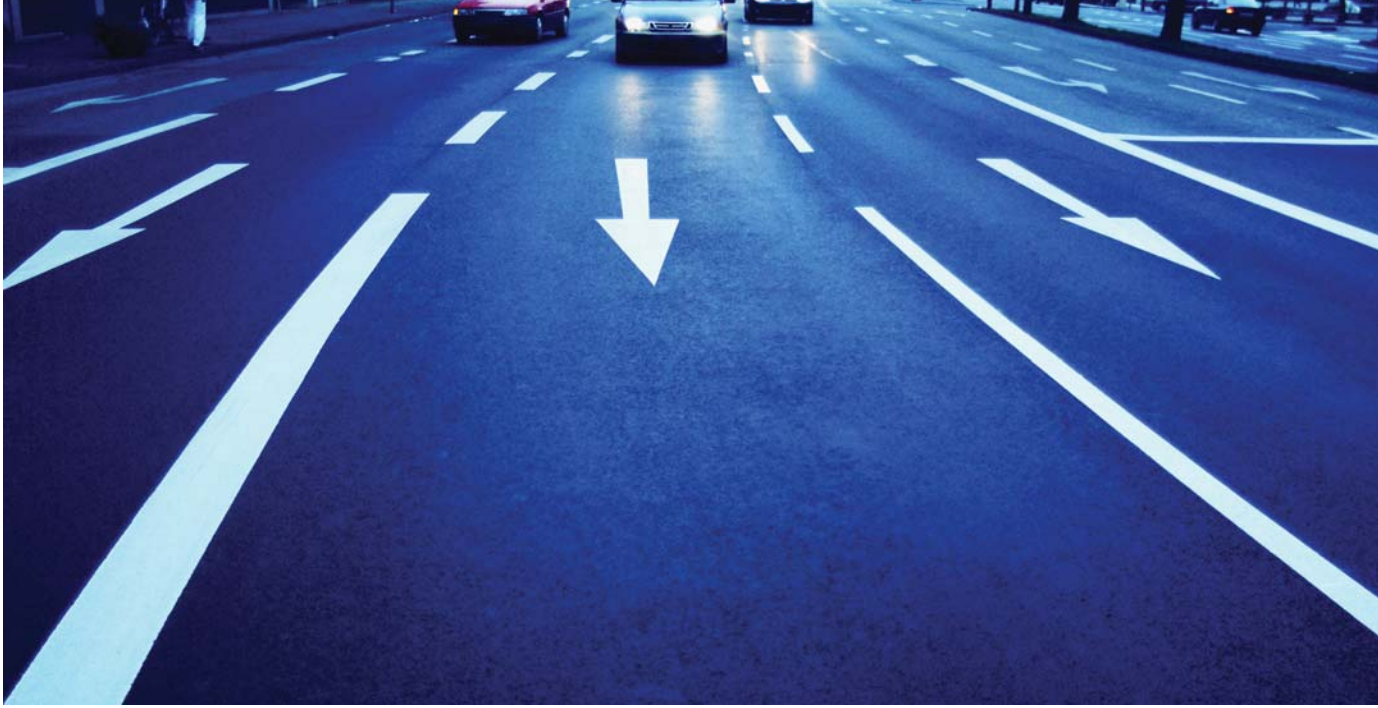


Road pricing

Can the technology cope?





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Green Light Group

The Green Light Group is a collaboration between professional organisations whose technical expertise informs our advice about the best methods of delivering a road pricing system in the UK.

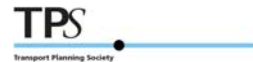
The group is led by the Institution of Civil Engineers (ICE) and includes representatives from the Chartered Institute of Logistics and Transport (CILT), the Institution of Highways and Transportation (IHT), the Institution of Mechanical Engineers (IMechE) and the Transport Planning Society (TPS).

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Introduction

Reducing traffic congestion could save the UK up to £12 billion a year. That works out on average to roughly £200 per person, or £800 for a family of four. Every year, there is more traffic on the road, and every year, congestion gets worse. Which means we're going to keep paying more for the privilege of waiting longer in bigger, more polluting queues of traffic.

