

Synthesis title:

Safety Cameras

Category: Compliance and Law



Other Relevant Topics:

- ▶ Type Approval
(Compliance and the Law)
- ▶ Laws & Regulations
(Compliance and the Law)
- ▶ Crime Interventions
(Compliance and the Law)
- ▶ Speed (Drivers)

Keywords:

Camera, Enforcement,
Speed Camera,
Red Light Camera

About the Road Safety Observatory

The Road Safety Observatory aims to provide free and easy access to independent road safety research and information for anyone working in road safety and for members of the public. It provides summaries and reviews of research on a wide range of road safety issues, along with links to original road safety research reports.

The Road Safety Observatory was created as consultations with relevant parties uncovered a strong demand for easier access to road safety research and information in a format that can be understood by both the public and professionals. This is important for identifying the casualty reduction benefits of different interventions, covering engineering programmes on infrastructure and vehicles, educational material, enforcement and the development of new policy measures.

The Road Safety Observatory was designed and developed by an Independent Programme Board consisting of key road safety organisations, including:

- ▶ Department for Transport
- ▶ The Royal Society for the Prevention of Accidents (RoSPA)
- ▶ Road Safety GB
- ▶ Parliamentary Advisory Council for Transport Safety (PACTS)
- ▶ RoadSafe
- ▶ RAC Foundation

By bringing together many of the key road safety governmental and non-governmental organisations, the Observatory hopes to provide one coherent view of key road safety evidence.

The Observatory originally existed as a standalone website, but is now an information hub on the RoSPA website which we hope makes it easy for anyone to access comprehensive reviews of road safety topics.

All of the research reviews produced for the original Road Safety Observatory were submitted to an Evidence Review Panel (which was independent of the programme Board), which reviewed and approved all the research material before it was published to ensure that the Key Facts, Summaries and Research Findings truly reflected the messages in underlying research, including where there may have been contradictions. The Panel also ensured that the papers were free from bias and independent of Government policies or the policies of the individual organisations on the Programme Board.

The Programme Board is not liable for the content of these reviews. The reviews are intended to be free from bias and independent of Government policies and the policies of the individual organisations on the Programme Board. Therefore, they may not always represent the views of all the individual organisations that comprise the Programme Board.

Please be aware that the Road Safety Observatory is not currently being updated; the research and information you will read throughout this paper has not been updated since 2017. If you have any enquiries about the Road Safety Observatory or road safety in general, please contact help@rospa.com or call **0121 248 2000**.

How do I use this paper?

This paper consists of an extensive evidence review of key research and information around a key road safety topic. The paper is split into sections to make it easy to find the level of detail you require. The sections are as follows:

Key Facts	A small number of bullet points providing the key facts about the topic, extracted from the findings of the full research review.
Summary	A short discussion of the key aspects of the topic to be aware of, research findings from the review, and how any pertinent issues can be tackled.
Methodology	A description of how the review was put together, including the dates during which the research was compiled, the search terms used to find relevant research papers, and the selection criteria used.
Key Statistics	A range of the most important figures surrounding the topic.
Research Findings	A large number of summaries of key research findings, split into relevant subtopics.
References	A list of all the research reports on which the review has been based. It includes the title, author(s), date, methodology, objectives and key findings of each report, plus a hyperlink to the report itself on its external website.

The programme board would like to extend its warm thanks and appreciation to the many people who contributed to the development of the project, including the individuals and organisations who participated in the initial consultations in 2010.

Key facts

- Inappropriate speed contributes to around 11 per cent of all injury collisions, 13 per cent of collisions resulting in a serious injury and 23 per cent of collisions which result in a death and are recorded by the police. (This includes both “excessive speed”, when the speed limit is exceeded, but also driving or riding within the speed limit when this is too fast for the conditions at the time).

(Department for Transport, 2017)

- The deployment of speed cameras leads to appreciable reductions in speed in the vicinity of the cameras, and substantial reductions in Road Traffic Incidents (RTIs) and casualties at those locations (over and above that which is attributable to regression-to-mean effects).
- The evidence from a study in West London is that speed cameras led to a reduction in casualties not only at camera sites, but across the wider road network also.
- Data for 2007–2009 supplied by a number of road safety partnerships, while not covering the whole country, suggest that big falls in fatal or serious casualties at camera sites have persisted over time.

