Sector

Watch this congested space

A road pricing system might reduce traffic congestion, but it raises concerns over privacy and the security issues concerned with having all tracking information on a centralised database, finds Wendy Grossman

The congestion charge has decreased traffic by 21% in Central London

According to a 2003 study by the Department for Transport, the number of road miles British vehicles travel has doubled in the last 25 years. Similarly, the distance people travel to work has increased by 17 per cent, and goods vehicle traffic has increased by 40 per cent.

Formerly, the congestion caused by increasing road usage sparked a new round of road construction. But this is no longer the case. It gets to the point when building more roads makes less sense than optimising use of the ones you have. The success of London's congestion charge – Transport for London says the number of vehicles entering Central London has dropped by 21 per cent and cycling has increased by 49 per cent – has put road pricing high on the agenda. In 2005, then Transport Secretary Alistair Darling announced a plan for a national road pricing scheme. Charges of up to £1.34 (€1.7) per mile for using a busy motorway at peak times would divert traffic to other times or roads.

> **'We're going to change your behaviour and charge you for the privilege' isn't much of a sales pitch**

There is no immediate prospect of such an extreme scheme; even Darling admitted the technology wouldn't be ready until at least 2014. But research into more modest, local schemes is going ahead. Local authorities may apply to the Department for Transport for grants to develop bids for larger sums with which to

implement schemes. So far, only two local authorities – Cambridge and Manchester – have come up with formal proposals, but more are expected to do so soon.

Three main types of road pricing systems dominate the discussion: automatic number plate recognition (ANPR) as used by London's congestion charge; tag and beacon, as used at Dartford Crossing and on northeast American turnpikes; and Time-Distance-Place, used in Germany's Maut HGV system. Each has its advantages and drawbacks.

Caught on camera

John Mason, head of enforcement operations for Transport for London, explains that London's congestion charge places a network of cameras at each entry point, with further cameras at points inside the zone. The system processes 1.5 million images every charging day, catching every vehicle on average 3.5 times. The system keeps only the best-quality capture per vehicle. That information is then checked against the database of vehicles that have either paid the charge or are exempt. If an image matches, it is deleted.

"We don't keep images or data," Mason says, adding that some data is anonymised and used for traffic monitoring purposes.

In a tag and beacon system, a transponder inside the windshield is activated and read as it passes a beacon. These systems work well when the number of traffic streams is limited – bridges and tunnels, or access roads to motorways. They're much harder to deploy in more complex settings, and the toll booth-like barriers needed to prevent fare-dodging by slowing the traffic passing through them are counterproductive if the goal is to speed up clogged city streets.

"We couldn't have barriers in central London," Mason says. "The area of central London that's most congested has over 227 entry points. That would be a lot of toll booths and barriers. So our first decision was that any scheme had to be free flow." At the time – 1999 to 2001 – tag and beacon was still a developing technology. "One of the key issues we've found since introducing the scheme that will be a major factor in whether we decide on tag and beacon in the future is how much customers will accept having tags in their vehicles." Most, he says, indeed 80 per cent, of vehicles entering the charging zone are infrequent users. "How valuable is a transponder to them?"

John Mason, Transport for London

> **The object might be to clear congestion, but the practice becomes to raise revenue or control vehicle flow**
> Toby Stevens, Enterprise Privacy Group

Like tag and beacon, TDP (time, distance, place) requires users to install a box in their vehicles. However, where the transponder tag activates only when passing a beacon, the TDP box tracks the vehicle via GPS and reports time and location data via a mobile phone network. This combination of GPS/GSM still has some kinks in it, largely because GPS still isn't completely accurate. The 2003 implementation of the German lorry system found that tracking units could not distinguish between adjacent and parallel roads and their accuracy diminished for elevated roads. The system now works, but monitoring 7 500 miles of major arteries is a much simpler problem than something comparable on a national level.

The longer-term difficulty is that the boxes are relatively expensive. "We're going to change your behaviour and charge you for the privilege" isn't much of a sales pitch. Even less acceptable is the thought of enabling government agencies to track driver movements throughout the UK, an idea that raises the worst fears of privacy advocates.

