UCL

PA Consulting Group

The national safety camera programme

Three-year evaluation report

June 2004

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The authors

Adrian Gains is a senior consultant with PA Consulting Group.
adrian.gains@paconsulting.com

Benjamin Heydecker is Professor of Transport Studies, University College London. His research interests include road safety and the statistical analysis of road collision data.
ben@transport.ucl.ac.uk

John Shrewsbury is a Traffic and Transport Analyst, University College London.

Sandy Robertson is a Senior Research Fellow in the Centre for Transport Studies, University College London.

Key definitions used

Personal injury collision
A collision involving personal injury occurring on the public highway (including footways) in which a road vehicle is involved and which becomes known to the police within 30 days of its occurrence. One collision may give rise to several casualties. Damage-only collisions are not included in these figures.

Killed
Human casualties who sustained injuries that caused death less than 30 days after the collision.

Serious injury
An injury for which the person is detained in hospital as an in-patient, or any of the following injuries whether or not the casualty is detained in hospital: fractures, concussion, internal injuries, crushings, severe cuts and lacerations, severe general shock requiring medical treatment and injuries causing death 30 or more days after the collision.

Slight injury
An injury of a minor character, such as a sprain, bruise or cut, which is not judged to be severe, or slight shock requiring roadside attention. This definition includes injuries not requiring medical treatment.

Executive summary

In 2000, a system was introduced that allowed eight pilot areas to recover the costs of operating speed and red-light cameras (safety cameras) from fines resulting from enforcement. In 2001, legislation was introduced that allowed the system to be extended to other areas. A national programme was then gradually introduced.

In February 2003, the Department for Transport (DfT) published a research report [1] that analysed the effectiveness of the system in the eight pilot areas over the first two years (April 2000 to March 2002). This report updates this analysis to the **24** areas that were operating within the programme over the first three years (April 2000 to March 2003). Only areas operating within the programme for at least a year were included in the analysis. High level results are as follows:

- **Vehicle speeds were down** – surveys showed that vehicle speeds at speed camera sites had dropped by around **7%** following the introduction of cameras. At new sites, there was a **32%** reduction in vehicles breaking the speed limit. At fixed sites, there was a **71%** reduction and at mobile sites there was a **21%** reduction. Overall, the proportion of vehicles speeding excessively (ie 15mph more than the speed limit) fell by **80%** at fixed camera sites, and **28%** at mobile camera sites
- **Both casualties and deaths were down** – after allowing for the long-term trend there was a **33%** reduction in personal injury collisions (PICs) at sites where cameras were introduced. Overall, this meant that **40%** fewer people were killed or seriously injured. At camera sites, there was also a reduction of over **100** fatalities per annum (**40%** fewer). There were **870** fewer people killed or seriously injured and **4,030** fewer personal injury collisions per annum. There was a clear correlation between reductions in speed and reductions in PICs
- **There was a positive cost-benefit of around 4:1**. In the third year, the benefits to society from the avoided injuries were in excess of **£221million** compared to enforcement costs of around **£54million**
- **The public supported the use of safety cameras for targeted enforcement.** This was evidenced by public attitude surveys, both locally and at a national level.

Overall, this report concludes that safety cameras have reduced collisions, casualties and deaths.

The background to this research report

Speed and red-light enforcement cameras (referred to collectively as 'safety cameras') were first deployed in the early 1990s. A large number of research studies, conducted both in the UK and abroad, have demonstrated that cameras were an effective means of reducing speeding and red-light running. One research study[2] concluded that, whilst cameras were effective at reducing casualties, the full benefits were not being realised due to budgetary constraints. The same study noted that these constraints could be removed by allowing local road safety partnerships to recover their enforcement costs from fines incurred by offenders. At that time, all fines were accrued to the Treasury Consolidated Fund.

In 1998, the Department for Transport (then the Department for Environment, Transport and the Regions) and other Government Departments took a policy decision to allow local road safety partnerships to recover their enforcement costs, subject to strict criteria to prevent abuse.

Management arrangements

In 1999, a national board was set up to oversee the introduction and operation of the cost recovery programme. This included representatives from the Association of Chief Police Officers (ACPO), the Home Office, the Department for Transport, the then Lord Chancellor's Department (now the Department for Constitutional Affairs), the Scottish Executive, the National Assembly for Wales, the Crown Prosecution Service (CPS), Her Majesty's Treasury (HMT), the Highways Agency (HA), the County Surveyors Society (CSS) and the Local Government Technical Advisors Group (TAG).

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[1] *A cost recovery system for speed and red-light cameras – two year pilot evaluation,* PA Consulting Group and UCL, 11 February 2003.

[2] *Cost benefit analysis of traffic light and speed cameras.* Police research series, paper 20. A Hooke, J Knox, D Portas. 1996.

To develop the practical arrangements and inform policy development, the national programme board decided to pilot the system in eight areas. The pilots were launched in April 2000 and were originally envisaged to run for two years. Results from the first year, however, were so encouraging that the Government decided to extend the system nationally. Legislation was introduced to allow this in the form of the Vehicles (Crime) Act 2001.

In order to operate the safety camera cost recovery programme, each area was required to form a local partnership and submit an operational case to the national programme board. Local partnerships included local authorities, Magistrates' Courts, the Highways Agency and the police. Treating road casualties represents a significant cost to the Health Service and some partnerships also actively involved their local NHS Trusts.

In February 2003, the Department for Transport published a research paper produced by PA Consulting Group (PA) and University College London (UCL) that analysed the effectiveness of the cost recovery system in the eight pilot partnership areas over the first two years (the two-year report).

By the end of the third year there were 24 partnerships that had been operational for a year or more. This report analyses the effectiveness of these partnerships (the three-year report). The following diagram illustrates the scope of the two and three year reports.

Figure 1 Scope of the two and three-year reports

How the performance of the system has been evaluated
Since April 2000, each partnership area has provided regular monitoring information to the national programme board. This evaluation report is based on an independent analysis of this data.

In terms of evaluation criteria, the operation of safety cameras within the cost recovery programme was considered to be a success if there was:

1. A significant reduction in speed at camera sites
2. A significant reduction in casualties at camera sites
3. General public acceptance of the road safety benefits
4. Satisfactory working of the funding and partnership arrangements.

Each element of the evaluation is covered in turn below.

1. There has been a significant reduction in speeds at camera sites
Each partnership was asked to conduct speed surveys at camera sites before installation and then periodically after. This was to assess the immediate and longer-term impacts on vehicle speed. Over **11,600** speed surveys have now been conducted and analysed. These show that:

- at the vast majority of sites where safety cameras were introduced there was a reduction in vehicle speed. Average speed across all new sites dropped by around **7%** or **2.4mph**
- the reduction in vehicle speed was particularly noticeable in urban areas (defined for this report as those with 30mph or 40mph limits) where average speed fell by around **8%**. Speed in rural areas (speed limit higher than 40mph) fell by **4%** on average
- there was a **32%** reduction in the proportion of vehicles breaking the speed limit at new camera sites. This was most noticeable at fixed camera sites, where the number of vehicles exceeding the speed limit dropped by **71%**, compared to **21%** at mobile sites
- there was a **43%** reduction in excessive speeding (ie.15mph more than the speed limit) at new camera sites. This fell by **80%** at fixed camera sites and by **28%** at mobile camera sites.

The introduction of speed cameras has reduced excessive speeding.
This conclusion is based on a substantial body of evidence, based on a larger number of sites across a large number of partnership areas. Speed surveys also confirmed that these reductions were sustained over time.

2. There has been a significant reduction in casualties at camera sites
For the two-year report, UCL developed a statistical model to assess the impact on casualties compared to the national long-term trend. For this three-year report, the model has been extended to include an additional year's data and also to include areas that joined in the two later tranches. The model has also been further refined to take into account the effects of the introduction of cameras, the effects of a partnership joining the programme and the introduction of the rules on camera visibility and conspicuity (that required fixed cameras to be made more visible and overt).

Where possible, results were analysed for different enforcement technologies and in urban and rural conditions. The findings in this report are based upon a more sophisticated model than used in the two-year report, in a larger number of partnership areas over a considerable period of time. We cannot, in all cases, make comparisons with the results from the previous report as there have been refinements in the modelling techniques used and an increase in data. Where there have been substantial changes to the results found last time, these are highlighted and, where possible, explained.

All 24 areas provided detailed casualty information, before and after enforcement, for over **2,300** sites. The data was subject to a rigorous validation process prior to the statistical modelling.

The following statistically significant results were found (after taking into account national trends):

- there was a **40%** reduction in the number of people killed or seriously injured (KSI) at sites where safety cameras were introduced. Overall, this equates to around **870** fewer KSI casualties per annum
- there was a **33%** reduction in the number of personal injury collisions at camera sites. Overall, this equates to around **4,030** fewer personal injury collisions per annum
- there were reductions in personal injury collisions and KSI casualties at both fixed and mobile safety camera sites. The former appeared to be the most effective – on average, the number of killed and serious injuries fell by **51%** at fixed sites, and by **28%** at mobile sites. These results were found to be consistent with speed surveys
- there was a **35%** reduction in the number of pedestrians killed and seriously injured at camera sites
- there were over **100** fewer people killed per annum at camera sites (**40%** fewer)
- there was a clear correlation between the fall in speed and the fall in PICs at camera sites.

The three-year results confirmed the findings of the two-year analysis and also showed that the benefits had been extended to a much wider area. The introduction of safety cameras had reduced collisions, casualties and deaths.

3. The majority of the public support the use of safety cameras for targeted enforcement

All partnerships have put considerable effort into communicating the dangers of excess speed and the rationale for the introduction of safety cameras. Partnerships were encouraged to commission independent surveys to monitor public attitudes towards safety cameras. These showed that the majority of the public supported a targeted approach to speed enforcement.

The level of public support for the use of cameras has been consistently high with **79%** of people questioned agreeing with the statement that 'the use of safety cameras should be supported as a method of reducing casualties'. From the public attitude surveys there was strong evidence that there was overall positive support for the use of cameras and this stemmed from the belief that the cameras were in place to save lives – **68%** of people surveyed agreed that the primary use of cameras was to save lives.

Despite a slight reduction in the level of support for safety cameras in comparison to both the original research by Brunel University[3] and the previous two-year report, overall support for safety cameras remained positive. Independent research validated this with a poll of polls, released in November 2003 by Transport 2000, which demonstrated ongoing support for safety cameras – an average of six national surveys showed that support for the use of cameras averaged **74%**.

4. The funding mechanism and partnership arrangements have worked well

In the third year, the programme had released around **£54million** per annum (in England, Wales and Scotland) for local partnerships to invest in safety camera enforcement and supporting education. Prior to cost recovery, fines accrued wholly to the HMT Consolidated Fund. In the third year, we have estimated that the benefits to society, in terms of the value of casualties saved, were in the region of **£221million**[4] per annum.

All 24 partnerships have had their accounts independently audited to ensure that funds were being used in accordance with the strict Government rules under which the safety camera programme operated.

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[3] *Department for Transport Road Safety Research Report No.11 – The effects of speed cameras: how drivers respond.* Feb 1999.

[4] This figure represents a fairly conservative estimate of the benefits attributed to camera enforcement in areas where the cameras are operating (estimate is based on *Department for Transport Highways Economics Note No1: 2002*).

The management arrangements for the programme have encouraged closer working arrangements between the police, highway authorities and other local stakeholders to improve road safety. The programme has also enabled a more consistent, targeted and evidence-based approach to be established for safety camera enforcement. The funding arrangements are working well.

Conclusions

In terms of speed and casualty reduction, public acceptability and funding arrangements we conclude that the programme has met its four main objectives.

Since March 2003, other areas have joined the programme. As of April 2004, a total of 42 partnerships covering 45 out of 51 of the UK police force areas have submitted successful bids to join the national safety camera programme.

Contents

Introduction

Road safety strategies involve a number of differing elements, broadly based around a balance of:

- **Education**, including campaigns aimed at speed reduction, reducing the levels of drink driving and encouraging drivers and passengers to wear seatbelts
- **Engineering solutions**, aimed at making physical improvements to the infrastructure to improve road safety. These include traffic calming measures, clearer signing and improved road lay-out
- **Enforcement**, including the use of safety camera equipment to detect offences such as speeding or red-light running.

Although education and engineering have an important safety role to play in their own right, this report focuses on the impact of camera enforcement. Specifically, it analyses the results from a programme that has allowed local partnerships to recover the costs of camera enforcement from fixed penalties paid by offenders. This report covers the first three years of this programme.

1.1 What are the national road safety objectives?

In 2000, the Government published the ten-year road safety strategy. This set out casualty reduction targets for 2010. These were:

"By 2010 we want to achieve (compared with the average for 1994-98):

- 40% reduction in the number of people killed or seriously injured in road collisions
- 50% reduction in the number of children killed or seriously injured
- 10% reduction in the slight casualty rate, expressed as the number of people slightly injured per 100million vehicle kilometres."

The road safety strategy also set out a wide range of initiatives to achieve these targets.

One initiative in the strategy was to introduce a cost recovery element for speed and red-light camera enforcement. The aim was to develop a system that delivered real road safety benefits that was paid for by offenders, rather than through public expenditure.

"Cameras have proved their effectiveness in enforcing speed limits and reducing speed-related collisions and casualties at collision hot spots. They are costly to install, operate and maintain, but these enforcement costs cannot be directly recovered by the police and local authorities where a fixed penalty notice is used. Only where cases are heard in court may the police and others claim their costs. To address this funding problem the Government now accepts that those responsible for installing and operating cameras should be able to retain some of the fine revenue from offences detected by camera, to cover their costs. This would enable better use to be made of existing cameras and for additional cameras to be introduced for road safety purposes. The next generation of cameras will be digital, offering greater capacity and flexibility at lower cost.

We are developing a funding system with effect from April 2000 to enable local authorities, the police, magistrates' courts committees and other agencies involved in the enforcement process to have some of their camera enforcement costs refunded from a proportion of the fine revenue. A programme to pilot a new funding system is being planned and, if successful, will become available country-wide."

Tomorrow's roads: safer for everyone [5]

The funding programme referred to in the strategy was introduced, as planned, in eight pilot areas in April 2000 and in 2001, following the success of the pilot, it was made available country-wide. This research report evaluates the success of the programme after three years.

1.2 The link between speed, collisions and casualties

Research has shown that reducing speed on roads is a major contributor to reducing collisions and injuries. The Transport Research Laboratory (TRL) reported in 1994 that every 1mph reduction in average speed led to a 5% reduction in collisions.[6] A study in 2000[7] validated this figure.

Further details about the link between speed and casualties are given in the DfT speed review (*New Directions in Speed Management*, 2000) and are summarised below:

- speed was indeed a major contributory cause of casualty collisions. Recent research had added greatly to our knowledge of where the problems were particularly acute
- slowing the fastest drivers would yield the greatest safety benefits
- In some areas, quite small reductions in average speed would bring large benefits
- speeders were disproportionately involved in collisions
- those that drove faster than most on a road, or exceeded speed limits even by relatively small margins, greatly increased the risk to themselves and others
- the higher speeds on any given road were associated with both more collisions and greater injury severity. This relationship held for all drivers and not just the less experienced
- the faster the speed at impact, the more severe the resulting injury. This was particularly so for collisions with pedestrians, cyclists and motorcyclists, who were unprotected from the forces of impact, unlike occupants of modern cars
- some people did not accept that speed is a problem. Even those that say they did, did not always act accordingly.

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[5] *Tomorrow's roads: safer for everyone*. The Government's road safety strategy and casualty reduction targets for 2010

[6] Finch DJ, Kompfner P, Lockwood CR and Maycock G (1994). *Speed, speed limits and accidents.* Transport Research Laboratory TRL Project Report 58. Crowthorne.

[7] Taylor M, Lynam D and Baruya A (2000). *The effects of drivers' speed on the frequency of road accidents.* Transport Research Laboratory TRL Report 421, Crowthorne.

Fixed speed camera

Speed over distance

Mobile camera (operator)

1.3 The law

Under Section 89 of the Road Traffic Regulations Act 1984 and Schedule 2 of the Road Traffic Offenders Act 1988, it is contrary to the law to exceed the prescribed speed limit on a public highway.

A number of police forces operate speed cameras to enforce the law. These cameras differ from speed-measuring devices, such as radar-guns or in-car devices, in that vehicles are not stopped at the road-side. Instead the offence is dealt with (initially) by post under the Conditional Offer of Fixed Penalty system (see Appendix C). Examples of three different types of speed camera are shown.

- **Fixed speed cameras**. These are usually unmanned and installed in camera housings. When the camera detects a speeding vehicle, two images are captured to verify the speed. These cameras normally enforce road lengths where there has been a cluster of collisions.
- **Speed over distance**. An alternative form of fixed speed camera involves two (or more) digital cameras linked to an automatic number-plate reader providing average camera-to-camera speed, based on the distance between the cameras divided by the time taken to travel. These cameras normally enforce roads where there has been a higher density of collisions spread over a distance.
- **Mobile speed cameras**. These are set up by the roadside and attended by a police officer or civilian enforcement officer. The camera is either video based or uses wet film and monitors traffic along a stretch of road. This type of enforcement is often used when collisions have been spread along longer lengths of road, rather than at specific sites, or when collisions occur at particular times of day or times of the year.

Under Section 36 of the Road Traffic Act 1988, it is an offence to contravene a red traffic light. In addition to speeding, cameras can be used to take images of vehicles passing through traffic lights whilst they are on red. They operate in a similar way to fixed site speed cameras.

Speed and red-light running enforcement cameras (henceforth collectively referred to as safety cameras) have to receive Home Office type approval before evidence from them can be used in court proceedings. To gain type approval, the Home Office's Police Scientific Development Branch (PSDB), in conjunction with independent laboratories, carries out rigorous testing to ensure the device in question is robust, reliable and can produce accurate readings or images under a variety of extreme conditions. The PSDB has published handbooks for manufacturers regarding the procedures for type approval, outlining the requirements and specifications for automatic traffic enforcement systems.

Once the PSDB is satisfied that any particular device fully meets the specifications, a type approval order is drawn up and signed by a Home Office Minister. The order includes the date from which the device is approved for police use. The type approval process provides an assurance of any equipment's accuracy and reliability.

1.4 Background to cost recovery

Speed and red-light running cameras were first deployed in the UK in the early 1990s. In 1996 a Home Office research report identified that while safety cameras contribute to road safety, their full benefits were not being realised because of budgetary constraints. In December 1998, the then Department for the Environment, Transport and the Regions (DETR), now the Department for Transport, strongly supported by other Government Departments, took a policy decision to allow fine revenue from enforcement cameras to be used to refund the costs of their installation, operation and maintenance. This was the first self-financing road safety system in Great Britain and was explicitly intended to free up resources to be spent on other local priorities, such as engineering and education.

The process of allowing agencies involved in camera enforcement to recover their costs is sometimes termed 'netting-off' or 'hypothecation', but the term 'cost recovery' is more generally understood and is used in this report. Her Majesty's Treasury applies strict criteria for approving cost recovery programmes. Specifically they must meet five key conditions:

- Will performance against policy objectives, eg crime-fighting and prevention, be likely to be improved?
- Are arrangements in place that will ensure that the activity will not lead to the abuse of fine and penalty collection as a method of revenue-raising and that operational priorities will remain undistorted?
- Will revenues always be sufficient to meet future costs, with any excess revenues over costs being surrendered?
- Can costs of enforcement be readily identified and apportioned without undue bureaucracy, and with inter-departmental and inter-agency agreement where necessary?
- Can savings be achieved through the change and are adequate efficiency regimes in place to control costs, including regular efficiency reviews?

To manage the programme, a national board was set up that included representatives from the Association of Chief Police Officers (ACPO), the Home Office, the Department for Transport, the Highways Agency, the then Lord Chancellor's Department (LCD, now the Department for Constitutional Affairs), the Scottish Executive, the National Assembly for Wales, the Crown Prosecution Service (CPS), Her Majesty's Treasury (HMT), the County Surveyor's Society (CSS) and the Local Government Technical Advisors Group (TAG).

In order to evaluate whether or not cost recovery was an appropriate mechanism for funding safety camera operations, the programme board decided to pilot the approach in eight areas (covering Cleveland, Essex, Lincolnshire, Northamptonshire, Nottingham, South Wales, Thames Valley and Strathclyde), based on local partnerships. These partnerships were comprised of representatives from local police forces, highway authorities, and Magistrates' courts and, where appropriate, the Highways Agency and other key stakeholders. Some of the areas also involved other local agencies recognising that a reduction in casualties has a wider benefit to society – for example for the health, ambulance and fire services.

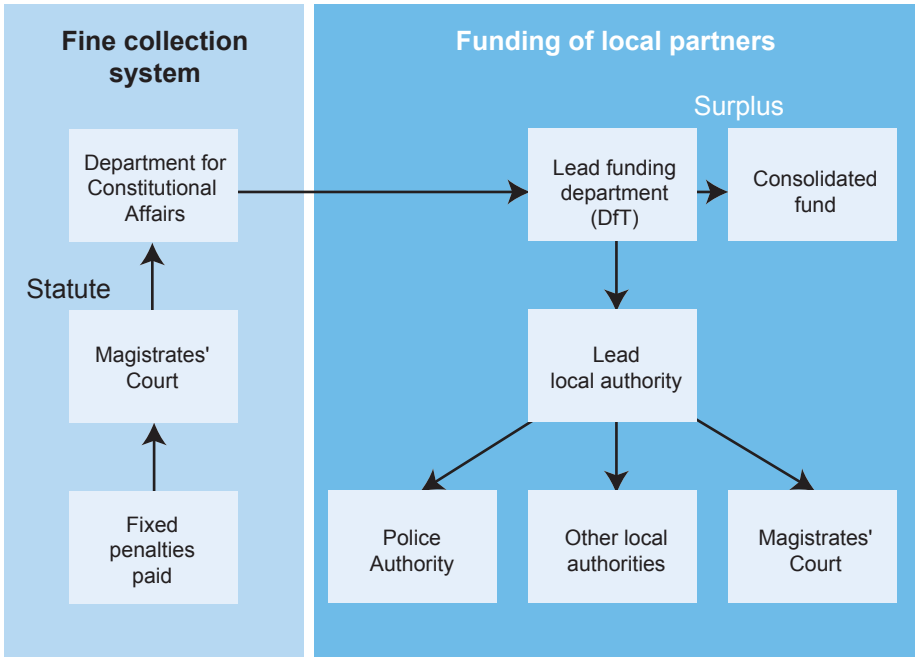
The pilot was scheduled to last for two years, but the evidence of speed and casualty reduction after one year was so compelling that the programme board decided to introduce the system to other areas. To enable this, a clause was introduced into the Vehicles (Crime) Act 2001. Clause 38 of the Act enabled the Secretary of State (DfT) to fund the expenditure of public authorities relating to specific offences in connection with speeding and traffic signals. (The relevant clause permitting this is included in Appendix B.)

1.5 The cost recovery system

The principle behind the introduction of a cost recovery system was that the fine income from the conditional offer of fixed penalties imposed for speeding and red-light running could be reinvested by local partnerships rather than accrued to the Treasury Consolidated Fund. However, it was not a straightforward process to pass money collected by the courts, in the form of penalties, to the police and local authorities involved. There were important issues of legality, accountability and timing that needed to be resolved – not least of which was the need to maintain a clear audit trail.

Legislation (Justices of the Peace Act 1997) requires Magistrates' Courts to pass all fine and fixed penalty revenue to the Department for Constitutional Affairs (DCA). There was, therefore, no opportunity to recycle funds locally without them being passed through a central Government Department. The system for recovering penalty revenue that was set up in England and Wales is shown in Figure 2.

Figure 2 Cost recovery system



The key points to make regarding the cost recovery mechanism are:

- all receipts from the fines generated from enforcement cameras were passed from Magistrates' Courts to the DCA, which passed funds to the lead policy Department. This is the DfT as cameras were a policy instrument used to further its road safety objectives
- the DfT passed the funds for the partnership to a local authority who acted as treasurer to redistribute the funds to each of the partners (police, Magistrates' Courts and other local authorities) to cover their camera enforcement costs
- at the end of year there was a reconciliation and audit to prove that the receipts were used for the primary purpose which, in this case, was to improve road safety
- according to HMT rules, the partnerships could only recover the costs of enforcement and supporting education. Any surplus was returned to the HMT Consolidated Fund.

Funding arrangements in Scotland were slightly different in that all receipts from the conditional offer of fixed penalty notices generated from cameras were passed to the Scottish Executive, which forwards income to local partnership treasurers.