It doesn't make a great deal of sense.

The Green Light Group is a collaboration between professional organisations concerned with transport. They are carrying out a wide-ranging investigation into if, and how, the UK should introduce a nationwide system of road pricing.

This report, the first in a series of publications over the coming months, focuses on the issue of technology; are current systems up to the job of handling a UK-wide, pay-as-you-go road charging scheme? It considers the pros and cons of each available technology, with the aim of simplifying the process of choosing the fairest, most reliable system for the UK.

Reducing traffic congestion could save the UK up to **£12 billion** a year. That works out on average to roughly £200 per person, or £800 for a family of four.

Road pricing

Can the technology cope?

01

Road pricing – frequently asked questions

What is road pricing?

There's nothing new about paying for the use of the UK's roads. We have been doing it for decades. Currently, we do it through Vehicle Excise Duty and Fuel Duty. It is a blunt instrument as the taxes fail to reflect the true cost of most individuals' motoring. As such, drivers on congested roads pay less than the real cost of their travel.

Road pricing would be a fairer way of charging for road use because you pay for what you use, as you would with a 'pay-as-you-go' mobile phone contract. Many of us know it as 'congestion charging'. However, road pricing is capable of much more than simply reducing congestion. It can be used to reduce environmental impacts, and to pay the costs of particular roads.

It can relate to a short stretch of carriageway – across a bridge, say – or to a toll motorway or city centre. At the other extreme, it could be applied to all of the roads in the UK.

The type of application is one of the factors at play in the choice of technology used in a road pricing system. There are a number of other options, ranging from the simple – paper licences and manual inspection – to the highly sophisticated. The most advanced technologies are automatic number plate recognition, tag-and-beacon, and systems based on satellite or mobile phone positioning (GPS or GSM).

Road pricing is a form of demand management. It works because it changes behaviour. Motorists are encouraged to change their habits, travelling at different times or by different routes, possibly to alternative destinations, or making their journey by bus, train, tram or bicycle instead. Road pricing works best, though, when applied in tandem with other measures, such as public transport improvements and better provisions for cyclists and pedestrians.

Why do we need road pricing?

Every working day of every week – and often at weekends – millions of British people have to endure the problems and knock-on effects caused by traffic congestion. Businesses have to absorb the cost of delayed freight and late or cancelled deliveries. It all adds up to an annual cost to the UK economy of £12 billion¹.

Roadworks, accidents and bad weather all play their part, but over two-thirds² of congestion is caused simply by the volume of traffic. The car culture that has emerged in the UK in the last 25 years has seen traffic increase by 81%. There are many more vehicles on the road and few new roads to accommodate them.

We can either continue to accept this state of affairs, its effect on our economy, environment and quality of life, or we can do something about it. We could build more roads, and some extra capacity is desirable. However, such a policy would be unsustainable on a scale needed to halt the growth in congestion. Reducing traffic by just a small amount, on the other hand, would have a big impact on congestion levels. Road pricing is designed to do just that.

What does road pricing mean for me?

The majority of road users will be no worse off as the result of road pricing. Where charges have to be higher – in dense urban areas where congestion is worst – the improvements in public transport they help to fund will benefit the whole community, including motorists, in terms of more reliable journey times and a cleaner, healthier environment.

Road tax and fuel duty could be restructured and reduced when a national road pricing system is introduced. Some have suggested a scheme in which road users pay a flat rate fee based on the type of vehicle and fuel they use, and then top it up with mileage-related charges for each trip.

Businesses, especially those operating just-in-time logistics, will benefit financially from improved, more predictable journey times. For business-related car use in city centres, road pricing will be fairer than if they were to incur a workplace parking levy.

¹ DfT Feasibility Study

² ICE State of the Nation 2006



What will road pricing do for the environment?

First of all, it will make a difference to air quality and standards of health. There are few things more harmful to the environment than slow-moving queues of cars and lorries. Vehicle engines are less efficient at low speeds and the emissions they produce are more toxic. Fewer vehicles, flowing freely through city streets, will make for cleaner, healthier air.

