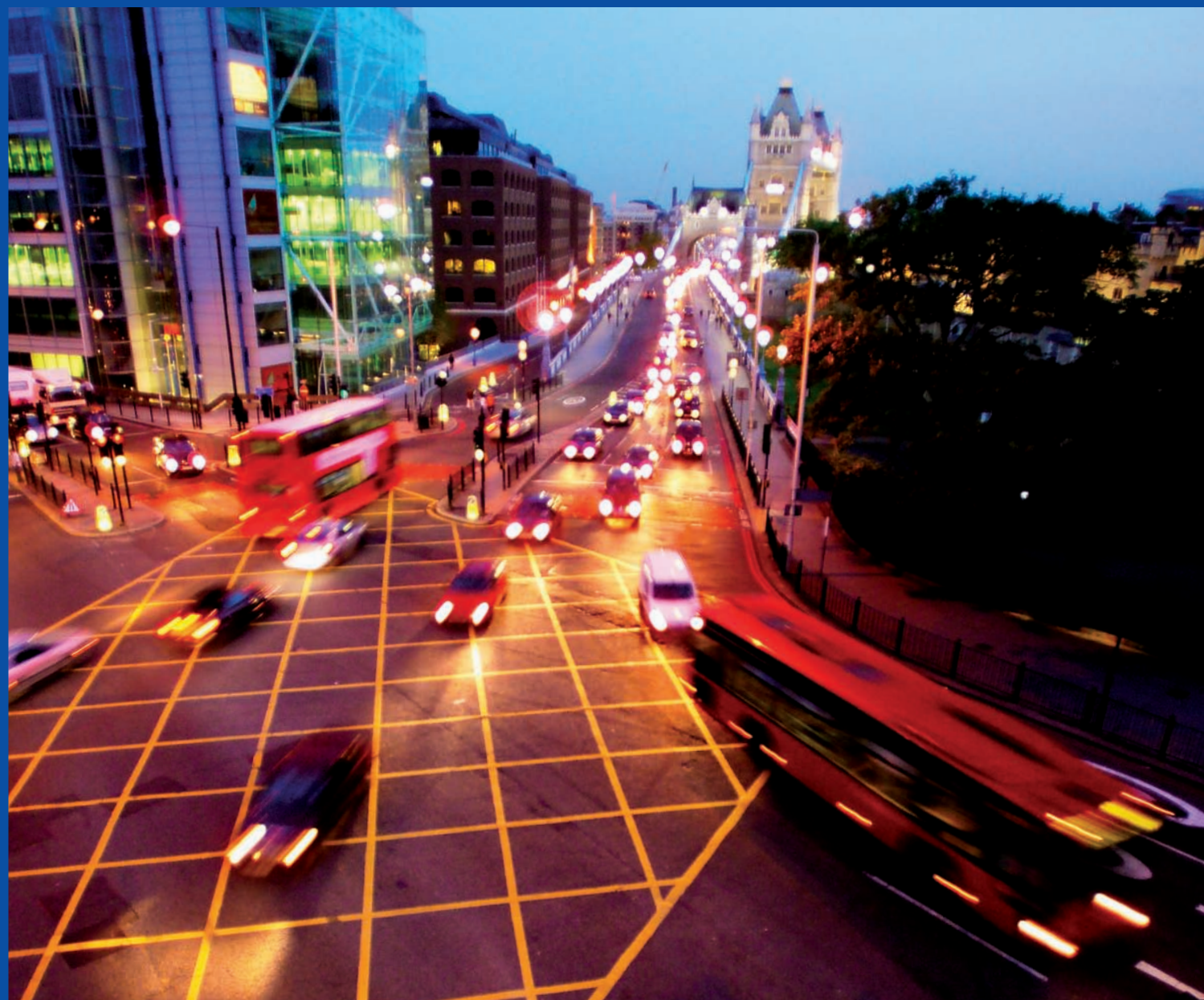


Traffic Enforcement Impact Analysis Second Annual Report – 2007



MAYOR OF LONDON

Transport for London



Contents

1	Introduction and Background	3
1.1	TfL Enforcement Strategies	4
1.2	Measurement Methodology	4
2	Parking Enforcement on the TLRN	10
2.1	Camera Enforcement	11
2.2	On-street Enforcement	12
2.3	Parking Compliance Surveys	13
2.4	CCTV Camera Enforcement Summary	19
2.5	TLRN Traffic Regulations	21
3	Moving-vehicle Offences	23
3.1	LLATA Overview	23
3.2	Box Junctions (LLATA)	24
3.3	Banned Turns (LLATA)	25
3.4	Weight Limit Controls	26
4	Bus Lane Enforcement	27
4.1	Bus-mounted Cameras	27
4.2	Static Roadside Cameras	27
4.3	CCTV Cameras	29
4.4	Other Benefits	30
5	Issues Going Forward	32
5.2	Developing Technologies	35
Appendices		37
Appendix A:	The Value of Compliance	37
Appendix B:	Measuring Compliance	38
Glossary of Abbreviations		39
Contact Details		40
	General Information	40
	Departmental Contacts	40
Document History		41

1 Introduction and Background

Traffic Enforcement (TE) is part of the Transport Policing and Enforcement Directorate (TPED) of Transport for London (TfL). It is the department responsible for traffic enforcement on the Transport for London Road Network (TLRN), often referred to as the Red Route, which comprises 580km of London's most important roads. Traffic Enforcement contributes directly to TfL's vision of **'a world class transport system that delivers the safe, reliable and efficient movement of people and goods that enhances London's economy, environment and social inclusion'**.

This is the second in a series of annual reports describing the impact of enforcing traffic regulations on the TLRN.

In June 2006 TfL published the first annual report "*Impact Assessment and Future Strategies*". This described the impact of enforcing traffic controls on the TLRN from 1997 - the introduction of bus lane enforcement, to March 2006 - including the addition of moving vehicle contraventions (such as yellow box junctions and banned turns) and stopping and parking enforcement on the Red Route.

The main focus of that document was on the impact of bus lane enforcement, since this was the main enforcement operation during the period that the report covered. It included the results of a pilot study on the enforcement of moving-vehicle regulations and the growth of the campaign up to March 2006. It also described the introduction of stopping and parking enforcement and showed that as bus lane enforcement matured resources were available for redeployment to moving-vehicle and parking enforcement.

This second report, "*Traffic Enforcement Impact Analysis, Second Annual Report*" extends the assessment of the impact based on monitoring and enforcement data up to March 2007. It assesses the trend in compliance as bus lane enforcement matures and the new campaigns develop. Also included are updates on the introduction of emerging technologies and systems proposed in the last report such as the portable enforcement camera, the vehicle mounted camera systems and establishing a London-wide removal service.

1.1 TfL Enforcement Strategies

1.1.1 TPED Strategic Goals

TfL's vision will be achieved by pursuing the following strategic goals:

- Prevent unwanted behaviour affecting TfL's transport system and the communities we serve;
- Improve public confidence in transport policing and enforcement services and through this London's transport system;
- Enable our staff and our partners to deliver excellence.

1.1.2 Traffic Enforcement Objectives

The strategic goals are the drivers of the following business objectives:

- Achieve high levels of compliance with traffic and parking controls on the TLRN
- Enable more reliable journeys
- Improve public confidence and support for traffic and parking enforcement
- Strengthen our joint work with internal stakeholders, the Police, local authorities, transport providers and other partners
- Attract, motivate, and develop our people, making TPED an employer of choice

1.2 Measurement Methodology

Given the long history of monitoring the enforcement of bus lanes, by far the largest volume of data available for analysis relates to bus lanes. Changes to the monitoring programme over the last year, means that resources are mostly focussed on parking and moving traffic contraventions. Most monitoring data is gathered using the TfL camera network (including bus-mounted cameras), on-street surveys of parking behaviour and public perception research.

Compliance with regulations, a key objective, is the absence of contraventions. A measure of something not occurring is difficult in any circumstance, however good proxies are being used to report and measure compliance. The three principal methods are:

- Compliance rates
- Incidents per flow
- Contraventions detected per hour

Depending upon the context, one or other, or a combination, of these measures can be used to determine the effectiveness of the enforcement activity.

1.2.1 Compliance Rates

Quantifying compliance is essentially an attempt to measure something that does not happen – ie, how many contraventions did not occur. For the purposes of determining the effectiveness of enforcement, TE has developed an assessment process that allows comparison between sites and over time.

Occupancy rates are calculated using data collected by surveyors who observe traffic behaviour on the street. A selection of key TLRN sites is surveyed every quarter and information is collected on parking activity at each survey site, including arrival times, duration of stay and activities which may be permitted such as loading or 'Blue Badge' parking. These observations are used in a formula that produces an occupancy rate. This rate, expressed as a percentage, represents the amount of kerbspace-time being used illegally and its converse is therefore a compliance measure.

The methodology is illustrated in Appendix B.

1.2.2 Incidents per Flow

This is measured using camera based monitoring surveys. Each site is surveyed for 12 hours with traffic flow and incidents recorded in 10-minute blocks throughout the period. The number of incidents and the traffic flow are combined to produce the measure. It is primarily used to measure compliance with yellow box junction and banned turn regulations but has also been used on an ad-hoc basis to monitor changes in bus lane compliance.

1.2.3 Contraventions per Hour

The distribution of PCNs by location and by time period can be derived from the enforcement recordings and processing information. For camera enforcement, sufficient details are available to be able to pinpoint any incident by date, time and site reference. On-street enforcement does not retain the same level of detail but summaries are available on an ad-hoc basis.

Bus-mounted cameras and on-street personnel are highly visible means of enforcement and this has a deterrent effect resulting in significantly fewer PCNs per hour of enforcement activity than other types of enforcement. CCTV systems are under direct operator control and can observe several sites within their range of pan and zoom capability. Certain installations allow CCTV cameras to observe more than one Red Route site simultaneously, potentially giving a higher number of contraventions per hour of enforcement activity.

The following table illustrates the relative 'productivity' of the different modes of traffic enforcement, measured in terms of numbers of Penalty Charge Notices issued per hour of enforcement activity. These figures have been updated to March 2007, and show the average numbers of incidents captured by enforcement

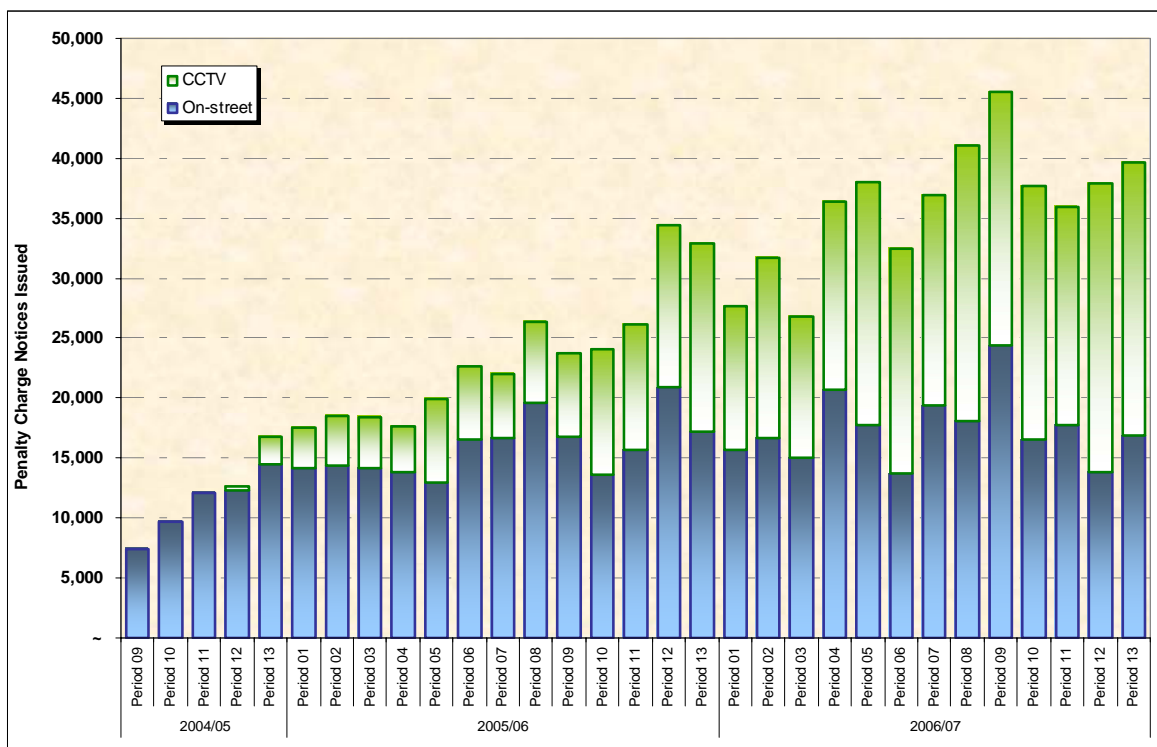
officers per hour of duty. Typically, 90% of identified incidents will become issued PCNs.