1.6 Rules and guidelines that govern the programme

To be included within the cost recovery programme, local partnerships (including as a minimum the local highways authorities, the police and the Magistrates' Courts) had to submit an operational case to the programme board setting out how they proposed to operate safety cameras in their area. The programme board set out the rules of the system in a handbook. This was updated for national rollout. A summary of the rules is given in Appendices A and B. Key aspects included:

- areas would prioritise enforcement at sites with the worst casualty and speed problems
- each area involved in the process was required to subject its accounts to an independent audit each year
- each area should sign a service level agreement that committed each member of the partnership to a minimum one-year period
- areas were expected to prepare a detailed communications and driver education strategy
- areas were expected to put in place robust procedures to deal with drivers who did not pay the fines and also to follow-up enquiries from other forces
- areas were expected to appoint a data analyst, whose role was to ensure that enforcement was targeted at the priority sites where most collisions occur. Every quarter, each partnership area had to submit a return to the DfT detailing traffic speed, casualty and collision data.

To continue operating within the programme, partnerships had to resubmit their operational case to the national programme board on an annual basis. Where appropriate, this case included revisions to the sites planned for enforcement (including casualty history and recent speed surveys), a communications strategy, revised financial projections and a service level agreement.

The programme covered only those detections made by speed and red-light cameras that generated a Conditional Offer of Fixed Penalty. The programme rules and guidelines did not have any legal bearing on traffic laws – speeding was and is an absolute offence designated under Section 89 of the Road Traffic Regulations Act 1984 and Schedule 2 of the Road Traffic Offenders Act 1988 and was not dependent on the cost recovery rules being met.

1.7 Evaluation

In order to evaluate the programme, the Department for Transport commissioned research to assess whether or not the programme was meeting its objectives.

1.7.1 Two year research report

In 2003, the DfT published a research report[8] that evaluated the eight pilot areas after the first two years. The key findings of that report were as follows:

- vehicle speeds at speed camera sites were down
- the number of injury collisions at camera enforcement sites was down
- public reaction to the safety camera programme had been positive
- the cost recovery system was working well

1.7.2 Three-year research report

Since the two-year report, there have been some substantial changes to the programme:

- **The programme had grown in size and complexity**. In April 2001, legislation was introduced that enabled other areas to recover the enforcement costs from speed and red-light camera offenders. At the beginning of April 2002, the third year of the programme, 24 areas had been approved by the national programme board to join the national programme in two additional phases.

Figure 3 Scope of three year report

April 2000	October 2001	April 2002	July 2002	October 2002	April 2003	July 2003
Cleveland	Cambridgeshire	Avon & Somerset [9]	Dorset	Devon & Cornwall	Cheshire	Tayside
Essex	Derbyshire	Bedfordshire	Kent	Hertfordshire	Cumbria	Northern Ireland
Lincolnshire	Lancashire	Hampshire		Sussex	Greater Manchester	Dumfries & Galloway 1.8.03
Northants	Norfolk	Leicestershire		West Midlands	Humberside	
Nottingham[10]	North Wales	London		Grampian	Northumbria	
South Wales[11]	Staffordshire	South Yorkshire			Suffolk	
Thames Valley	Warwickshire	West Yorkshire			West Mercia	
Strathclyde		Wiltshire			Lothian & Borders 1.6.03	
		Fife				

This report focuses on the results from the 24 partnership areas up to and including April 2002.

- **The eight pilot areas had operated an additional year**. More data was, therefore, available to evaluate the longer term effects of the programme.
- **The cameras were made conspicuous**. In June 2002, ministers announced guidelines on camera conspicuity (that made fixed cameras more visible).

[8] *A cost recovery system for speed and red-light cameras – two year pilot evaluation,* Department for Transport, 11 February 2003, PA Consulting Group, UCL.
[9] Expanded to include Gloucestershire and called Avon, Somerset and Gloucestershire.
[10] Originally just Nottingham City, this expanded in April 2002 to include Nottinghamshire.
[11] In April 2002, South Wales expanded to include Gwent and Dyfed Powys and renamed South and Mid Wales.

This research paper is divided into five further chapters with supporting evidence in the Appendices.

Chapter two – impact that cameras have had on vehicle speed

Chapter three – impact the cameras have had on collisions and casualties

Chapter four – assessment of public awareness

Chapter five – costs and benefits of the programme to date

Chapter six – conclusions

Have speeds dropped as a result of camera enforcement?

In this section, we set out the results from an analysis of vehicle speeds from evidence collected from over 11,600 speed surveys.

2.1 Why do we need to measure speed?

There are a number of reasons why it is important to have collect good information on vehicle speeds before and after enforcement:

1. To confirm whether or not speeding was a problem prior to establishing a site
2. To provide local partnerships, on a site-by-site basis, with management information that could be used to verify that local enforcement strategies were having a positive effect on local driver behaviour – to reduce speeds at sites with a history of collisions
3. To establish at a national level whether or not enforcement was having a generally positive effect on driver behaviour and, hence, reducing the risk and severity of collisions. An accepted relationship, derived from research, was that each 1mph reduction in speed should result in around a 5% reduction in collisions. A reduction in speed across all areas should, over time, equate to a reduction in casualties.

2.2 Data collection and validation

In total, there have been more than 11,600 speed surveys taken periodically throughout the first three years of the programme. This presented a substantial body of evidence to establish whether or not cameras have reduced vehicle speeds.

To measure changes in speed and compliance with speed limits the following measures were used across the partnerships (although not all were able to supply all of the measures for all of the sites, due to differences in speed recording equipment):

- average (mean) speed
- 85th percentile speed (the speed at or below which 85% of vehicles are travelling)
- percentage of vehicles exceeding the speed limit
- percentage of vehicles exceeding the speed limit by more than 15mph.

Each area submitted this information using a common format – this was amalgamated to a national database. The validation process is described in Appendix D.

2.3 Data analysis

The first part of the analysis was to assess the overall change at speed camera sites.

1. We selected sites that had valid baseline 'before' surveys, either prior to the introduction of the cameras or for existing camera sites
2. We then selected those sites that had conducted 'after' surveys in 2002/3 and took an average of these readings.

The second part of the analysis was to look at the effects on vehicle speed split by partnership area, by camera type and by urban/rural. These results are summarised in the tables below and provide a conservative estimate of the true scale of speed reduction since average values have been used rather than end values that are typically lower. In particular, it underestimates the effects of mobile cameras that were found to become more effective over time.

Given the number of surveys, it was also possible to begin to draw some conclusions about the longer-term effects of speed cameras on vehicle speeds.

More detailed analyses for new fixed and mobile sites are included at Appendix E as supporting information.

2.4 Changes in speed at new camera sites, by partnership area

Table 1 summarises the effects of speed cameras on the speed of vehicles before and after enforcement at over 1,000 new camera sites in 19 partnership areas[12]. This is to indicate whether or not there has been variation in changes in vehicle speeds in different areas. For the purposes of this report, a new camera site is defined as a site that has been introduced after a partnership has been accepted to join the national safety camera programme.

Table 1 Changes in speed at new camera sites ('before' compared to an average of 2002/3 surveys 'after')

Partnership area [13]	Change in average speed		Change in 85th percentile speed		% change in vehicles exceeding the speed limit	% change in vehicles exceeding the speed limit by more than 15mph
	mph	%	mph	%		
Avon and Somerset	-4.8	-13%	-4.9	-11%	-43%	-61%
Bedfordshire	-0.9	-2%	-0.9	-2%	-7%	-21%
Cambridgeshire	-3.5	-7%	-4.3	-8%	-48%	-72%
Cleveland	-5.1	-14%	-4.3	-10%	-46%	-52%
Derbyshire	-1.1	-3%	-0.8	-2%	-9%	2%
Essex	-1.3	-4%	-2.8	-7%	-25%	3%
Hampshire	-3.3	-9%	-1.4	-3%	2%	5%
Lancashire	-2.3	-9%	-4.5	-13%	-51%	-80%
Leicestershire	-2.5	-6%	-2.8	-6%	-34%	-62%
Lincolnshire	-4.7	-11%	-6.4	-12%	-72%	-52%
Norfolk	-0.2	0%	-0.1	0%	-6%	2%
North Wales	-2.3	-6%	-3.3	-7%	-32%	-49%
Northamptonshire	-7.5	-20%	-8.8	-21%	-79%	-99%
Nottinghamshire	-0.8	-2%	-0.5	-1%	-5%	-8%
South and Mid Wales	-2.8	-8%	-3.8	-9%	-35%	-54%
Staffordshire	-4.1	-12%	-2.3	-6%	-64%	-100%
Strathclyde	-5.0	-15%	-6.4	-16%	-59%	-40%
Warwickshire	-0.4	-1%	-0.6	-1%	-8%	-20%
Wiltshire	-0.3	-1%	-0.7	-1%	-5%	2%
All cameras	**-2.4**	**-7%**	**-3.2**	**-7%**	**-32%**	**-43%**

Comments

- Looking across all new camera sites, there was a 2.4mph reduction in average speed
- The average speed at new camera sites had fallen by 7%. The 85th percentile speed was also down by the same amount (-7%)
- There was a 32% reduction in vehicles exceeding the speed limit
- In addition, there was a 43% reduction in vehicles exceeding the speed limit by more than 15mph
- There was wide variation in changes in speed between areas. The relative maturity of partnerships may be a factor
- The areas that have been operational much longer than the others appeared to be performing better. This was encouraging as it showed that the effect on speed was not just a one-off reduction but was sustained over time.

[12] Note that some areas provided only limited data and these effects should be seen to be indicative only.

[13] Fife and London provided data for existing sites but not new sites. West Yorkshire and South Yorkshire provided no data. Thames Valley data is excluded because of changes to recording method.

2.5 Changes in speed at new camera sites, by partnership area

Table 2 summarises the effects of speed cameras on the speed of vehicles before and after enforcement at over 1,000 new camera sites, by speed limit. This was to assess whether or not cameras were more effective at reducing speed in urban[14] or rural areas.

Table 2 Changes in speed, by speed limit for new cameras sites ('before' compared to an average of 2002/3 surveys 'after')

	Change in average speed		Change in 85th percentile speed			% change in vehicles exceeding the speed limit	% change in vehicles exceeding the speed limit by more than 15mph
Speed limit	**Sites**	**mph**	**%**	**mph**	**%**		
30 mph sites	673	-2.4	-8%	-3.4	-9%	-33%	-46%
40 mph sites	128	-2.8	-7%	-3.2	-7%	-34%	-47%
Urban Total	**801**	**-2.5**	**-8%**	**-3.3**	**-9%**	**-33%**	**-46%**
50 mph sites	45	-1.7	-4%	-1.0	-2%	-19%	-12%
60 mph sites	152	-2.2	-4%	-2.9	-5%	-23%	-35%
70 mph sites	21	-2.6	-4%	-2.5	-3%	-20%	-14%
Rural total	**218**	**-2.1**	**-4%**	**-2.5**	**-4%**	**-22%**	**-29%**
All camera sites	**1019**	**-2.4**	**-7%**	**-3.2**	**-7%**	**-32%**	**-43%**

Comments

- Cameras appeared to be more effective in urban areas (2.5mph reduction in average speed) than rural areas (2.1mph reduction in average speed)
- This was confirmed across the other speed measures that showed that cameras in urban areas were more effective at reducing vehicle speeds
- This is perhaps a result of the higher proportion of fixed sites in urban areas and the higher proportion of mobile cameras in rural areas. We will show later (in section 2.6) that there were greater reductions in speed at fixed camera sites
- In urban areas, the proportion of drivers exceeding the speed limit fell by 33% and the proportion of vehicles excessively speeding (more than 15mph) fell by 46%
- It is reassuring to see the reduction in excessive speeding (more than 15mph) since it is known that reducing the number of faster drivers will yield the greatest safety benefits (section 1.2).

[14] For the purposes of this report, roads with speed limits of 40mph or below are called urban. Those with a higher speed limit are called rural.

2.6 Changes in speed at camera sites, by camera type

Table 3 summarises the effects of new speed cameras on the speed of vehicles before and after enforcement at new camera sites, by camera type. This is to assess whether or not there were different effects on vehicle speeds between different types of camera (fixed, mobile and speed over distance – see section 1.3 for descriptions).

Table 3 Change in speed, by camera type at new cameras sites ('before' compared to an average of 2002/3 surveys 'after')

		Change in average speed		Change in 85th percentile speed		% change in vehicles exceeding the speed limit	% change in vehicles exceeding the speed limit by more than 15mph
Camera type	**Sites**	**mph**	**%**	**mph**	**%**		
Fixed site	213	-5.3	-15%	-7.5	-18%	-71%	-80%
Mobile site	804	-1.6	-4%	-2.0	-5%	-21%	-28%
Speed over distance site	3	-2.3	-6%	-3.3	-7%	-37%	-86%
All camera sites	**1020**	**-2.4**	**-7%**	**-3.2**	**-7%**	**-32%**	**-43%**

Comments

- All types of cameras reduced speed against all of the measures
- Overall, the greatest reduction in average speed was at new fixed cameras with an overall 5.3mph reduction in vehicle speeds (representing a fall of around 15%)
- New fixed cameras reduced the proportion of vehicles exceeding the speed limit by 71%
- Speed over distance cameras have been particularly effective at reducing excessive speeds (more than 15mph over the speed limit) – a fall of 86%· New mobile cameras were less effective at reducing average speeds with an overall 1.6mph reduction in vehicle speeds (representing a fall of around 4%)
- The difference between new fixed and mobile cameras was expected. New fixed cameras are affecting driving behaviour all of the time. Mobile cameras, on the other hand, operate periodically at locations and, therefore, one would expect the reductions in speed overall to be less.

2.7 Changes in speed at camera sites, by camera type and speed limit

Tables 4 to 7 summarise the effects of new speed cameras on the speed of vehicles before and after enforcement at new camera sites, by camera type and by speed limit. This was to assess whether or not there were different effects on vehicle speeds at different speed limits between different types of camera (fixed and mobile).

Table 4 Change in average speed, by camera type at new cameras sites urban and rural ('before' compared to an average of 2002/3 surveys 'after')

	# Sites			Change in average speed (mph)		
Camera type	**Urban**	**Rural**	**All Speeds**	**Urban**	**Rural**	**All Speeds**
Fixed site	181	31	212	-5.4	-4.3	-5.3
Mobile site	618	186	804	-1.6	-1.8	-1.7
All camera sites	**799**	**217**	**1016**	**-2.5**	**-2.2**	**-2.4**

Table 5 Change in 85th %ile speed, by camera type at new cameras sites urban and rural ('before' compared to an average of 2002/3 surveys 'after')

	# Sites			Change in 85th percentile speed (mph)		
Camera type	**Urban**	**Rural**	**All Speeds**	**Urban**	**Rural**	**All Speeds**
Fixed site	182	31	213	-7.7	-6.0	-7.5
Mobile site	617	186	803	-2.0	-1.9	-2.0
All camera sites	**799**	**217**	**1016**	**-3.3**	**-2.5**	**-3.2**

Table 6 Change in % over the speed limit, by camera type at new cameras sites urban and rural ('before' compared to an average of 2002/3 surveys 'after')

	# Sites			Change in percentage of vehicles above the speed limit		
Camera type	**Urban**	**Rural**	**All Speeds**	**Urban**	**Rural**	**All Speeds**
Fixed site	177	29	206	-72%	-46%	-71%
Mobile site	601	180	781	-21%	-19%	-21%
All camera sites	**778**	**209**	**987**	**-33%**	**-22%**	**-32%**

Table 7 Change in % 15mph over the speed limit, by camera type at new cameras sites urban and rural ('before' compared to an average of 2002/3 surveys 'after')

	# Sites			Change in percentage of vehicles 15 mph or more above the limit		
Camera sites	**Urban**	**Rural**	**All Speeds**	**Urban**	**Rural**	**All Speeds**
Fixed sites	178	31	209	-82%	-64%	-80%
Mobile sites	617	186	803	-30%	-20%	-28%
All camera sites	**795**	**217**	**1012**	**-46%**	**-28%**	**-43%**

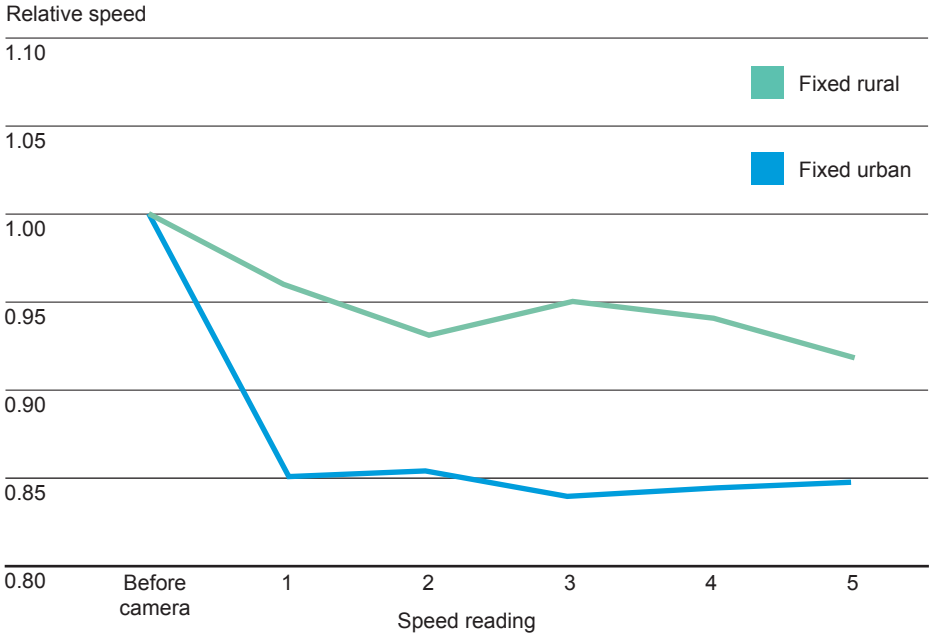
Comments

- Against all four measures, the greatest reduction in speed (in absolute and percentage terms) was found at urban fixed speed camera sites
- The least reduction in speed was found at rural, mobile speed camera sites.

2.8 Were speed changes at camera sites sustained over time?

Figures 4 and 5 illustrate the long-term effects of both fixed and mobile cameras on vehicle speeds. They are also split by speed limit (urban and rural). Comparisons are made with sites with the same number of speed-readings.

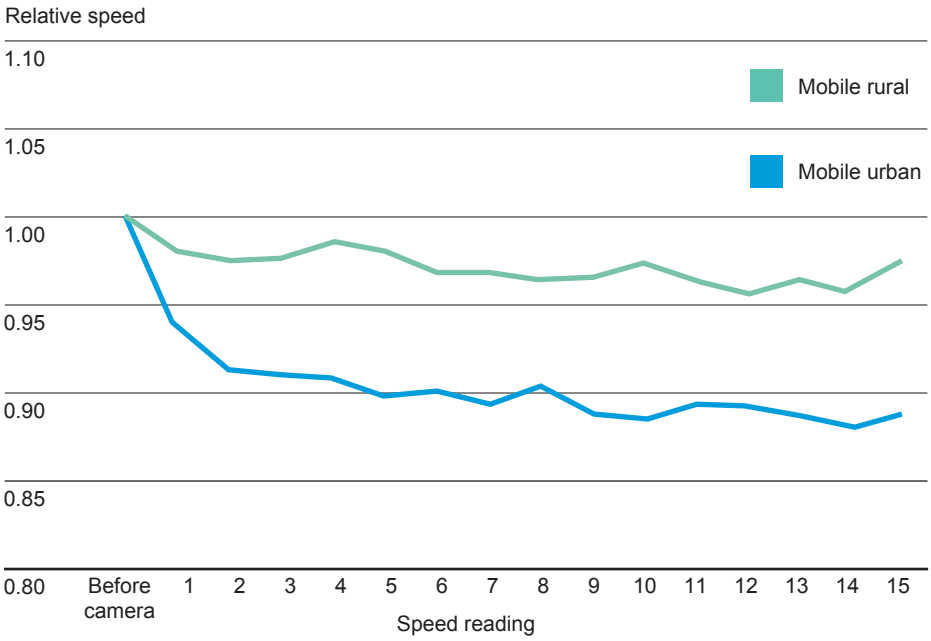
Figure 4 Trends in speed at fixed camera sites established under cost recovery (based on 43 sites with at least 5 'after' speed readings)



Comments

- Looking at the long-term effects of cameras, we conclude that fixed-rural cameras reduced long-term average speed by around 8% and fixed urban cameras by around 15%
- The longer-term findings confirm those found across all cameras – the effect was immediate and sustained.

Figure 5 Trends in speed at mobile camera sites established under cost recovery (based on 34 sites with at least 15 'after' speed readings)



Comments

- Looking at the long-term effects of cameras, we conclude that mobile-urban reduce long-term average speed by over 10% and rural-mobile cameras by less than 5%
- These show that mobile sites take longer to establish an effect.

2.9 Conclusions

- We conclude that both fixed, mobile and speed over distance cameras have been effective in reducing speed and maintaining high levels of compliance with speed limits
- Fixed cameras have proved more effective than mobile cameras in reducing speed
- Taking all cameras into account, the reductions in speed have been greatest at fixed, urban sites
- From areas that conducted speed surveys over a sustained period, we conclude that the reductions were not just 'one-off' but were sustained over time. In fact, for mobile sites, the one-off reductions were not only sustained but actually strengthened further as sites matured.

Has there been a reduction in collisions and casualties?

Given the reductions in speed found at camera sites, we would hope to find, over time, reductions in the frequency and severity of these collisions. In this section, we set out the results from a statistical analysis of casualties at over 2,000 camera sites in the 24 partnerships.

3.1 Why do we need to measure collisions and casualties?

The overall objective of the safety camera programme was to improve road safety. Collecting evidence that cameras were contributing towards this goal was critically important. In addition, there were a number of reasons why it was important to collect good information on collisions and casualties before and after enforcement:

1. To ensure that enforcement is intelligently deployed at the areas of greatest need (by time of day, by location, by day of week etc)
2. To provide local partnerships, on a site-by-site basis, with management information that can be used to verify that local enforcement strategies are having a positive effect on driver behaviour
3. To identify whether or not the increase in enforcement at a national level is achieving its policy objectives - that is to reduce the number of collisions and their severity.

3.2 Data collection and validation

Throughout this report we use two widely accepted measures for counting road collisions and road casualties. For collisions, we refer to personal injury collisions (PICs) – this is a road collision that results in at least one casualty (fatal, serious or slight). To measure casualties, we refer to people who were killed or seriously injured (KSIs) as a result of a road collision.

Each partnership provided the following baseline information for each camera site:

- Name
- Local authority
- Camera type
- Grid reference
- Date established
- Date made conspicuous
- Total number of PICs and KSIs (in three year baseline period)
- Pedestrian PICs and KSIs (in three year baseline period)
- Speed limit.

The following casualty information was collected for each camera site each month after the camera was installed:

- Total number of PICs and KSIs
- Pedestrian PICs and KSIs.

This was subject to a rigorous and extensive process of data cleansing to check, where possible, for completeness, consistency and accuracy. This process is included as Appendix D.

The resultant data was then prepared as input into the statistical model created by UCL.

3.3 Data analysis

We cannot reliably compare before and after frequencies to assess the impact of safety cameras because there are a number of other factors that influence the frequency of collisions. These include national trend, seasonality (there are more collisions at certain times of year), speed limit, length of observation, type of camera, location of installation etc. Also, we wished to see if different types of area had different effects and separate out the effect of cost recovery. To separate out all of these effects we adopted a statistical modelling approach.

A statistical analysis of the data was conducted in order to estimate the effect of the introduction of safety cameras on road safety. This analysis separates out those parts of the variations in the observed personal injury collision (PIC), and killed and seriously injured (KSI) casualty data that were associated with

safety cameras from others that were present in the data (for example the underlying national trend, seasonality, speed limits, etc). The model allowed for the number of months for which data was available in both the 'before' and 'after' camera period.

The safety camera effects on casualties and collisions that were investigated were associated with:

- the introduction of the camera itself (where this occurred after the partnership joined the national safety camera programme)
- increase in conspicuity of the camera (when fixed sites became more visible)
- the change to operation under cost recovery (when the partnership joined the national safety camera programme).

This allowed for cameras that were established before the start of the study period (in which case no effect of camera introduction was applied) and for new cameras. The changes that were made to make cameras more conspicuous were only applied to fixed cameras and not mobile cameras. Table 8 below describes how the model took into account the different combinations of cameras and effects.