Secondly, reducing congestion by introducing road pricing will reduce the need for so many new or widened roads, whose construction takes its own toll on the environment and whose eventual use results in even higher traffic volumes.

The car culture that has emerged in the UK in the last 25 years has seen traffic increase by **81%**.

What are the alternatives to road pricing?

The first alternative to road pricing is modal shift: reducing congestion by encouraging motorists to switch to bus, tram or train. UK motorists have been particularly resistant to modal shift in the past even when improved public transport is available. Road pricing could provide the encouragement they need. For it to succeed, though, the public transport alternatives need to be convenient, comfortable and affordable enough to attract people out of their vehicles.

People would drive less if essential services – schools, shops, workplaces, social services and so on – were closer to home. The second alternative to road pricing is urban planning that can recreate communities with services within walking distance. Such a turnaround would take many years to achieve, though, and might only happen once road pricing offers a commercial and financial incentive to locate facilities locally rather than centrally or out of town.

Remote working holds the promise of preventing millions of trips to and from offices, with employees enabled by powerful IT networks to work just as efficiently from home. An en-masse switch to remote working, though, still seems only a distant possibility.

Finally we can continue to build more roads, or to sit in ever increasing traffic queues. Neither is tenable.

Road pricing

Can the technology cope?

02 Road pricing systems

How would it work?

There are two ways of charging for road use. One is to measure the distance travelled by road users. The other is to use zones such as city centres or stretches of motorway, and to charge a fixed fee for travel into or within those zones.

Because the second method tends to unfairly penalise people living just outside zones for making short trips that take them across the cordon, distance charging is generally regarded as fairer. And better at reducing congestion.

In both systems, charges can be varied by factors such as vehicle type and time of day or week. They can be applied nationwide, where the use of any road is charged for, or selectively to certain zones or types of road, for example using a consistent national system.

The main technologies used in road pricing schemes are:

- DSRC: Direct Short Range Communications, also known as 'tag-and-beacon'
- REP: Remote Electronic Positioning, using either satellites (GPS) or (more likely in the future) mobile phone systems (GSM)
- ANPR: Automatic Number Plate Recognition, using cameras to visually identify vehicles

DSRC involves roadside beacons detecting electronic tags on the windscreens of passing vehicles, and then charging the vehicle owner. It is most widely used on toll roads and bridges and other zonal schemes, but the roadside equipment can be expensive and intrusive, particularly in urban settings. Its reliability is high, though, and can be consistently above 98%.

In the future DSRC systems could use radio frequency ID (RFID) chips as tags. These chips, currently used to manage retail supply chains, could be embedded in number plates to act as electronic tax discs, which would also allow DSRC systems to detect them.

ANPR is the system used for the Congestion Charge in London and also used in an enforcement role in schemes where charging is carried out via another technology. ANPR is around 90% reliable but, as with DSRC, the equipment is relatively cumbersome and expensive.

REP is widely regarded as the best option since it can track vehicles continuously and make distance-based charging work. Its drawback is its drop in reliability in densely built-up areas, where tall buildings can temporarily sever the communications link between vehicle and satellite, although technological solutions have been and continue to be developed.

The current cost of a standard GPS in-car black box is around £100 and will fall over time. Another issue is that any satellite-based system is reliant for its accuracy and availability on the owner of the infrastructure; currently only the US military. If GPS is switched to operate in a degraded mode for civilian applications – as it has been in the past, for US defence reasons – a road pricing scheme would need to have a back-up system in place, ready to go. However, the new EU Galileo system, which should be in operation by 2012, has been designed for civil use so it will not suffer this problem.

REP offers the advantage to the operator of being able to vary charges in real time, according to road conditions and congestion levels, using a system similar to the variable speed limit technology in place on sections of the UK motorway network. In other words, the heavier the traffic, the higher the charge. To gain acceptance, though, the system would have to include some means for users to estimate their journey costs before setting out on particular routes.

The best solution could be to combine technologies: general distance charging using REP, supported by a DSRC system for charging in those central urban areas where tall buildings make REP less reliable.



How would I pay?

There are several payment systems available, including payments online, by telephone (including text messaging), through direct debit or via a monthly account.