Enforcement type	Incidents per hour March 2007
Street patrols – Red Route regulations	0.5
CCTV – Red Route regulations	11.6
CCTV – Moving-vehicle regulations	11.7
CCTV – Bus lanes	6.1
Roadside cameras – Bus lanes	9.9
Bus-mounted cameras	0.1

1.2.4 Enforcement Trends

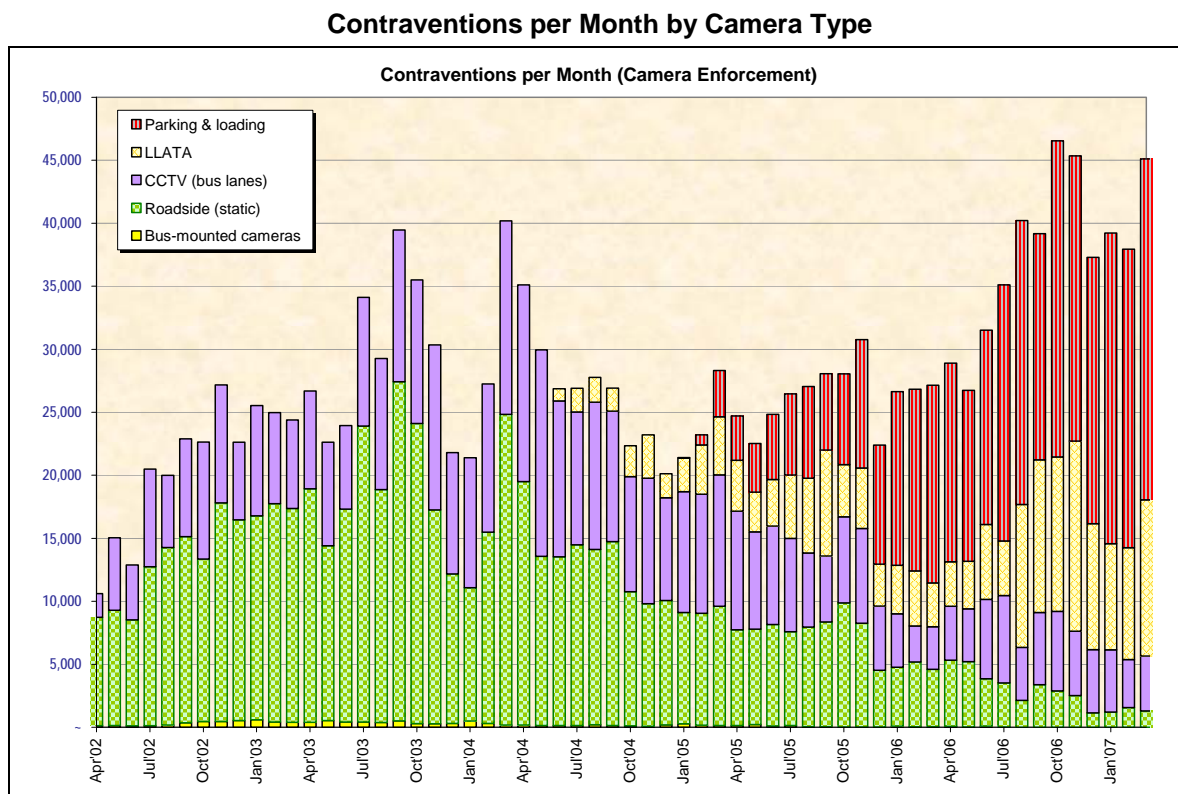
The following graph illustrates the numbers of PCNs issued by on-street and camera enforcement teams. On-street enforcement has a higher deterrence effect and the trend has levelled off, albeit with significant variations in each period. The trend in camera enforcement is still increasing, reflecting the ability to switch enforcement activities to the areas of greatest need.

Penalty Charge Notices issued



1.2.5 Operational Emphasis, Camera Enforcement

The following graph illustrates the changing proportions of contraventions identified by the different camera enforcement modes.



The profile shows the way in which the numbers of contraventions recorded by each camera mode first increases and then declines. Points to note are:

- The roadside (static) cameras have become a mature enforcement tool with their impact evolving from capturing contraventions to deterring them;
- The CCTV enforcement of bus lanes is also heading towards a degree of maturity, but seems to have a lower level of deterrence;
- YBJ and banned turns initially took up the slack in the maturing CCTV enforcement but more recently have developed a growth of their own;
- Red Route contraventions are growing in number, representing an early stage in the enforcement cycle during which resources are still being added and compliance has yet to be achieved.

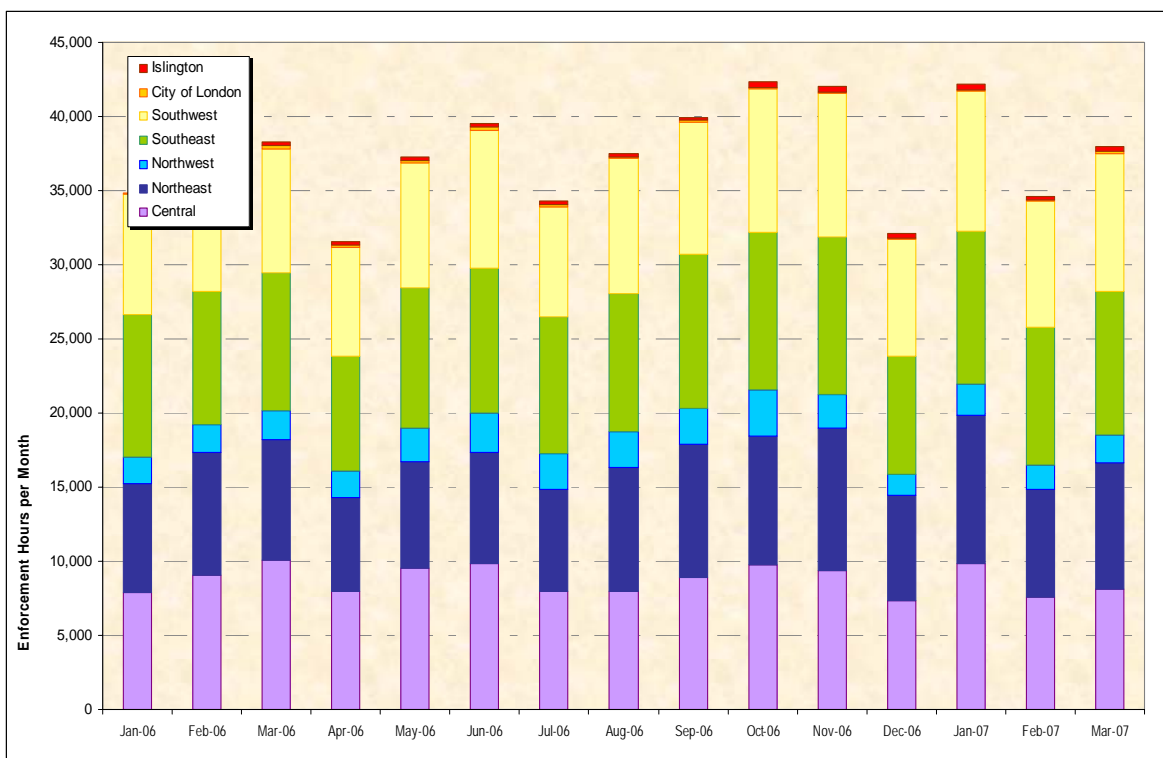
The graph does not illustrate the early years of camera enforcement, 1998 to 2001, when the bus-mounted cameras were responsible for identifying a significantly larger proportion of contraventions. Bus-mounted cameras have attained a strong deterrent status with the widespread knowledge that any one of London's 8,000 buses could, potentially, be carrying an enforcement camera.

1.2.6 Operational Emphasis, On-street Enforcement

The following graph illustrates the geographical distribution of the on-street enforcement activities, in terms of the hours recorded for each enforcement area.

The areas are Central, North-east, North-west, South-east and South-west which are managed through the Metropolitan Police Service, plus Islington and the City of London where special service agreements have been established.

On-street Enforcement, Enforcement Hours per Month



1.2.7 Managing the Enforcement Mix

An enforcement mix occurs when an area of road is subject to simultaneous enforcement by both camera observation and foot patrols. Each of these activities has an impact on the effectiveness of the other. In general, the presence of a uniformed enforcement officer on the street has the effect of deterring potential offenders. An ability to predict the effects of changes in the enforcement mix would mean that the enforcement resources could be deployed to achieve compliance targets and thereby maximise the benefits of enforcement. This ability would also allow future resourcing requirements to be estimated more accurately.

A series of reports has been commissioned from the Technical University of Berlin with the purpose of evaluating the parking enforcement mix. The third report contains in-depth methodology and formulae, which can be used to determine a theoretical compliance value for a known combination of camera enforcement and foot patrols. The research into the enforcement mix was commissioned to enable enforcement managers to deploy the level of enforcement necessary to achieve the required compliance at a specific site. In principle, the use of the formula allows the dynamic assignment of camera and foot patrols to achieve desired compliance levels, with compliance in this instance being a measure of the number of contraventions that is deemed to be acceptable at any given location.

The formula has at its core the following key assumptions:

- It is drivers' awareness of the enforcement system that is crucial for maintaining compliance.
- The visibility of enforcement is most obviously represented by the presence of on-street personnel such as Traffic Wardens or TPSCOs.
- Cameras are relatively inconspicuous. Moreover, there are so many cameras installed (for different purposes) that the deterrence effect caused by their visibility tends towards nil.

For the formula to be a viable enforcement management tool these assumptions must be challenged and the formula validated in practice.

TfL has the resources and scale of operation that would allow a suitable pilot study to be undertaken. The TLRN offers locations where both on-street and camera enforcement can be applied under known conditions, and the outcomes measured with sufficient accuracy. It may be necessary to explore further the assumptions made in the formula, in particular to verify how the compliance forecasts might be affected by variations in traffic flows or road frontage activities. Finally, the results of the pilot study could be submitted for appraisal in the wider enforcement community, demonstrating TfL's pioneering work and offering guidelines for others to follow.

2 Parking Enforcement on the TLRN

Transport for London is responsible for the management of the TLRN, often referred to as the red route, which comprises 580km of London's roads. This represents 5% of London roads yet carries 35% of London's traffic; in traffic management terms therefore, it is imperative that these routes are kept clear of obstructions to moving traffic.

Enforcement of parking regulations on the TLRN had previously been the responsibility of the Metropolitan Police Service (MPS). Contravening these regulations would earn a driver a 'fixed penalty fine'. However, the enforcement was limited due to the demand for the MPS resources for other policing operations. In order to address the lack of resources, parking enforcement was decriminalised and enforcement responsibility passed to TfL.

In November 2004, TfL established an on-street presence through a Special Services Agreement with the Metropolitan Police Service, which provides Traffic Wardens and Transport Police Community Support Officers to enforce the TLRN. In February 2005, TfL started camera enforcement of TLRN parking and stopping regulations through the Traffic Enforcement Camera Operations. These two enforcement methodologies are described in more detail in the following sections.

In order for a red route site to be enforced it must comply with the regulations in terms of clearly visible signage and road markings. TfL has a dedicated maintenance team to ensure that the Red Route is enforceable. In 2004 only about 80% of the red route was enforceable. This increased to 96% by March 2007.

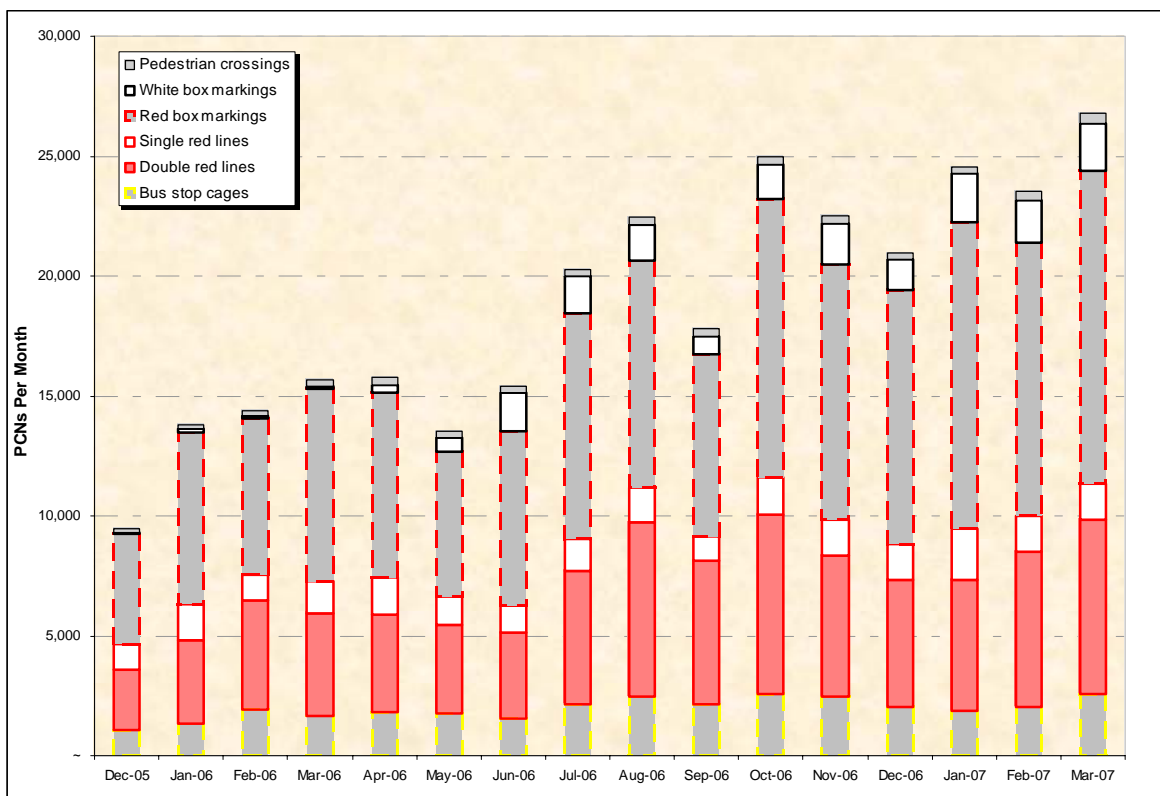
2.1 Camera Enforcement

Camera enforcement of Red Route controls utilises three camera modes. CCTV had been long established for bus lane enforcement; it was extended to cover Red Route controls in February 2005. The Portable Enforcement Camera (PEC) was introduced in July 2006, and the Vehicle Mounted Camera (VMC) was first deployed in August 2006. (PEC and VMC are described in detail later in this document).

