The Congestion Charging Schemes of London and Singapore:
Why Did London Choose Different Technology, and Was this a Mistake?

By Harry Commin

1. Introduction

As the global car population grew explosively in the 20th century, traffic congestion soon became a familiar problem across the world. Amongst its numerous negative effects, concerns have been raised regarding emissions, vehicle wear, fuel wastage and stress amongst motorists. The greatest impact of all, though, has risen from the amount of time people waste in traffic. This lost time translates to enormous financial losses (which reach into billions of pounds per year for many major cities today) [1, 2, 3].

With the financial incentives being so high, it was recognised from an early stage that strategies needed to be developed to combat congestion. Following rigorous economic analysis, one such scheme that has been widely recognised to give a net benefit to society is Congestion Pricing (or Congestion Charging). Under this scheme, surcharges are imposed upon drivers during peak periods with the key purpose of reducing congestion. (It should be noted, therefore, that this is distinctly different from Road Pricing, which seeks to generate revenue for the purpose of financing the road infrastructure).

There are numerous key factors that make congestion charging so successful. The underlying principle is that road users should be forced to pay for their road usage in proportion to the negative effects that this usage creates. In calculating such cost, it is not easy to be exact, but congestion charging provides a platform for greater accuracy, since it can be tailored to target specific places at specific times. This makes it a far more direct strategy than, for example, fuel taxing, which penalises road users evenly, regardless of their true negative impact.

Charging in this way has a number of important knock-on effects. Crucially, it makes drivers more aware of their impact and thus reduces unnecessary driving. The result is that demand is regulated and redistributed such that congestion is reduced without having to increase supply (build more roads). In economic terms, this approach is desirable since it corrects the shortage by charging the equilibrium price rather than just increasing supply. Increasing supply only serves to lower the 'price' and hence reincrease demand (so generally only offers a short-term solution). This effect is often summed up by the phrase “building more roads increases traffic” [4].

Two of the first electronic urban congestion charging schemes in the world were introduced by Singapore and then London. However, London officials decided upon a different underlying technology – despite the obvious successes that had already been seen in Singapore. So, in this dissertation, we will look at some of the important differences between the two cities that motivated this different choice of technology. We will then compare the two systems and therefore try to decide whether London’s different choice may, in fact, have been a mistake.

2. Historical Background

By 1973, officials from both London and Singapore had identified congestion charging as a possible solution to their traffic problems. An in-depth study in London concluded that such a system would have a positive effect on both congestion and the environment whilst also generating revenue [5]. However, it was Singapore that led the way and became the first city in the world to put a serious road pricing system into action, introducing its Area Licensing Scheme (ALS) in 1975.

At that time, technology was not available to implement the ALS electronically. Instead, drivers were required to display daily or monthly windshield licences if they wished to enter the 2.0 square-mile central Restricted Zone (RZ) during morning peak hours. A workforce of about 150 was required in order to staff the ticket booths and the 34 gantries that surrounded the RZ [6]. Heavy fines were imposed to discourage violators.

Figure 2.1: *Singapore’s road congestion and an ALS licence sales booth in 1975.*

(Source: worldbank.org)

The impacts of the ALS were substantial and immediate. The flow of cars into the RZ fell suddenly by 73% (from 42,800 to 11,400 per day). By the early 1980s, more than half the cars entering the RZ carried four or more passengers. People flocked onto the improved and expanded bus and rail systems, with 69% of morning peak-time travellers choosing public transport (compared to 33% in 1976).

Through the 1980s, despite large growths in RZ employment (up 34% by 1983) and the overall car population (up 72% by 1988), the observed increase in traffic entering the RZ was just 24%. Revenues continued to soar, with the ALS producing S$6.2 million profit every year [5].

The success was continuing, but being the first system of its kind, the ALS inevitably had to undergo numerous changes. Particularly, charging times were first expanded to include evening peak-time in 1989, and this was soon extended to all-day charging in 1994. Charging was also introduced on three busy expressways outside the RZ.