(R. Allsop, 2010)

- The Cochrane report (which is a systematic review of other studies) highlights the consistency of reported positive reductions in speed and Road Traffic Incident (RTI) results across all studies examining the effectiveness of cameras.
- This suggests that speed cameras are a worthwhile intervention for reducing the number of road traffic injuries and deaths.

(C. Wilson *et al.*, 2011)

- A comprehensive study on average speed cameras (ASC) systems installed in Great Britain between 1990 and 2015, found that, after accounting for site-selection periods, trend and reduction to the mean effects, the ASC systems are effective in reducing collisions, especially those of a high severity.

(R. Owen, G. Ursachi and R. Allsop, 2016)

- Studies on the effects of speed cameras on road traffic accidents in England found significant reductions in the number of accidents at speed camera sites.

(A. Hoye, 2015; D. J. Graham, *et al.*, 2017)

Summary

Higher vehicle speeds increase the risk of RTIs, as well as increasing the severity of RTIs when they occur. Therefore, reducing vehicle speeds to the posted speed limit will help to achieve reductions in RTIs and the severity of injuries that occur.

Safety cameras provide one way of reducing speeds as well as discouraging dangerous driving (such as jumping red lights). The implementation of these cameras has been met with some opposition from a minority of motorists who believe that they are simply a money generating mechanism for the Treasury. This has given rise to a vociferous ongoing debate as to whether safety cameras provide a real benefit to road safety.

There is a substantial (and growing) body of evidence which suggests that safety cameras have a positive effect on reducing vehicle speeds, RTI rates and injury severity.

Studies show, with very few exceptions, that the installation of safety cameras has helped to reduce vehicle speeds and RTIs. Average speed cameras have been shown to be even more effective at reducing speeds over larger sections of road than fixed point cameras.

Parties responsible for road safety and RTI prevention firmly believe that these published studies clearly demonstrate the association between safety cameras and RTI reduction. This synthesis shows that whilst this evidence base is substantial, there are some calls for more robust studies to be undertaken. While some researchers indicate that the data collection and analysis methods could be improved, cameras have had at least some impact on vehicle speeds.

Opponents of the cameras often cite the phenomenon of regression-to-mean as a reason for the reduction in speeds and RTIs. It is for this reason that more robust data collection and analysis would be of benefit in clarifying if the reductions in vehicle speeds and RTIs are a result of cameras, or the regression-to-mean phenomenon. Latest research, taking into account factors like regression-to-mean, site-selection period and trend influences still found clear and significant safety effects of speed cameras, at the speed cameras sites for fixed cameras or for the stretch of road covered by average speed camera systems.

Safety cameras can be used in a variety of locations and in a range of different ways. Fixed point speed cameras are used on rural and urban roads as well as motorways to enforce speed limits at a particular location. Fixed point cameras can also be used to enforce variable speed limits on sections of managed motorways, such as the M42. Average speed cameras enforce a speed limit over a large section of road by calculating a vehicle's average speed between two points. While they are permanently employed throughout a number of towns and cities in the UK, they are most commonly used for enforcing speed limits through roadworks.

Red light cameras provide a deterrent to dangerous driving by triggering the prosecution process which ultimately fines offending drivers for jumping red lights. Fixed cameras are found to be effective in reducing collision incidence even after being switched off. Finally, cameras are also being used to monitor overweight vehicles crossing structures such as bridges, which might be damaged by excessive weight.

Methodology

The predominant types of camera used for road safety enforcement are speed cameras. The term speed camera is specific to those cameras which record a vehicle's speed. Safety cameras encompass both speed (including mobile/fixed and spot speed/average) and red light cameras. Some reports refer to safety cameras while others are more specific and refer to speed cameras. Due to the potential for a term to be used in a particular context or with reference to a specific piece of equipment, the synthesis uses whichever term is used in the original report.

Although only touched upon in the synthesis (due to relatively limited information being available), camera technology has also been trialled as part of weigh-in-motion systems to monitor overweight vehicles. These cameras do not fit within the safety camera bracket, but still come within the camera enforcement remit of this synthesis. While outside the scope of this synthesis, cameras are also used for a number of non-safety reasons e.g. yellow box enforcement, banned turns.