2.1.1 PCNs Issued

From December 2005 to March 2007 inclusive 301,774 PCNs were issued across the TLRN as a result of camera enforcement of parking regulations. The enforcement data show that parking and loading box infringements represented over 50% of all the observed contraventions, whereas single and double red lines together amounted to some 35%.

Red Route Contraventions by Location Type



2.2 On-street Enforcement

2.2.1 Background to On-street Enforcement

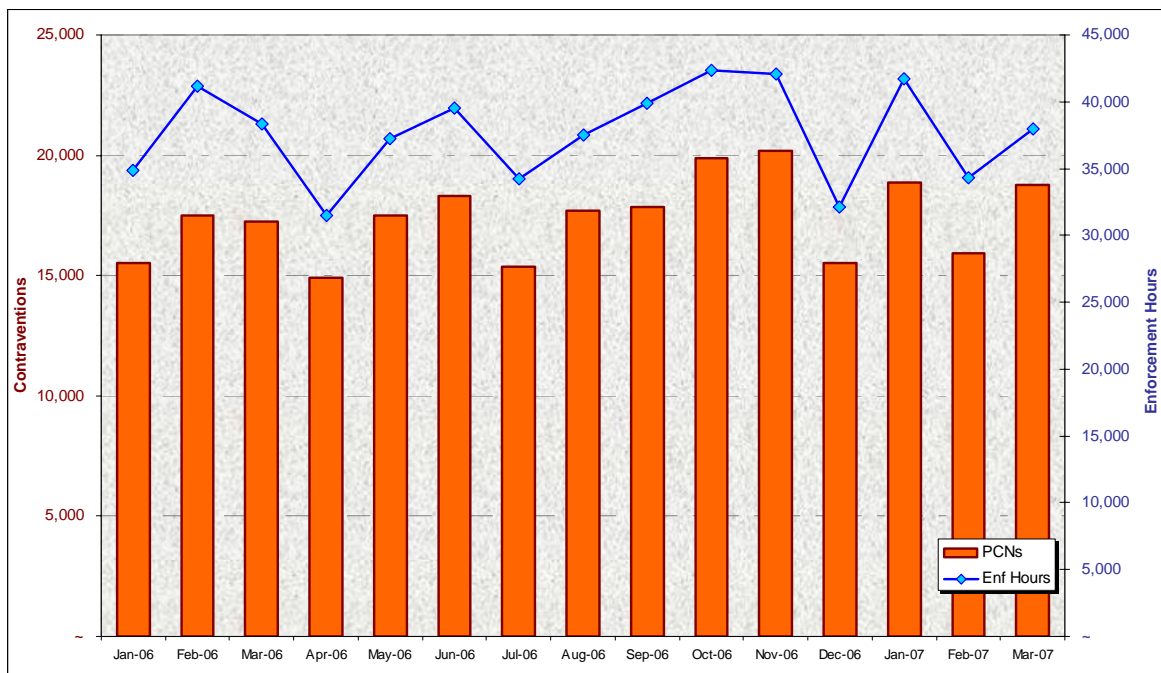
Since decriminalisation of the TLRN, the Metropolitan Police Service (MPS) has been enforcing traffic regulations on the TLRN under a special service agreement with TfL, using Traffic Wardens and Transport Police Community Support Officers (TWs, TPCSOs). These enforcement measures have brought increased compliance with parking restrictions and led to improved traffic flows and reduced congestion.

2.2.2 On-street Enforcement Activity

During the financial year 2006/07, the on-street enforcement patrols accumulated a total of 450,400 hours and issued some 210,700 PCNs. The graph below superimposes the on-street activity onto the total number of PCNs issued, and illustrates that there is a high degree of correlation between the enforcement presence and the number of PCNs issued. This relationship is attributed to the deterrent effect of a uniformed foot patrol on-street, and is discussed later in this document.

There is, of course, no statistical method for calculating the number of law-abiding drivers who would have liked to have parked but who were dissuaded by the controls themselves.

On-street Enforcement Activity Summary



2.3 Parking Compliance Surveys

Parking compliance surveys are carried out on a regular cycle, by two principal methods:

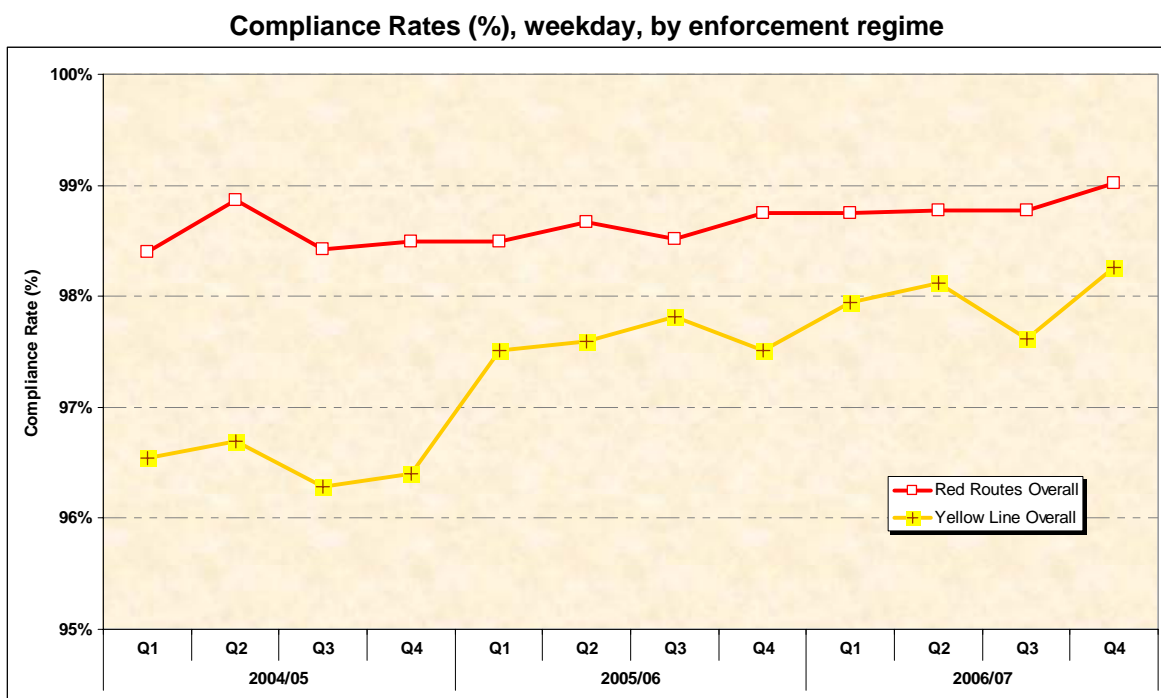
- Firstly, there are on-street quarterly surveys of key TLRN (red route) sites, used to indicate trends in parking behaviour and compliance.
- Secondly, the observations of a mobile traffic patrol, which records the number of red line contraventions per mile as observed on a representative sample of the TLRN.

The two methods are described in more detail in the following sections.

2.3.1 Quarterly Parking Surveys

Parking surveys have been conducted by a third-party contractor every quarter since April 2004. These surveys have consistently shown that there is already a high level of compliance across the network. However, these overall figures do mask a number of particular sites or times of day where further improvements in compliance are needed.

The compliance rate is derived from the number of illegal parking actions and their average duration, compared with the theoretical capacity of the kerb space to accommodate parked vehicles. It is the inverse of the illegal occupancy rate. The following graph illustrates the variations in compliance over the life of the compliance surveys to date. The Red Route shows a consistent growth in compliance, reaching 99% in 2006/07 Q4. The yellow line sites also demonstrate that compliance across London generally is still improving.



Illegal Parking Activity

The tables below show a summary of the latest observations in comparison with those of one year earlier. The tables give overviews for retail sites, residential sites and bus lane sites, where the site type is defined by the principal frontage activity

Overall, the number of Red Route contraventions has dropped but there has been a smaller increase in the average duration of the illegal parking. The combined occupancy rate, which is a measure of non-compliance, has dropped by some 17% on the Red Routes.

Illegal Parking Duration			
Times are shown in mm:ss	Q8: Jan/Feb '06	Q12: Jan/Feb '07	Change
Red Route all sites	08:46	10:36	21%
Red Route retail sites	11:06	13:19	20%
Red Route residential sites	07:59	08:32	7%
Red Route bus lane sites	07:17	09:26	30%
Borough bus lane sites	10:15	06:59	(32%)

The average duration is derived from 12-hr observations of the sites. The duration quoted is the total duration of illegal activity divided by the number of vehicles observed.

Illegal Parking Acts			
	Q8: Jan/Feb '06	Q12: Jan/Feb '07	Change
Red Route all sites	2,638	1,708	(35%)
Red Route retail sites	856	649	(24%)
Red Route residential sites	899	469	(48%)
Red Route bus lane sites	883	590	(33%)
Borough bus lane sites	625	612	(2%)

The number of illegal parking acts is derived from 12-hr observations of the sites and is a count of the individual vehicles seen to be parking in contravention of the traffic regulations.

Combined Occupancy Rates			
	Q8: Jan/Feb '06	Q12: Jan/Feb '07	Change
Red Route all sites	1.20%	1.00%	(17%)
Red Route retail sites	1.20%	1.10%	(8%)
Red Route residential sites	1.20%	0.90%	(25%)
Red Route bus lane sites	1.30%	0.90%	(31%)
Borough bus lane sites	1.50%	1.00%	(33%)

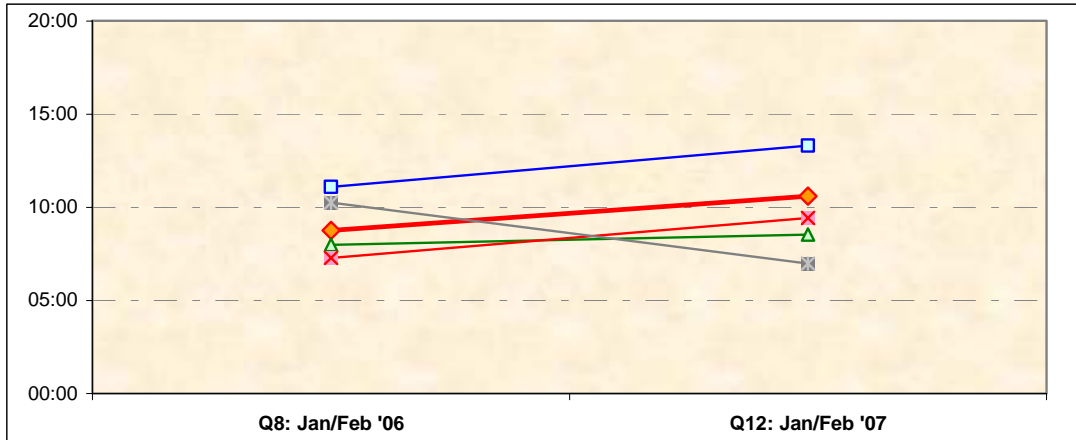
The combined occupancy rate is derived from the number of illegal actions and their average duration. The occupancy rate is effectively that proportion of the observation period when the kerb space was occupied illegally.