As a part of this learning curve, there were also certain small failures. A park-and-ride bus service saw only 900 of its 10,000 parking spaces being used daily and was duly aborted [7]. Also, lower charges were initially offered to vehicles carrying multiple passengers in order to encourage car-share. However, this policy was mysteriously cancelled in 1989, with seemingly no explanation in official documentation. However, any Singaporean veteran of this era will confirm this cancellation was due to extremely widespread abuse by wily pedestrians hitching free lifts into the RZ (a win-win situation for both driver and passenger) [8].

So, by the mid-1990s, Singapore had enjoyed more than two decades of success from its ALS and learnt numerous valuable lessons. Meanwhile, London had taken no such major steps towards easing congestion. However, technological advances were now finally reaching a stage where electronic implementations were becoming a realistic option and this would have radical consequences for both cities.

3. The Vehicle Populations of London and Singapore

In order to better understand the overall issue of implementing a congestion charging scheme in London compared with Singapore, it is necessary to discuss some of the important differences between these two cities.

A highly relevant factor is that Singapore is an island city-state. It is almost entirely self-enclosed (with its only land links being two bridges to neighbouring Malaysia). Despite being the second most densely-populated country in the world, its population is only 4.6 million. Furthermore, its enormous immigrant workforce (the largest, by proportion, in Asia) means that the true number of permanent residents is just 3.6 million.

By comparison, the London metropolitan area is home to around 13 million people. However, in direct contrast to Singapore, it is also freely accessed by a nation totalling 61 million people.

Also, the cost of vehicle ownership (relative to general living expenses) in Singapore is astronomically high. The myriad of extra fees and taxes include the "Additional Registration Fee" (ARF), set at a mind-boggling 100% of the vehicle's open market value [9]. Excise duty is also high (20% compared to 0% - 10% in the UK) and, every 10 years, drivers must bid for a "Certificate of Entitlement" (COE). In May 2009, a COE cost around S$10,000 (£4,400), but fluctuating figures over the previous 12months, at their peak, reached almost double that [10].

Singaporean drivers are also offered financial incentives to own new cars. "Preferential Additional Registration Fees" (PARF) are paid back to drivers who scrap or export their cars before they reach the age of 10 years. After this age, road tax surcharges of up to 50% are imposed. Thus, very few people are willing to commit to the purchase of a 10-year non-transferrable COE for an older car and the cheap second-hand car industry simply doesn't exist in Singapore.

The point being made is that it is hugely more difficult to afford a car in Singapore. To put this roughly in context, we can consider my first car, which was 17 years old when I bought it for £400 in the UK. No such equivalent would be available in Singapore and so the closest alternative would be to buy the up-to-date model. In 2009, this (VW Polo) would cost a total of S$63,200 (£27,500) [11]. For many, this obviously isn't an option.

So, bringing together this above information, we can obviously see that the number of cars that are free to access Singapore's urban roads will be tiny compared to London's. Not only are there many fewer people with direct access to Singapore's city centre, but also the enormous vehicle ownership costs mean that each of these people is less likely to own a car. Indeed, by the time both cities had implemented their electronic congestion charging systems (in 2003), Singapore had just 100.5 private cars per 1000 people, while the UK had 439.2 [12].

Today, this amounts to private car populations of 450,000 in Singapore [13] and over 27 million [14] in the UK. Although all the UK's cars will not enter London on a daily basis, Singapore's car population is still much smaller and more predictable. We will see later that this gives Singapore a unique advantage when it comes to implementing an electronic congestion charging system.

4. Congestion Charging Approaches

Before thinking about the details of technological implementation, we should take note of the general shapes that congestion charging systems can take as a whole. Loosely speaking, there are three main forms of urban congestion pricing systems:

i. **Single Facility Congestion Charging**: Charges are applied for the use of a single facility (such as a single road) at peak times. Often achieved by simply altering existing road pricing schemes (e.g. at toll bridges/tunnels/roads) to vary with time.
ii. **Cordon Area Congestion Charging**: Drivers are charged to enter into the charging zone.
iii. **Distance-based Congestion Charging**: Drivers are charged according to the distance they drive whilst inside the charging zone.

Distance-based congestion charging is generally regarded to be the most direct and fair way of charging drivers for their true impacts. However, we will see later that suitable technology has not yet been developed to make this feasible in an urban context.