Table 8 Description of how the model deals with the different combinations of urban/rural, fixed/mobile, existing/new and conspicuity

PIC/ KSI model	Input data			The model examines the combined effect of all three interventions		
	Type	Baseline	After	1. Partnership accepted onto the programme	2. Effect of introduction of camera (urban and rural)	3. Cameras made more conspicuous
Existing cameras	Fixed	Before cost recovery	Number of collisions and casualties	Yes	No	Yes
	Mobile	Before cost recovery	Number of collisions and casualties	Yes	No	No
New cameras	Fixed	Before camera introduction	Number of collisions and casualties	Yes	Yes	Yes
	Mobile	Before camera introduction	Number of collisions and casualties	Yes	Yes	No
Date		**Three years**[15]	**Monthly**	**By area**	**By camera**	**By camera**

All established cameras that were operating under cost recovery were taken to be conspicuous on or before the date that this was made mandatory (June 2002), and those that were established after this date were taken to be conspicuous from the start. The effect of operation under cost recovery was taken to apply to each camera site from whichever date was the later of the partnership's acceptance into the programme and the establishment of the camera site.

[15] For Thames Valley, one year's baseline data was used due to changes in reporting practice in the baseline period.

3.3.1 Statistical modelling to separate out the effects of the cameras against other factors

Investigation showed that the effects of cameras varied substantially according to whether or not the site was urban or rural (as represented by speed limit: sites with a speed limit of 40mph or less being taken as urban, those with higher speed limits being taken as rural) and the camera type (mobile or fixed). We found no statistically significant difference between fixed, red-light and digital cameras (they were found to be equally effective), and these have been grouped together in the analysis as 'fixed cameras'.

Thus separate estimates of effectiveness in respect of PICs and KSIs were made for each of the four combinations: Urban-Fixed, Urban-Mobile, Rural-Fixed and Rural-Mobile. In order to estimate the combined effect of safety cameras, the proportionate change was aggregated according to the number of sites of each combination to achieve weightings that were appropriate to the data. This method was used to find estimates for each of the categories Fixed (Urban-Fixed and Rural-Fixed), Mobile (Urban-Mobile and Rural- Mobile), Urban (Urban-Fixed and Urban-Mobile), Rural (Rural-Fixed and Rural-Mobile), and All.

The model considers variations in the observed numbers of casualties and collisions at each site. Several effects that were not associated with safety cameras are included, such as seasonal variations and long-term trend. Changes in the frequency of casualties and collisions that occur at the same time as safety camera interventions (establishment of a camera, a change in conspicuity requirements, or a change to operation under cost recovery) were then associated with this intervention.

Full details of the modelling approach are given in Appendix G.

As part of the data collection, we were also able to obtain substantial data on the number of people killed at camera sites before and after the introduction of cameras. These were annualised and compared directly.

3.4 Results from statistical modelling

Over the study period there was a national trend of over 4% per annum reduction in KSIs and a 1.5% per annum reduction in PICs. All figures quoted in section 3.4 are model estimates over and above these national long-term trends.

3.4.1 Changes in killed and seriously injured casualties at camera sites, by urban/rural and by camera type

Table 9 shows the model's estimates of the impact of safety cameras, in terms of changes to the frequency of KSIs, by urban (30mph and 40mph) and rural (50mph and above) and by camera type.

Table 9 Absolute and % changes in killed and seriously injured, for all cameras split by urban/rural and camera type (all figures over and above national long-term trend)

Changes to killed and seriously injured casualties (all partnership areas excluding South Wales[16])									
	No of sites			Change in KSIs(absolute numbers)			Change in KSIs(percentage)		
Speed limit	**Urban**	**Rural**	**Total**	**Urban**	**Rural**	**Total**	**Urban**	**Rural**	**Total**
Fixed sites	985	170	1155	-430	-81	-510	-49.0%	-59.9%	-50.6%
Mobile sites	782	259	1041	-263	-97	-360	-29.4%	-24.0%	-28.0%
All sites	**1767**	**429**	**2196**	**-692**	**-178**	**-870**	**-40.7%**	**-38.2%**	**-39.9%**

Comments

- The headline figure is that KSIs fell by 40% at camera sites
- This equated to 870 fewer KSIs per annum at these camera sites. 20% of this reduction was in rural areas. 80% of the reduction in KSIs was in urban areas
- Fixed sites have been more effective at reducing KSIs (-50%) when compared to mobile sites (-28%)
- Cameras have been similarly successful at reducing KSIs in urban and rural areas
- The most effective combination of camera type and area was fixed camera sites operating in rural areas (-60%)
- The least effective combination of camera type and area at reducing KSIs, although still showing a substantial reduction (-24%), was mobile cameras in rural areas
- We conclude that fixed sites in both urban and rural areas were more effective than mobile camera sites at reducing KSIs
- About half of the overall reduction in KSIs was achieved at fixed camera sites in urban areas
- The findings are also consistent with the speed analysis that also showed fixed camera sites to be more effective than mobile ones
- The estimate of 40% reduction in KSIs has a 95% confidence interval of 32% to 42% (see Appendix G for a list of all confidence intervals).

[16] South Wales was excluded from the KSI analysis because of changes in reporting practice in the baseline period.

3.4.2 Changes in personal injury collisions at camera sites, by urban/rural and by camera type

Table 10 shows the model's estimates of the impact of safety cameras, in terms of changes to the frequency of PICs, by urban (30mph and 40mph) and rural (50mph and above) and by camera type.

Table 10 Absolute and % changes in personal injury collisions, for all cameras split by urban/rural and camera type (all figures over and above national long-term trend)

Changes to personal injury collisions (all partnership areas)									
	No of sites			Change in PICs (absolute numbers)			Change in PICs (percentage)		
Camera type	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Fixed sites	1073	170	1243	-2555	-200	-2555	-42.1%	-38.1%	-41.6%
Mobile sites	857	275	1132	-1302	-173	-1475	-25.2%	-15.2%	-22.8%
All camera sites	1930	445	2375	-3657	-373	-4030	-34.6%	-23.9%	-32.6%

Comments

- The headline figure is that PICs fell by around 33% in total
- This equated to a reduction in PICs of 4,030 at camera sites. Less than 10% of this reduction in PICs was in rural areas. 90% was in urban areas
- On the whole, fixed sites were more effective at reducing PICs (-42%) when compared to mobile sites (-23%)
- On the whole, cameras were more successful at reducing PICs in urban areas (-35%) than in rural areas (-24%)
- The most effective combination of camera type and location at reducing PICs was fixed camera sites operating in urban locations (-42%)
- The least effective combination of camera type and location at reducing PICs, although still a reduction (-15%), was mobile cameras in rural locations
- We conclude that fixed camera sites in both urban and rural areas are more effective than mobile camera sites at reducing collisions
- The findings are consistent with the results of the speed analysis, which also showed fixed cameras to be more effective than mobile ones
- The estimate of 33% reduction in PICs has a 95% confidence interval of 28% to 36%.

3.4.3 Changes in pedestrian collisions and casualties at camera sites, by camera type

In addition to examining the effect on total pedestrian KSIs and PICs at camera sites, 21 out of the 24 partnership areas were also able to provide data on the number of pedestrian KSIs and PICs at camera sites. A further run of the model was carried out to establish whether or not we could identify whether or not there had been an impact on pedestrian collisions and casualties at camera sites.

Tables 11 and 12 show the model estimates of the combined impact, in terms of changes to the frequency of pedestrian KSIs and PICs, by camera type.

Table 11 Absolute and % changes in pedestrian KSI casualties, by camera type (all figures over and above national long-term trend)

	Number of sites contributing to the analysis	Changes in overall number of pedestrian KSIs	Changes in pedestrian KSIs
Camera type		**Total**	**%**
Fixed sites	938	-61	-46%
Mobile sites	702	-70	-28%
All camera sites	**1640**	**-131**	**-35%**

Table 12 Absolute and % changes in pedestrian PIC collisions, by camera type (all figures over and above national long-term trend)

	Number of sites contributing to the analysis	Changes in overall number of pedestrian PICs	Changes in pedestrian PICs
Camera type		**Total**	**%**
Fixed sites	790	-96	-18%
Mobile sites	1029	-233	-28%
All camera sites	**1819**	**-329**	**-23%**

Comments

- Overall, across all cameras and 21 partnership areas, there was a 35% reduction in pedestrian KSIs, and a 23% reduction in pedestrian PICs
- There was a greater reduction in pedestrian KSIs at fixed camera sites (-46%) than at mobile sites (-28%)
- There was a greater reduction in pedestrian PICs at mobile camera sites (-28%) than at fixed sites (-18%)
- In absolute terms, across 21 partnership areas, there was a total reduction of 131 pedestrian KSIs and 329 fewer pedestrian PICs per annum
- The estimate of 35% reduction in pedestrian KSIs has a 95% confidence interval of 31% to 40%
- The estimate of 23% reduction in pedestrian PICs has a 95% confidence interval of 19% to 25%.

3.4.4 Changes in personal injury collisions at camera sites, by partnership area

In order to investigate the possibility of differences between the performance of partnership areas, the statistical model was extended to include a separate effect for each area (details of this are given in Appendix G). This model estimated for each partnership area the performance over and above that attributed to the mix of camera types (fixed/mobile) and their locations (urban/rural).

The results of this model, aggregated over all sites within a partnership area, can be used to provide an indication of the performance of each area. The results of this are shown in Table 13. These provide estimates for the site-by-site change in mean frequency of occurrence of PICs within the partnership areas, and can be compared with the general effect of 33% reduction estimated jointly from all sites in the study.

As would be expected, these estimates are distributed around the general value: there are several reasons for these differences between partnerships, including differences between the mix of cameras that were deployed, differences between the sites that were treated, and differences between the scope for making improvements in light of the prevailing levels of road safety.

3.4.5 Changes in killed and seriously injured at camera sites, by partnership area

A model similar to that described in 3.4.4 was also used to investigate differences between the effects on KSIs between areas. Because KSIs occur relatively infrequently, there was not sufficient data (in terms of active camera months) to produce a reliable estimate for all areas. For this reason, we exclude model results from areas that had only been operational for one year (ie those starting in April 2002). Evidence is, however, accumulating and subsequent analysis could revisit this in due course once more data is available for these partnerships.

Table 14 shows the model estimates for the 14 areas that have been operational for at least 18 months (as with other analyses of KSI casualties, excluding South Wales). Each of the area estimates was compared with the general effect of 40% reduction in KSIs estimated jointly from all sites in the study.

Table 13 Estimates of the combined effect on PICs of cameras operating under cost recovery, by partnership area

Effect on personal injury collisions (per annum)		
Partnership area *	**Overall effect (absolute numbers)**	**Overall effect on PICs (%)**
Avon, Somerset and Gloucestershire		
- Avon and Somerset	-120	-13%
- Gloucestershire	-42	-23%
Bedfordshire	-84	-42%
Cambridgeshire	-14	-21%
Cleveland	-52	-50%
Derbyshire	-148	-23%
Essex	-152	-23%
Fife	-31	-15%
Lancashire	-434	-54%
Leicestershire	-68	-11%
Lincolnshire	-30	-24%
London	-648	-35%
Norfolk	-93	-41%
North Wales	-91	-41%
Northamptonshire	-43	-46%
Nottinghamshire		
- Nottingham (City)	-99	-16%
- Nottinghamshire (excluding City)	-29	-12%
South and Mid Wales		
- South Wales	-115	-32%
- Dyfed-Powys	-73	-28%
- Gwent	-71	-39%
South Yorkshire	-627	-60%
Staffordshire	-139	-20%
Thames Valley	-152	-28%
Warwickshire	-66	-23%
West Yorkshire	-376	-72%
Wiltshire	-36	-64%

* Although Hampshire and Strathclyde had reductions in the frequency of PICs at camera sites, there was insufficient data for the model to produce reliable estimates of specific effects for these areas.

Table 14 Estimates of the combined effect on KSIs of cameras operating under cost recovery for at least eighteen months, by partnership area

Effect on killed and seriously injured (per annum)		
Partnership area *	**Overall effect on KSIs (absolute numbers)**	**Overall effect on KSIs (%)**
Cambridgeshire	-11	-55%
Derbyshire	-26	-17%
Lancashire	-81	-58%
Lincolnshire	-7	-18%
Norfolk	-55	-56%
North Wales	-34	-68%
Northamptonshire	-13	-46%
Nottingham (City)	-38	-33%
Staffordshire	-16	-30%
Strathclyde	-7	-34%
Thames Valley	-52	-43%
Warwickshire	-35	-42%

Comments on PIC and KSI tables

- 22 out of the 24 areas had statistically significant changes at PIC level that were either consistent with the general effect or different from zero. All of the changes were reductions
- 12 out of the 14 areas had statistically significant changes in KSIs at camera sites that were either consistent with the general effect or different from zero. All of the changes were reductions.
- The effects are illustrated in Figures 6 to 9

* Although Cleveland and Essex had reductions in the frequency of KSIs at camera sites, there was insufficient data for the model to produce reliable estimates of specific effects for these areas.

Figure 6 % change in PICs at camera sites, by partnership area (only significant effects shown)

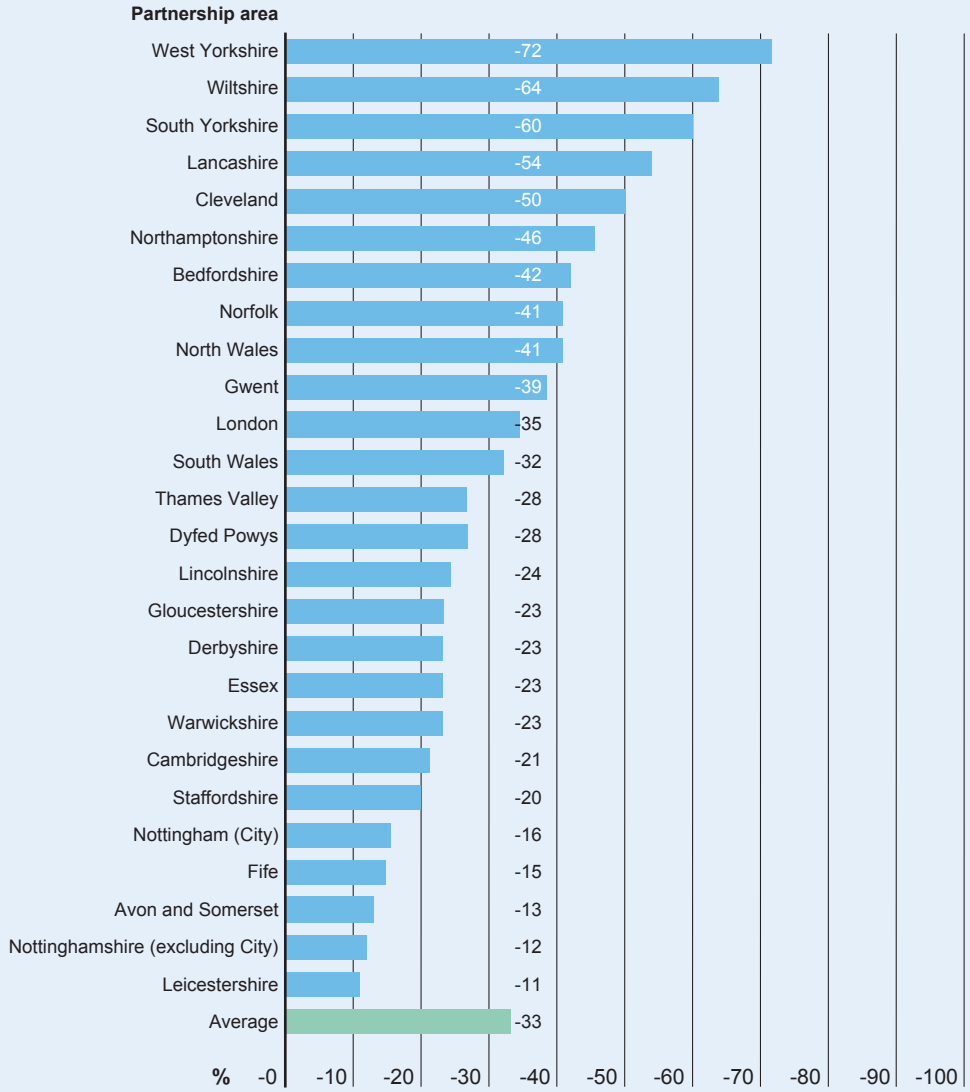


Figure 7 Percentage change in PICs by camera type, by urban/rural

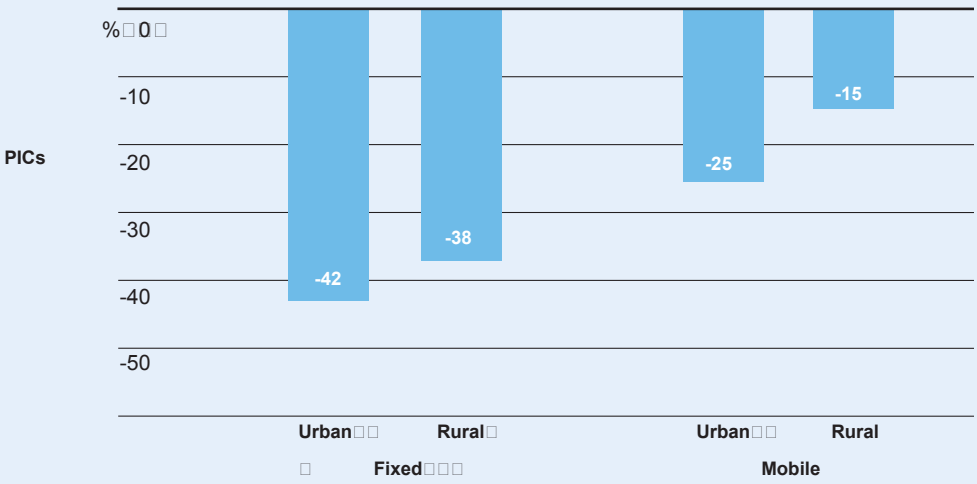


Figure 8 % change in KSIs at camera sites, by partnership area (only significant effects shown)

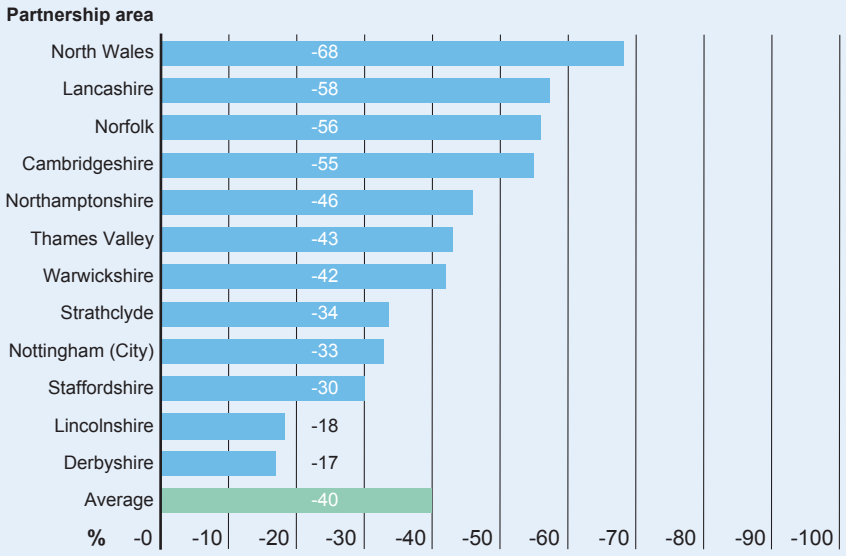
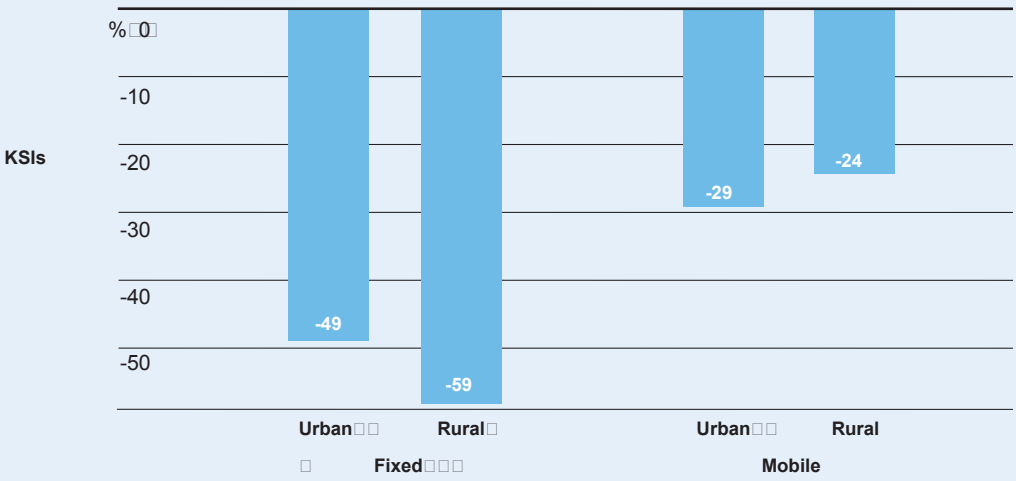


Figure 9 Percentage change in KSIs by camera type, by urban/rural area



3.5 Further analysis

3.5.1 Changes in fatalities at camera sites, by partnership area

We were also asked to examine whether or not there had been changes in overall number of fatalities at camera sites. A request for data was sent to the 24 partnership areas to look at all their camera sites and supply the number killed before (3 years) and after enforcement. Results – shown in Table 15 – were annualised to allow a direct before and after comparison.

Table 15 Changes in fatalities only, by camera type and urban/rural, showing the before and after frequency at camera sites

Changes to fatalities at camera sites (per annum figures)									
	No of sites			Change in fatalities (absolute numbers)			Change in fatalities (percentage)		
Camera type	**Urban**	**Rural**	**Total**	**Urban**	**Rural**	**Total**	**Urban**	**Rural**	**Total**
Fixed sites	1655	201	1856	-35	-15	-50	-41%	-56%	-45%
Mobile sites	1188	332	1520	-42	-13	-55	-47%	-20%	-36%
All camera sites	**2843**	**533**	**3376**	**-77**	**-28**	**-105**	**-44%**	**-31%**	**-40%**

Comments

- Across 3,376 sites, there were 105 fewer fatalities per annum in the 24 partnership areas. (In absolute numbers, there were 265 fatalities per annum before and 160 per annum after)
- This equates to a 40% reduction in frequency which, coincidentally, is the same reduction as the model estimated for changes in KSIs
- No adjustment was applied to account for long-term trend as the number of killed did not drop substantially in this study period.

3.5.2 Can we associate changes in speed with changes in casualties?

In section 2, we compared speeds at camera sites before and after enforcement and showed that there had been substantial reductions in speed at camera sites. In this section, we have also shown that there have been significant reductions in casualties at camera sites. Tables 16 and 17 compared the reductions in casualties to the reductions in speeds to see if there is any correlation between the reductions in speed and reductions in casualty. This was split between fixed and mobile camera and also urban and rural speed limits.

Table 16 Is there a correlation between changes in speed and casualties (% changes)

	Changes in speed (%)					Changes in casualties (%)			
Camera type	Speed limit	% exceeding	% >15mph over limit	Average speed limit	85th percentile speed	Personal injury collisions	Killed	Killed and seriously injured	Pedestrian KSI
Fixed	Urban	-72%	-82%	-17%	-20%	-42%	-41%	-49%	-46%
	Rural	-46%	-64%	-8%	-10%	-38%	-56%	-60%	–
Mobile	Urban	-21%	-30%	-5%	-5%	-25%	-47%	-29%	-28%
	Rural	-19%	-20%	-3%	-3%	-15%	-20%	-24%	–

Table 17 Is there a correlation between changes in speed and casualties (absolute numbers)

	Changes in speed (absolute numbers)					Changes in casualties (numbers per annum/1000 sites)			
Camera type	Speed limit	% exceeding limit	% >15mph over limit	Average speed	85th percentile speed	Personal injury collisions	Killed	Killed and seriously injured	Pedestrian KSI
Fixed	Urban	-37.9%	-3.4%	-5.4mph	-7.7mph	-2915	-21	-436	-79
	Rural	-8.1%	-2.2%	-4.3mph	-6.0mph	-1178	-75	-474	–
Mobile	Urban	-10.6%	-0.8%	-1.6mph	-2.0mph	-1519	-35	-335	-70
	Rural	-4.6%	-0.5%	-1.8mph	-1.9mph	-630	-39	-377	–

Comments

- There is a correlation between changes in speed and casualties at PIC level
- Speed surveys at mobile sites showed that, whilst they do reduce vehicle speeds, greater reductions in speeds were achieved at fixed camera sites
- This translates into consistently greater casualty reductions at fixed camera sites when compared to mobile sites in both percentage and absolute terms
- Mobile cameras affect PICs in a similar way to fixed cameras. Mobile cameras are effective, but less so than fixed cameras.