An alternative is the smartcard. As in Singapore, this would be inserted into a black box fixed in the vehicle at the start of a journey, although achieving security could be challenging. It would hold credit card or other payment details, and allow roadside equipment to charge the driver as the journey progresses. All details of the journey could remain private, undisclosed to outside agencies.

Enforcement would be a key part of the system whichever payment method is adopted, and would involve electronic detection as well as mobile teams of enforcement officers.

Has the technology been proven?

Plenty of other countries have introduced road pricing systems using these technologies. France, Italy, Spain and Portugal have used DSRC to toll motorways, and similar systems are in operation in Austria, Norway and Sweden. In the UK, both the M6 Toll and Dartford River Crossing employ DSRC technology. Singapore's road pricing system, which has operated since 1975, successfully adopted DSRC with in-car smartcards in 1998.

REP (using GPS) has been used to charge freight vehicles on German motorways.

London has successfully used ANPR, which is also increasingly being used to enforce speed limits.

Remote Electronic Positioning (REP) is widely regarded as the best option since it can track vehicles continuously and make distance-based charging work.

Comparison of Direct Short Range Communications (DSRC) and Remote Electronic Positioning (REP) road pricing systems

	DSRC	REP
Holds personal journey data	The system could hold data at a crude level by recording which zones the user entered. Most tag systems hold central transaction records.	Yes, although the use of smartcard technology could limit the extent.
How it works	Microwave communication at discrete roadside beacons.	Continuous recording of geographic position and comparison to electronic mapping.
Cost	The in-car tag is cheap to produce, and could be installed as part of the MOT process, or at time of vehicle manufacture. The roadside equipment is relatively expensive.	The in-car black box is reasonably cheap to produce, and could potentially be installed as part of the MOT process, or at time of vehicle manufacture. The satellite system is pre-existing.
Available now?	Yes.	Yes.
Ease of use	Very easy to use.	Very easy to use.
Ease of administration	Because the system only records a vehicle at discrete locations the risk of non-compliance is higher than with REP.	The experience from the Norwich Union pay-as-you-go insurance trial is that the system can be straightforward to administer.
Reliability	98%.	90% but can be unreliable in city environments. Over 99% on German motorways.
Applicable nationwide	Could only be applied over large areas with difficulty.	Yes.
Current applications	Widely used.	Following trials, this has recently been launched by Norwich Union as a mainline insurance product. REP using GPS is the basis for the German motorway lorry charging system.

03 Making road pricing work

What are the ingredients for success?

First of all, we have to define success. In the context of a UK road pricing scheme, success in reducing congestion would mean meeting the three main objectives:

- 1 Making most efficient use of the road network
- 2 Reducing emissions and other environmental impacts of congestion
- 3 Improving the health of the population by reducing car reliance, and associated impacts from emissions

With these objectives in mind, we see the following requirements as vital to establishing a fair and successful system.

- Technical standards have to be agreed, so that all equipment is compatible and deployed consistently. A Europe-wide road pricing scheme is a future possibility, so these standards should at least match those of our neighbours.
- Users should be able to understand and use the system easily, and receive every help in making informed travel decisions both before and during their journeys.
- Charging must be seen to be fair, and to reflect motorists' actual usage of the road system. That means prices should take into account vehicle type, location, time of travel, distance travelled and other important factors.
- Reliability of the technology is key, as is simplicity of operation, to keep costs down. The London scheme requires 50% of its revenues to cover operating costs, the German freight system requires 20%, and the Dutch government has set a target of just 5% for a proposed national system.
- The system should be visibly robust against both fraud and accidental evasion. It should also be able to generate legally admissible records of non-compliance for use in the courts.
- It needs to cope with vehicles visiting from abroad, as well as those with faulty equipment on-board. This could be crucial in ensuring a level playing field for freight carriers and other commercial road users.

- Public expectations have to be managed, and the lessons of the abandoned Edinburgh scheme learnt as well as those from Stockholm. Charges must be seen by everyone to be fair, and the benefits real.
- There need to be reassurances for the public about the collection and storage of 'private' data relating to their journeys.
- There must not be an unfair burden placed on the freight business or any other industrial sector.