We have already briefly discussed Singapore's ALS, which is an example of cordon area charging (with additional single facility charging later included on some expressways). The crucial limitations of the ALS had risen from its manual implementation. Firstly, transaction costs were relatively high (since gantries and ticket booths had to be manned). Also, the system offered little flexibility – prices were rigid and difficult to vary with time.

The way charges should vary with time has been noted as an important consideration by economists. As observed with Singapore's ALS, discontinuous fee variations gave an excessive incentive for drivers to jump in ahead of charging periods or to lag just behind them. This caused undesirable mini-peaks immediately before and after charging periods. A smoother response requires smoother charge variations which, realistically, require some form of electronic implementation.

5. Congestion Charging Technology

Being two of the first cities to ever implement electronic congestion charging systems, officials of London and Singapore had to carefully consider all the different methods available to them. There are four key base technologies:

i. **Automatic Number Plate Recognition (ANPR)**: Optical Character Recognition (OCR) is used to read licence plate numbers captured by video cameras.
ii. **Dedicated Short-range Radio Communications (DSRC)**: Each vehicle carries a transponder that deducts payments when it passes through a gantry (i.e. 'tag and beacon').
iii. **Global Positioning System (GPS)**: Satellite-based positioning.
iv. **Global System for Mobile (GSM)**: Uses 'Location Based Services' present in mobile telephones to establish position.

These four technologies potentially offer quite different functionality. Essentially, the first two allow vehicles to be identified when they pass some sort of detection point, while the last two seek to locate the vehicle without the need for fixed detection points.

From a technological perspective, the key to any detection system is its accuracy. More specifically, there will be requirements in terms of: spatial accuracy (certainty that the vehicle is within a charging zone), temporal accuracy (certainty that it was there during a charging period) and identification accuracy (certainty that the correct vehicle has been identified). Other basic considerations include setup/running costs and also whether any special equipment is required by the driver.

A brief overview of approximate performance is given as follows [15]:

	Spatial Error	Identification Success	Detection Points	In-car Units
ANPR	Small	70 – 80%	Yes	No
DSRC	Small	99.0 – 99.5%	Yes	Yes
GPS	60 – 250m	High	No	Yes
GSM	800 – 2400m	High	No	Yes

Table 5.1: Performance overview of congestion charging technologies.

5.1 ANPR

The key attraction regarding Automatic Number Plate Recognition is that it can detect vehicles without them carrying any special kind of technology. In fact, this is an absolutely fundamental requirement for any electronic congestion charging system. In-car units could either malfunction or be deliberately removed by drivers wishing to avoid charges. So, at the very least, some form of camera-based reinforcement is required by all systems.

An obvious drawback is that identification accuracy is relatively poor (70 – 80%). This is mostly due to licence plates being obscured by dirt or obstacles (such as tow bars and bicycle racks). A more subtle problem with ANPR is that video captures represent a large amount of data. Communicating all this data on a large scale proves to be very expensive.

5.2 DSRC

Dedicated Short-range Radio Communications addresses the drawbacks of ANPR at the expense of requiring an in-car transponder. Firstly, it offers an enormous reduction in network load on camera-facing channels since the need for video captures is largely eliminated. Also, the high detection rate (99.0 – 99.5%) is massively desirable as it brings in the possibility of period-based billing (such as monthly billing). This is an important point, so the options will be discussed with care.

Low detection rates are only tolerable for per-use billing, as this gives freedom to impose heavy fines to deter violators. For example, ANPR would not be suitable for monthly billing because up to 20 – 30% of all vehicles could go undetected and those journeys would not be billed. However, if drivers face heavy fines for not paying up front for every transaction, they will generally choose to make sure that they pay (despite the 20 – 30% chance of a free journey).

However, the point here is that period-based billing (as offered by DSRC) is hugely preferable since it significantly reduces the network load on customer-facing channels (and hence cuts down operation costs).

5.3 GPS and GSM

The good thing about GPS and GSM is that they are somewhat suited to being used in a distance-based congestion charging scheme. They do not rely upon fixed detection points and so, in theory, can keep track of a vehicle's movements while it is inside the charging zone.