3.6 Conclusions

- The results showed that, overall, the number of killed and serious casualties and personal injury collisions had reduced at camera sites. These reductions were over and above the national long-term trend
- There was around 40% fewer KSIs at cameras sites and 33% fewer PICs
- Fixed camera sites were more effective at reducing casualties than mobile cameras, although both reduce speed, collisions, casualties and deaths
- Fatalities were down substantially at camera sites (a reduction in excess of 40%). There were over 100 fewer deaths
- Pedestrian casualties were also down (a reduction of 23% in PICs and a reduction of 35% in KSIs)
- There was a strong correlation between the fall in speed and the fall in collisions, casualties and deaths at camera sites.

Has there been a general acceptance of the road safety benefits?

In this section, we consider results from independent surveys of public opinion that were commissioned by local partnerships in the first three years of the safety cameras cost recovery programme. We also consider a number of results from national surveys.

4.1 Why do we need to measure public awareness?

One of the objectives of the programme was to reassure the public that the primary motivation behind additional enforcement activity was to improve road safety. Each partnership area allocated a proportion of its approved budget for public awareness and communication programmes.

4.2 Data collection and validation

Most areas have commissioned independent research, which asked four standard questions. Results were compared to a previous research study in 1998[17]. In addition to the standard questions, three additional questions were asked. These were first used by the Lincolnshire partnership in 2001/2.

[17] Department for Transport Road Safety Research Report No.11 – *The effects of speed cameras: how drivers respond.* Feb 1999.

Original Brunel University questions (% agree)

- Cameras are meant to encourage drivers to stick to the limits, not punish them
- Fewer collisions are likely to happen on roads where cameras are installed
- Cameras are an easy way of making money out of motorists
- Cameras mean that dangerous drivers are more likely to get caught

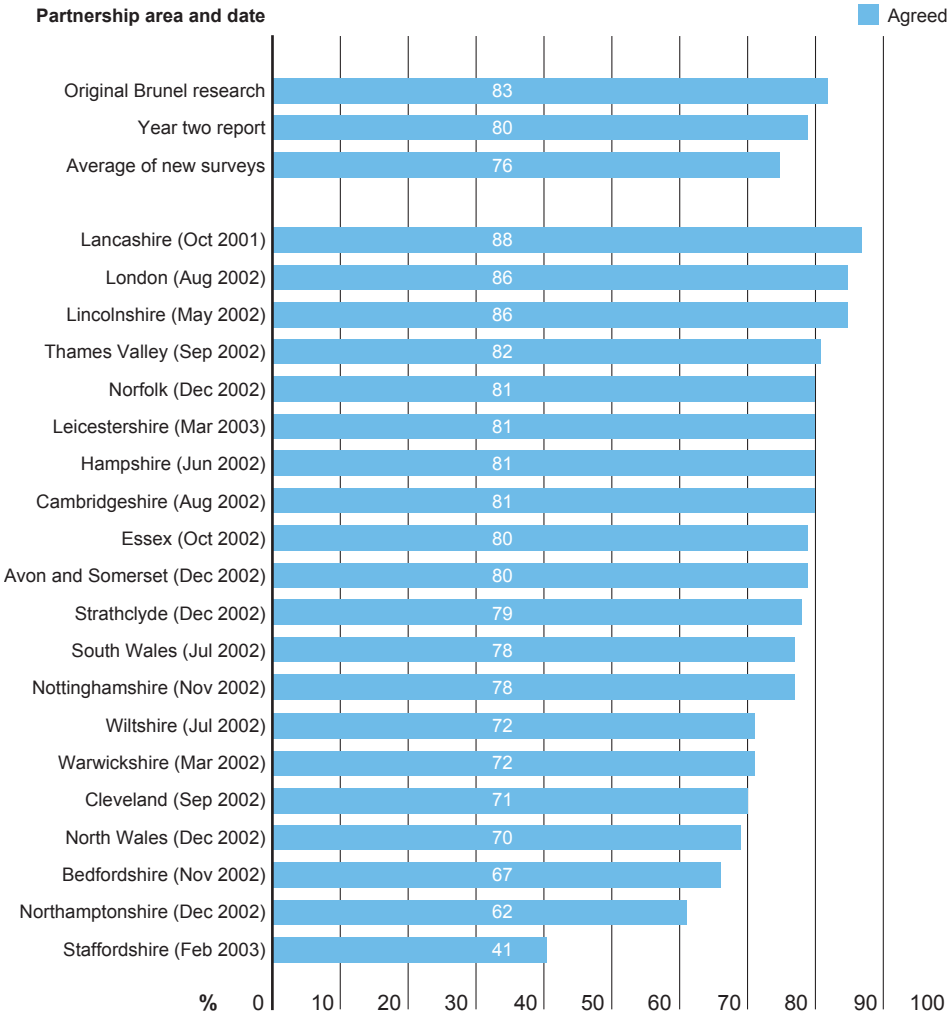
Additional questions (% agree)

- The use of safety cameras should be supported as a method of reducing casualties
- The primary aim of cameras is to save lives
- There are too many safety cameras in our local area

Results for each of these questions are given in Charts 1 to 7, split by partnership area.

4.2.1 Cameras are meant to encourage drivers to stick to the limits

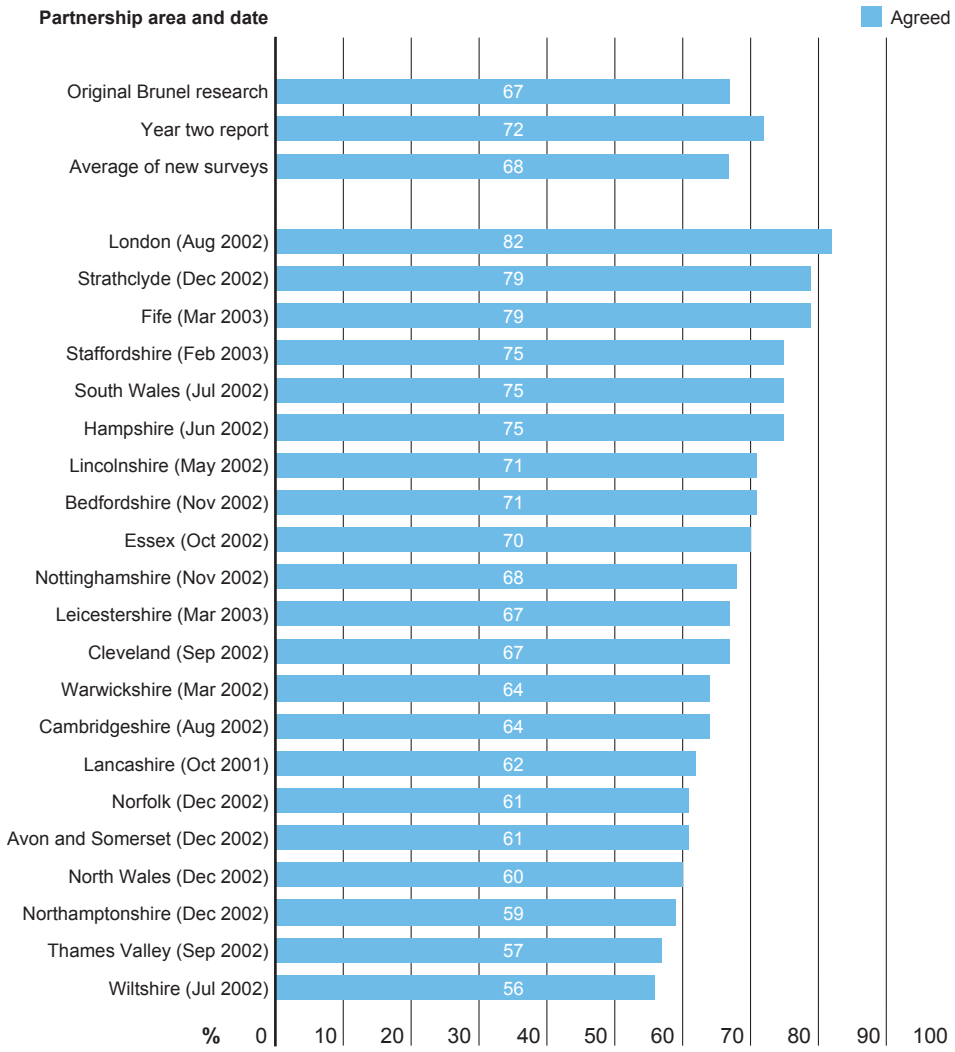
Chart 1 Cameras are meant to encourage drivers to stick to the limits



- Although there was a wide variation in the responses, a significant majority of respondents still agreed with the statement that the purpose of cameras was to encourage compliance with speed limits.

4.2.2 Fewer collisions are likely to happen on roads where cameras are installed

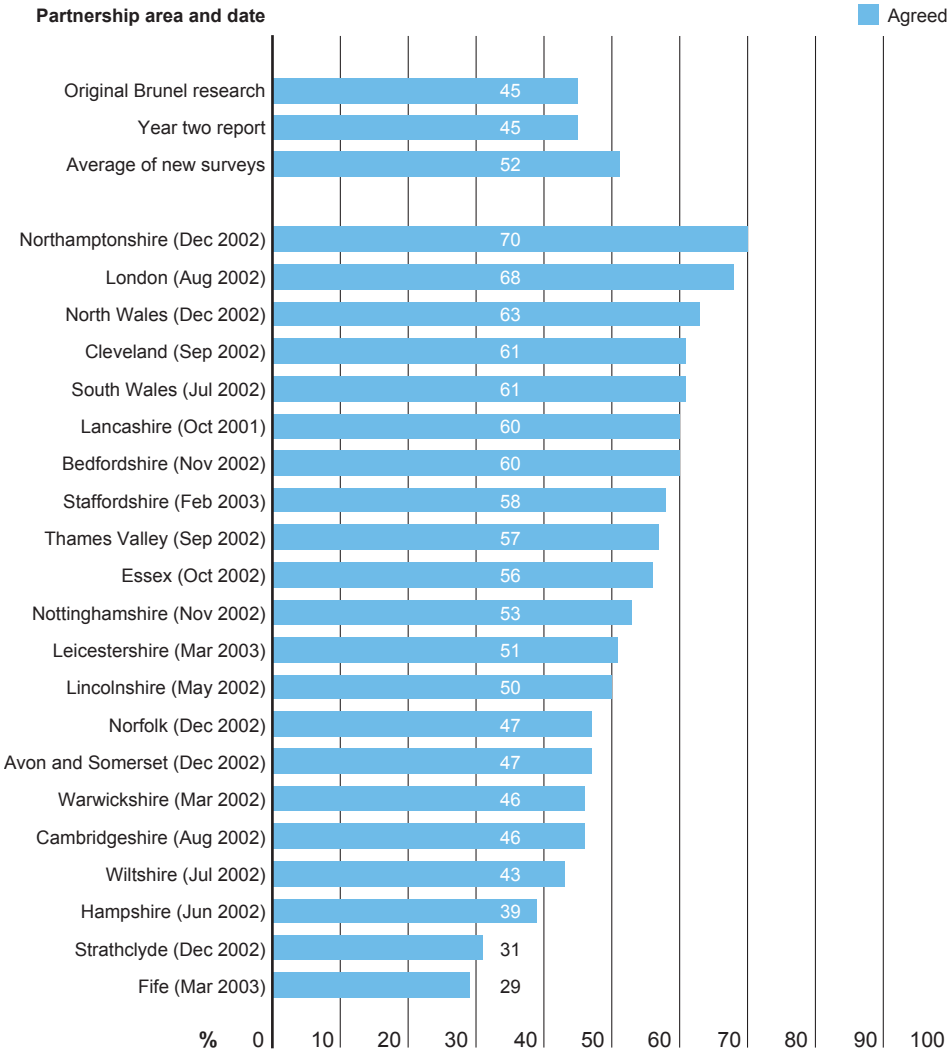
Chart 2 % agreement with the statement that 'fewer collisions are likely to happen on roads where cameras are installed'



- The majority of respondents believed that safety cameras were likely to reduce collisions
- We conclude that the public, in general terms, continued to accept that there was an established link between cameras and collision reduction.

4.2.3 Cameras are an easy way of making money out of motorists

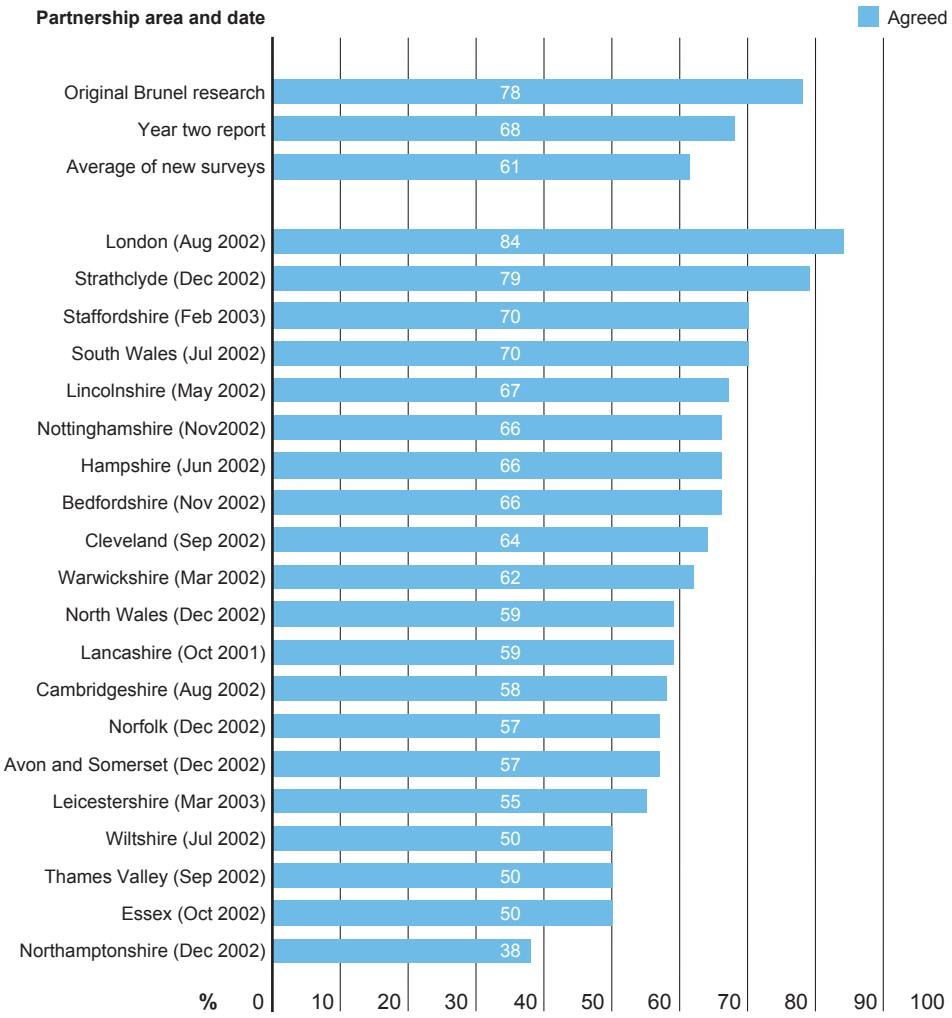
Chart 3 Cameras are an easy way of making money out of motorists



- Around half of respondents agreed with the statement that cameras were an easy way of making money out of motorists – an increase over previous surveys (+7%)
- This is not, perhaps, surprising, given the national coverage that the programme has received. What is surprising is the considerable variation between different partnership areas.

4.2.4 Cameras mean that dangerous drivers are more likely to get caught

Chart 4 Cameras mean that drivers are more likely to get caught

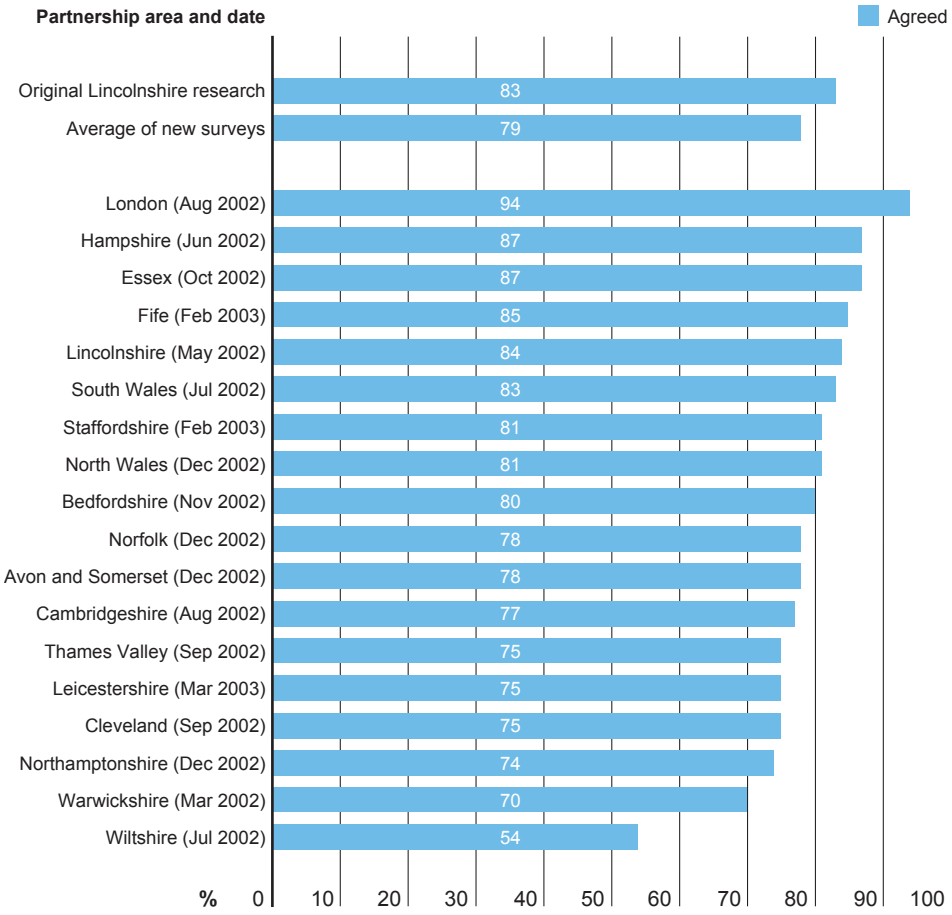


- The survey results indicated that the public generally accepted that cameras increased the probability of catching dangerous drivers, although again there is a wide variation between partnership areas
- Although a significant majority continue to accept this view, this has declined from previous surveys.

4.2.5 The use of safety cameras should be supported as a method of reducing casualties

In addition, to the standard four questions, an additional three questions were added for national rollout (first asked in Lincolnshire). Results from these are summarised below.

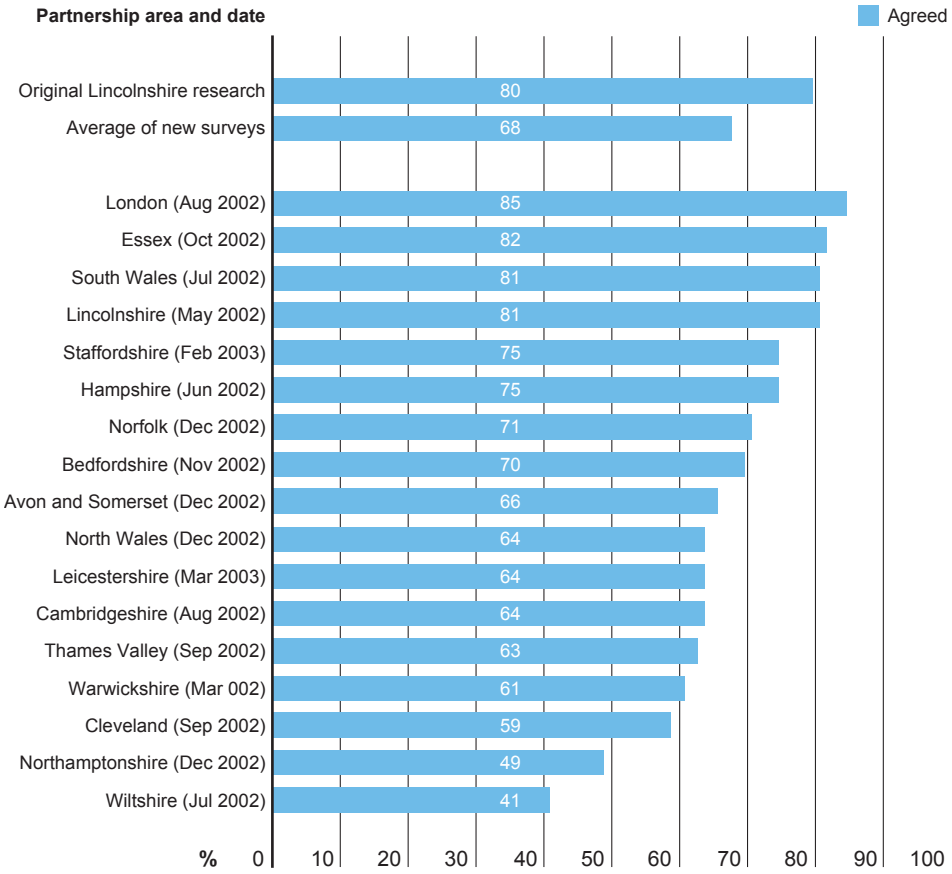
Chart 5 The use of cameras should be supported as a method of reducing casualties



- Across all partnerships 79% supported the use of cameras to reduce road casualties – a similar effect to that found in Lincolnshire
- We conclude that the public, in general terms, accepted that there is a link between cameras and casualty reduction and are supportive of their use for these purposes.

4.2.6 The primary aim of cameras is to save lives

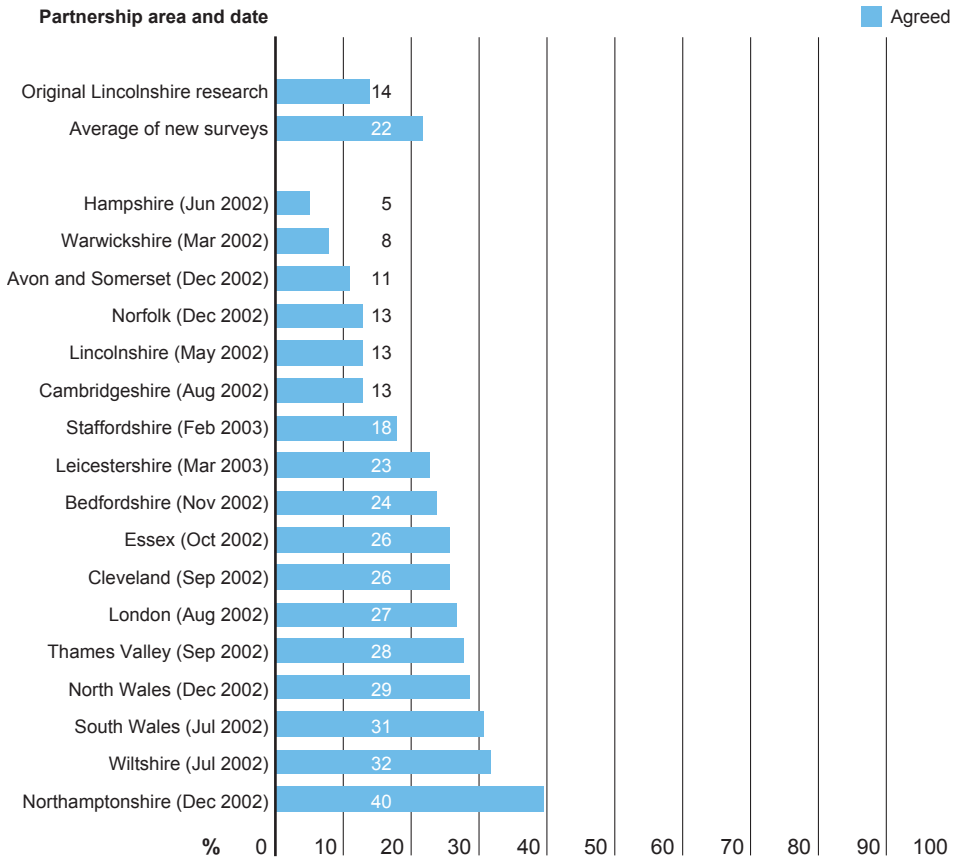
Chart 6 The primary aim of cameras is to save lives



- 68% agreed with the statement that the primary use of safety cameras was to save lives. This was less than found in Lincolnshire originally, but remained positive across the majority of partnership areas surveyed
- On this basis and the responses to other questions, we conclude that the majority of the public acknowledge and support the use of cameras to improve road safety.

4.2.7 There are too many safety cameras in our local area

Chart 7 Proportion of people agreeing with the statement 'There are too many speed cameras in our area'



- Only a small number of respondents thought that were too many safety cameras in their area although this is higher (+8%) when compared to the original Lincolnshire survey
- Only 22% agreed with the statement that there were too many speed cameras in their area.