These observations are illustrated in graphical form overleaf

Illegal Parking Activity – year-on-year comparisons

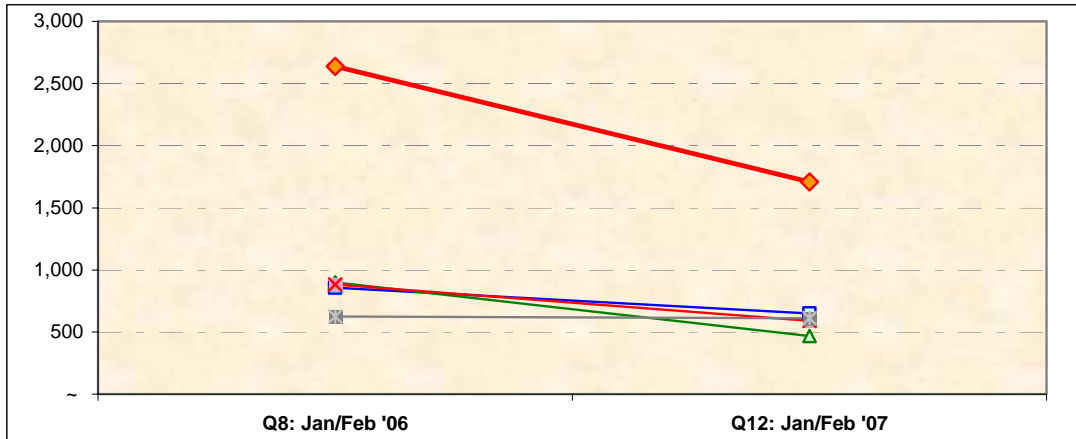
Illegal Parking Duration

Times are shown in mm:ss

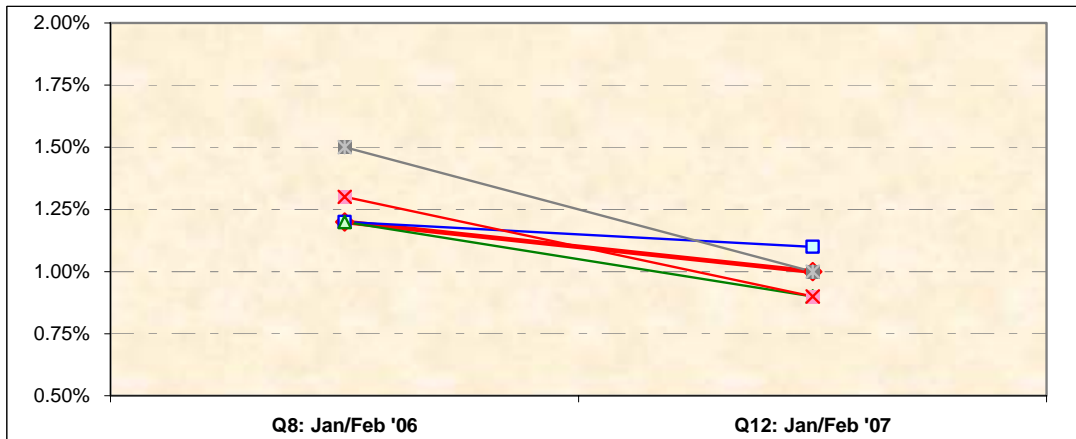


Illegal Parking Acts

12-hr observations at selected sites



Combined Occupancy Rates



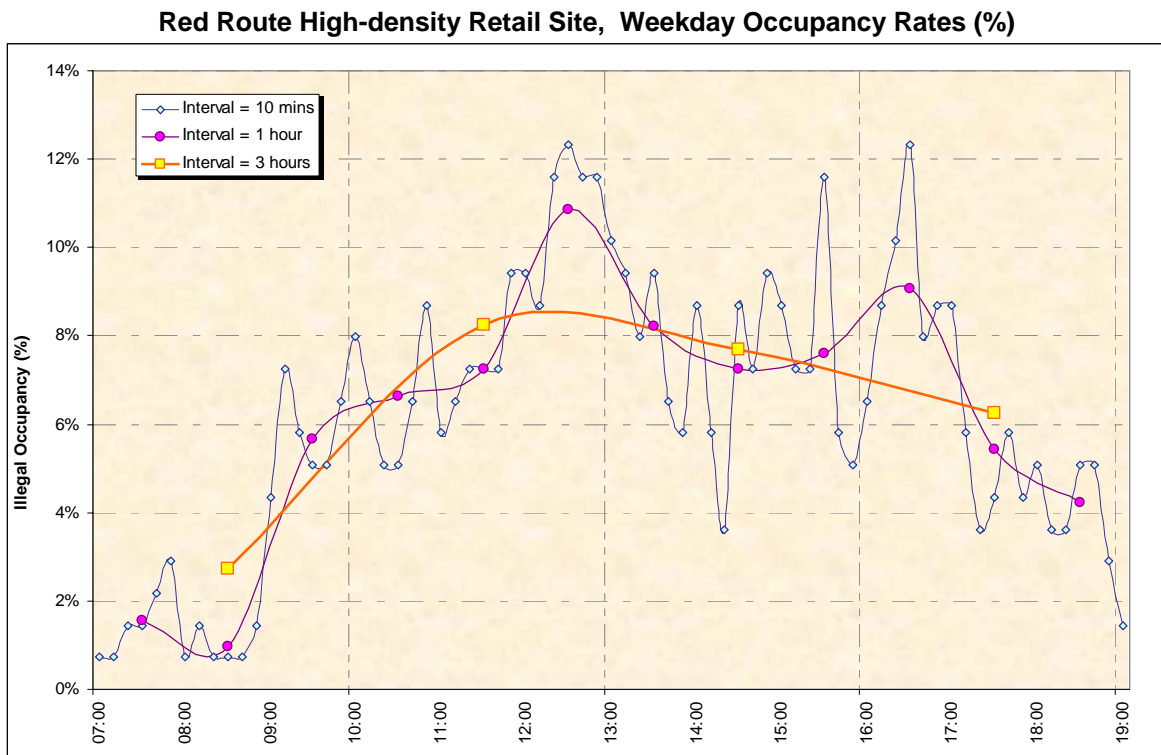
- ◆ Red Route all sites
 □ Red Route retail sites
△ Red Route residential sites
- × Red Route bus lane sites
 ■ Borough bus lane sites

Daily Occupancy Profile

The compliance surveys record illegal parking activity over a period of 12 hours at each site. The data include the start and finish times of each parking act, together with an indication of whether or not it is permitted by the controls. The observation period is 07:00 to 19:00, and covers the morning and evening peak travel times as well as the inter-peak period. Each site includes a variety of red route controls. Taken as a whole, the 12-hour data shows a high level of compliance, but this may mask particular times of day or certain locations where compliance is much lower.

This is illustrated by the example of Upper Richmond Road, which is classified as a high-density retail frontage. An analysis of the data for Qtr 12 (Jan & Feb 2007) indicates an occupancy rate of some 4% when the 12-hour survey period is considered as a whole. This equates to a compliance rate of 96%.

The graph below illustrates how the occupancy rate varies during a typical 12-hour survey, with profiles given for counting intervals of 10 minutes, 1 hour and 3 hours. A more detailed examination of the survey records shows that illegal occupancy ranges between 1% during most of the morning peak and 12% at both 12:30 and 16:30. These variations in driver behaviour are not apparent when the whole 12-hour period is considered as a whole.



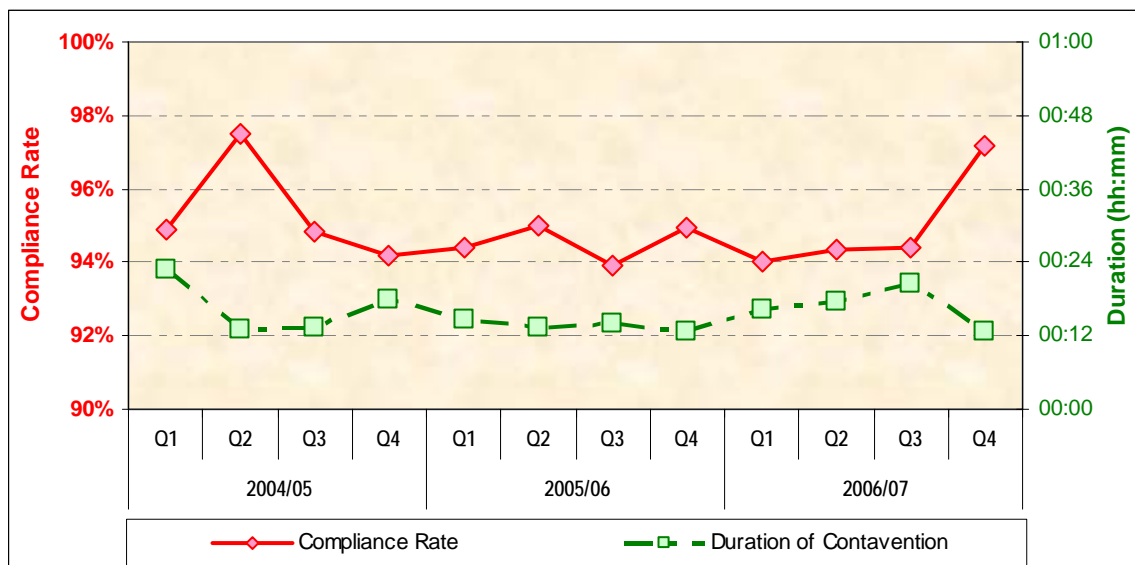
These observations can be fed back into the enforcement process in order to give a more efficient deployment of resources.

2.3.2 Enforcement and Compliance

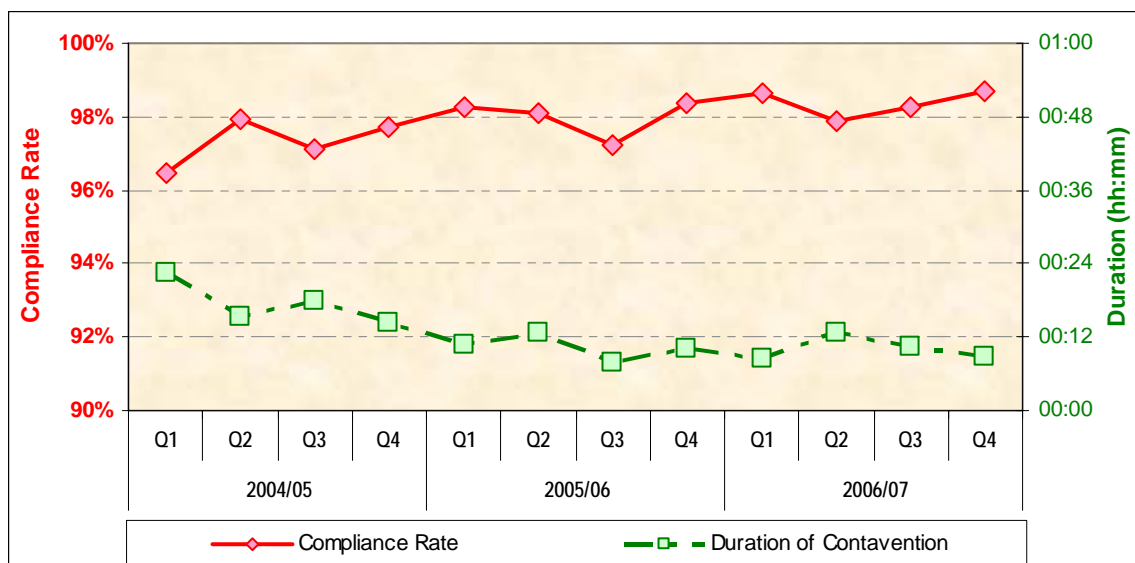
The following graphs illustrate two of the frontage types used in the quarterly compliance surveys. In each case, they show a comparison between the compliance rate and the average duration of contravention.

At the retail site, there is some correlation between the compliance and the average duration of contraventions, in that a shorter duration is reflected in a higher level of compliance. The residential site shows a higher level of compliance than the retail site, again with the inverse correlation to the average duration.

Red Route high-density retail site in inner London

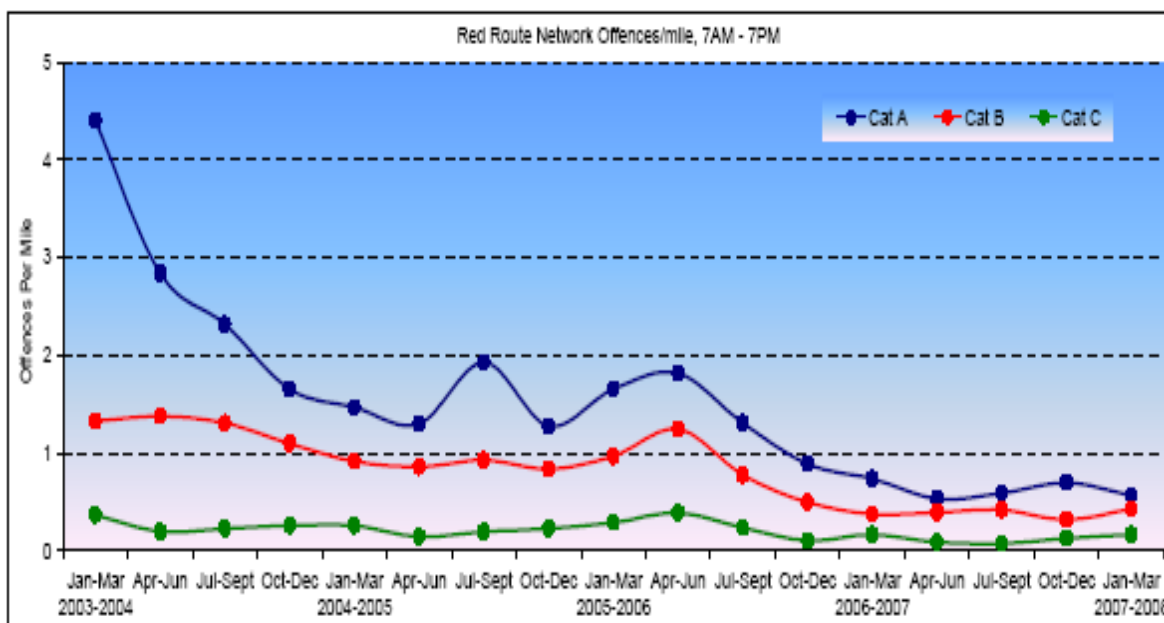


Red Route residential site in inner London



2.3.3 Traffic Warden Monitoring Surveys

Data are compiled from the observations of a mobile traffic patrol, which records the number of red line offences observed per mile, on a real-time basis, on a representative sample of the TLRN. A service level agreement between the MPS and the Traffic Director for London set a target of 1.2 offences per mile. This target has been carried forward into current operations. The graph below indicates how this target is being achieved, from January 2003/04 to March 2007.