The obvious problem with these technologies at present is that their spatial accuracy is poor. At the very least (using GPS), a 60 – 250m buffer zone would have to be established around the charging zone. This is not practical, but encouraging improvements are being made. It is expected that the future of congestion charging in Singapore rests with GPS [16]. Similarly, London officials describe GPS distance-based charging as potentially offering the "Gold Standard" of congestion charging.

6. Congestion Charging Schemes of London and Singapore

Figure 6.1: *(a) London's Congestion Charge sign, by Transport for London (TfL).*
(b) Singapore's Electronic Road Pricing sign, by the Land Transport Authority (LTA).

6.1 Singapore's Electronic Charging Scheme

Having pioneered the world's first major congestion charging strategy in 1975, it was again Singapore that put through the first automated system, with their Electronic Road Pricing (ERP) scheme in 1998.

Figure 6.2: The Locations of *Singapore's ERP Gantries*. (Source: [17])

DSRC technology was chosen to implement a cordon area scheme, with additional single facility charging on expressways (by direct replacement of the old ALS gantries). Today, there are 37 detection points enforcing the RZ and a further 27 on surrounding roads. The map above shows an approximate outline of the RZ (red square). Expressways are marked in orange.

This DSRC implementation has three main components [18], which will now be summarised:

6.1.1 In-vehicle Units (IU)

It is generally mandatory that any vehicle wishing to enter a charging zone in Singapore must have an IU installed. They are permanently fixed to the vehicle's windscreen (or handlebars for motorcycles) and are powered by the vehicle's battery. Different IUs are required by different classes of vehicle and these are colour-coded to discourage misuse. Charges generally range from S$0.50 to S$4.00 [19]. Foreign visitors can choose to rent (S$5/day ≈ £2.10/day) or buy (S$120 ≈ £50) an IU, or pay a flat-rate $10/day (£4.20/day) for unlimited ERP access.

For payment purposes, a stored-value smart card (the NETS CashCard) must be inserted into the IU. The NETS CashCard is a widely-used electronic payment method in Singapore and can also be used in stores, vending machines and public telephones.

Figure 6.3: (a) In-vehicle Unit with CashCard and (b) ERP Gantry. (Source: [17])

6.1.2 ERP Gantries

Each fixed detection point actually comprises two gantries, spaced 12 – 15m apart. As the vehicle approaches the first gantry, its IU is interrogated and instructed to deduct the correct payment (according to the time, place and vehicle class) from the CashCard account. By the time the vehicle passes under the second gantry, the payment transaction has completed and the IU sends confirmation to that gantry.

Payments will not always succeed, for example if the CashCard or IU is faulty/absent, or there is insufficient balance on the CashCard. If this is the case, then optical sensors on the second gantry detect the passing vehicle. Then, cameras (mounted on the first gantry) photograph the rear number plate of the violating vehicle and send the images to the control centre.

6.1.3 Control Centre

The control centre keeps a log of all successful transactions in order to claim these funds back from the CashCard operators at the end of each day. Unsuccessful transactions (violations) are dealt with by extracting number plate information from the relevant photo images with OCR (optical character recognition). The control centre also monitors general functionality and alerts maintenance crews when problems occur.

Communication between gantries and the control centre is achieved across leased telephone lines. As long as the number of violations stays low, transfer of images is minimised and so network operating costs are also kept to a minimum.

6.2 Notes on Singapore's Implementation

A key motive for Singapore's conversion to electronic congestion pricing was illustrated by research carried out at Nanyang Technological University, starting in 1995 [20]. According to their traffic flow models, optimal throughput of traffic was not achieved simply by higher road speeds. Instead, there exists a range of speeds within which traffic flows most efficiently, and these optimal speeds are different for expressways and arterial roads.