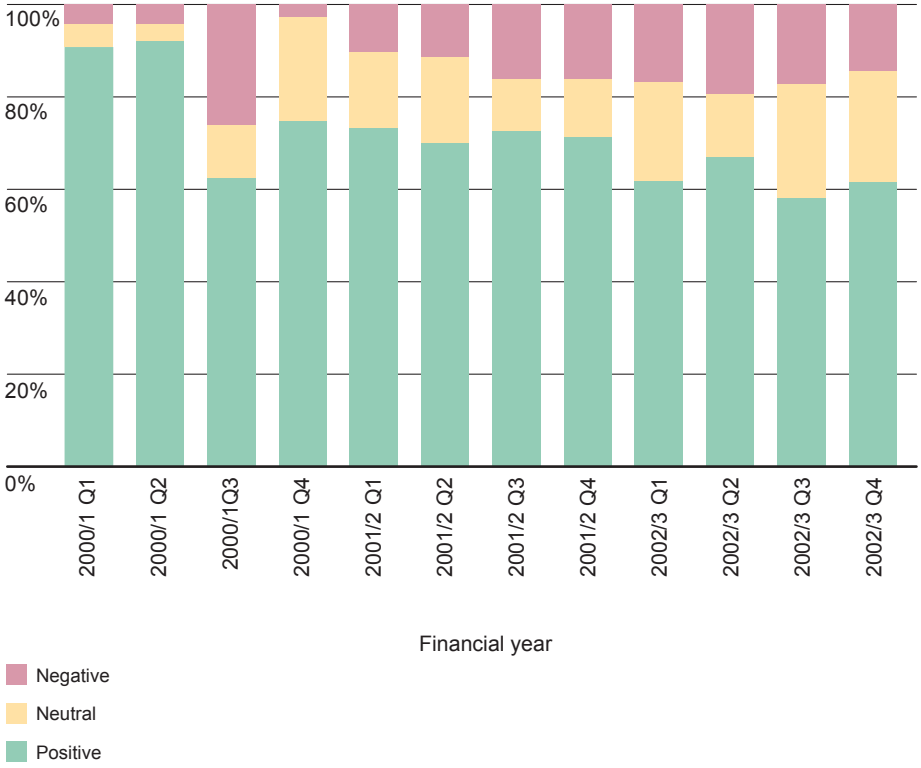
4.3 Local press coverage

Twenty partnership areas recorded the amount of local press coverage (in column inches) relating to the pilot during the first two years of the system and recorded whether or not coverage was positive, negative or neutral. This data was collated on a monthly basis during the first three years of the programme.

4.3.1 Proportion of positive, negative and neutral local press coverage

Chart 8 shows the overall level of support for camera enforcement in 20 areas in the first three years.

Chart 8 Local press coverage for camera 20 safety partnerships



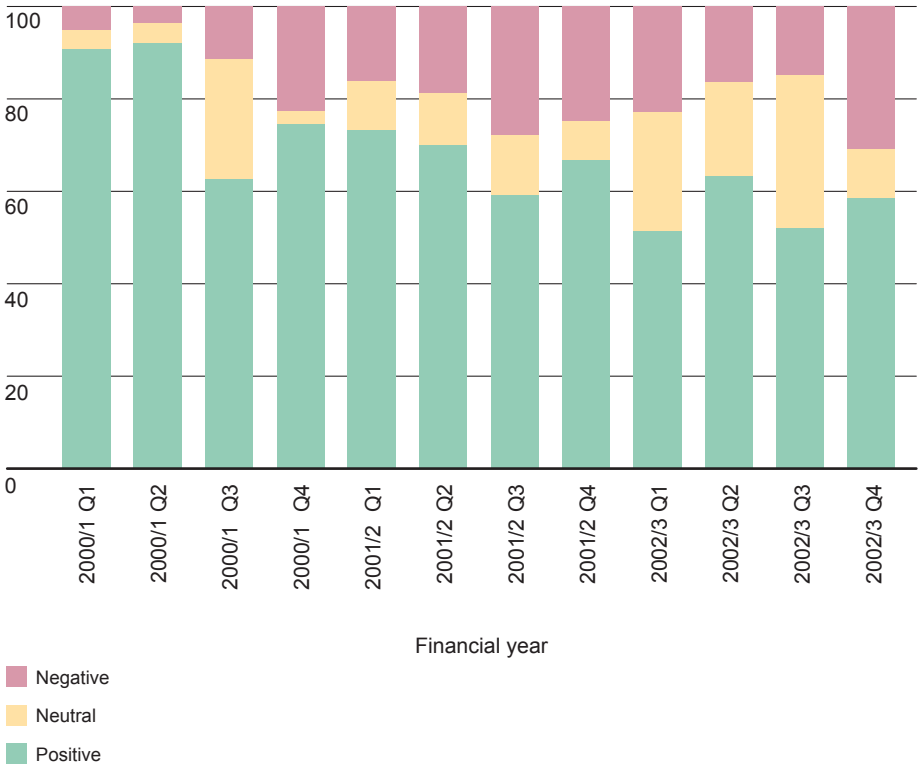
The analysis shows that, in the first six months of the pilot, local press coverage was overwhelmingly supportive (more than 90% of column inches devoted to cameras supported camera enforcement). After the first six months of the system the percentage of column inches that were in support of camera enforcement remained at around 70%.

On average, over the first three years of the programme, 67% of press coverage was supportive of camera enforcement, 18% was neutral and 15% was negative.

4.3.2 Tracking local press coverage in the eight original pilot areas

The chart below shows the local press coverage for camera enforcement in the eight original pilot areas in the first three years.

Chart 9 Coverage of the safety camera programme in eight pilot areas

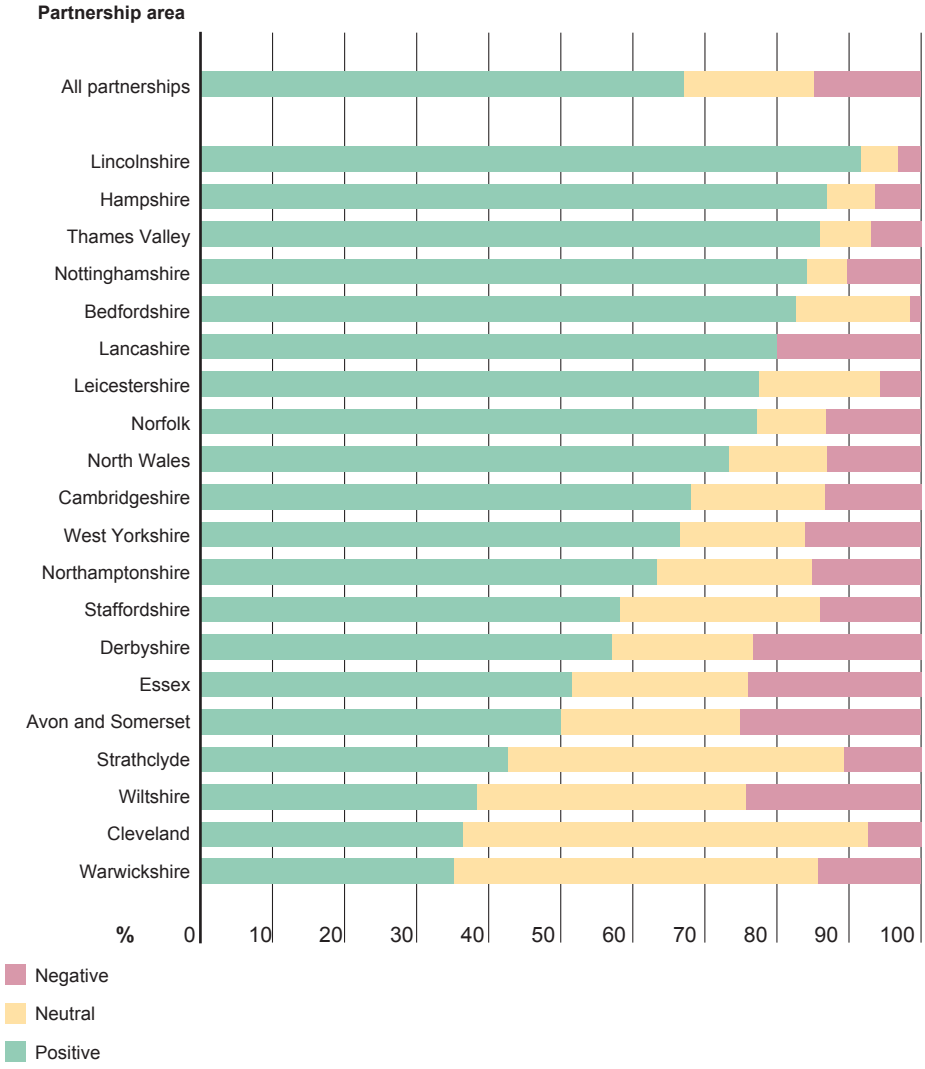


The analysis shows the proportion of positive, neutral and negative press coverage that the eight pilot areas have had in the first three years. The majority has been positive or neutral, although there has been more negative publicity in the last two years.

4.3.3 Local press coverage by partnership area

Chart 10 shows the proportion of local press coverage (as measured by column inches) that each partnership has received.

Chart 10 Balance of local press coverage of safety cameras by partnership areas



- On balance, taken across all partnership areas, local press coverage was generally positive towards the safety camera programme, a situation not always reflected in national coverage
- On average, 85% of all local coverage was positive or neutral
- There was a wide variation in the coverage across the country.

Chart 11 Examples of the range of press coverage

4.4 Additional national surveys

In addition to surveys carried out at regular intervals by the pilots, a number of independent national surveys were carried out. The most recent of these was a poll of polls, released in November 2003 by Transport 2000, which demonstrated ongoing popular support for speed cameras. Based on six different surveys, this showed that support for the use of speed cameras averaged 74%. The latest poll was carried out by ICM for the BBC and showed support for speed cameras running at 75% with only 19% against.

- The ICM Research Ltd poll carried out for the BBC in October 2003 asked: "Taking all things into account, on balance, would you say you are in favour of speed cameras or against speed cameras." 75% cent responded to say they were in favour; with only 19% against
- An NOP/Evening Standard poll in summer 2002 found that 84% of motorists in London and the southern region viewed the use of speed cameras as a good thing, even though more than half had been 'flashed', or flashed and fined, by one
- A November 2002 You Gov poll by Transport 2000 showed that 75% of respondents in London thought that cameras should be used more widely on dangerous roads
- A 2003 study for the Scottish Executive carried out by researchers at Napier University said that 75% of drivers thought speed cameras to be a good thing
- The 2003 Used Car Market Report recorded 62% approval for speed cameras amongst motorists

- A survey by MORI on behalf of Direct Line in July 2001[18] questioned 2,000 individuals across the country about their attitude towards cameras. The results of this survey were that:
  - 70% of people questioned thought that well placed cameras were a useful way of reducing collisions and saving lives
  - Only 21% of people thought that speed cameras were an infringement of civil liberties and only 16% thought they were a waste of time and money
  - 89% of respondents said that cameras made them think more carefully about how fast they were driving
  - 72% thought that speeding in a 30mph limit was a very serious offence.
- A separate national survey published by the RAC in January 2002 revealed that 45% of respondents cited driving too fast as the main cause of collisions on the road compared to just 9% who identified drink driving as a main cause of road collisions. The vast majority of drivers in the RAC survey (78%) stated that speed cameras were a good way of deterring people from speeding and did not consider them to be an infringement of their personal liberty and 76% of drivers supported having more cameras at traffic lights to catch red-light runners.

4.5 Conclusions

- The majority of people questioned in local surveys believe that cameras are meant to encourage drivers to keep to speed limits rather than to punish them and, as a result, reduce collisions and casualties
- The level of public support for the use of cameras has been consistently high with 79% of people questioned agreeing that the use of safety cameras should be supported as a method of reducing casualties
- On average, over the first three years of the programme, 85% of all local press coverage was positive or neutral
- On balance, whilst support for safety cameras generally varied from area to area, the public remained broadly supportive, although there is some evidence that this support was declining in a number of areas, and there remained some concern that the cameras are associated with revenue raising and not casualty reduction.

[18] Direct Line survey reveals drivers approve of speed cameras http://www.mori.co.uk/polls/2001/dl-010720.shtml

Have the funding and partnership arrangements worked well?

In this section, we set out some of the financial aspects of the programme to evaluate the costs and the benefits of the programme as a whole.

5.1 Why measure the funding and partnership arrangements?

As well as putting in place mechanisms to control costs, HMT guidance is that cost recovery systems should also satisfy the following rules:

- are arrangements in place that will ensure that the activity will not lead to the abuse of fine and penalty collection as a method of revenue-raising and that operational priorities will remain undistorted?
- will revenues always be sufficient to meet future costs, with any excess revenues over costs being surrendered?
- can costs of enforcement be readily identified and apportioned without undue bureaucracy, and with interdepartmental and inter-agency agreement where necessary?
- can savings be achieved through the change and are adequate efficiency regimes in place to control costs, including regular efficiency reviews?

Financial systems were put in place satisfy these rules and these have been operating successfully since the original pilots began in April 2000.

5.2 Data collection

In order to ensure that the partnerships were complying with these rules, a handbook was prepared (summarised in Appendix A) that set out what constitute allowable expenditure. Each year, each partnership submitted an operational case to the national programme board. This included their planned enforcement activity and their expected expenditure. At the end of the year, each partnership submitted their accounts to an independent auditor to ensure that expenditure was in line with the handbook rules.

Under the rules of cost recovery, all eligible costs associated with camera enforcement and the processing of fixed penalty notices were recoverable by members of the partnership (police, local authorities, Magistrates' Courts). Any surplus over and above these costs was returned to HMT Consolidated Fund. At the end of each year, partnerships were required to submit audited accounts showing that only costs relating to camera enforcement had been claimed. Only when a clear audit certificate had been issued did a partnership receive final payment to cover its costs. To date, all partnerships have received clear audit certificates. Figures for costs and income, covered in this section, were obtained from these audit certificates.

5.3 Costs and receipts

In total over three years, the 24 partnerships have recovered around £79million of their expenditure on camera enforcement, whilst the Department for Constitutional Affairs (originally the Lord Chancellor's Department) has received around £99million in fixed penalty receipts with over £20million being returned to HMT (after taking into account deficits).

Table 18 below summarises the total recovered costs and receipts (excluding grants) in the programme to date.

Table 18 Total programme receipts and costs per annum for first three years (excluding grants)

Financial year	Receipts	Costs incurred	Surplus/ deficit
2000/1	£10,352,440	£ 8,985,247	£ 1,367,193
2001/2	£19,660,780	£16,106,559	£ 3,554,221
2002/3	£68,872,320	£54,256,502	£14,615,818
Three year total	**£98,885,540**	**£79,348,308**	**£19,537,232**

A detailed breakdown of costs and income for each area is provided in Appendix F.

In assessing the management of the safety camera programme, we have also considered the efficiency. The principal measure in this regard is the revenue cost incurred per fixed penalty notice paid. This relates the costs of administration, education and policing associated with speed and red light camera enforcement (see Table 19).

Table 19 Revenue cost to process a paid fixed penalty notice

	Financial year		
	2000/2001	**2001/2002**	**2002/2003**
Cost per FPN paid	£19.83[19]	£34.67	£31.13

- The full costs of processing a fixed penalty notice rose from 2000/1 to £34.67 in 2001/2 and declined in 2002/3 to £31.13 due to efficiency improvements.

5.4 Economic assessment of programme

The annual cost of road collisions in Great Britain is around £17.8bn a year (2002 figures). Table 20 below gives a breakdown of the value of preventing all injuries on a per collision basis using DfT values for the costs associated with road injuries. It shows that, on average across all injuries, the cost of a collision, with respect to casualty costs, is approximately £55,000[20].

Table 20 Average value of prevention per PIC across all levels of injury

Injury severity	Lost output (£)	Medical and ambulance (£)	Human costs (£)	Total (£)
All personal injury[21]	11,410	2,520	41,050	54,980

It was hoped that safety cameras introduced as part of the programme would bring about a reduction in collisions and casualties and this, in turn, would also bring about a saving in social and human costs. It has been estimated that 4,030 fewer PICs will occur annually as a result of the safety cameras in place across all 24 partnerships. The annual economic benefit of cameras in place at the end of year three is therefore at least **£221million**.

This figure incorporates the costs of all personal injuries at collisions (fatal, serious and slight) and does not take account of the fact that safety cameras reduce KSIs more than PICs. Therefore, the economic benefit associated with safety cameras in the programme is potentially underestimated.

One means of assessing the efficiency of spend is the revenue costs per collision prevented which, over the three years, equates to **£13,736** per collision prevented across all injury types. The corresponding economic benefit (as a result of injuries prevented) per collision is **£54,980**. This gives a positive cost-benefit ratio of around **4:1**.

5.5 Conclusions

- There have been significant savings in social and human terms across the partnership areas. The estimated value of the reduction in collisions in 2002/3 was in the region of £221million. This equates to a cost-benefit of around 4:1.

[19] Note that the cost recovery rules changed from year one to year two. (In 2000/1, areas were permitted to recover the additional costs of enforcement over and above existing activity – this was changed in 2001/2 to include all costs.)

[20] These costs only relate to injury costs and therefore do not include collision costs such as property damage, police and insurance costs.

[21] Values as per *Highways Economic Note No.1 (HEN1)* Department for Transport. (2002) – Table 3, average value of prevention per collision by severity and element of cost.

Summary of conclusions

In this section, we summarise the conclusions drawn from the previous sections.

The safety cameras cost recovery programme was considered to be a success if there was:

1. A significant reduction in speed at camera sites
2. A significant reduction in casualties at camera sites
3. General public acceptance of the road safety benefits
4. Satisfactory working of the funding and partnership arrangements.

A significant reduction in speed at camera sites

- We conclude that both fixed, mobile and speed over distance cameras have been effective in reducing speed and maintaining high levels of compliance with speed limits
- Fixed cameras have proved more effective than mobile cameras in reducing speed
- Taking all cameras into account, the reductions in speed have been greatest at fixed, urban sites
- From areas that conducted speed surveys over a sustained period, we conclude that the reductions were not just 'one-off' but were sustained over time. In fact, for mobile sites, the one-off reductions are not only sustained but actually are strengthened further as sites matured.

General public acceptance of the road safety benefits

- The majority of people questioned in local surveys believed that cameras are meant to encourage drivers to keep to speed limits rather than to punish them and, as a result, reduce collisions and casualties
- The level of public support for the use of cameras has been consistently high with 79% of people questioned agreeing that the use of safety cameras should be supported as a method of reducing casualties
- On average, over the first three years of the programme, 85% of all local press coverage was positive or neutral
- On balance, whilst support for safety cameras generally varied from area to area, the public remained broadly supportive, although there is some evidence that this support was declining in a number of areas, and there remained some concern that the cameras are associated with revenue raising and not casualty reduction.

A significant reduction in casualties at camera sites

- Results showed that, overall, the number of killed and serious casualties and personal injury collisions had reduced at camera sites. These reductions were over and above the national long-term trend
- There were around 40% fewer KSIs at cameras sites and 33% fewer PICs
- Fixed camera sites were more effective at reducing casualties than mobile cameras, although both reduce speed, collisions, casualties and deaths
- Fatalities were down substantially at camera sites (a reduction of 40%). There were over 100 fewer deaths
- Pedestrian casualties were also down (a reduction of 23% in PICs and a reduction of 35% in KSIs)
- There was a strong correlation between the fall in speed and the fall in collisions, casualties and deaths at camera sites.

Satisfactory working of the funding and partnership arrangements

- There have been significant savings in social and human terms across the partnership areas. The estimated value of the reduction in collisions in 2002/3 was in the region of £221million
- This equates to a cost-benefit of around 4:1.

In general, we conclude that the programme is extremely successful at reducing speed, collisions, casualties and saving lives. The cost recovery element is working well and substantial savings to society have been identified. The general public are generally supportive of the safety camera programme objectives, which is to use safety cameras to reduce road casualties.

Appendix A:
Handbook summary

Prior to the start of the programme a handbook was developed which gave guidance about how the cost recovery system should operate. As the pilots progressed, and more was learned about best practice, this guidance has been strengthened. These are summarised in the table below.

Guidelines for pilot areas	Guidelines for national rollout
1. The effects on speed and casualties must be monitored	
Camera sites must be located where there is a history of speed related collisions. Cameras cannot be located for political and/or revenue generating purposes. All sites must be monitored for before and after speeds in areas where the cameras are operating.	Prior to approval, partnerships must prioritise sites and have quantified evidence that those selected have the greatest casualty problems. Broadly, these should follow the guidelines in Table 22 below although there is some flexibility. In total, enforcement should aim to cover at least 10% of KSIs in an area and ideally more. Partnerships must collect data on child and pedestrian casualties and hospital bed data. Partnerships must have conducted speed surveys in advance of case approval to demonstrate that excess speed is a problem at the priority sites.
2. Public perception must be actively managed	
All areas have to produce a robust strategy as to how they are handling local education and communication issues	All partnerships are required to have a dedicated communications manager. The cameras should be well signed and highly visible. The location of the cameras should be published in local papers, local radio and on web-sites.

3. Partnerships must include all relevant local organisations	
Partnerships must include police, highways authorities and Magistrates' Courts. All parties must sign up to a Service Level Agreement - this committed each partnership at a senior level for the duration of the project.	Should also involve local health authority, CPS and Highways Agency. Each partnership should have a dedicated project manager. All local authorities in an area should be part of the partnership.
4. Financial protocols	
All capital and revenue expenditure has to be directly attributable to additional speed and red-light camera enforcement - these were detailed in a handbook which set out the rules of the system Each partnership had a treasurer who kept the accounts Partners were paid on the basis of receipts for expenditure incurred. At the end of the financial year, these accounts were audited by the District Auditor against rules set out by the Audit Commission (for England and Wales – Accounts Commission in Scotland) Failure to receive a clear audit certificate would result in the privilege to 'net off' receipts' to be withdrawn.	All costs attributable to speed and red-light cameras are recoverable rather than additional costs. No change. No change. No change. Revised guidelines are produced in conjunction with the Audit Commission (and Accounts Commission) following the end of year audit. No change.
5. Benchmarking	
Partnerships should produce benchmark costs that proved that unit costs are reducing	Partnerships must compare favourably in efficiency with existing partnerships before being accepted on to the system. The use of new technology to reduce manual processes and, in particular, police intervention is encouraged. Chasing non-payers and making out of force enquiries is mandatory.
6. Signing and visibility	
Partnerships ensured that signing arrangements comply with Traffic Signs Regulations and General Directions appropriate for various circumstances.	Fixed speed camera housings in all but exceptional circumstances should be yellow. All camera housings (existing and new) should be visible to road users and not hidden behind bridges, signs, trees or bushes. The minimum visibility distance should be 60 metres where the speed limit is 40 mph or less and 100 metres for all other limits. For mobile cameras, camera operatives at the mobile camera sites should wear fluorescent clothing and abide by all Health and Safety requirements, and vehicles should be clearly marked as camera enforcement vehicles. Camera warning and speed limit reminder signs must be placed in advance of fixed or mobile speed enforcement taking place. Ideally these should be placed within 1km of fixed camera housings and at the beginning of a targeted route for mobile enforcement sites. Signs must only be placed in areas where camera housings are present or along routes where mobile enforcement will be targeted.

Table 22 provides a summary of the guidance issued to local partnerships to assist in prioritising sites for enforcement. It is at the discretion of the local partnerships as to the proportion of enforcement that is allocated to these priority sites. Some discretion is allowed to enforce at sites where there is genuine public concern about speeding and also at roadworks.