This synthesis was compiled during November - December 2012.

A detailed description of the methodology used to produce this review is provided in the Methodology section of the Observatory website at <http://www.roadsafetyobservatory.com/Introduction/Methods> .

The steps taken to produce this synthesis are outlined below:

- **Identification of relevant research** – searches were carried out on pre-defined research (and data) repositories. As part of the initial search some additional information sources were also consulted, which included <http://www.ingentaconnect.com> and various project archives. Search terms used to identify relevant papers included but were not limited to:
 - 'Safety cameras';
 - 'Speed cameras';
 - 'Average speed cameras';
 - 'Red light cameras'; and,
 - 'Enforcement cameras'.

A total of 41 pieces of potentially relevant research were identified.

- **Initial review of research** – primarily involved sorting the research items based on key criteria, to ensure the most relevant and effective items went forward for inclusion in this synthesis. Key criteria included:
 - Relevance – whether the research makes a valuable contribution to this synthesis, for example robust findings from an academic report are more relevant than views given on a privately hosted website.

- Provenance – whether the research is relevant to drivers, road safety policies or road safety professionals in the UK. If the research did not originate in the UK, the author and expert reviewer have applied a sense check to ensure that findings are potentially relevant and transferable to the UK.
- Age – cameras are heavily affected by advances in technology, and as improvements are made, the effectiveness of cameras for the purposes of enforcement will alter significantly. Therefore, priority is given to the most up to date titles in the event of over-lap or contradiction.
- Effectiveness – whether the research credibly proves (or disproves) the effectiveness of a cameras for enforcement purposes.

Following the initial review, 17 pieces of research were taken forward to form the basis for this synthesis, 15 of which were published in the UK.

A similar search was conducted in October 2015, but limited to new research studies that had been published in 2013 to 2015, following which 8 new studies were added to the review, and reported casualty data was updated to include 2014 data, the latest available at the time of the update.

Statistics from Reported Road Casualties Great Britain were updated in December 2017 to [Reported Road Casualties Great Britain 2016](#).

- **Detailed review of research** – key facts, figures and findings were extracted from the identified research to highlight pertinent road safety issues and interventions.
- **Compilation of Synthesis** – the output of the detailed review was analysed for commonality and a synthesis written in the agreed format. Note that the entire process from identifying research to compiling the synthesis was conducted in a time bound manner.
- **Review** – the draft synthesis was subjected to extensive review by a subject matter expert, proof reader and an independent Evidence Review Panel.

Key statistics

Drivers travelling at higher speeds have less time to identify and react to what is happening around them and take longer to bring their vehicle to stop. In addition, if an RTI occurs it will be more severe, causing greater injury to the occupants and any pedestrian or rider hit by the vehicle. Therefore, reducing speed through the use of cameras has the potential to reduce RTI numbers and severity of injury

Road traffic incidents and speeding

- RTIs are a significant cause of death and disability worldwide. Every year around the world 1.2 million people are killed and up to 50 million are injured or disabled as a result of RTIs.
- Morbidity from RTIs is expected to increase in future years, and it is estimated that RTIs will move from ninth to third place in the global burden of disease ranking, as measured in disability adjusted life years.

(P. Pilkington, and S. Kinra, 2005)

- Inappropriate speed contributes directly to 10 per cent of all injuries, 13 per cent of serious injuries and 24 per cent of deaths on the road. Over 400 people are killed each year on Britain's roads, and 3,000 are seriously injured, because drivers and riders travel too fast.
- In 2014 exceeding the speed limit contributed to 7 per cent of all seriously injured road casualties and 17 per cent of all road fatalities, resulting in the deaths of 282 people, and serious injuries to almost 1,500 more people.
 - These are conservative estimates as the numbers are based on police STATS19 contributory factors which under report the number of crashes that are speed related.
- Most drivers exceed the speed limit at some time. Around half (45 per cent) of car drivers exceed the 30 mph limit in urban areas during free flowing traffic and on 40 mph roads, 21 per cent exceed the speed limit.