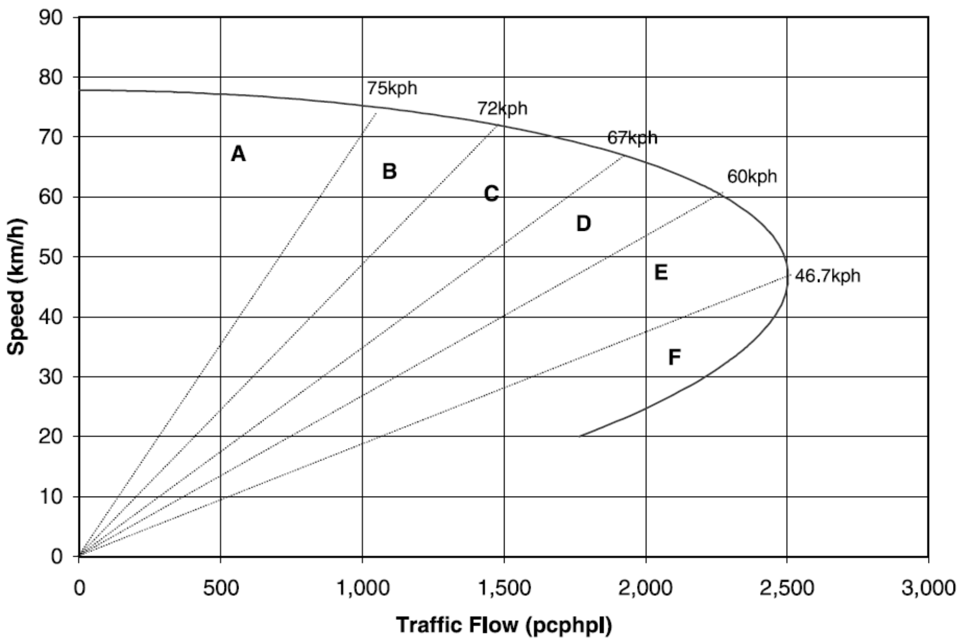

Figure 6.4: *The Speed-flow Relationship for Singapore's Expressways.* (Source: [20])

In order to achieve this, the ERP charging scheme is extremely adaptive. The charging period is divided into 30-minute time slots. Then, the charge for passing each gantry within each time slot is altered every three months according to the traffic speeds during those three months. If speeds were too high/low, charges are decreased/increased by S$0.50 to encourage the correct flow of traffic.

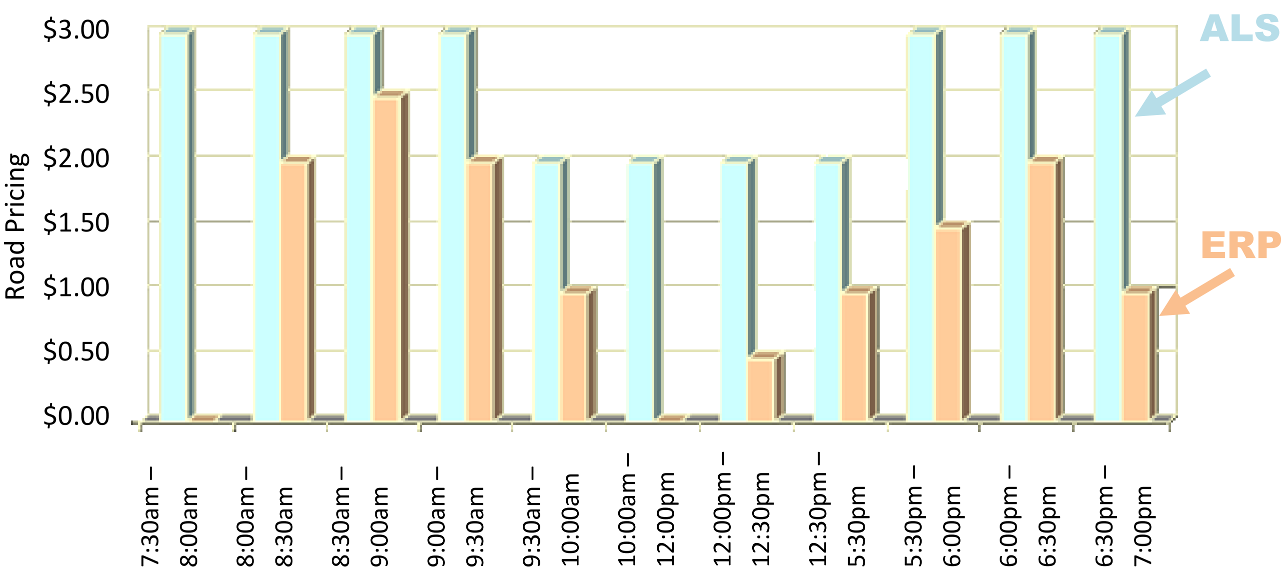

Figure 6.5: *An example of the greater adaptability of ERP compared to ALS.* (Source: [21])

Notably, this led to Saturday charging being totally eliminated. Other charges generally range from around S$0.50 – S$4.00.