Table 22 Site selection guidelines

Criteria	Fixed	Mobile	Speed over distance	Red-light
1. Site length	Between 400-1500 metres metres (can be linked into a longer route strategy if more than three stretches satisfy the criteria)	Between 400 and 3000 metres	Between 3000 and 10000 metres	50 metres
2. Number of killed collisions (KSI) and serious	At least 4 KSI per km in (not per annum) last three calendar years	At least 2 KSI per km in last three calendar years (not per annum)	At least 5 KSI per km in last three calendar years along a minimum 3km stretch of road (not per annum). At least 4KSIs in previous three calendar years in each subsequent km (not per annum).	2 KSI at junction (+/- 50m) in last three years (not per annum)
3. Number of personal injury collisions (PIC)	At least 8 PIC per km in last three calendar years	At least 4 PIC per km in last three calendar years	At least 10 PIC per km in last three calendar years (min 3km). At least 8 PIC in previous 3 calendar years in each subsequent km.	At least 4 PIC at junction (+/- 50m)
4. Causation factors	Causation factors indicate that speeding was a contributory factor in some or all of the collisions - sites that are clearly not speed-related have been de-selected			Red-light running is a causation factor in some or all of the collisions (including child and pedestrians)
5. 85th percentile speed at (or approach to) collision hot spots	85th percentile speed at least 10% above speed limit plus 2mph - i.e. 35mph in a 30 zone) for free-flowing traffic (excluding any rush-hour periods)			N/A
6. Percentage over the speed limit	At least 20% of drivers are exceeding the speed limit			N/A
7. Site conditions are suitable for the type of enforcement proposed	Loading and unloading the camera can take place safely	Location for mobile enforcement is easily accessible, there is space for enforcement to take place in a visible and safe manner	Loading and unloading the camera can take place safely	Loading and unloading the camera can take place safely
8. Distribution of collisions	Collisions are clustered close together around a single stretch of road or junction	Collisions are more likely to be evenly distributed along a route	High density of collisions distributed evenly along a stretch of road	Collisions are clustered at a road junction with traffic lights
9. No other engineering solutions are appropriate	There has been a site survey by a qualified road safety engineer and there are no obvious viable measures to improve road safety along this stretch of road			
10. Camera visibility	Enforcement cameras are well signed and highly visible in line with DfT guidelines			

Appendix B:
Allowable expenditure

B.1 Legislative provisions

Section 38 of the Vehicles (Crime) Act 2001 contains the primary legislation that enables the Secretary of State to make payments to local partnerships for speed and red-light camera enforcement.

(1) The Secretary of State may make payments in respect of the whole or any part of the expenditure of a public authority in relation to:

a. the prevention or detection of offences to which subsection (2) applies; or
b. any enforcement action or proceedings in respect of such offences or any alleged such offences.

(2) This subsection applies to offences under:

a. section 16 of the Road Traffic Regulation Act 1984 (c. 27) which consist in contraventions of restrictions on the speed of vehicles imposed under section 14 of that Act;
b. subsection (4) of section 17 of that Act which consist in contraventions of restrictions on the speed of vehicles imposed under that section;
c. section 88(7) of that Act (temporary minimum speed limits);
d. section 89(1) of that Act (speeding offences generally);
e. section 36(1) of the Road Traffic Act 1988 (c. 52) which consist in the failure to comply with an indication given by a light signal that vehicular traffic is not to proceed.

(3) Payments under this section shall be made to:

a. the public authority in respect of whose expenditure the payments are being made; or

b. any other public authority for payment, in accordance with arrangements agreed with the Secretary of State, to, or on behalf of, the public authority in respect of whose expenditure the payments are being made.

(4) Payments under this section shall be paid at such times, in such manner and subject to such conditions as the Secretary of State may determine.

(5) In this section "public authority" means:

a. any highway authority (within the meaning of the Highways Act 1980 (c. 66));

b. any police authority established under section 3 of the Police Act 1996 (c. 16), the Metropolitan Police Authority or the Common Council of the City of London in its capacity as a police authority;

c. any responsible authority (within the meaning of section 55 of the Justices of the Peace Act 1997 (c. 25)) or the Greater London Magistrates' Courts Authority; and

d. any body or other person not falling within paragraphs (a) to (c) and so far as exercising functions of a public nature

B.2 Allowable expenditure – enforcement equipment·

- Speed and red-light cameras that are Home Office type approved
- Fixed (speed over distance and wet-film) and mobile camera systems, including housings, alarms, dummy equipment, 'permanent' mobile sites and signs
- Analysis, design, planning, installation, test and set-to-work costs are allowable (in order to be accepted onto the programme, partnerships must demonstrate that cameras will be operating in areas where there is a history of both collisions and speeding)
- Signing in order to comply with DfT guidance on camera conspicuity.

B.3 Allowable expenditure – supporting equipment·

- IT and communication systems
- Speed monitoring equipment
- Office equipment
- Film processing and viewing

- Printing, scanning, copying and mailing
- Filing and archiving
- Vehicles (only those required for the purpose of enforcement and not patrol vehicles)
- Collision mapping and recording systems.

B.4 Allowable expenditure – revenue costs

- Partnership staff salaries and on-costs (training, national insurance, etc) but not, for example, shared management costs
- Police officer and civilian staff costs
- Camera and system maintenance – only those directly associated with camera activity
- Camera and system lease costs
- Communication and education programmes directly related to this system
- Reasonable IT and communication systems maintenance associated with camera activity
- Vehicle maintenance and running costs (including fuel) – only for vehicles solely employed on camera activity or pro-rata
- Speed and casualty analysis (including that required to build up the operational case)
- Consumables and ancillary costs (stationery, film, print etc)
- Leased accommodation (including office and IT equipment if applicable).

Appendix C:
The enforcement process

The administrative process

Partnerships were allowed to keep some of the fixed penalty revenue from speeding drivers (or drivers passing through red-lights) to pay for the costs associated with processing the associated conditional offer fixed penalty notices. There are a number of stages in this process and these are explained below.

The key elements of the enforcement process are as follows:

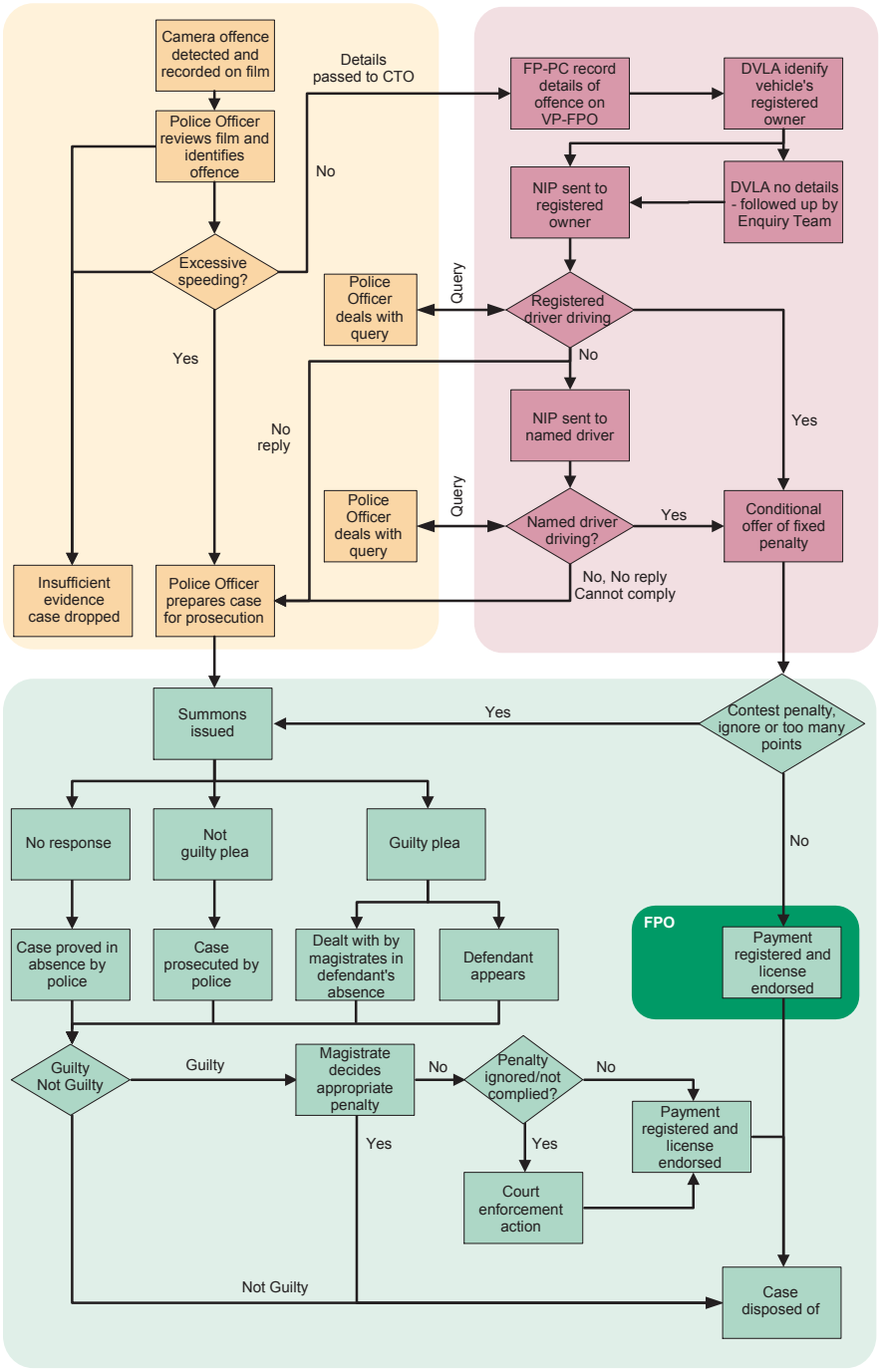
- A Notice of Intended Prosecution (NIP) is sent to the registered vehicle keeper. This identifies that the vehicle was recorded on film committing a speeding or red-light offence and that the registered keeper is required to provide the full name and address of the driver at the time of the alleged offence. The law states that in order for a prosecution to proceed the NIP needs to be served to the registered keeper within 14 days of the alleged offence taking place
- Where the registered keeper does not reply to the NIP or does not identify the driver, The Central Ticket Office (CTO) notifies the enforcement officer who recorded the alleged offence. This enforcement officer reviews the video evidence and seeks to interview the registered vehicle keeper with a view to preparing a file for prosecution by the police
- Where the registered vehicle keeper replies that they were not the driver at the time of the alleged offence, they are required to notify the CTO who was. A NIP is then sent to the driver identified
- Once the driver at the time of the alleged offence is identified, the CTO sends a Conditional Offer of a Fixed Penalty. The driver then has the opportunity to

pay a fixed penalty fine (£60) and accept three penalty points or they may contest the offence in a Magistrates' Court. Where they accept the Conditional Offer, the driver is required to present the required monies and their driving licence to the Fixed Penalty Office (usually by post)

- If a driver contests the offence or fails to pay the fine, the police prepare a file for prosecution in the courts. In any case where the addition of Penalty Points will lead to a ban (for example where a driver has already amassed nine or more points), the case is dealt with via the local Magistrates' Court.

A map of the administrative processes associated with camera enforcement is shown below.

Figure 20: The process associated with camera enforcement



Appendix D:
Data validation process

D.1 Speed data validation

In order to get to the dataset used for the three-year analysis, the information in the database has been through a number of ‘filters’. These were as follows:

- Only sites in the year-three group of partnerships (latest joining date 1st April 2002) have been included.
- Camera should have a meaningful identifier – ie cameras with names containing "duplicate" or "xx" are excluded.
- Camera should have specified a 'date established', which should be before 1st April 2003.

Additional checks applied for the speed analysis on baseline data are:

- Baseline 85th percentile speed is greater than baseline average speed
- Baseline percentage more than 15mph above speed limit less than or equal to baseline percentage above speed limit
- Only fixed, speed over distance and mobile cameras are included
- Speed limit should be specified
- New cameras introduced within cost recovery have been analysed

For speed-readings conducted in the after period the following criteria have been applied:

- Only speed-readings performed between April 2002 and April 2003 have been included.
- 85th percentile speed > Average speed
- Percentage more than 15mph above speed limit should be less than the percentage above speed limit

This produced a list of eligible sites that were then used equally in the analysis.

D.2 Collision and casualty data collection

This involved a six-stage process:

Data cleansing activity

1 A query was run on the un-cleansed database, highlighting cameras with missing or unusual values (for example where the KSIs were larger than PICs) a list of cameras with 'issues' was identified for each partnership. This was sent to the partnerships with a request for them to correct the issues in their local database and resubmit.
2 When a partnership returned a database, the data was again submitted to the same set of checks. If some issues were still not addressed, a list describing the issues was issued to the partnership. This was repeated until all issues were either solved or explained. Only cameras with a 'satisfying' or 'valid' baseline would 'proceed' to the next step.
3 After the baseline issues were resolved, a list with missing monthly casualty registrations was issued to the partnerships. The missing registrations would typically be caused by either the appearance of inactive cameras in the database or by partnerships having inadvertently missed an entry.
4 Again, when a partnership returned their database, the data was again submitted to the same rigorous check. If some monthly entries were still missing this was communicated to the partnerships. This was repeated until all missing entries are either present or explained.
5 The final set of checks checked the 'sanity' of the data. We tested for extreme values (outliers), excessive uniformity (every month having identical values), and radical effects (large differences in baseline and 'after' values). Based on these checks, a list of cameras and monthly casualty entries were sent to the partnerships for confirmation.
6 Based on this list, the partnerships confirmed and, where necessary, corrected their database.

On the basis of the cleansing exercise, all of the partnership areas invested a considerable amount of time into validating their PIC and KSI data.
The above six stages were repeated until we had a full, cleansed national dataset. We also examined the data on a site-by-site, month-by-month basis to identify further outliers and unusual behaviours. This involved checks on around 75,000 records (PICs and KSIs).

In parallel with the submission of 'cleansed' data, we requested additional information such as:

- start and end date of the baseline period for each camera
- confirmation that baseline data for KSIs was casualties and for PICs was collisions (and they were consistent before and after)
- confirmation that before and after camera site data covered the same geographic area
- confirmation for all partnerships that were featured in the eight pilot area report that the database contained data that was consistent with the data supplied to UCL for their analysis and included in the report
- confirmation that the area wide data was consistent with published RAGB figures
- information on overlapping camera sites, and major changes to sites (eg speed limit changes, single to dual carriageway, traffic calming).

Appendix E:
Detailed speed analysis

The number of cameras that have contributed data to the speed analysis is 1,876. Of these 1,059 are new. The different numbers in different tables are a result of the ‘individual filtering’ process where we try to maximise the number of sites for any part of the analysis (see D1).

E.1 Changes in average speed at new camera sites

Table 23 Changes in the average speed of vehicles at camera sites

Partnership area	Number of sites	Number of visits in FY 02/03	Average speed before (mph)	Average speed after (mph)	Change in average speed (mph)	% change in average speed
Northamptonshire	1	3	47.0	46.0	-1.0	-2.1%
Nottinghamshire	2	2	36.5	33.5	-3.0	-8.2%
All speed over distance sites	**3**	**5**	**40.0**	**37.7**	**-2.3**	**-5.8%**
Avon, Somerset & Gloucestershire	1	2	58.0	29.5	-28.5	-49.1%[1]
Bedfordshire	11	18	44.7	43.0	-1.7	-3.8%
Cambridgeshire	11	21	42.1	34.8	-7.3	-17.4%
Derbyshire	2	2	29.0	31.0	2.0	6.9%[2]
Essex	38	76	33.8	28.5	-5.3	-15.6%
Lancashire	24	24	27.5	24.6	-3.0	-10.7%
Leicestershire	3	3	33.3	25.7	-7.7	-23.0%
Lincolnshire	20	65	41.0	34.4	-6.6	-16.0%
Norfolk	4	25	31.5	30.1	-1.4	-4.5%
North Wales	6	27	31.8	29.2	-2.6	-8.1%
Northamptonshire	10	31	35.7	27.5	-8.2	-22.9%
Nottinghamshire	1	1	40.0	40.0	0.0	0.0%
South and Mid Wales	55	101	33.2	26.3	-6.9	-20.7%
Staffordshire	7	7	36.0	31.9	-4.1	-11.5%
Strathclyde	10	10	33.6	28.6	-5.0	-14.9%
Warwickshire	9	31	44.3	43.7	-0.7	-1.5%
All fixed camera sites	**212**	**444**	**35.2**	**29.9**	**-5.3**	**-14.9%**
Avon, Somerset & Gloucestershire	79	179	37.3	32.8	-4.5	-12.0%
Bedfordshire	45	77	35.0	34.3	-0.7	-1.9%
Cambridgeshire	14	26	52.1	51.6	-0.4	-0.8%
Cleveland	35	114	37.0	32.0	-5.1	-13.7%
Derbyshire	31	46	35.5	34.2	-1.3	-3.8%
Essex	158	300	30.5	30.2	-0.3	-1.0%
Hampshire	8	8	34.9	31.6	-3.3	-9.3%
Lancashire	43	68	25.7	23.7	-2.0	-7.7%
Leicestershire	51	51	40.3	38.1	-2.2	-5.5%
Lincolnshire	9	27	52.0	51.5	-0.5	-1.0%
Norfolk	37	247	49.9	49.8	-0.1	-0.2%
North Wales	21	113	40.0	37.8	-2.2	-5.6%
Nottinghamshire	39	39	42.8	42.1	-0.7	-1.6%
South and Mid Wales	202	449	37.8	36.0	-1.8	-4.6%
Warwickshire	14	35	48.4	48.1	-0.3	-0.6%
Wiltshire	19	21	45.6	45.2	-0.3	-0.8%
All mobile sites	**805**	**1800**	**37.1**	**35.5**	**-1.6**	**-4.4%**
All camera sites	**1020**	**2249**	**36.8**	**34.4**	**-2.4**	**-6.5%**

1 This was due to a change in the speed limit (applies to all tables 23 to 26).

2 This may have been due to changes in speed recording method (applies to all tables 23 to 26).

E.2 Changes in the 85th percentile speed

Table 24 Changes in the 85th percentile speed of vehicles at camera sites

Partnership area	Number of sites	Number of visits	85th percentile before (mph)	85th percentile after (mph)	Change in 85th percentile (mph)	% change in 85th percentile
Northamptonshire	1	3	54.0	51.0	-3.0	-5.6%
Nottinghamshire	2	2	41.5	38.0	-3.5	-8.4%
All speed over distance sites	**3**	**5**	**45.7**	**42.3**	**-3.3**	**-7.3%**
Avon, Somerset & Gloucestershire	1	2	63.0	31.5	-31.5	-50.0%
Bedfordshire	11	18	53.4	50.4	-3.0	-5.5%
Cambridgeshire	11	21	47.3	40.5	-6.8	-14.3%
Derbyshire	2	2	38.0	40.5	2.5	6.6%
Essex	38	76	39.4	33.4	-6.0	-15.2%
Lancashire	26	26	34.4	26.3	-8.0	-23.4%
Leicestershire	3	3	43.0	29.7	-13.3	-31.0%
Lincolnshire	20	65	48.1	38.9	-9.2	-19.1%
Norfolk	4	25	36.5	34.8	-1.7	-4.6%
North Wales	6	27	37.3	33.5	-3.9	-10.3%
Northamptonshire	10	31	41.6	32.2	-9.4	-22.6%
Nottinghamshire	1	1	44.0	44.0	0.0	0.0%
South and Mid Wales	54	99	39.3	28.5	-10.8	-27.5%
Staffordshire	7	7	39.6	37.3	-2.3	-5.8%
Strathclyde	10	10	39.9	33.5	-6.4	-16.0%
Warwickshire	9	31	51.6	50.7	-0.8	-1.6%
All fixed sites	**213**	**444**	**41.4**	**33.9**	**-7.5**	**-18.0%**
Avon, Somerset & Gloucestershire	79	179	43.3	38.8	-4.5	-10.4%
Bedfordshire	45	77	40.8	40.5	-0.3	-0.8%
Cambridgeshire	14	26	62.9	60.5	-2.3	-3.7%
Cleveland	35	114	41.7	37.3	-4.3	-10.4%
Derbyshire	31	46	44.5	43.6	-1.0	-2.2%
Essex	156	297	38.0	35.9	-2.1	-5.5%
Hampshire	8	8	41.9	40.5	-1.4	-3.3%
Lancashire	43	69	34.4	32.0	-2.4	-6.9%
Leicestershire	51	51	47.9	45.7	-2.2	-4.6%
Lincolnshire	9	27	59.9	59.8	-0.1	-0.2%
Norfolk	37	247	56.8	56.9	0.1	0.2%
North Wales	21	113	47.2	44.1	-3.1	-6.6%
Nottinghamshire	39	39	48.4	48.0	-0.4	-0.8%
South and Mid Wales	203	450	43.5	41.6	-1.9	-4.3%
Warwickshire	14	35	56.4	56.0	-0.4	-0.8%
Wiltshire	19	21	52.5	51.8	-0.7	-1.4%
All mobile sites	**804**	**1799**	**43.9**	**41.9**	**-2.0**	**-4.6%**
All camera sites	**1020**	**2248**	**43.4**	**40.2**	**-3.2**	**-7.3%**

E.3 Change in percentage of vehicles exceeding speed limit

Table 25 Changes in the number of vehicles exceeding the speed limit at camera sites

Partnership area	Number of sites	Number of visits	% > speed before (mph)	% > speed after (mph)	% change in vehicles exceeding speed limit
Northamptonshire	1	3	22.0	11.0	-50.0%
Nottinghamshire	2	2	53.0	35.0	-34.0%
All speed over distance	**3**	**5**	**42.7**	**27.0**	**-36.7%**
Avon, Somerset & Gloucestershire	1	2	29.0	24.5	-15.5%
Bedfordshire	9	14	26.1	19.2	-26.4%
Cambridgeshire	11	21	51.6	11.0	-78.7%
Derbyshire	2	2	57.0	61.0	7.0%
Essex	37	74	47.9	12.8	-73.2%
Lancashire	25	25	33.8	5.2	-84.5%
Leicestershire	3	3	69.0	16.7	-75.8%
Lincolnshire	19	62	30.1	4.3	-85.5%
Norfolk	4	25	46.0	34.6	-24.8%
North Wales	6	27	56.8	31.4	-44.8%
Northamptonshire	10	31	39.5	7.7	-80.5%
Nottinghamshire	1	1	37.0	32.0	-13.5%
South and Mid Wales	53	98	63.5	12.8	-79.9%
Staffordshire	7	7	47.6	17.1	-64.0%
Strathclyde	9	9	59.0	24.1	-59.1%
Warwickshire	9	31	34.1	29.3	-14.0%
All fixed camera sites	**206**	**432**	**47.7**	**14.0**	**-70.6%**
Avon, Somerset & Gloucestershire	75	174	52.5	29.9	-43.1%
Bedfordshire	45	77	38.9	37.4	-4.0%
Cambridgeshire	14	26	40.5	33.4	-17.5%
Cleveland	32	103	67.3	36.3	-46.1%
Derbyshire	31	46	31.4	27.9	-11.1%
Essex	153	292	42.3	37.3	-11.8%
Hampshire	8	8	37.1	38.0	2.4%
Lancashire	40	65	28.1	20.6	-26.6%
Leicestershire	50	50	45.6	31.7	-30.5%
Lincolnshire	9	27	14.0	12.4	-11.5%
Norfolk	36	241	23.8	23.2	-2.5%
North Wales	21	133	55.5	40.2	-27.7%
Nottinghamshire	39	39	57.8	55.8	-3.5%
South and Mid Wales	197	437	50.7	40.6	-20.0%
Warwickshire	14	35	27.6	26.7	-3.6%
Wiltshire	18	20	32.6	31.0	-4.8%
All mobile cameras sites	**782**	**1753**	**44.7**	**35.5**	**-20.6%**
All camera sites	**991**	**2190**	**45.3**	**31.0**	**-31.6%**

E.4 Percentage change in vehicles exceeding the speed limit by more than 15mph

Table 26 Change in the number of vehicles exceeding the speed limit by more than 15mph at camera sites

Partnership area	Number of sites	Number of visits	% > speed by 15mph or more (before)	% > speed by 15mph or more (after)	% change in vehicles exceeding speed limit by 15mph or more
Northamptonshire	1	3	1.0	0.0	-100.0%
Nottinghamshire	2	2	3.0	0.5	-83.3%
All speed over distance	**3**	**5**	**2.3**	**0.3**	**-85.7%**
Avon, Somerset & Gloucestershire	1	2	6.0	0.0	-100.0%
Bedfordshire	11	18	4.4	0.9	-80.2%
Cambridgeshire	11	21	5.0	0.1	-97.7%
Derbyshire	2	2	2.5	6.0	140.0%
Essex	38	76	0.8	0.2	-74.2%
Lancashire	25	25	1.6	0.0	-100.0%
Leicestershire	3	3	7.3	0.0	-100.0%
Lincolnshire	20	65	1.3	0.2	-87.1%
Norfolk	4	25	0.8	0.8	5.6%
North Wales	6	27	3.0	0.4	-87.0%
Northamptonshire	10	31	9.1	0.1	-99.5%
Nottinghamshire	1	1	0.0	0.0	0.0%
South and Mid Wales	54	99	5.6	0.1	-98.4%
Staffordshire	7	7	0.4	0.0	-100.0%
Strathclyde	7	7	6.4	3.9	-40.0%
Warwickshire	9	31	15.8	11.0	-30.2%
All fixed camera sites	**209**	**440**	**4.0**	**0.8**	**-79.6%**
Avon, Somerset & Gloucestershire	79	179	3.7	1.4	-60.6%
Bedfordshire	45	77	3.1	3.1	-0.4%
Cambridgeshire	14	26	6.0	2.7	-55.2%
Cleveland	35	113	2.6	1.3	-51.5%
Derbyshire	31	46	1.5	1.4	-12.5%
Essex	158	300	0.7	0.9	23.7%
Hampshire	8	8	8.0	8.4	4.7%
Lancashire	43	69	1.0	0.4	-59.8%
Leicestershire	51	51	2.7	1.2	-55.5%
Lincolnshire	9	27	1.6	1.8	14.3%
Norfolk	37	246	1.3	1.3	1.3%
North Wales	21	113	2.6	1.6	-36.8%
Nottinghamshire	39	39	4.2	3.9	-5.6%
South and Mid Wales	201	447	3.0	2.1	-31.2%
Warwickshire	14	35	10.6	9.6	-9.4%
Wiltshire	19	21	1.3	1.3	2.0%
All mobile camera sites	**804**	**1797**	**2.6**	**1.8**	**-27.8%**
All camera sites	**1016**	**2242**	**2.9**	**1.6**	**-42.9%**

Appendix F:
Detailed cost analysis

F.1 Detailed cost and income analysis

The table below summarises the receipts (partnership income from fines paid by speed and red-light offenders) against the costs incurred, by partnership, for each year of the programme (these were obtained from audit certificates).