(Department for Transport, 2015)

- The level of public support for the use of cameras has been consistently high with 80 per cent of drivers polled finding "the use of speed cameras acceptable of very acceptable."
- 79 per cent of the drivers surveyed thought that speed cameras have contributed to reduced road deaths in recent years whilst 75 per cent of drivers supported the use of speed awareness courses instead of fines for drivers caught speeding with a clean licence. This support for speed awareness courses increased to 84 per cent amongst 17 to 24 year olds.

(IAM, 2013)

Research findings

Summaries of key findings from several research reports are given below. Further details of the studies reviewed, including methodology and findings, and links to the reports are given in the References section.

Cameras and speed

Reducing vehicle speeds also reduces the number and severity of RTIs that occur. Therefore a reduction in speed caused by the installation of safety cameras should have a positive effect on RTI and casualty numbers.

- Although the factors contributing to RTIs are numerous and diverse, speeding is widely considered to be a major determinant.
(R. Tay, 2010)

- Approximately two-thirds of all RTIs in which people are injured happen on roads with a speed limit of 30 mph or less. For fatalities, however, the majority happen in rural areas.
- The evidence for speed cameras shows that they are effective at reducing speeds and preventing RTIs, especially in preventing more serious and fatal RTIs.

(RoSPA, 2011)

- Drivers and riders who exceed speed limits cause more RTIs, and kill and injure more people, than drivers who do not exceed speed limits.
- This is why speed management is a major part of the UK's road safety strategy, with safety cameras being one tool of this speed management strategy.
- Cameras enable a much higher level of speed enforcement to be conducted than is possible using police officers on their own.
- In 2009, cameras provided evidence for 85 per cent of the 1.1 million fixed penalty notices issued for speeding offences. Without cameras, the level of enforcement would reduce significantly.
- Cameras are an effective way of identifying drivers who would benefit from attending a Speed Awareness Course, and so they provide a good opportunity to re-educate, and not just punish, drivers.

(RoSPA, 2011)

The national safety camera evaluation programme is one of the most prominent reviews of safety camera effectiveness and the mechanisms by which they are funded.

- Gains *et al.* assessed the impact of cameras in 38 camera partnerships over a four year period. The overall results showed that there was a significant reduction in speeds at camera sites.

(A. Gains *et al.*, 2005)

The RAC Foundation also undertook a comprehensive review of the effectiveness of speed cameras which demonstrated that they offer safety benefits to road users:

- The report found that deployment of speed cameras leads to appreciable reductions in speed in the vicinity of the cameras, and substantial reductions in RTIs and casualties at those locations over and above that which is attributable to regression-to-mean effects.
- National surveys indicate clear and sustained falls in the average speeds of cars on 30 mph roads, and in the proportion of cars exceeding the limit.
- Increases in speeds and speeding at various sites where cameras were visibly out of action have been recorded over the years since 2004.

(R. Allsop, 2010)

Since the 2010 Allsop study, the RAC Foundation commissioned research which used data released in 2011 as part of a government move to make speed camera operations more transparent to the public. The updated approach provided guidance to the public on the analysis of speed camera data, including the identification of site selection periods. The revision shows a smaller, but still sizable, benefit from the use of speed cameras in the areas where data were analysed.

(R.Allsop, 2013)

As well as the RAC Foundation report, there are many other studies which demonstrate the impact that safety cameras have on vehicle speeds.

- Measures to reduce traffic speed are considered essential to reducing casualties on the road.
- Speed cameras are increasingly used to help reduce traffic speeds in the belief that this will reduce RTIs and casualties, and an expansion in the use of speed cameras began in 2005 in many countries, most notably the United Kingdom. However, in recent years there has been a reversal of speed camera use (particularly in the UK) as cameras are turned off in an effort to save money.
- In an analysis of 14 papers on camera effectiveness, all but one of the studies demonstrated effectiveness of cameras within three years of installation.

(P. Pilkington, and S. Kinra, 2005)

- All studies reporting speed outcomes reported a reduction in average speeds post-intervention with speed cameras.