6.3 Impacts of Singapore's ERP:

In line with the context of this dissertation, we will only consider impacts regarding traffic congestion and financial benefits. Discussion of further impacts can be found here: [5].

6.3.1 Traffic Congestion

Since the ERP scheme was merely a replacement of the ALS, its impacts may be expected to be small. Furthermore, since the adaptive pricing scheme led to almost all charges being reduced, the expectation might be that traffic volumes may even have increased. Incredibly, though, the number of vehicles entering the RZ during the charging period dropped by a remarkable 15% within the first year.

The reason for this reduction is believed to be a result of the per-entry charging. In contrast to the era of the ALS, drivers now had to plan their journeys better and avoid unnecessarily re-entering the RZ. Indeed, the number of multiple trips into the RZ had fallen by 34% [22].

In terms of the all-important optimal road speeds, the adaptive nature of the charging meant that failure to achieve these goals was not really conceivable. Land Transport Authority (LTA) reports confirm that the desired speed ranges (20 – 30kph on major roads and 45 – 65kph on expressways) have been consistently achieved.

6.3.2 Financial

According to LTA figures, the introduction of ERP actually led to 40% lower revenues than the old ALS system [22]. They cite this as clear evidence that ERP was implemented purely to improve traffic management, not to generate extra revenue.

The conversion from ALS to ERP carried setup costs of around S$200 million. As much as half of this value was spent on free installation of IUs in the country's cars [5]. Annual revenue is S$80 million, with around S$64 million in net profits [23]. These profits go into the Government Consolidated Fund and there is no requirement to invest particularly in public transport [18].

6.4 London's Electronic Charging Scheme

Following a shift in London's political structure and the appointment of Ken Livingstone as mayor in 2000, London's long-awaited Congestion Charge was finally introduced in February 2003.

Here, ANPR technology was chosen to enforce a standard cordon area charging scheme. Initially covering 8.0 square miles, the charging zone was subsequently doubled in size with the Western Extension Zone (WEZ) in 2007. The charging zone is enforced by over 1100 cameras, including 275 fixed detection points around the perimeter and 10 van-mounted mobile units [24].