The graph shows the downward trend in the number of red line parking offences observed by traffic wardens over a 12 hour period. The categories A, B and C classify stretches of highway according to the priority given to them by traffic wardens - stretches of road most likely to be congested (category A) are given the highest priority and visited most frequently; category C roads are the least likely to be congested and therefore receive a lower level of enforcement.

2.3.4 Level of compliance on TOCU corridors and the TLRN

There has been a significant improvement year on year in the number of red line offences observed per mile of Red Route, from 0.74 to 0.57 year on year. Offences during the 07:00-10:00 and 16:00-19:00 periods have also decreased. These are the lowest overall number of offences per mile recorded since the TOCU started and indicate a positive reflection of the impact of civil enforcement. However, for the full performance year, PCNs issued are up by 10%.

Note that this survey measures only those offences which are observed on single and double red lines. In particular, it does not include parking and loading box contraventions; in 2006, red line offences amounted to some 35% of all red route contraventions.

2.4 CCTV Camera Enforcement Summary

2.4.1 General Trends

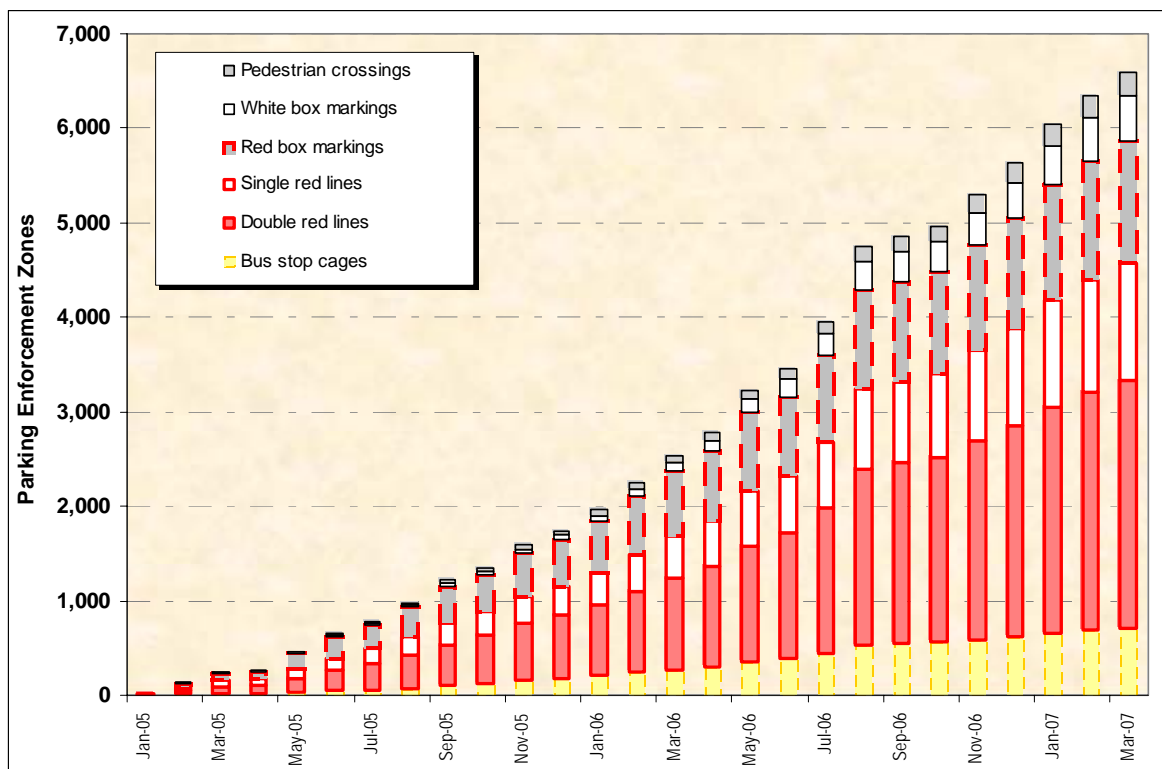
The TLRN is divided into parking enforcement zones (PEZ), which are individual parking controls, such as loading bays, parking boxes or street locations. The PEZs are given individual identification numbers, cross-referencing them to a database that records the location characteristics of each PEZ.

The camera deployment strategy is determined by the use of an enforcement demand model (EDM), which is used to prioritise the PEZs depending on their strategic position in the network. PEZs in locations where illegal parking is most likely to have a detrimental effect on traffic flow are given the highest priority.

The PEZs are monitored twenty-four hours a day, 7 days a week, from a secure control room by qualified enforcement officers utilising Traffic Enforcement's network of over 350 CCTV cameras. The image of any vehicle observed contravening the regulations is captured on to recording media, together with the other details necessary to demonstrate a contravention. These are compiled and the details sent electronically to the notice processing agent.

The graph below illustrates the growth in the number of locations where camera enforcement can be undertaken.

Red Route Enforcement Locations, by control type



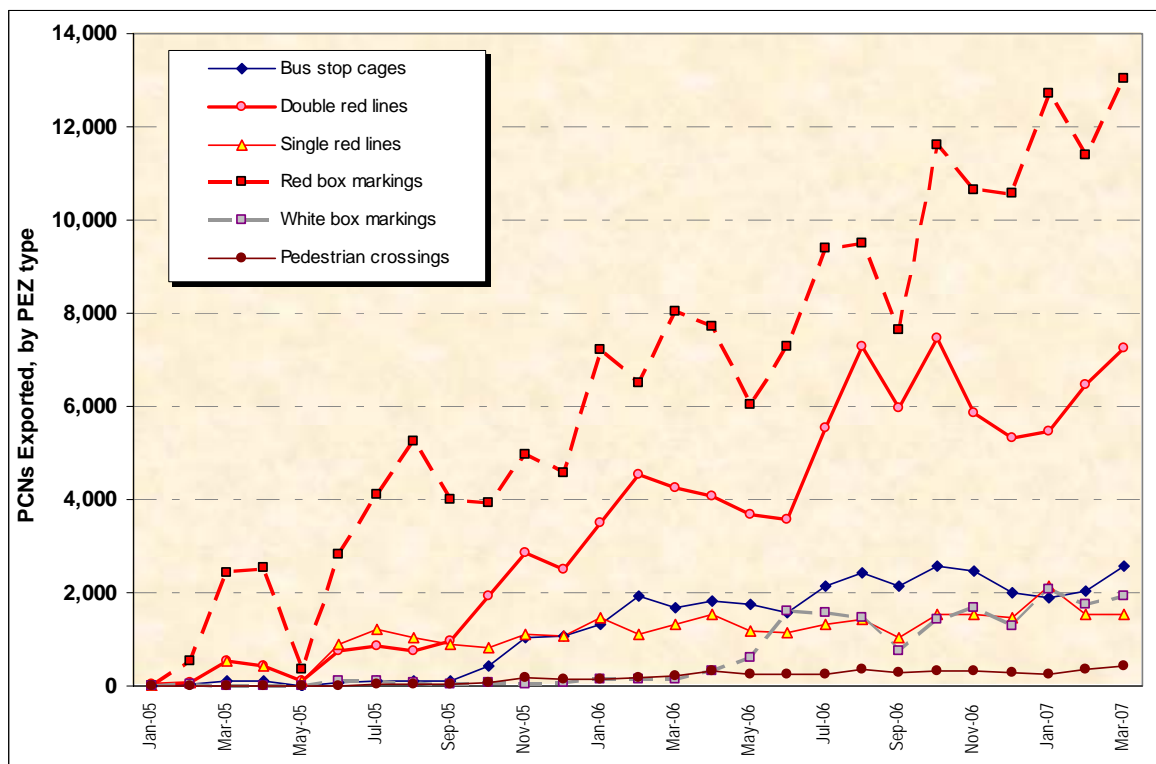
2.4.2 Contraventions identified, by Red Route control type

CCTV parking enforcement started in February 2005 and enforcement had taken place at a total of 6,615 Parking Enforcement Zones (PEZs) by March 2007. PEZs are individual Red Route parking controls, such as loading bays or parking boxes, and correspond to schedule entries in the appropriate Traffic Management Order. These sites came on-stream at various dates during the period.

The camera enforcement data include a breakdown of Penalty Charge Notices issued by PEZ type. The graph below shows the number of PCNs issued by camera enforcement and should be compared with that for the total PEZs identified, as shown above. The parallel trends of the two graphs suggest that the increase in PCNs is due to increased enforcement activity.

Red box markings and double red lines are leading the growth in the number of PCNs issued through the camera enforcement process.

Camera Enforcement: Contraventions identified, by Red Route control type



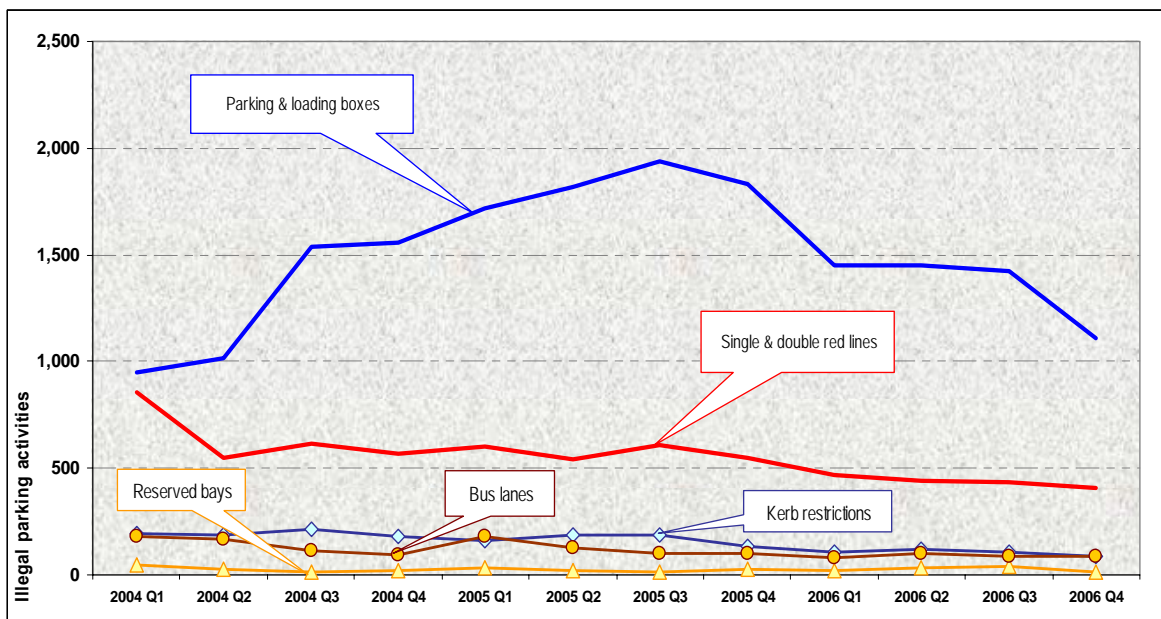
2.5 TLRN Traffic Regulations

2.5.1 Overview

Research¹ has shown that over 75% of drivers interviewed believe the TLRN regulations are simply 'no stopping' or 'no parking' at all. Only 25% were able to name an exception and only 2% were aware of all of the specific rules and exceptions. Conversely, misinterpretation or lack of understanding was greatest for loading, unloading, disabled sign and the parking limit signs.

The monitoring compliance surveys indicate that the amount of illegal parking on single and double red lines has largely stabilised, as shown in the graph below. However, the illegal use of parking and loading bays continued to rise long after the enforcement had taken effect elsewhere. Taken with the research findings earlier and enforcement data, it is clear that compliance problems are greatest in parking and loading bays.

Illegal Parking Activity, by type of control



The surveys show consistently low levels of contraventions in bus lanes and reserved bays (those for doctors, residents, taxis and blue badge holders), and for general kerb restrictions such as accesses, dropped kerbs, keep clear markings, pedestrian crossings and zigzags.

¹ Synovate, November 2005, Red Route Signs Research.

2.5.2 Red Route Review



As with all highway networks, the TLRN is a dynamic entity. When the Traffic Director for London's Red Route Network was implemented in the early 1990s, considerable effort was expended to balance the needs of road users, residents and local businesses. After the formation of TfL, the Red Route Network formed the basis of the TLRN (commonly called the red route). However, road layouts evolve, traffic regulations are amended and frontage characteristics change. Consequently, the red route regulations need to be revisited periodically, to ensure that the maximum benefits for all road users can be maintained. A Red Route Enforcement Forum has been established, which brings together representatives of road user groups as stakeholders in the review process.

It was anticipated that when parking enforcement was decriminalised in November 2004, allowing TfL greater involvement in enforcement and enabling the use of enforcement cameras, this would result in the identification of areas where the existing controls had become outmoded. For this reason it was planned to undertake a review of the controls as soon as the decriminalised system had settled down.

This review was undertaken to capture the learning from TfL's direct involvement in enforcement and to canvass the views of stakeholders through the Red Route Enforcement Forum. The forum brings together a range of stakeholders with an interest in the network and has met several times during the year. Each session showcases a particular area of interest to enable both TfL and the other stakeholders to better understand the issues.