Table 27 Costs and receipts for all partnership areas in the first three years of the programme

2000/2001	Receipts (£) (a)	Net costs incurred (£) (b)	Surplus / deficit (£)(a)-(b)		Released to HMT Consolidated Fund (£)
Cleveland	898,960	771,901	127,059		127,059
Essex	1,846,480	1,846,480	0		0
Lincolnshire	627,000	512,721	114,279		114,279
Northamptonshire	2,167,840	1,702,404	465,436		465,436
Nottingham	556,360	622,371	-66,011		0
South Wales	1,567,000	1,330,277	236,723		236,723
Strathclyde	449,680	373,454	76,226		76,226
Thames Valley	2,239,120	1,825,639	413,481		413,481
Totals	**10,352,440**	**8,985,247**	**1,367,193**		**1,433,204**
2001/2002	**Receipts (£)**	**Net costs incurred (£)**	**Surplus / deficit (£)**	**Prior year approved deficits to recover (£)**	**Released to HMT Consolidated Fund (£)**
Cambridgeshire	135,420	113,760	21,660		21,660
Cleveland	865,080	578,470	286,610		286,610
Derbyshire	654,000	502,126	151,874		151,874
Essex	3,524,120	3,179,304	344,816		344,816
Lancashire	1,197,180	761,017	436,163		436,163
Lincolnshire	628,640	508,504	120,136		120,136
Norfolk	160,140	425,167	-265,027		0
North Wales	648,780	904,022	-255,242		0
Northamptonshire	2,733,520	2,245,342	488,178		488,178
Nottinghamshire	868,320	778,489	89,831		89,831
South Wales	1,876,240	1,745,591	130,649		130,649
Staffordshire	631,200	629,246	1,954		1,954
Strathclyde	860,960	719,620	141,340		141,340
Thames Valley	4,672,880	2,638,665	2,034,215		2,034,215
Warwickshire	204,300	377,236	-172,936		0
Totals	**19,660,780**	**16,106,559**	**3,554,221**		**4,247,426**
2002/2003	**Receipts (£)**	**Net costs incurred (£)**	**Surplus / deficit (£)**	**Prior year approved deficits to recover (£)**	**Released to HMT Consolidated Fund (£)**
Avon & Somerset	4,084,020	3,129,982	954,038		954,038
Bedfordshire	3,047,520	2,655,021	392,499		392,499
Cambridgeshire	771,360	728,192	43,168		43,168
Cleveland	1,463,700	787,328	676,372		676,372
Derbyshire	1,931,520	2,318,979	-387,459		0
Essex	5,672,220	5,150,286	521,934		521,934
Fife	421,740	435,188	-13,448		0
Hampshire	1,745,760	1,270,484	475,276		475,276
Lancashire	5,909,700	2,935,078	2,974,622		2,974,622
Leicestershire	2,018,640	1,580,534	438,106		438,106
Lincolnshire	1,573,320	1,137,625	435,695		435,695
London	5,121,060	4,549,380	571,680		571,680
Norfolk	1,206,060	860,142	345,918	265,027	80,891
North Wales	2,609,040	2,146,485	462,555		462,555
Northamptonshire	3,590,700	2,849,533	741,167		741,167
Nottinghamshire	2,802,660	2,513,002	289,658		289,658
South Wales	7,264,560	5,127,849	2,136,711		2,136,711
South Yorkshire	948,840	1,722,776	-773,936		0
Staffordshire	2,177,940	1,723,510	454,430		454,430
Strathclyde	1,670,160	1,938,047	-267,887		0
Thames Valley	6,895,980	4,067,090	2,828,890		2,828,890
Warwickshire	2,388,600	1,403,981	984,619	172,936	811,683
West Yorkshire	2,255,640	2,252,017	3,623		3,623
Wiltshire	1,301,580	973,993	327,587		327,587
Totals	**68,872,320**	**54,256,502**	**14,615,818**	**437,963**	**15,620,585**
Three year totals	**Receipts (£)**	**Net costs incurred (£)**	**Surplus / deficit (£)**	**Prior year approved deficits to recover (£)**	**Released to HMT Consolidated Fund (£)**
	98,885,540	**79,348,308**	**19,537,232**		**21,301,215**

Note: The amount released to HMT over the three-year period is £21.3m. This is higher than the total surplus of £19.5m because the rules of the scheme state that where an individual partnership makes a deficit in any one year, the partnership can only recover costs to the level of fine income collected. In these instances the partner organisations must fund the deficit (or excess costs) and therefore the funds released to HMT exclude the deficit amounts. In exceptional circumstances, usually in the first year of operation, partnerships have been given approval to carry forward deficits to be recovered from future years' fine income. In these instances, the deficit amount is recovered by reducing the amount released to HMT in the following year.

F.2 Relative efficiency of processing penalties

The table shows the relative costs of processing fixed penalty notices for each partnership area (calculated by dividing the revenue, or running, costs by the number of penalties paid.

Table 28 Costs and receipts for all partnership areas in the first three years of the programme

2000/2001	Revenue (£) (a)	Capital (£) (b)	Total costs (£) (a) + (b)	FPNs Paid (c)	Revenue cost per FPN (£)(a/c)
Cleveland	477,259	294,642	771,901	22,474	21.24
Essex	1,234,453	612,027	1,846,480	46,162	26.74
Lincolnshire	192,965	319,756	512,721	15,675	12.31
Northamptonshire	831,159	871,245	1,702,404	54,196	15.34
Nottingham	248,570	612,126	860,696 a	13,909	17.87
South Wales	638,070	692,207	1,330,277	39,175	16.29
Strathclyde	227,461	145,993	373,454	11,242	20.23
Thames Valley	1,283,213	542,426	1,825,639	55,978	22.92
TOTAL	**5,133,150**	**4,090,422**	**9,223,572**	**258,811**	**19.83**
2001/2002	**Revenue (£)**	**Capital (£)**	**Expenditure (£)**	**FPNs Paid**	**Revenue cost per FPN (£)**
Cambridgeshire	103,760	10,000	113,760	2,257	45.97
Cleveland	578,470	0	578,470	14,418	40.12
Derbyshire	322,613	179,513	502,126	10,900	29.60
Essex	2,081,271	1,098,033	3,179,304	58,735	35.43
Lancashire	404,680	356,337	761,017	19,953	20.28
Lincolnshire	271,120	237,384	508,504	10,477	25.88
Norfolk	412,149	43,018	455,167 b	2,669	154.42
North Wales	464,477	439,545	904,022	10,813	42.96
Northamptonshire	1,799,058	446,284	2,245,342	45,559	39.49
Nottingham	328,720	449,769	778,489	14,472	22.71
South Wales	786,962	958,629	1,745,591	31,271	25.17
Staffordshire	241,708	387,538	629,246	10,520	22.98
Strathclyde	418,710	300,910	719,620	21,524	19.45
Thames Valley		2,638,665	2,638,665 c	77,881	n/a
Warwickshire	339,784	37,452	377,236	3,405	99.79
Totals	**8,553,482**	**7,583,077**	**16,136,559**	**324,572**	**34.67**
2002/2003	**Revenue (£)**	**Capital (£)**	**Expenditure (£)**	**FPNs Paid**	**Revenue cost per FPN (£)**
Avon & Somerset	1,626,503	1,503,479	3,129,982	68,067	23.90
Bedfordshire	1,466,266	1,188,755	2,655,021	50,792	28.87
Cambridgeshire	520,622	207,570	728,192	12,856	40.50
Cleveland	707,196	80,132	787,328	24,395	28.99
Derbyshire	862,046	1,456,933	2,318,979	32,192	26.78
Essex	2,953,196	2,197,090	5,150,286	94,537	31.24
Fife	356,137	79,051	435,188	7,029	50.67
Hampshire	932,223	338,261	1,270,484	29,096	32.04
Lancashire	1,804,658	1,130,420	2,935,078	98,495	18.32
Leicestershire	754,949	825,585	1,580,534	33,644	22.44
Lincolnshire	593,174	544,451	1,137,625	26,222	22.62
London	3,762,583	786,797	4,549,380	85,351	44.08
Norfolk	664,666	195,476	860,142	20,101	33.07
North Wales	1,587,556	558,929	2,146,485	43,484	36.51
Northamptonshire	1,886,384	963,149	2,849,533	59,845	31.52
Nottingham	1,321,798	1,191,204	2,513,002	46,711	28.30
South Wales	3,707,819	1,420,030	5,127,849	121,076	30.62
South Yorkshire	605,720	1,117,056	1,722,776	15,814	38.30
Staffordshire	1,051,873	671,637	1,723,510	36,299	28.98
Strathclyde	1,907,187	30,860	1,938,047	27,836	68.52
Thames Valley	4,067,090	0	4,067,090	114,933	35.39
Warwickshire	830,379	573,602	1,403,981	39,810	20.86
West Yorkshire	1,279,203	972,814	2,252,017	37,594	34.03
Wiltshire	480,483	493,510	973,993	21,693	22.15
Totals	**35,729,711**	**18,526,791**	**54,256,502**	**1,147,872**	**31.13**
2002/2003	**Revenue (£)**	**Capital (£)**	**Expenditure (£)**	**FPNs Paid**	**Revenue cost per FPN (£)**
Three year totals	**49,416,343**	**30,200,290**	**79,616,633**	**1,731,255**	**29.89**

Notes a - Figures shown gross of grant from Highways Agency to the value of £238,325
b - Figures shown gross of grant from Highways Agency to the value of £30,000
c - Split of costs between revenue and capital not provided. Revenue cost per FPN excludes costs and FPNs paid for Thames Valley in 2001/02

Appendix G:
Technical details of casualty analysis

G.1 Background

This work has been undertaken to provide a statistical analysis of road collision and casualty data in the 24 partnership areas that had joined the national safety camera programme for at least one of the three years April 2000 to March 2003. The data that are investigated here relate to road collisions and casualties that occurred at camera sites during the period following acceptance onto the programme. These are compared with baseline data for the corresponding site, which generally come from the previous three-year period.

In view of the long-term general downward trend in frequency of collision and casualty occurrence, the impact is estimated here in a way that reflects this trend. Consideration was also given to seasonal variation in the frequency of personal injury collisions (PIC) and killed and seriously injured casualties (KSI). To undertake this investigation, data for KSIs and for PICs from all areas of Great Britain were used (with a few exclusions that are outlined later).

The purpose of this analysis is to estimate the effect on KSIs and PICs at safety camera sites, after taking into account relevant background reductions and other variations.

The approach of the investigation is to fit a statistical model to the road collision and casualty record of individual camera sites that accounts explicitly for various effects associated with the introduction of safety cameras at sites. We represented three distinct components of the intervention at each site:

- the establishment of a camera
- the introduction of cost recovery
- the increase in conspicuity.

This separate representation of the different components of intervention enabled us to allow for sites at which cameras were established before the cost recovery programme commenced, and for mobile cameras that were not substantially affected by the changes in the conspicuity requirements.

By their nature, these interventions cannot be introduced independently. For this reason, we sought to estimate from the model the size of changes associated with combinations of the interventions that are relevant to different kinds of site.

The resulting models provide information about the expected effects of safety cameras over different kinds of sites; the effects at individual sites will generally differ from these.

G.2 Description of the data

By the end of the study period, 24 partnership areas had been accepted onto the national safety camera programme and were able to provide at least one year's data. These areas supplied data on the numbers of killed and seriously injured casualties (KSI) and the number of personal injury collisions (PIC) at each site. Collision and casualty data for each site was split according to the following time periods:

1. Within a certain distance of a camera site during a period (generally 36 months duration) immediately preceding entry into partnership for that area (referred to as the baseline period)
2. For a camera site (starting from the date at which it was established) the number of PICs and KSIs occurring during each month up to and including March 2003 (referred to as the after period).

The fixed camera sites were generally the section of road within 0.5 km of the location of the camera itself. This varied by location but was consistent between baseline and after periods.

Other data that were reported for each site were:

- a unique identifier for that site
- the kind of camera that was used
- the date at which the camera site was established
- the date of entry into the cost recovery partnership
- the date at which the site was made conspicuous
- prevailing speed limit

In this analysis, the data for the different sites were not all for periods of identical duration. For this reason, the start date and the months that the camera was active was taken into consideration on the modelling.

Four main kinds of cameras were used under cost recovery. These were:

- standard fixed camera installations
- digital cameras (speed over distance)
- red light cameras
- mobile cameras.

Initial investigation showed that the effect of cameras differed largely according to whether the camera site was fixed (standard fixed, digital and red light cameras) or mobile. For this reason, two groups of camera kinds were used in the statistical analysis: fixed, and mobile. Data for sites at which mobile cameras were used were collected continuously from the date that the site was established, irrespective of the frequency of enforcement.

The number of sites cross-classified by urban-rural and fixed-mobile.The sites that contributed to the analysis are shown in Table 29. This included three digital cameras; one in Northamptonshire (50 mph speed limit, hence classed as rural), and two in Nottingham City (one each at 30 mph and 40 mph speed limits, hence both classed as urban). This also includes 216 red light cameras, the locations of which are shown in Table 30. Almost all of the red light cameras are in urban locations, with eight in rural ones.

Table 29: Number of sites of each kind for which data were used in the present analysis.

Area	Urban Fixed	Mobile	Rural Fixed	Mobile
Avon, Somerset and Gloucestershire				
- Avon and Somerset	30	100	19	18
Gloucestershire	11	12	1	6
Bedfordshire	24	42	12	10
Cambridgeshire	0	4	0	6
Cleveland	0	32	0	3
Derbyshire	30	50	2	18
Essex	62	121	0	0
Fife	0	33	0	23
Hampshire	4	21	1	2
Lancashire	110	52	2	3
Leicestershire	8	37	1	19
Lincolnshire	20	0	27	5
London	190	0	14	0
Norfolk	16	3	4	34
North Wales	7	24	0	7
Northamptonshire	19	0	11	0
Nottinghamshire				
- Nottingham City	24	14	0	0
- Nottinghamshire (XCity)	10	16	4	10
South and Mid Wales				
- South Wales	88	75	0	16
- Dyfed-Powys	7	64	0	29
- Gwent	11	37	1	8
South Yorkshire	69	56	6	0
Staffordshire	171	0	34	0
Strathclyde	28	0	0	0
Thames Valley	78	21	11	13
Warwickshire	10	23	11	28
West Yorkshire	40	12	4	3
Wiltshire	6	8	5	14
Total	**1073**	**857**	**170**	**275**

Table 30: Red light cameras (which are included as Fixed in Table 29)

	Red light		
Area	**Urban**	**Rural**	**All**
Avon, Somerset and Gloucestershire			
- Avon and Somerset	1	2	3
Derbyshire	1		1
Hampshire	4	1	5
Leicestershire	2		2
London	109		109
Norfolk	6		6
Nottinghamshire			
- Nottingham City	21		21
- Nottinghamshire (XCity)	6	3	9
South and Mid Wales			
- South Wales	29		29
- Gwent	3		3
South Yorkshire	19	1	20
Warwickshire	6	1	7
Wiltshire	1		1
Total	**208**	**8**	**216**

Data on pedestrian collisions and casualties at safety camera sites were available from 21 partnership areas. Because of this, the results of analysis of the effect of the safety cameras on pedestrian collision involvement can be estimated for these partnerships, but are not directly comparable with those from the other analyses.

G.3 Comparison groups

Two distinct kinds of comparison are made. The first is with areas that did not become partnerships before April 2003, and the second is with sites within partnership areas at times when no intervention was made.

In the case of non-partnership areas, KSI and PIC data for the whole area were provided by the Department for Transport in three-month observations. Long-term trends and seasonal variations in these data were incorporated into the model, and therefore form part of the reference against which the effects of interventions are estimated. Safety improvements in these areas included those arising from the introduction of safety cameras outside the cost recovery programme.

The sites that were accepted for inclusion in the cost recovery programme conformed to the handbook requirements that are specified in Appendix A of the present research report. The requirement for a record of PICs during recent years is a central criterion for selection. However, there was also a requirement to identify speed as a contributory factor to these collisions, a clear indication of motorists speeding, suitability of the site for treatment by enforcement, and unsuitability of further engineering remedial measures. Because of this requirement to identify the sites as suitable for this particular safety measure, and in particular that the collision record was not the sole criterion for selection, the established statistical phenomenon of regression to the mean (also known as bias by selection) will not apply in full measure. Furthermore, the results of the statistical analysis of casualties and collisions at speed cameras are consistent with the observed reductions in speeding, showing that the enforcement measures are working as intended.

G.4 Data issues

Certain features of the data that were used in the present modelling and analysis are recorded here.

Nottingham City
Nottingham City digital camera sites were on the ring road.

Strathclyde
Strathclyde provided data for 28 sites, all of which are located in Glasgow.

South Wales
There was a change in reporting practices in South Wales around the end of 1999 or early on in 2000. The effect of these changes is thought to have increased the recording of KSI casualties. It was concluded that given the uncertainties with regard to the impact of the reporting changes at safety cameras (and given that the implementation of safety cameras could affect the ratio of KSI to slight casualties) South Wales data were excluded from the analysis of KSI casualties.

Thames Valley

Due to a change in KSI casualty reporting practice in Thames Valley from 1999, data prior to 1999 is not comparable with later years. Sufficient comparable data was available to provide at least one year of baseline (i.e. pre-cost recovery programme) data for 123 sites. However, a further 133 sites were omitted from the analysis due to apparently incomplete data. This omission does not affect the validity of the national model estimate (the omitted sites account for 1,596 site-months out of a national total of 82,104 site months before cost recovery).

Essex, Surrey and Hertfordshire

Collision data at certain camera sites in these counties were reported to the Metropolitan police. These sites were therefore treated as belonging to the London area rather than to their county.

Data provided by the Department for Transport

The Department for Transport provided data from Quarter 1 (Q1) 1997 to Q1 2003 for each of the police force area in Great Britain that was not treated as a partnership in the present study. Provisional data were provided for Q1 2003 subject to the understanding that they are subject to review and may be under-estimates.

G.5 Analysis

In order to estimate the part of the variations in the observed occurrence of PIC and KSI at camera sites that can be associated with introduction of safety cameras, we undertook a statistical modelling exercise. The model that was developed is log-linear in form, to estimate the mean frequency (number per unit time) of a Poisson process. The modelling was undertaken using the GenStat statistical analysis package (GenStat Committee, 2002).

Because the observations are reported in units of various durations, the durations were accommodated by using the GenStat offset facility. We supposed that the data have a Poisson distribution with mean frequency that is modelled as follows. The same model form was developed for each of KSIs and for PICs, but with different parameter values fitted for each. The description below is that for KSIs.

$$N_{tp} = \exp\left(O_{tp} + P_p + Tt + Q_{q(t),u(p)} + A_{f(p),u(p)}\, a(p,t) + B\, b(p,t) + C\, c(p,t)\, f(p)\right) + \varepsilon_{tp}$$

where

N_{tp} is the recorded number of KSI casualties for observation dated t at site p,

O_{tp} is the logarithm of the duration of the observation period t at site p,

P_p is a parameter to allow for the differing number of KSI casualties between sites p due to their sizes, populations and other fixed attributes. (Note that in this model, the whole of non partnership areas are treated as single sites).

T is a parameter that represent the general change in frequency of KSI casualties over time t, which is measured from the start of the study period.

$Q_{q,u}$ is a parameter to represent the seasonal variation in KSI casualties during each year with a value that varies between quarters q at sites in location of kind u (u = 1 for urban, u = 0 for rural),

$q(t)$ is the quarter year into which the observation falls: in cases where the observation spans several quarters, the quarterly effects were averaged,

$A_{f,u}$ is a 2 ´ 2 parameter to represent the effect associated with a camera of kind f (f = 1 for fixed, f = 0 for mobile) in location of kind u (u = 1 for urban, u = 0 for rural),

$a(p,t)$ is the proportion of the period of observation t at site p for which the camera was established,

B is a parameter to represent the effect associated with operation under cost recovery,

$b(p,t)$ is an indicator of whether site p operated under cost recovery during observation t (when $b(p, t)$ = 1) or not (when $b(p, t)$ = 0),

C is a parameter to represent the effect associated with increased conspicuity,

$c(p,t)$ is an indicator of whether site p was recorded as or required to be conspicuous during observation t (when $c(p, t)$ = 1) or not (when c(p, t) = 0),

$f(p)$ is an indicator of whether the camera as site p is fixed (when $f(p)$ = 1) or not (when $f(p)$ = 0),

$u(p)$ is an indicator of whether the location of site p is urban with speed limit < 40 mph (when $u(p)$ = 1) or not with speed limit > 40 mph (when $u(p)$ = 0)

e_{pt} is an error term that is assumed to have Poisson distribution.

Use of a separate parameter P_p for each of the sites *p* means that comparisons are made for each site individually according to its collision record. Use of the temporal parameter *T* allows for long-term trend in the mean frequency of KSI casualties, and use of the parameters Q_q allow for seasonal variation in the mean collision frequency through the year.

The effect of the interventions at a camera site is represented through the parameters *A, B* and *C* . In the case of fixed cameras, all three components of the effect are taken to apply, whilst at mobile sites, the additional conspicuity requirements are believed not to have has any substantial influence, so that the conspicuity component represented by parameter *C* was not modelled at them and is not applied in estimating their effect: this is included in the structure of the model by multiplying the conspicuity parameter *C* by *c(t, p)* to represent the conspicuity requirement and by *f(p)* to represent its application only at fixed sites. Similarly, where a camera was established before the start of the baseline period, the camera component represented by parameter *A* was not modelled at them; this was controlled by the presence indicator *a(p, t)* , which takes the value 1 throughout at such sites.

Thus the proportional effect on the mean frequency of occurrence of KSI casualties of establishing a conspicuous fixed camera operating under cost recovery at a site *p* is estimated as

$$\exp\left(A_{1,u(p)} + B + C\right)$$

Similarly, the proportional effect on the mean frequency of occurrence of KSI casualties of establishing a mobile camera operating under cost recovery at a site *p* is estimated as

$$\exp\left(A_{0,u(p)} + B\right)$$

Because of the nature of the data from which this model was estimated, estimates of the parameters *A, B* and *C* are correlated. For this reason, the standard error s of the sum of parameters (given generically as *r* and *s*) was calculated using the formula

$$\sigma = \sqrt{\sigma_r^2 + 2\rho_{rs}\sigma_r\sigma_s + \sigma_s^2}$$

where σ_r denotes the standard error of estimation of parameter *r*, and
ρ_{rs} denotes the correlation between estimates of parameters *r* and *sp* .

The GenStat software provided values for the parameter estimates, their standard errors of estimation, and the correlation between estimates: these values were used in the analysis of results presented here.

G.6 Results

The results are presented separately for the KSI data and the PIC data. We investigated the general effects at camera sites on the basis of the results as a whole. In this, we considered the different effects of the different kinds of cameras (fixed and mobile) in different locations (urban and rural).

G.6.1 KSI casualties.

The results of fitting the full model described in the previous section to the KSI data are shown in Table 31 and Table 32. The parameter estimates shown in Table 31 describe the general development of KSI casualties during the six years of the study period, whilst those in Table 32 describe the differences from the general development that are associated with the various combinations of kind of camera and kind of location. The content of each of these tables is discussed below.