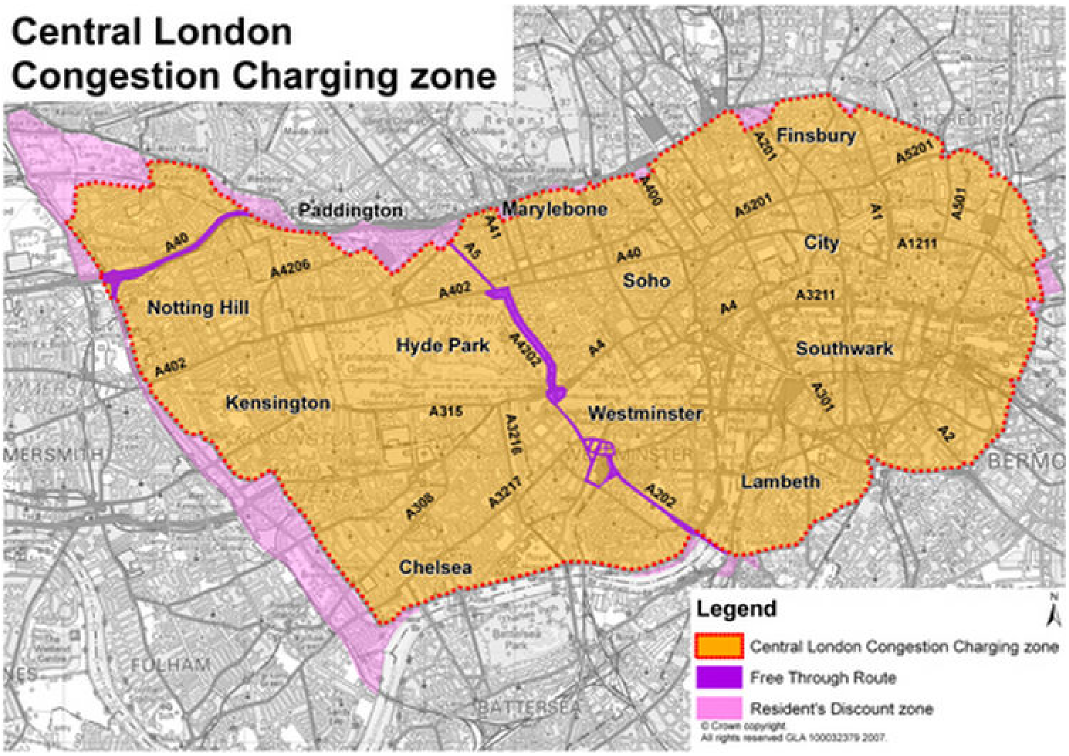

Figure 6.5: *The London Congestion Charging Zone.* (Source: TfL)

As they pass through the detection points, all vehicle number plates are recorded on camera. In the original charging zone (excluding the WEZ), this image data is then passed via dedicated optic fibre channels to a central processing centre, where the licence plate is automatically read using OCR. However, with the new technology used in the WEZ, this processing is carried out at the roadside. This subtle but important difference has great consequences that we will discuss later (also see Appendix A).

With no automated payment system, drivers must pay the £8 flat-rate fee in advance or before the end of that day if they enter during the charging period of 7am – 6pm. Payment can be made via the Internet, a paypoint (at designated retail outlets), call centres or by SMS text message. Next-day payment is accepted with a £2 surcharge, but later payments can incur fines of up to £120.

6.5 The Impacts of London's Congestion Charge

Transport for Longon (TfL) boldly states that London congestion charging has accomplished its stated objectives. We will look at the appropriate aspects of this success separately [5].

6.5.1 Traffic Congestion

Mobility improved immediately. Within 1 year, the number of vehicles entering the charging zone at charging times had fallen 18%. This had allowed traffic delays to fall by 25% and travel speeds to increase by 30%. Crucially, travel times also showed less fluctuation, so more people were able to plan their journeys correctly and arrive on time.

Of the people no longer entering London by car (60,000 fewer cars per day), the majority had moved to public transport. In particular, usage of the bus service had increased by 40%.

Subsequent reports from TfL suggest that these mobility improvements have been largely maintained.

6.5.2 Financial

The initial setup costs were about £161.7 million. Revenue is approximately £250 million per year, but due to high operating costs, the annual net income is only about £89 million. By law, every penny of profit must be reinvested into London's public transport network.

7. Comparing the Schemes of London and Singapore

7.1 The Question

The fact that the congestion charging schemes in both London and Singapore have had overall positive effects is more or less beyond doubt. However, we cannot help but feel that Singapore's ERP system is a somewhat more elegant solution than London's Congestion Charge. Specifically, DSRC transaction costs are very low. With Singapore's ERP, there is very little data flow associated with ANPR video captures. Indeed, it was estimated that the running costs of London's Congestion Charge (even before the Western Extension) were almost 50 times more than Singapore's ERP [25]. In addition, DSRC offers the potential for account-based billing which further reduces operating costs.

What we want to know is whether such a system could or should have been implemented in London. Earlier, we discussed the fact that Singapore's car population is much smaller and more predictable than London's. This made it feasible for almost every vehicle in Singapore to be fitted with an IU. Doing this, even for this relatively small number of vehicles, accounted for half of their S$200 million setup costs. It is clear, therefore, that such universal installation would not have been possible for London. It was inevitable that London would have to rely more heavily on technology that required no special in-car equipment (i.e. ANPR).