(C. Wilson *et al.*,2011)

- The speed limit and enforcement type have been shown to affect the impact on speed reduction.
- From 2009/10 to 2010/11 there was a 16 per cent increase in the number of people issued with a fixed penalty after being caught exceeding the speed limit or running a red-light at a safety camera site. Between 2007/8 and 2009/10 there was a 21 per cent reduction in the number of fixed penalty notices issued.

(Scottish Safety Camera Partnership, 2012)

- Another more recent review of safety camera effectiveness by the RAC Foundation indicated that the combination of enforcement and education is changing attitudes to speeding, particularly in urban areas.
- The reduction in cars exceeding 35 mph in 30 mph areas was particularly notable.
- At least part of the reduction in speed limit offences since 2005 does seem to reflect real reductions in speeding, as well as possibly better awareness of the locations of speed enforcement cameras and the introduction of speed awareness courses in place of penalties.

(C. Mitchell, 2012)

Numerous other studies and reports have highlighted the impact that cameras can have on speed reduction. However, it should be noted that the extent of their effectiveness can be influenced by their placement.

- The number of vehicles exceeding the speed limit fell by 70 per cent at fixed camera sites.

(CIHT, 2009)

- Speed limits, intended to control top speeds, are often ignored and vehicle speed capabilities far exceed posted speed limits, and thus enforcement is important.
- Studies in North America, Australia and Europe have found speed cameras to be effective in reducing speeds and RTIs.
- Despite widely different styles in camera use (mobile cameras are used more extensively in Australia, while fixed cameras are more common in the UK), studies in these countries indicate that vehicle speeds and casualty RTI frequencies have been reduced. These reductions have occurred both at camera sites and across the road network.

(A. Delaney *et al.*, 2005)

- It is clear that speed cameras placed on major roads are more effective at reducing RTIs, whilst installing cameras on minor roads appear to have a limited effect.

- Cameras installed on roads with speed limits above 40 mph are also more effective at reducing fatal RTIs.
- As expected, the effectiveness of a camera reduces as the distance from its installation point increases.

(T. K. Utley, 2012)

- The presence of speed cameras has a great impact on speed at the exact installation points, but fails to ensure compliance with speed limits by a significant share of drivers 200 metres after the cameras.
- (D. F., de Oliveira, 2015) A literature review of average speed cameras found a growing body of evidence to suggest a number of road safety benefits associated with reducing speed over larger sections of the road network.
- The basis for introducing average speed cameras is that it encourages drivers to reduce their speed across an entire section of road and greater levels of behaviour change can therefore be obtained.
- The review of international “literature investigating the effectiveness of average speed enforcement suggests that there is considerable evidence to demonstrate a positive influence of the approach on vehicle speeds and crash rates. Specifically, studies have shown that the implementation of average speed enforcement has been associated with reductions in average and 85th percentile speeds, the proportion of speeding vehicles and speed variability. Perhaps more importantly, the approach has been noted as a particularly effective countermeasure in reducing excessive speeding behaviour.”
- Numerous studies have also demonstrated considerable reductions in crash rates, particularly fatal and serious injury crashes in association with average speed enforcement systems. Additional benefits cited in the various studies include more homogenised traffic flow and increased traffic capacity through reduced vehicle speed variability and there were a limited number of studies which suggested a positive impact of average speed enforcement on vehicle emissions and fuel consumption.
- The reviewers highlighted that the existing body of literature contains a number of methodological limitations, for example, not controlling for confounding factors such as driving exposure and regression-to-the-mean.

(Soole at al., 2013)

Cameras, RTIs and Injuries

Evidence presented in the previous section shows that safety cameras help to reduce vehicle speeds at the site of the camera, as well as in the surrounding area (although this may be to a lesser extent). These reductions in vehicle speeds have been proven to reduce the number and severity of RTIs. This section presents evidence of casualty reductions that have been achieved as a result of installing safety cameras.

A number of reports have undertaken meta-analysis (comparing and contrasting findings from numerous reports on the same topic) to investigate the effectiveness of safety cameras.

- The DfT camera review found that there has been a significant reduction in casualties at camera sites.
- There was an association between the fall in speed and the fall in personal injury RTIs at camera sites.