Table 31: Parameter estimates ($\hat{\theta}$) for those non-treatment factors that were significant in the Poisson/log-linear model of KSIs together with estimates for upper and lower limits on their 95% confidence intervals, calculated as $\hat{\theta} \pm 1.96\,\sigma_{\hat{\theta}}$

KSI	Estimate	Standard error	95% Confidence interval	
Factor	$\hat{\theta}$	$\sigma_{\hat{\theta}}$	**Lower**	**Upper**
Time (year)	-0.0429	0.0011	-0.0450	-0.0408
Quarter 1 (urban)	-0.1590	0.0070	-0.1727	-0.1453
Quarter 2 (urban)	-0.1060	0.0072	-0.1201	-0.0919
Quarter 3 (urban)	-0.0848	0.0071	-0.0987	-0.0709
Quarter 1 (rural)	-0.1574	0.0082	-0.1734	-0.1414
Quarter 2 (rural)	0.0061	0.0081	-0.0098	0.0220
Quarter 3 (rural)	0.0879	0.0079	0.0723	0.1035

(This dataset excludes South Wales)

Note: In a log-linear model of the kind used here, the proportionate effect of a unit change in variable x that has associated parameter $\hat{\theta}$ is $\exp(\hat{\theta}) - 1$. Thus for small absolute values of $\hat{\theta}$ (a few percent), a unit change in the value of x will result in a proportionate change of approximately $\hat{\theta}$ in the estimated quantity.

The fitted value of the parameter for time shows that the frequency of occurrence of KSI casualties in the whole of GB fell at a little over 4% each year throughout the study period. This reflects the general improvement in road safety and includes the effects of the introduction of safety cameras outside the partnership. The effects for quarters 1, 2 and 3 of the year are referenced to the final quarter of the year, and these show that in urban areas, the frequency of KSI casualties increases in urban areas from quarter to quarter through the year. The seasonal effects represented by quarters differ with statistical significance between urban and rural sites, with rural areas having a peak during quarter three.

Table 32: Parameter estimates ($\hat{\theta}$) for the camera effects in the Poisson/log-linear model for KSI casualties together with standard errors of estimation for the various kinds of area.

KSI		Estimate	Standard error
Fixed	Urban	-0.6733	0.0486
	Rural	-0.9141	0.1077
Mobile	Urban	-0.3474	0.0283
	Rural	-0.2744	0.0449

(This dataset excludes South Wales)

The fitted value of the model parameters for each of the four combinations of fixed and mobile cameras at urban and rural sites are shown in Table 32. This shows that the effects of safety cameras differed between camera types and location of deployment, with fixed cameras having a greater effect than mobile ones on the frequency of occurrence of KSI casualties, and cameras having a greater effect in urban areas than in rural ones. The proportionate effect of the different kinds of cameras in these locations can be estimated from these parameters by exponentiation. These estimates, together with their 95% confidence intervals, are given in Table 33. This shows that fixed cameras had the effect of reducing KSI casualties by about half when introduced (together with conspicuity and cost recovery) at urban and rural sites. Mobile cameras had the effect of reducing KSI casualties at urban and rural sites where they were used under cost recovery by about a quarter.

Table 33: Estimates of proportionate change in frequency of KSI casualties at sites after introduction of cameras, together with 95% confidence intervals.

KSI		Proportion	95% Confidence interval	
Fixed	Urban	-0.4900	-0.5363	-0.4390
	Rural	-0.5991	-0.6754	-0.5049
Mobile	Urban	-0.2935	-0.3316	-0.2532
	Rural	-0.2400	-0.3040	-0.1700

(This dataset excludes South Wales)

The proportionate estimates of changes can be aggregated according to the number of sites of each kind that contributed to the study, which are shown in Table 34 (note that no KSI data from South Wales were used in this analysis). Approximate confidence intervals can be calculated by performing corresponding calculations on the end points of the cross-classified ones given in Table 33. The approximation arises because the correlation between estimates in the different cases is less than unity, which will lead to greater precision than indicated here, whilst this aggregation is linear in the proportionate changes rather than their logarithms. The results of this aggregation are shown in Table 35. This shows that, after taking into account

the different kinds of camera that are used in each of urban and rural areas, the typical changes in frequency of KSI casualties are similar between urban and rural areas at about 40% reduction.

Table 34: Number of sites of each kind that contributed KSI data at the end of the study period.

Sites	Urban	Rural	All
Fixed	985	170	1155
Mobile	782	259	1041
All	**1767**	**429**	**2196**

(This dataset excludes South Wales)

Table 35: Estimates of proportionate changes in frequency of KSI casualties, aggregated by site.

KSI	Proportion	95% Confidence interval	
Fixed	-0.5060	-0.5568	-0.4487
Mobile	-0.2802	-0.2802	-0.1861
Urban	-0.4030	-0.4457	-0.3568
Rural	-0.3823	-0.4512	-0.3027
All	**-0.3990**	**-0.4160**	**-0.3242**

Finally, the change in numbers of KSI casualties can be estimated from this according to the mean number of KSI casualties at sites of each kind. In order to make this estimate, we used the mean annual number of KSI casualties recorded for sites during the whole of the study period. These means are given in Table 36, and the estimates of changes, calculated by multiplying corresponding cells of Tables 35 and 36, are given in Table 37. These represent estimates of the annual savings in KSI casualties that arise from the introduction of safety cameras operating under the prevailing rules of cost recovery summed across all of the sites that contributed data to the study. They show that the bulk of the savings (about 692 per annum out of 870) accrue at urban sites, whilst about a fifth accrue at rural sites. Although the effectiveness of cameras at mobile sites is about half that at fixed ones, the frequency of KSI casualties at mobile rural sites is about three times greater than that at fixed rural sites, so that the reduction (98 per annum) in frequency of KSI casualties at mobile rural sites is slightly greater than that (81 per annum) at fixed rural ones.

Table 36: Mean frequency of KSI casualties at sites of each kind during the study period.

KSI pa	Urban	Rural	All
Fixed	876.8	134.6	1011.4
Mobile	894.5	406.4	1300.9
All	**1771.3**	**540.9**	**2312.3**

(this excludes South Wales)

Table 37: Estimated total change in annual frequency of KSI casualties at sites of each kind

KSI pa	Urban	Rural	All
Fixed	-430	-81	-510
Mobile	-263	-97	-360
All	**-692**	**-178**	**-870**

(this dataset excludes South Wales)

G.6.2 PICs.

The results of fitting the full model described in the previous section to the PIC data are shown in Table 38 and Table 39. The parameter estimates shown in Table 38 describe the general development of PICs during the six years of the study period, whilst those in Table 39 describe the differences from the general development that are associated with the various combinations of kind of camera and kind of location. The content of each of these tables is discussed below.

Table 38: Parameter estimates ($\hat{\theta}$) for those non-treatment factors that were significant in the Poisson/log-linear model of PICs together with estimates for upper and lower limits on their 95% confidence intervals, calculated as $\hat{\theta} \pm 1.96\ \sigma_{\hat{\theta}}$

PIC	Estimate	Standard error	95% CI	
Factor	$\hat{\theta}$	$\sigma_{\hat{\theta}}$	**Lower**	**Upper**
Time (year)	-0.0153	0.0007	-0.0166	-0.0140
Quarter 1 (urban)	-0.1460	0.0039	-0.1536	-0.1384
Quarter 2 (urban)	-0.1079	0.0040	-0.1157	-0.1001
Quarter 3 (urban)	-0.1075	0.0040	-0.1153	-0.0997
Quarter 1 (rural)	-0.1666	0.0061	-0.1786	-0.1546
Quarter 2 (rural)	-0.1390	0.0063	-0.1513	-0.1267
Quarter 3 (rural)	-0.0405	0.0061	-0.0525	-0.0285

The fitted value of the parameter for time shows that the frequency of occurrence of PICs in the whole of GB fell at a little over 1.5% each year throughout the study period. This reflects the general improvement in road safety and includes the effects of the introduction of safety cameras outside the partnership areas. The effects for quarters 1, 2 and 3 of the year are referenced to the final quarter of the year, and these show that in urban areas, the frequency of PICs increases from quarter to quarter through the year. Within this general pattern, the seasonal effects represented by quarters differ with statistical significance between urban and rural sites.

Table 39: Parameter estimates ($\hat{\theta}$) for the After periods in the Poisson/log-linear model for PICs together with standard errors of estimation for the various kinds of area.

PIC		Estimate	Standard error
Fixed	Urban	-0.5466	0.0269
	Rural	-0.4794	0.0848
Mobile	Urban	-0.2903	0.0166
	Rural	-0.1648	0.0373

The proportionate effect of the different kinds of cameras in these locations can be estimated from these parameters by exponentiation. These estimates, together with their 95% confidence intervals, are given in Table 40. This shows that fixed cameras had the effect of reducing PICs by about 40% when introduced (together with conspicuity and cost recovery) at urban and rural sites. Mobile cameras had the effect of reducing PICs at urban and rural sites where they were used under cost recovery by about 20%.

Table 40: Estimates of proportionate change in frequency of KSI casualties at sites after introduction of cameras, together with 95% confidence intervals.

PIC		Proportion	95% Confidence interval	
Fixed	Urban	-0.4211	-0.4508	-0.3897
	Rural	-0.3808	-0.4756	-0.2689
Mobile	Urban	-0.2520	-0.2760	-0.2271
	Rural	-0.1519	-0.2117	-0.0876

The proportionate estimates of changes can be aggregated according to the number of sites of each kind that contributed to the study, which are shown in Table 29 (all sites contributed to the analysis of PICs). The proportional changes at each of fixed, mobile, urban, rural, and all sites can be aggregated by affording identical weight to the estimated change at each site. As for the KSI casualties, approximate confidence intervals are calculated by performing corresponding calculations on the end points of the cross-classified ones given in Table 40. The results this of aggregation are shown in Table 41. This shows

that, after taking into account the different kinds of camera that are used in urban areas, typical changes in frequency of PICs is about 35% reduction, and in rural areas, the typical changes in frequency of PICs is about 24% reduction. Because there are about 10 times as many urban sites than rural ones, the estimate of change at all sites is about 33% reduction.

Table 41: Estimates of proportionate changes in frequency of PICs, aggregated by site.

PIC	Proportion	95% Confidence interval	
Fixed	-0.4156	-0.4542	-0.3732
Mobile	-0.2277	-0.2604	-0.1932
Urban	-0.3460	-0.3732	-0.3175
Rural	-0.2394	-0.3126	-0.1569
All	**-0.3260**	**-0.3618**	**-0.2874**

Finally, the change in numbers of PICs can be estimated from this according to the mean number of PICs at sites of each kind. In order to make this estimate, we used the mean annual number of PICs recorded for sites during the whole of the study period. These means are given in Table 42, and the estimates of changes, calculated by multiplying corresponding cells of Tables 41 and 42, are given in Table 43. These represent estimates of the annual savings in PICs that arise from introduction of safety cameras operating under the prevailing rules of cost recovery summed across all of the sites that contributed data to the study. They show that the bulk of the savings (about 3,657 per annum out of 4,030) are at urban sites, whilst about a tenth accrue at rural sites.

Table 42: Mean frequency of PICs at sites of each kind during the study period.

PIC pa	Urban	Rural	All
Fixed	5592.1	525.6	6117.7
Mobile	5168.1	1140.5	6308.7
All	**10760.2**	**1666.2**	**12426.4**

Table 43: Estimated total change in annual frequency of PICs at sites of each kind

PIC pa	Urban	Rural	All
Fixed	-2355	-200	-2555
Mobile	-1302	-173	-1475
All	**-3657**	**-373**	**-4030**

G.6.3 Differences between partnerships

In order to investigate the difference in changes between partnership areas, a further model was developed that included the interaction between introduction of cameras and the partnership areas. This model included all of the effects of the main model to account for differences between areas in composition of urban and rural, fixed and mobile sites. Because of this, these

coefficients can be interpreted as representing an estimate of the difference between the safety performance of each partnership after allowance has been made for the different kinds of safety cameras and their location of deployment. These coefficients provide an indication of the combination of scope for improvement in the circumstances of the area and the performance within that scope.

The coefficients fitted to the interaction term between partnership area and the camera presence variable *a(p, t)* in the PIC model are shown in Table 44, together with their standard errors of estimation and resulting *T* values.

Table 44: Coefficients of partnership area – camera presence interaction terms in the log-linear model for PICs

Partnership name	Parameter	SE	*T*
Avon and Somerset and Gloucestershire			
- Avon and Somerset	-0.2744	0.0590	-4.65
- Gloucestershire	-0.3732	0.0954	-3.91
Bedfordshire	-0.6427	0.1027	-6.25
Cambridgeshire	-0.4985	0.1965	-2.54
Cleveland	-0.9159	0.0825	-11.11
Derbyshire	-0.3844	0.0633	-6.07
Essex	-0.3613	0.0575	-6.28
Fife	-0.4123	0.1431	-2.88
Hampshire	-0.1536	0.1502	-1.02
Lancashire	-0.7712	0.0657	-11.74
Leicestershire	-0.3176	0.0767	-4.14
Lincolnshire	-0.2547	0.1092	-2.33
Norfolk	-0.6964	0.1079	-6.45
North Wales	-0.6951	0.0885	-7.85
Northamptonshire	-0.5352	0.1068	-5.01
Nottinghamshire			
- Nottingham City	-0.1726	0.0503	-3.43
- Nottinghamshire (XCity)	-0.2628	0.0929	-2.83
South and Mid Wales			
- South Wales	-0.4448	0.0652	-6.82
- Dyfed-Powys	-0.5451	0.0842	-6.47
- Gwent	-0.6515	0.1044	-6.24
South Yorkshire	-0.7727	0.0557	-13.87
Staffordshire	-0.1080	0.0681	-1.59
Strathclyde	0.0500	0.1087	0.46
Thames Valley	-0.3202	0.0876	-3.65
Warwickshire	-0.4335	0.0962	-4.51
West Yorkshire	-1.2613	0.0939	-13.44
Wiltshire	-1.1762	0.2835	-4.15

The results in Table 45 show that there was sufficient evidence from almost all partnerships individually to establish that the partial effect of introduction of safety cameras alone led to reduction in the mean frequency of PICs. In the cases of Strathclyde and Hampshire there was insufficient evidence for a statistically significant effect from the introduction of cameras alone. The coefficients in this table represent only part of the whole effect of safety cameras operating under cost recovery; in order to estimate the whole effect, the terms representing the effects of conspicuity, urban/rural location, and fixed/mobile camera type are required, which vary according to the individual camera and site within partnerships.

Table 45: Coefficients of partnership area – camera presence interaction terms in the log-linear model for KSIs

Partnership name	Parameter	SE	*T*
Avon and Somerset and Gloucestershire			
- Avon and Somerset	0.1090	0.1067	1.02
- Gloucestershire	-0.2341	0.1821	-1.29
Bedfordshire	-1.2903	0.1876	-6.88
Cambridgeshire	-1.0056	0.3243	-3.10
Cleveland	-0.2189	0.1347	-1.63
Derbyshire	-0.2296	0.0984	-2.33
Essex	-0.0942	0.0923	1.02
Fife	0.3357	0.1587	2.11
Hampshire	0.3386	0.2531	1.34
Lancashire	-0.7569	0.1142	-6.63
Leicestershire	-0.9248	0.1681	-5.50
Lincolnshire	0.0823	0.1478	0.56
Norfolk	-0.9068	0.1332	-6.81
Northamptonshire	-0.2945	0.1367	-2.15
Nottinghamshire			
- Nottingham City	-0.3122	0.0857	-3.64
- Nottinghamshire (XCity)	-0.2167	0.1295	-1.67
South Yorkshire	-0.8355	0.1001	-8.35
Staffordshire	-0.0876	0.1523	-0.58
Strathclyde	-0.1723	0.1531	-1.13
Thames Valley	-0.4418	0.1321	-3.34
Wales			
- Dyfed-Powys	-0.8300	0.1142	-7.27
- Gwent	-1.2864	0.1786	-7.20
- North Wales	-1.2187	0.1588	-7.67
Warwickshire	-0.6064	0.1335	-4.54
West Yorkshire	-0.5798	0.1536	-3.77
Wiltshire	-1.2777	0.3574	-3.57

The coefficients fitted to the interaction term between partnership area and the camera presence variable $a(p, t)$ in the KSI model are shown in Table 45, together with their standard errors of estimation and resulting T values. These results show that there was sufficient evidence from several of the partnerships individually to establish that the partial effect of introduction of safety cameras alone led to reduction in the mean frequency of KSIs. This applied in the cases of Bedfordshire, Cambridgeshire, Derbyshire, Dyfed-Powys, Gwent, Lancashire, Leicestershire, Norfolk, North Wales, Northamptonshire, Nottingham City, South Yorkshire, Thames Valley, Warwickshire, West Yorkshire, and Wiltshire. The coefficients in this table represent only part of the whole effect of safety cameras operating under cost recovery; in order to estimate the whole effect, the terms representing the effects of conspicuity, urban/rural location, and fixed/mobile camera type are required, which vary according to the individual camera and site within partnerships. Because the frequency of KSI casualties is lower than that of PICs, partnership areas that had been established for only one year could provide little data for this extended model. In view of this, the estimates of area-specific camera parameters for these partnerships were not considered to be reliable.

G.6.4 Pedestrian collisions

We now consider the effect of safety camera operation under cost recovery on collisions that involve pedestrian casualties. The pedestrian data cannot be compared directly to the data for all user groups because the data come only 21 of the areas and from only some of the sites within those. The data that were used in this part of the analysis are summarised in Table 46.

Table 46: Summary of data used in analysis of pedestrian casualties.

PIC pa	Urban	Rural	All
Mobile	775	254	1029
Fixed	652	138	790
All	**1427**	**392**	**1819**

KSI sites	Urban	Rural	All
Mobile	700	238	938
Fixed	564	138	702
All	**1264**	**376**	**1640**

(This dataset for the KSI analysis excludes South Wales)

Investigation of non-treatment effects showed that both the long-term trend and the seasonal variations differed significantly between urban and rural areas; this was therefore respected in the models of pedestrian PICs and KSIs that were developed. Different effects of safety cameras were investigated

according to whether they were fixed or mobile. In estimating and using this model, the effects of changes in conspicuity requirements were not applied at mobile sites.

The results of fitting the model corresponding to that in the previous section to data for pedestrian casualties who were either killed or seriously injured are shown in Table 47 and Table 48. The parameter estimates shown in Table 47 describe the general development of pedestrian KSI casualties during the study period, whilst those in Table 48 describe the differences from the general development that are associated with introduction of safety cameras.
The content of these tables is discussed below.

Table 47: Parameter estimates ($\hat{\theta}$) for those non-treatment factors that were significant in the Poisson/log-linear model of pedestrian KSIs together with estimates for upper and lower limits on their 95% confidence intervals, calculated as $\pm$ 1.96 $\sigma_{\hat{\theta}}$

KSI	Estimate	Standard error	95% Confidence interval	
Factor	$\hat{\theta}$	$\sigma_{\hat{\theta}}$	**Lower**	**Upper**
Time (urban)	-0.0426	0.0013	-0.0452	-0.0400
Time (rural)	-0.0611	0.0043	-0.0695	-0.0527
Quarter 1 (urban)	-0.1107	0.0063	-0.1230	-0.0984
Quarter 2 (urban)	-0.2131	0.0067	-0.2263	-0.1999
Quarter 3 (urban)	-0.2608	0.0068	-0.2741	-0.2475
Quarter 1 (rural)	-0.2167	0.0203	-0.2564	-0.1770
Quarter 2 (rural)	-0.3996	0.0222	-0.4431	-0.3561
Quarter 3 (rural)	-0.2748	0.0213	-0.3166	-0.2330

(This dataset excludes South Wales)

The fitted value of the parameter for time shows that the frequency of occurrence of pedestrian KSIs in GB fell at a little over 4 per in urban areas cent and at a little over 6% in rural areas each year throughout the study period. This reflects the general improvement in road safety and includes the effects of the introduction of safety cameras outside the partnership areas. The effects for quarters 1, 2 and 3 of the year are referenced to the final quarter of the year, and these show that in urban areas, the frequency of KSIs is greatest during the final quarter of the year, and is substantially lower during the second and third quarters, especially in rural areas.

The proportionate effect of the different kinds of cameras in these locations can be estimated from the model. These estimates, together with their 95% confidence intervals, are given in Table 48. This shows that fixed cameras had the effect of reducing pedestrian KSI casualties by about 45% when introduced

together with conspicuity and cost recovery. Mobile cameras had the effect of reducing pedestrian KSI casualties where they were used under cost recovery by about a quarter. Aggregating these estimates of effectiveness using the numbers of camera sites of each kind shown in Table 48 leads to an estimate of effectiveness of about 35% reduction in frequency of pedestrian KSIs at camera sites.

Table 48: Estimates of proportionate change in frequency of pedestrian KSI casualties at sites after introduction of cameras, together with 95% confidence intervals.

KSI	Proportion	95% Confidence interval	
Mobile	-0.2795	-0.3159	-0.2411
Fixed	-0.4558	-0.5039	-0.4031
All	**-0.3550**	**-0.3964**	**-0.3104**

(This dataset excludes South Wales)

The results of fitting the corresponding model to data for pedestrian PICs are shown in Table 49 and Table 50. The parameter estimates shown in Table 49 describe the general development of pedestrian PICs during the study period, whilst those in Table 50 describe the differences from the general development that are associated with introduction of safety cameras. The content of these tables is discussed below.

Table 49: Parameter estimates ($\hat{\theta}$) for those non-treatment factors that were significant in the Poisson/log-linear model of pedestrian PICs together with estimates for upper and lower limits on their 95% confidence intervals, calculated as $\pm$ 1.96 $\sigma_{\hat{\theta}}$

PIC	Estimate	Standard error	95% Confidence interval	
Factor	$\hat{\theta}$	$\sigma_{\hat{\theta}}$	**Lower**	**Upper**
Time (urban)	-0.0218	0.0009	-0.0236	-0.0200
Time (rural)	-0.0399	0.0043	-0.0484	-0.0314
Quarter 1 (urban)	-0.0768	0.0045	-0.0856	-0.0680
Quarter 2 (urban)	-0.1318	0.0047	-0.1411	-0.1225
Quarter 3 (urban)	-0.1676	0.0048	-0.1769	-0.1583
Quarter 1 (rural)	-0.1687	0.0206	-0.2092	-0.1282
Quarter 2 (rural)	-0.3358	0.0225	-0.3799	-0.2917
Quarter 3 (rural)	-0.2197	0.0217	-0.2622	-0.1772

The fitted value of the parameter for time shows that the frequency of occurrence of pedestrian PICs in the whole of GB fell at a little over 2% in urban areas and at about 4% in rural areas each year throughout the study period. The effects for the three quarter-years are referenced to the final quarter of the year, and these show that in urban areas, the frequency of PICs

is greatest during the final quarter of the year, and is lower during the second and third quarters, especially in rural areas.

The proportionate effect of the different kinds of cameras in these locations can be estimated from the model. These estimates, together with their 95% confidence intervals, are given in Table 50. This shows that fixed cameras had the effect of reducing pedestrian PICs by about 18% when introduced together with conspicuity and cost recovery. Mobile cameras had the effect of reducing pedestrian PICs where they were used under cost recovery by 28%. Aggregating these estimates of effectiveness using the numbers of camera sites of each kind shown in Table 50 leads to an estimate of effectiveness of about 23% reduction in frequency of pedestrian PICs at camera sites.

Table 50: Estimates of proportionate change in frequency of pedestrian PICs at sites after introduction of cameras, together with 95% confidence intervals.

PIC	Proportion	95% Confidence interval	
Mobile	-0.2769	-0.3059	-0.2467
Fixed	-0.1781	-0.2392	-0.1120
All	**-0.2340**	**-0.2769**	**-0.1882**

G.7 References

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Appendix H:
Glossary of terms

ACPO	Association of Chief Police Officers (for England and Wales)
CS	Court Service
COFPN	Conditional Offer of a Fixed Penalty Notice
CSS	County Surveyors Society
CPS	Crown Prosecution Service
CTO	Central Ticket Office
DfT	Department for Transport
DVLA	Driver and Vehicle Licensing Agency
FPO	Fixed Penalty Office
FPN	Fixed Penalty Notice
HA	Highways Agency
HMT	Her Majesty's Treasury
KSI	Killed or Serious Injury
LCD	Lord Chancellor's Department
NHS	National Health Service
NIP	Notice of Intended Prosecution
NS	Not significant
PA	PA Consulting Group
PIC	Personal Injury Collision
PFA	Police Force Area
TAG	Local Government Technical Advisers Group
UCL	University College London
VP-FPO	Vehicle Procedures – Fixed Penalty Office (an IT System)
VRM	Vehicle Registration Mark

Appendix I:
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Corporate headquarters

123 Buckingham Palace Road
London SW1W 9SR
United Kingdom
Tel: +44 20 7730 9000
Fax: +44 20 7333 5050
E-mail: info@paconsulting.com

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