However, even if only a small number of vehicles carried tags, their transactions would still cost less to process than for ANPR. So, shouldn't DSRC have been used anyway? Answering this question requires a somewhat laborious inspection of TfL's three-stage technology trials (see [15] and Appendix A), but this will be necessary in order to fully address the purpose of this dissertation.

7.2 The Answer

Let us start by recalling that some ANPR is always required to detect violators of a DSRC system. Additionally, TfL point out that even vehicles carrying DSRC tags would have to undergo ANPR reads in order to (amongst other reasons) match the DSRC transaction to a specific vehicle. If the ANPR and DSRC systems didn't communicate in this way, then both systems would process a charge for that vehicle (resulting in heavier data flow).

But, why isn't this a problem with Singapore's ERP? Crucially, the ERP is able to achieve accurate spatial matching via the optical sensors on the second gantry. So, ANPR reads are directed specifically at only those vehicles that fail CashCard payment. But, why can't the same be done in London? This comes back to a very early statement by TfL that ERP-style gantries (see Figure 6.3b) would be "unacceptably intrusive" in London and so cameras and beacons would have to be mounted at the roadside (see Figure 7.1, below).

Figure 7.1: A less intrusive roadside DSRC gantry proposed for London. (Source: [15])

It is not feasible to use optical detectors on these roadside masts, so camera-based matching (ANPR) is required for every vehicle. This effectively eliminates one of the key advantages of the DSRC system – the ability to remove some ANPR reads from the data stream.

Instead, we saw that TfL addressed this problem (slightly less elegantly) with roadside ANPR processing (which is used only in the Western Extension Zone). So, the only advantage that remains regarding DSRC in London would be higher detection accuracy and therefore the possibility of account-based billing. This is the main reason why TfL sees DSRC as a possible next step in the "evolution" of the London Congestion Charge.

So, with hindsight, what might TfL have done differently? Since ANPR is required to enforce any electronic congestion charging system, it is safe to say that starting with ANPR was the right decision for London.

The problem was with the exact implementation of the system. Only the Western Extension Zone incorporates road-side ANPR processing, which is crucial in London due to the much higher proportion of ANPR reads. To add sure embarrassment to this situation, the new mayor of London, Boris Johnson, announced at the end of 2008 that the Western Extension Zone was to be scrapped. Potentially, this will leave London with an entirely outdated charging system.

8. Conclusions

In this dissertation, we have tried to understand why TfL chose not to implement a DSRC congestion charging system like Singapore's ERP. The decision seemed to come down to two crucial points: London's car population is larger and more unpredictable than Singapore's, and ERP-style gantries were deemed unsuitable for London due to aesthetic reasons. A large, unpredictable car population leads to an inevitably heavy reliance upon ANPR. Roadside gantries don't offer sufficiently precise spatial matching to eliminate ANPR reads during DSRC transactions. Thus, a DSRC implementation can never be as effective in London as in Singapore.

So, London's decision to start with ANPR was not a mistake. Instead, their mistake was perhaps that they chose to process ANPR reads remotely. The resulting heavy loads on data channels have proved to be enormously and unnecessarily expensive. In summary, London's congestion charging scheme can never be as cheap to run as Singapore's, but the good results they have achieved could perhaps have been done at a lower cost.

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Appendix A

Letter from Transport for London

An explanation is provided as to exactly when and how ANPR reads can be eliminated from the data stream:

23rd June 2009

Dear Mr Commin,

Central London Congestion Charging - 3719551/SR

Thank you for your email which we received on 8 June 2009, about the Congestion Charging Scheme.

We can confirm that the two points aren't contradictory. Automatic Number Plate Recognition (ANPR) reads can be eliminated from the data stream depending on where the data processing takes place. In Western Extension Zone (WEZ) it's at the roadside, whereas in central London Congestion Charging Zone, it's sent back via fibre optic cable to the back office.

Should dedicated short range communications be introduced in London at any time in the future, it'd be possible to take ANPR reads out of the data stream by using the same processing system as we use for WEZ.

If you have any questions, please call us on 0845 900 1234, (or Textphone 0207 649 9123 if you have impaired hearing), or contact us via our website www.cclondon.com.

Yours sincerely

Joanne Marsh
Contact Centre Operations Manager
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MAYOR OF LONDON