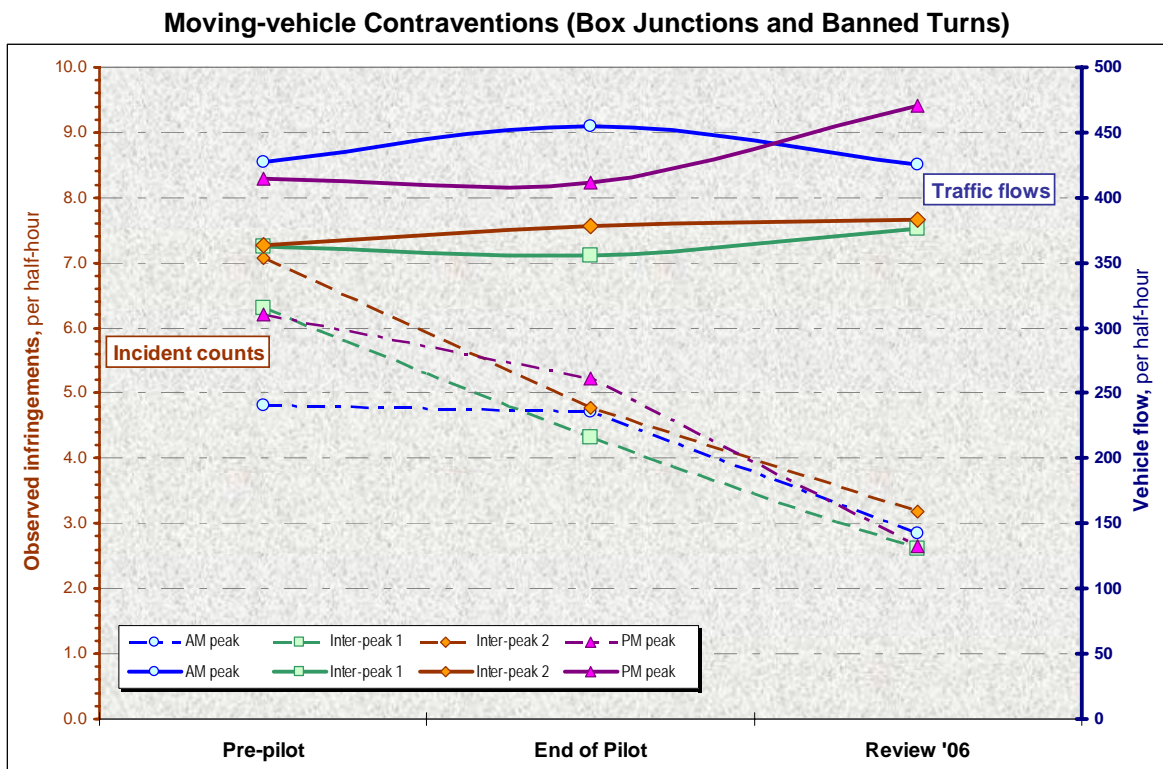
The review did not look at detailed parking controls at a particular location, but at how the controls are perceived by stakeholders. The final report was presented to the forum and issued to TfL's Director of Road Network Development for incorporation in the Network Management Plan Project, to inform its development.

3 Moving-vehicle Offences

In June 2004 TfL and six London boroughs assumed powers under the London Local Authorities and TfL Act 2003 (LLATA) and piloted a decriminalised enforcement of certain moving vehicle contraventions. The contraventions include stopping in a yellow box junction, banned turns, and driving the wrong way down a one-way street.

3.1 LLATA Overview

The graph below shows the results of Yellow Box Junction (YBJ) and Banned Turn (BT) enforcement since the original pilot study was carried out. There have been three specific studies of moving-vehicle contraventions to assess the impact of ongoing enforcement; these are prior to the pilot, at the end of the pilot (Nov'04), and 30 months after the completion of the pilot (Nov'06).



A comparison of the sites that were used in all three studies shows a drop in the average observed incidents per hour from 12.8 (Pre Pilot), through 9.8 (End of Pilot), to 6.3 (Nov'06). In generalised terms, this represents a drop of 51% in the rate of offences relative to traffic flows.

3.2 Box Junctions (LLATA)

The wide scale enforcement of yellow box junctions began in August 2005. A total of 180 incidents were recorded during that month. By comparison, a total of 7,554 contraventions were recorded in August 2006. A total of 137 YBJ sites had been identified and enforced by the end of March 2007.

During the final month covered by this document, March 2007, a total of 28 sites were recorded on 31 days, producing 5,368 observed incidents. Of these, 5,092 (95%) were exported for issue as PCNs. There were 303 repeat offences, defined as being when an individual vehicle receives more than 1 PCN during the current calendar month. The maximum number of incidents at any one site was 1,434 at the junction of East India Dock Road and Crisp Street.

In comparison with March 2006, the rate of PCNs per hour of enforcement has fallen from 2.2 to 1.7, which indicates an improvement in compliance of some 33%.

Traffic Impact

A correlation analysis was undertaken to explore the relationship between the flow of vehicles and the number of contraventions at yellow box junctions. A series of 100 correlation tests were carried out at 12 yellow box junctions subject to CCTV enforcement using a 10-minute count interval. In this type of test, a high value of negative correlation would suggest that the number of contraventions might be impeding the traffic flow.

The analysis showed that for about half the tests there was no significant correlation between the traffic flow and the contravention count. At most of the other sites the correlation was positive, indicating that as the flow increased so did the number of contraventions. There was only one test where the negative correlation exceeded a value of 10% but this is not statistically significant.

Sensitivity tests were undertaken to assess the effect of varying the count period. This ranged from a 30 minute interval to one which matched the traffic count periods to the timing of the traffic signals at that junction. This latter time interval most closely resembles a driver's on-street experience. It was found that the shorter the count period the higher the positive correlation between flows and counts.

Overall, these results indicate that the level of contraventions at these junctions has been reduced to below the level where it would significantly impede traffic flows.

3.3 Banned Turns (LLATA)

Apart from 1 proving site used in Oct'05 to Jan'06, the wide scale enforcement of banned turns began in September 2006. A total of 50 sites had been enforced by the end of March 2007.

During March 2007, a total of 27 sites were recorded on 29 days, producing 7,777 observed incidents. Of these, 7,109 (91%) were exported for issue as PCNs. There were 2,222 repeat offences, defined as being when an individual vehicle receives more than 1 PCN during the current calendar month. The maximum number of incidents at any one site was 2,990 at Whitechapel Road E1.

The intensive enforcement of banned turns did not start until September 2006, so it is not possible to make a year-on-year comparison. However, the PCNs per hour rate of 2.1 in April 2007 compares favourably with that of 2.7 in September 2006. This indicates an improvement in compliance of some 32% over the 7-month period.

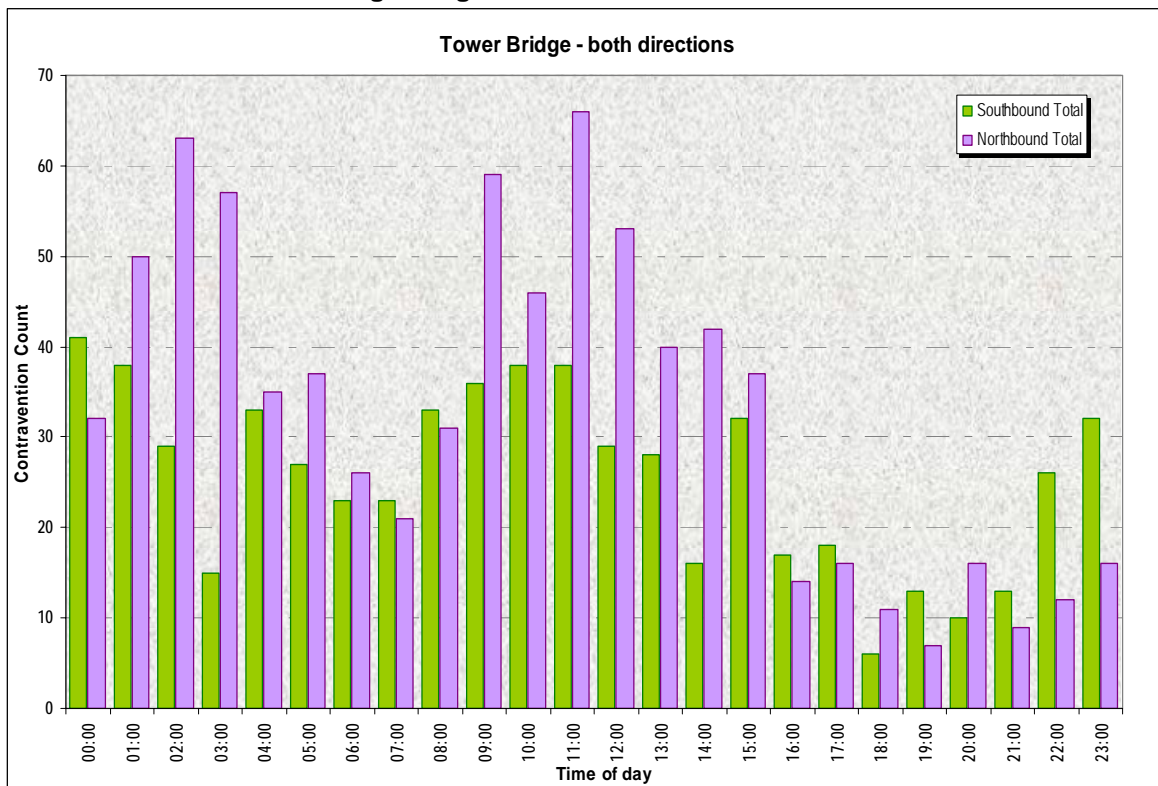
3.4 Weight Limit Controls

There is a vehicle weight restriction on Tower Bridge that is intended to prevent the use of the bridge by vehicles weighing over 18 tons. CCTV is being used to enforce the weight restriction, using the number of axles per vehicle as a proxy for gross vehicle weight.

Camera enforcement started in July 2005. In the period from then to the end of March 2007 a total of 1,570 incidents have been observed and 1,441 PCNs initiated. The majority of infringements to date have been committed by foreign registered vehicles, with the maximum by any one vehicle being 25 PCNs over a period of 5 months.

The following graph illustrates the combined daily profile of contraventions for the twelve months ending March 2007. The profile shows that truck drivers tend to avoid the usual traffic peak periods, preferring instead the inter-peak period and overnight. Analysis of the incident data indicates that persistent offenders tend to use the bridge during the night and the evidence from the cameras has been used to deploy police officers to the bridge at these times.

Tower Bridge Weight Restriction – Contravention Profile



4 Bus Lane Enforcement

Analysis of compliance from the different camera systems indicates an overall improvement in compliance with bus lane regulations. Generally, compliance improves by upward of 50% during the first year of enforcing a new site. There are currently three complementary types of cameras used in bus lane enforcement.

4.1 Bus-mounted Cameras

Bus-mounted cameras (BMCs) are fitted on a proportion of London's buses. They start recording automatically as the bus enters a bus lane, and stop as it exits. This is controlled by a device in the camera, which responds to radio beacons along the route; the bus driver has no control over the camera. The camera records on to video tape, which is then collected at the bus depot and passed to the Traffic Enforcement Camera Operations (TECO) section for review.

Bus-mounted cameras have the facility to move along a route, deterring or detecting offenders throughout the enforceable length of road. The recordings can also be used to derive bus journey times and delays, and obstructions to the route such as roadworks or other legitimate uses of the bus lane.

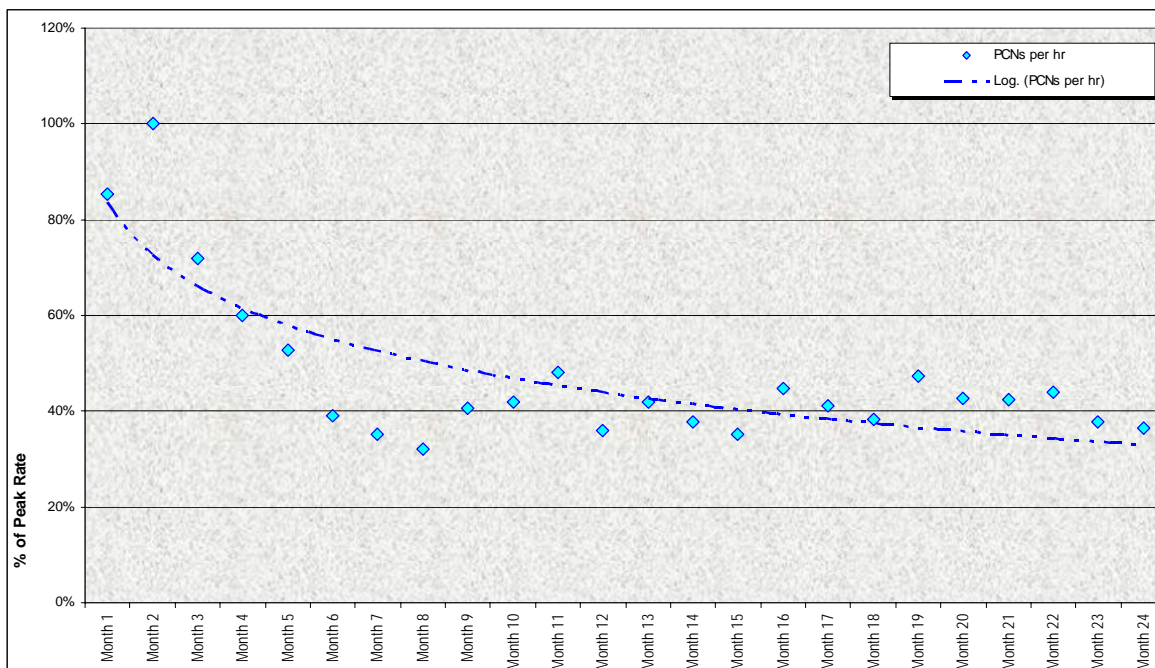


4.2 Static Roadside Cameras

Static roadside cameras (SRCs) are located in permanent, fixed positions where there are known to be particularly high numbers of contraventions. They record all the activity in a specific bus lane and the adjacent length of highway. They are pre-set to record when the bus lane is operational, which may be during specific periods (eg during peak periods) or 24 hours per day. As with BMCs, the video tape recordings are then reviewed by the TECO section of the Traffic Enforcement department.