Big Brother is watching you

"Motor vehicle information is inevitably personal data", says assistant information commissioner Jonathan Bamford. "So once you can [charge owners and keepers] with a vehicle-based location system of some description, you're starting to build a picture of that individual and what they're getting up to. From the data protection point of view, what we're keen to achieve in any of these schemes is something that minimises the amount of personally identifiable information."

As unacceptable as this kind of tracking is to consumers, it's likely to be even less appealing to businesses.

Toby Stevens, a director of the Enterprise Privacy Group who has run road pricing workshops for the Department for Transport, points out that for many companies, road traffic data is commercially sensitive. Fleet operators, he says, are concerned about their competitors having access to the data and finding out where their vehicles go and on what schedule. On the other hand, some companies, such as rental car companies or insurers, are eager to have this kind of tracking because it could enable much more fine-grained pricing.

Most companies, he says, already know how to take care of commercial confidential data. "The big problem," he says, "would

be differentiating between personal and corporate data. How do you stop a company from being able to track the movements of its staff outside of office hours?" Bamford makes a similar point, and ultimately it would be up to the Information Commissioner's office to issue guidance on drawing the line between an employer's legitimate interests and unacceptable monitoring of employees. "You can argue that we've been here before with mobile phone records," says Stevens.

'Function Creep'

It's notable that so far all the schemes under public discussion involve a centralised database, the kind of setup that, as Privacy International executive director Simon Davies says, is subject to "function creep". First the data is used for traffic monitoring, then law enforcement gets access for solving crimes and preventing terrorism, and ultimately it's used for whatever any government agency wants, no matter how trivial.

Stevens points out that it does not have to be this way. The German system is subject to such stringent privacy protections that proposing to open the TDP traffic data to law enforcement caused a constitutional crisis.

As an alternative architecture, Alastair Beresford, an academic at the University of Cambridge Computer Laboratory, has proposed a peer-to-peer system in which all vehicles are fitted with four inexpensive items that could be built into an intelligent number plate to be checked in the MOT: camera, radio transceiver, computer, and positioning system. Vehicles would use the radio interface to pay for tickets and download local charging information, as well as communicate with other vehicles. The camera and computer use ANPR to identify the vehicles in front of the car and check that they've paid up by requesting a digital certificate. Only cars whose payment status could not be verified would be reported centrally; all other information would be deleted locally. Beresford argues that it isn't necessarily true that options are limited to either compromising privacy or having no system.

"My personal preference," says Beresford, "would be to have a distributed scheme and push enforcement and data collection to the edge. I don't think the technology is unachievable. It's scalable, you save on central resources, you don't have to answer information requests because you don't have any data. But the extra uses that just happen to conveniently be there for law enforcement are why people don't choose it."

However, it does require mass compliance. "You would have to legislate compliance," says Stevens, "and it would cause arguments over revenue." As with all government schemes, he adds, "The object might be to clear congestion, but the practice becomes to raise revenue or control vehicle flow, which was never intended."

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Brian Collins, Department for Transport

Toby Stevens, Enterprise Privacy Group

The importance of transparency

It's this sort of consequence that Brian Collins, a chief scientific advisor to the Department for Transport, is attempting to study. Collins says that feedback from workshops has taught him more consideration needs to be given to the balance between surveillance and the use of data in tracking.

"It's important that there be transparency about what the data is being used for," he says. As for protecting that data, he notes that all the normal practices of any good security operation apply: storing it in encrypted form, backing it up, vetting staff who have access, auditing accesses.

Equally important to Collins is trying to understand the possible social impact of road user charging. Even GPS by itself is a problem: "Because all GPS will choose the same route, people don't know there are other routes, so everybody ends up in the same place," he says. Even black cabs' famous ability to nip through little-known short-cuts is being eroded. Without real-time congestion information, GPS by itself will just make things worse. This suggests however, that such real-time navigation assistance might buy consumer acceptance of TDP systems.

Collins will spend the next couple of years building models big and comprehensive enough to simulate a road pricing regime. "What is unpredictable," he says, "is how people will behave. Do they stick with cars anyway because they want the perception of comfort and privacy? Or will they resist having to navigate themselves around a different set of roads every day because that's where the smart navigation system will take them? Watch this congested space.