What are the pitfalls?

Road pricing schemes have their drawbacks and side-effects, but these are usually heavily outweighed by their benefits.

- The design of any scheme must guard against social exclusion, and prevent primary routes becoming the preserve of the wealthy, whose choice of route might be unhindered by the prospect of paying more than they did in the pre-charging era.
- Road pricing will lead to changes in land use and land values. These could be used to stimulate regeneration, or they could create pockets of economic decline. Again, careful scheme design is the answer.
- The point of road pricing is to change people's behaviour, but it won't work in isolation. Investment in public transport improvements, including bus, tram and rail, will be needed to provide an alternative for motorists who want to avoid the road charge.
- Some vehicles, such as emergency services and buses, might need to be exempt from charging, and the system would need to make allowance for these.
- The recording of vehicle locations is sure to raise concerns in some quarters that it constitutes an invasion of privacy so appropriate safeguards must (and can be) be built in.
- The motorways are the UK's safest roads. Any pricing scheme that encourages motorists off motorways without the safety implications being thoroughly considered and acted on, may inadvertently cause accident rates to rise.

04 Making road pricing happen

Where will road pricing be applied?

Broadly, there are two options for a road pricing scheme. One is to create a nationwide scheme that applies to all roads. The other is to apply pricing to discrete areas such as city centres, busy motorways and so on, using a uniform national charging system.

The choice will go a long way to determining the best technology for the job and the timescale for rolling the system out.

One thing worth considering from the Singapore experience is the use of the smartcard for other purposes, such as paying for parking. Here, a popular public transport chargecard such as Oyster could be extended to pay for road use, making a smoother, more convenient introduction of the system for millions of travellers.

The technology
to implement
road pricing
already exists.

When will it happen?

As we've said, the technology to implement road pricing already exists. It has been claimed that 'technological constraints' would prevent a viable road pricing scheme being established in the UK for at least 10 years. This is not the case. Even if technological improvements need to be developed, they could be available long before the necessary political and planning processes had reached their conclusion.

Singapore started with a paper-based scheme in 1975 and developed it into an automated system stage-by-stage. There will always be a better technology around the corner. But if we keep waiting for the next one to arrive, we won't get anywhere.

The real issue is whether an available technology can be expanded into a system that can operate successfully nationwide. However, nationwide operation isn't a necessity from day one. It should be possible to design a system that can be rolled out across the UK over time. Norwich Union, by operating distance-based insurance (using GPS and black boxes in vehicles) alongside traditional premium-based products, has shown that the new and the old can cohabit. A similar transition could be constructed for the move from road tax to road pricing.

For a nationwide scheme to be developed, political commitment is vital; the private sector alone will not drive road pricing forward. Complex systems tend to take shape in response to deadlines. In the case of the London scheme, it was the date of the mayoral elections that concentrated minds. A firm political commitment could ensure that systems were made ready for nationwide deployment within a few years.

The Government need not operate the system. A franchising system could be established, similar to that in the mobile phone industry, in which competing companies offer road credits to their customers. Such an arrangement would generate private investment in the system, where the infrastructure is owned by the state but operated by the private sector.

Conclusion

The UK needs road pricing. A successful system would begin the process of making the country's transport system sustainable. It would improve our economic competitiveness, help us meet our environmental commitments and raise the quality of life for people in Britain.

Technology is not a barrier to implementing a scheme in the UK, nor is it a reason to delay the start of the outline system design process. Road pricing has already been successfully adopted by a number of countries to fund investment or curb congestion.

The Green Light Group calls for the Government to commit to a fixed timetable for the staged implementation of a combined REP/DSRC road pricing system. REP (Remote Electronic Positioning) could be used for real-time distance-based charging from vehicle-mounted smartcards. DSRC (Direct Short Range Communications, or tag-and-beacon) could be used at cordons around zones where REP is less reliable, such as dense city centres.

This system needs to be implemented alongside traffic management measures, infrastructure improvements, public transport enhancements and changes in spatial planning.

Fewer vehicles, flowing freely through city streets, will make for cleaner, healthier air.

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