Unlike bus-mounted cameras, which move along all the lanes on a particular route, the SRCs can provide the benefits of enforcement to all the routes that operate on a particular length of highway.

Incidents per Hour – All Static Roadside Cameras



Roadside cameras were introduced when camera enforcement of bus lanes was relatively new. Typically, the first peak has been during the second month of enforcement at each new roadside camera site. This initial month represents a period of drivers learning about the introduction of enforcement at each site.

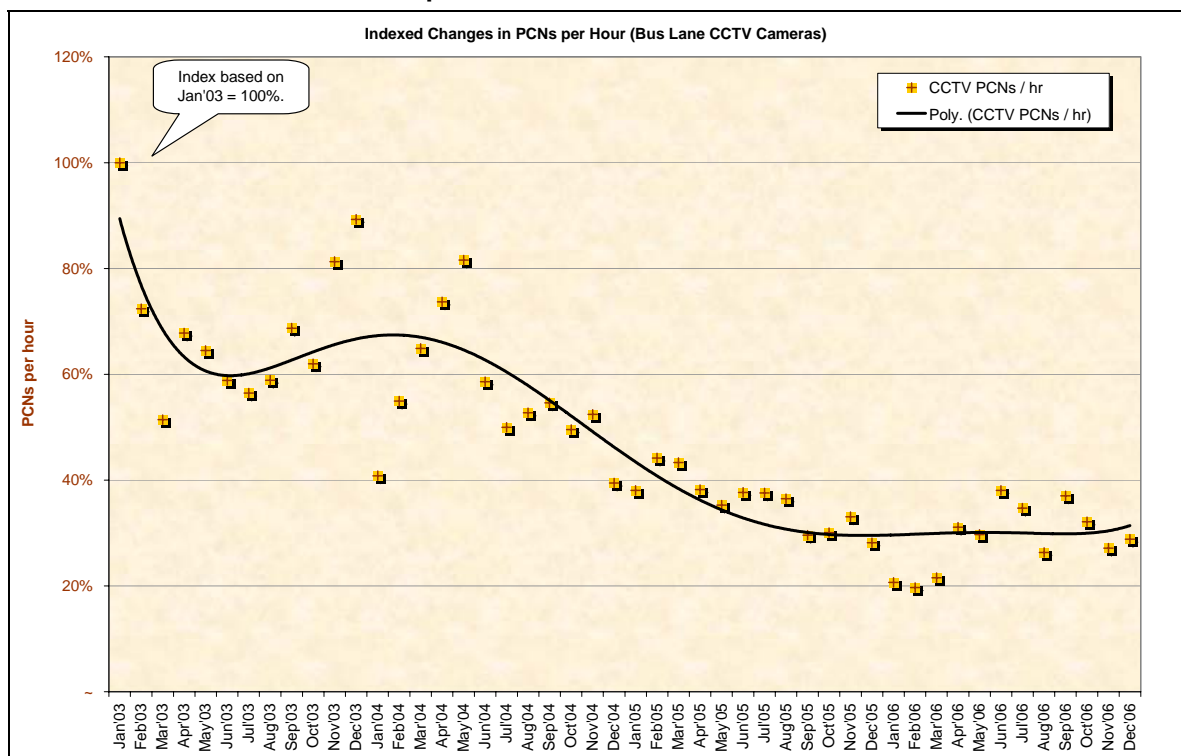
The number of incidents per hour from roadside cameras was indexed to a common starting point and expressed as a percentage of the peak incident rate. The resultant trend is clearly downward, indicating approximately 60% improvement in the first 12 months and a gradual improvement in compliance over the 24 months.

4.3 CCTV Cameras

CCTV (closed circuit television) cameras are situated at fixed locations, but can be moved around to view the area surrounding the camera, rather than recording a fixed view. They can also zoom in and out, and can clearly view a distance of over 100 metres from the camera. They are operated 'live' (in real time) by an enforcement officer (EO), though the images are recorded simultaneously on to videotape in order to provide supporting evidence for the enforcement operation. CCTV cameras are used primarily for red route offences, as well as yellow box junctions and bus lanes.

The enforcement of traffic regulations by CCTV cameras is a logical extension of the existence of CCTV traffic management cameras and the established principles of camera enforcement. An essential and integral part of our CCTV system is a Code of Practice, which sets out the objectives of the system and the rules by which we operate. The Code of Practice ensures that issues such as data protection, privacy, integrity and fairness are properly and consistently dealt with.

Incidents per Hour – Bus Lane CCTV Cameras



The rates of incidents per hour from CCTV cameras were indexed to a common point in January 2003 and expressed as a percentage of that incident rate. The resultant trend is clearly downward, indicating a 60% improvement in the first 24 months. The contravention rate then remained constant up to December 2006.

4.4 Other Benefits

4.4.1 Independent Academic Review

The differential impact of TPED's camera enforcement has been assessed by an external research team from the Technical University of Berlin who have particular expertise in cameras from a variety of EU funded projects. They have assessed and quantified the impact of camera enforcement on compliance using established social modelling techniques.

Their modelling study² found that the visibility of the enforcement system plays a major part in its effectiveness. It is drivers' awareness of their potential visibility to the enforcement system that is crucial for maintaining compliance, and this in turn is reinforced by the visibility of the system to drivers who may consider contravening the regulations. The visibility of the system is most dramatically represented by the presence of buses, which are believed to carry cameras, as every bus can potentially be perceived as a big red camera.

The researchers have demonstrated that the impact of reactive mechanisms, where drivers are sent penalty notices after infringing the rules, such as being caught in the act by a camera, are now lower overall than the impact of proactive mechanisms, which deter drivers from committing the offence in the first place. The impact of PCNs on compliance occurs after a time delay of one month, which correlates to the period between committing the offence and paying the penalty. In the majority of the year, the model developed shows conformity between TPED's camera systems and bus speeds, thus demonstrating that camera enforcement directly improves bus journey times. The model is currently being refined further, by the addition of more data, and is also being expanded to include on-street enforcement factors. Continuing analysis of these data should therefore demonstrate the efficiency of traffic enforcement operations and their contribution to improving the reliability of buses as well as general traffic flows in London.

4.4.2 Public Perception

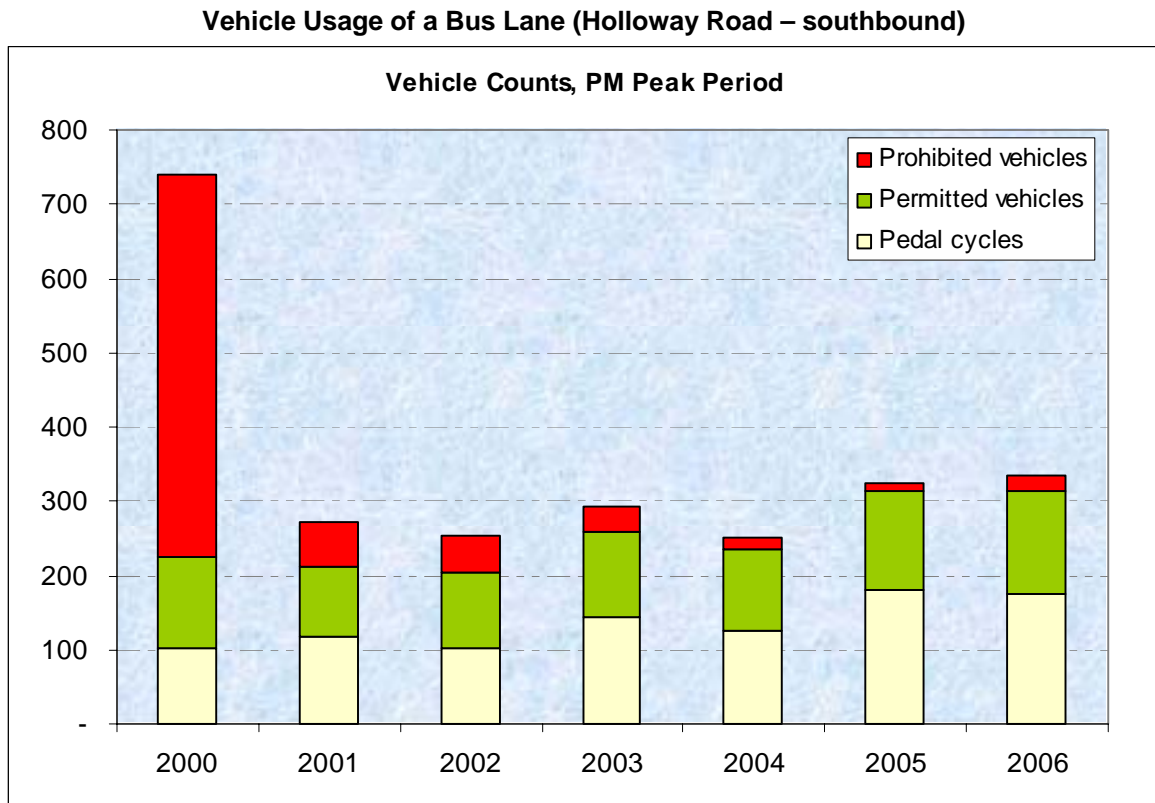
Effective enforcement has contributed to an improved bus service by maintaining clear bus lanes and box junctions. The following criteria taken from the London Buses performance summary illustrate improvements for bus passengers:

Performance Criteria	FY 2003/04	FY 2005/06
Average actual passenger waiting time	5.8 minutes	5.5 minutes
Satisfaction with reliability	79%	80%
Bus passenger journeys (millions)	1,702	1,816

² Technical University of Berlin, Modelling Report, June 2005.

4.4.3 A Visible Effect

Since the commencement of enforcement, we have also seen a dramatic improvement in bus lane compliance and in the cycle usage of bus lanes. The example of Holloway Road below is typical of the observations at static roadside camera sites.



Over the first five years of monitoring the site, prohibited vehicles in the lane reduced by 98%, permitted vehicles (eg taxis and buses etc) showed very little change and cycle usage increased by 80%.

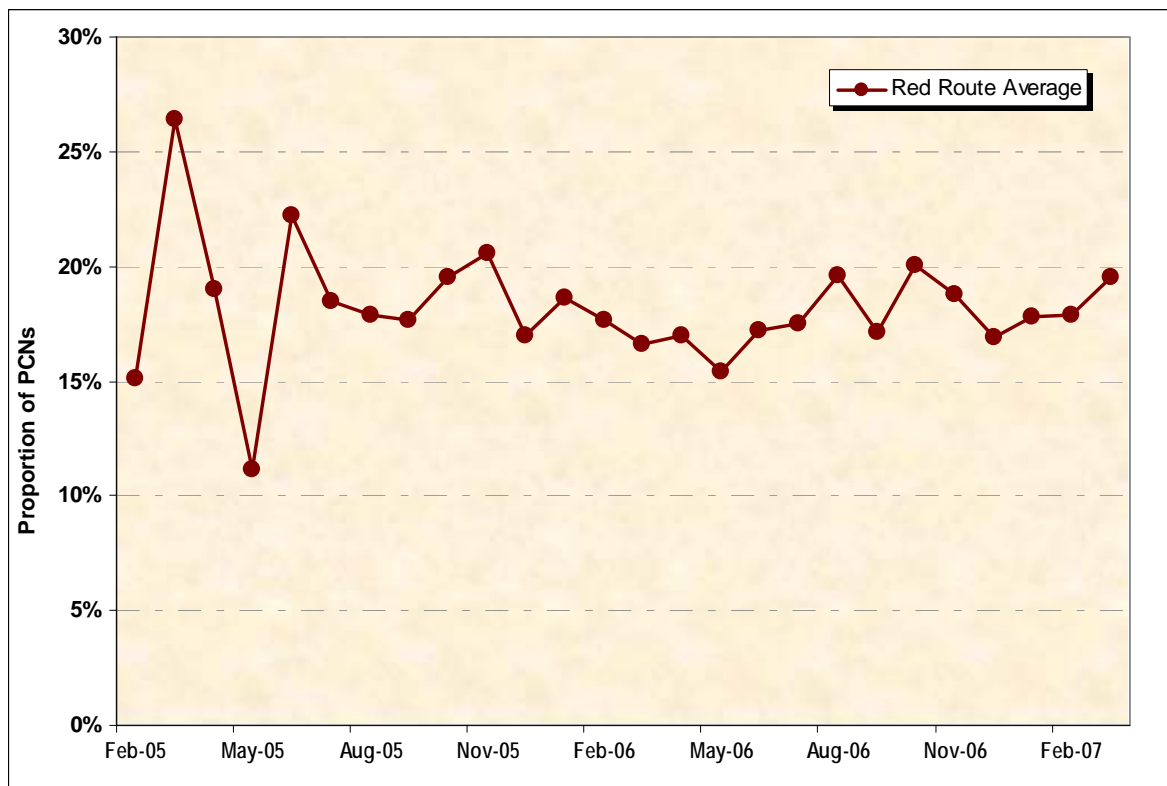
5 Issues Going Forward

From our monitoring data, where key TLRN sites have been monitored quarterly for 12 hours per day, we have estimated that there are 56 million illegal parking contraventions on the TLRN annually. Dramatically improving this situation will require considerable effort, and plans to achieve this are included in our vision of the future. Some of the issues to be tackled include:

5.1.1 Repeat Offenders

Studies by TOCU and elsewhere have suggested that drivers who contravene parking regulations may have a tendency to disregard other traffic regulations as well. The following graph illustrates the proportion of PCNs issued as second or subsequent PCNs, using camera enforcement, to vehicles that have received a previous PCN during the same calendar month. For the purposes of this graph, data are included for repeat PCNs only where one or more of the PCNs (first and/or subsequent PCNs) were issued for a parking offence. This number of repeat PCNs is shown as a percentage of all the parking PCNs issued during the calendar month.

Repeat Offender PCNs as a Percentage of All Parking PCNs



This analysis includes PCNs that have been paid and indicates that, following an initial period of learning, the number of repeat offences stabilises at 15 - 20%.

5.1.2 Persistent Evaders

A separate project to tackle the problem of persistent evasion is looking at intelligence-led solutions plus a more effective removals operation across the capital. The ANPR³-based project allows Traffic Enforcement, Congestion Charging and the MPS to identify those vehicles which are untaxed, carrying false VRM plates or which are incorrectly registered with the DVLA; or those which may be driven by motorists who are uninsured or disqualified from driving. Traffic Enforcement will use the project to support the Bill, currently being promoted in Parliament, which gives more powers to authorities and TfL to take enforcement action against persistent evaders.

5.1.3 Suspect Vehicles

This analysis of camera enforcement details identifies stolen and other suspect vehicles from their DVLA records. There also is a procedure for enforcement officers (EOs) to identify vehicles that they regard as being suspect.

The following table gives the results from **March 2007**:

Number of incidents identified	49,700
Number of PCNs issued	45,104
Number of vehicles untaxed	381
Number of vehicles reported as stolen	15
Number of vehicles reported as exported	20
Number of vehicles reported as scrapped	11
Number of vehicles unknown to DVLA	134
Number of suspect vehicles (EO observations)	6

An analysis of these data over a longer term suggests that about 2% of the vehicles contravening the TLRN regulations may be operating illegally. Around 32% of the vehicles identified above fall into two or more of these categories of illegal operation.

³ Automatic Number Plate Recognition

5.1.4 Foreign vehicles

Camera enforcement depends upon being able to identify vehicle keepers through the vehicle registration records. Drivers of foreign-registered vehicles are less likely to be effectively pursued through the current decriminalised enforcement process.

Key points about foreign vehicles:

- Amount to approximately 2% of incidents observed.
- Erosion of the benefits of compliance, causing congestion or traffic hazards.
- Ineffective enforcement, due to the inability to make the traffic regulations stick and setting a bad example to other drivers.

A detailed analysis of offending vehicles began in November 2006 with the objective of quantifying the scale of the problem. The following table illustrates the findings from camera enforcement up to the end of **March 2007**:

Total	Incidents recorded (=100%)	221,772	Distribution
Foreign	All except GB mainland and diplomatic	4,028	1.8%
GB+NI	Northern Ireland and GB islands	191	0.1%
EU-GB	EU countries except GB+NI	3,301	1.5%
Non-EU	All foreign vehicles except all EU countries	257	0.1%
Diplomatic	All diplomatic vehicles	279	0.1%

In a league table of offenders, vehicles with French, German or Polish plates each have more than 10% of the foreign incidents identified. Together, they account for over 40% of the total.

What can be done?

The Enforcement Task Force, of which Transport for London is a member, has already recognised that cross-border enforcement of traffic contraventions is a key issue, and is tackling it through its **SPARKS**⁴ Programme. A study has been commissioned on behalf of the SPARKS Programme in order to better understand the presence and behaviour of foreign registered vehicles on UK roads. The study is due to report in June 2007, but its initial findings suggest that foreign registered vehicles may represent a higher risk than UK registered vehicles, and that levels of contravention in some areas are higher. The differences do not appear to be great enough to target enforcement activities at foreign registered vehicles in general but a proportion of drivers of foreign registered vehicles take advantage of the current enforcement system, and action should be taken to pursue this group specifically.

⁴ SPARKS: Shared Parking And Registered Keeper information Service

5.2 Developing Technologies

5.2.1 Portable Enforcement Cameras

The Portable Enforcement Camera (PEC) system is based around new portable CCTV cameras which complement the existing network of fixed CCTV cameras.

The new cameras can be fixed to a site, such as a lamppost, in a matter of minutes. They have a wireless link to a control vehicle (which will park off the main road), from which 2 staff can monitor several cameras in the vicinity. In this way, the PEC is ideal for targeting localised traffic problems such as disobeyed banned turns, and can provide a rapid response to incidents. The system can also be used for monitoring prospective sites prior to the installation of permanent cameras



The PEC van has been operating since July 2006. Since then, it has recorded a total of 11,102 incidents for the period to March 2007, with 10,326 (93%) leading to the issue of a PCN. Analysing these by contravention type shows that 44% of incidents resulted from box junctions and banned turns, with the remainder resulting from Red Route contraventions.

5.2.2 Vehicle Mounted Cameras (Smart Car)



The Smart Car is part of a Digital Traffic Enforcement System (DTES) that has been developed by Traffic Enforcement. Equipped with automatic number plate recognition cameras, global positioning and DVD recording, the Smart Car is used to enforce parking violations on the TLRN.

The car is programmed with enforcement details of a specific route and when a contravening vehicle is detected, it automatically captures the vehicle's details and images as evidence.

In the future the Smart Car will be upgraded with new technology including, banking encryption standards, wireless transmission and high speed broadband connectivity.



The Smart Car has been enforcing since August 2006. In the eight months to March 2007, a total of 4,144 incidents were identified, with 3,779 (91%) leading to the issue of a PCN. Some 62% of the incidents identified were related to red box offences, with single and double red line offences making up the majority of the remaining incidents with 16% and 14% respectively.

The distribution of PCNs on a weekday basis is relatively uniform, with Mondays to Fridays each producing between 17% and 19% of the weekly totals.

Appendices

Appendix A: The Value of Compliance

The following table illustrates the methodology for accruing a value to the time savings resulting from increased bus speeds in enforced bus lanes.

<i>From London Buses Network Performance Report:</i>				
Bus passenger distance, Jul-Sep'05	(a)	1,460	million km	
Bus passenger journeys, Jul-Sep'05	(b)	394	million	
Quarter to full year conversion	(c)	4		
...				
Bus passenger distance, annual equivalent	(d)	5,840	million km	a*c
Bus passenger journeys, annual equivalent	(e)	1,576	million	b*c
Average journey distance	(f)	3.71	km	d/e
<i>From TPED Core Route Monitoring:</i>				
Average trip speed in bus lanes, (2004Q3)	(g)	12.84	kph	
Average trip speed in bus lanes, (2005Q3)	(h)	13.44	kph	
Bus lane proportion, by distance	(i)	23%		
Change in bus speed	(j)	5%		h/g
Average journey distance in bus lanes	(k)	0.85	km	f*i
Average journey time (bus lanes)	(l)	00:03:59		k/g
Average journey time (bus lanes)	(m)	00:03:48		k/h
Total journey time at 2004Q3 speeds	(n)	105	million-hrs	l*e
Total journey time at 2005Q3 speeds	(o)	100	million-hrs	m*e
Aggregated time savings	(p)	4.7	million-hrs	n-o
<i>From Department for Transport, Values of Time and Operating Costs, December 2002:</i>				
Base value of commuting time, 2002	(q)	5.04	£ per hour	DTp
Annual growth adjustment, 2002 to 2005	(r)	1.060		DTp
Attributed value per hour	(s)	5.34		q*r
Aggregated value of time savings	(t)	25.0	£m	p*s

Appendix B: Measuring Compliance

Compliance rates are calculated using data collected by surveyors who observe traffic behaviour on the street. A selection of key TLRN sites is surveyed every quarter and information is collected on parking activity at each survey site.

This data is used in a compliance formula, given below, which produces a compliance rate. This rate, expressed as a percentage, represents the amount of kerb space time not being used illegally and is therefore a compliance measure.

$$\text{Compliance Rate} = 1 - \frac{(\text{Total Time All Vehicles Contravene} * 5.5)^{(A)}}{(\text{Kerbside Length} * \text{Total Time Observed})^{(B)}}$$

Note: The constant '5.5' is used as the average length of a vehicle or vehicle space. The surveys contractor uses the standard bay length of 5.5 metres; at 1 vehicle per bay the effective length of a vehicle (including manoeuvring space) is also 5.5 metres.

Application of the compliance formula:

Consider a length of road comprising 10 parking bays, ie 55 metres long, being observed for 12 hours. The potential for parking is 10 vehicles for 12 hours each, totalling 120 vehicle-hours or 660 metre-hours (120*5.5).

Now consider a similar length of red route, where parking is prohibited throughout the observation period.

- If no vehicles park then the compliance is 100%
- If 10 vehicles park for the full period then the compliance is 0%
- If 5 vehicles contravene throughout a 6-hour period, then the illegal activity is one-quarter of the potential capacity of that length of road and the compliance rate would be 75% - ie 1-¼
- A more complex example has the same 5 vehicles contravening, over a 12 hour period, where 3 of the vehicles contravene for 20 minutes each and 2 for 30 minutes each. The compliance rate would be:

$$\text{Road occupancy (A)} = [(3 \times 20/60) + (2 \times 30/60)] \times 5.5 = 11 \text{ metre-hours}$$

$$\text{Road capacity (B)} = [55 \times 12] = 660 \text{ metre-hours}$$

$$\text{Occupancy rate (C)} = A/B = 11/660 = 0.0166$$

$$\text{Compliance Rate} = 1 - C = 1 - 0.0166 = 0.9833 = 98.3\%$$

The 12-hour observation period used in this study does return relatively high rates of overall compliance, but these do mask the shorter periods when compliance may vary significantly. The formula does allow for different period to be analysed, depending upon the availability of the parking data.

Glossary of Abbreviations

ANPR	Automatic Number Plate Recognition
BL	Bus Lane (one of four frontage types; see also HR, LR and RES)
BMC	Bus-mounted Camera
CCTV	Closed Circuit Television
DTES	Digital Traffic Enforcement System
DVLA	Driver and Vehicle Licensing Agency
EO	Enforcement Officer
GPS	Global Positioning Systems
HR	High Density Retail Frontage (one of four frontage types; see also LR, RES and BL)
KPI	Key Performance Indicator
LLATA	London Local Authorities and TfL Act 2003
LR	Low Density Retail Frontage (one of four frontage types; see also HR, RES and BL)
MPS	Metropolitan Police Service (commonly called the Met)
NMP	Network Management Plan
PCN	Penalty Charge Notice
PEC	Portable Enforcement Camera
PEZ	Parking Enforcement Zone
RES	Residential (one of four frontage types; see also HR, LR and BL)
SRC	Static Roadside Camera
SSA	Special Services Agreement
TE	Traffic Enforcement
TECO	Traffic Enforcement Camera Operations
TfL	Transport for London
TLRN	Transport for London Road Network
TOCU	Transport Operational Command Unit
TPCSO	Transport Police Community Support Officer
TPED	Transport Policing and Enforcement Directorate
VMC	Vehicle-mounted Camera
TW	Traffic Warden
VRM	Vehicle Registration Mark (commonly called a number plate)

Contact Details

General Information

Transport Policing and Enforcement Directorate
Transport for London
Windsor House
50 Victoria Street
London SW1H 0TL

Email: TEadmin@streetmanagement.org.uk
Website: www.tfl.gov.uk

Departmental Contacts

The following table gives the principal contact details for each of the departments within Traffic Enforcement:

Traffic Enforcement Camera Operations

All aspects of the camera enforcement operations, including maintenance of highway infrastructure and enforcement apparatus.

Robert Steer, 020 7126 2909, Robert.Steer@tfl.gov.uk

Enforcement Partnerships

Liaison with London Boroughs and other stakeholders

Rikky Hill, 020 7126 2475, Rikky.Hill@tfl.gov.uk

Enforcement Services

Management of the penalty ticket processing operation

Tope Longe, 020 7126 2774, Tope.Longe@tfl.gov.uk

On-Street Operations

All aspects of the on-street (foot patrols) enforcement operation

John McArdle, 020 7126, John.Mcardle@tfl.gov.uk

Client Support

Monitoring, reporting and general information

Steve Smith, 020 7126 2725, Steve.Smith(ST)@tfl.gov.uk

Document History

This document has been produced by Traffic Enforcement department of Transport for London. A summary version of this report is also available.

Version	Date	Comments
V0.1	September 2005	Draft for internal discussion.
	December 2005	TE presentation
	March 2006	Released for TfL consultation.
V1.0	June 2006	Published for general circulation.
V1.1	June 2006	Summary version for general circulation.
V2.0	January 2007	Updated and revised for internal comments.
V2.1	March 2007	Updated and revised for general circulation.
V2.2	March 2007	Updated and revised for internal comments.
V2.3	July 2007	Redrafted to incorporate comments received

This version:

<H:\CSupport\Library\TE Impact Assessment\TEIAfull07Jun26.doc>
13 September 2007, 12:59

[EoF]