(A. Gains *et al.*, 2005)

- The evidence from a study in West London is that speed cameras led to a reduction in casualties not only at camera sites, but across the wider road network also.
 - Following the installation of 21 cameras, this study looked at changes in accident occurrence at the camera sites over the preceding and succeeding three years. A comparison was also made with changes in accident occurrence elsewhere in London.
- Data for 2007–2009 supplied by a number of road safety partnerships, while not covering the whole country, suggest that big falls in fatal or serious casualties at camera sites have persisted over time.

(R. Allsop, 2010)

- A revision of the analysis by Allsop, commissioned by RAC Foundation and using published speed camera data, found that on average, the number of fatal and serious collisions in the vicinity of 551 fixed cameras in 9 different areas fell by more than a fifth (22%) after their installation. There was also an average reduction of 14% in personal injury collisions in the vicinity of 551 cameras. However, there were 21 camera sites in these areas where the number of collisions have increased enough to make the cameras worthy of investigation.

(R. Allsop, 2013)

- The Cochrane Collaboration looked at 28 studies measuring the effect of speed cameras on RTIs. All 28 studies found a lower number of RTIs in the speed camera areas after implementation of the program.

- The quality of the included studies in this review was judged as being of overall moderate quality at best. However, the consistency of reported positive reductions in speed and RTI results across all studies show that speed cameras are a worthwhile intervention for reducing the number of road traffic injuries and deaths.
- To affirm this finding, more studies of a scientifically rigorous and similar nature are necessary to provide the answer to the magnitude of the effect.

(C. Wilson *et al.*, 2011)

- The UK evidence shows large reductions in deaths and injuries where speed cameras have been deployed.
- The magnitude and consistency of the results across different countries and types of road provides a high level of confidence that the introduction of speed cameras does reduce RTIs at the sites where they are located.
- Whilst more research would strengthen the evidence base, the studies demonstrating their effectiveness are the strongest evidence available and must be used to inform decision making.

(RoSPA, 2011)

The process of comparing and contrasting findings from different reports helps to identify patterns in the research, and as can be seen from the summaries above there seems to be a positive correlation between speed cameras and reductions in RTIs.

Various other individual studies have also demonstrated a link between the use of speed cameras (both mobile and static) and reductions in RTIs.

- A study of the effect of safety camera enforcement showed that the number of tickets issued has a significant independent effect in reducing the number of injury RTIs above the deterrent effect provided by police presence alone.

(R. Tay, 2010)

- Overall, the cameras reduced all types of RTI by around 30 per cent, which varied significantly depending on road class and zone of influence of the camera (increasing in circular size around camera) considered. However, it is certain that their introduction has reduced the occurrence of RTIs in all cases.

(T. K. Utley, 2012)

- The experience gathered so far indicates that average speed cameras are an efficient speed enforcement method, leading to reductions in speeds across entire sections of roads and reductions in the number of RTIs and casualties.

(ETSC, 2009)

- Research from New Zealand suggests that the use of covert cameras can result in greater reductions in casualty RTIs than overt cameras.

(A. Delaney *et al.*, 2005)

As well as reductions in the number of RTIs taking place, research has indicated that cameras can help to reduce the severity of the RTIs that do occur.

- One study, while focused on mobile speed cameras, found that both the number of camera operating hours and the number of drivers apprehended per month had statistically significant effects in reducing the number of injury RTIs per month.
- Outcomes in the immediate vicinity of camera sites across studies ranged from:
 - Reductions of 5 to 69 per cent for collisions;
 - Reductions of 12 to 65 per cent for injuries; and,
 - Reductions of 17 to 71 per cent for deaths.

(P. Pilkington, and S. Kinra, 2005)

- The high correlation between the fatality and all injury severity casualty rates for pedestrians on built-up roads and the percentage of cars exceeding the limit in 30 mph areas demonstrates an association between casualties and speeds, though it cannot prove a causal link.
- The moderately high correlations between car occupant fatalities and the percentage of cars exceeding 80 mph on motorways, and between RTIs per vehicle kilometre and the percentage of cars exceeding 80 mph on motorways, reinforces this association.
- The higher correlations with the percentages of cars exceeding 80 mph than those exceeding 70 mph emphasises that it is the faster vehicles that are associated with RTIs and casualties.

(C. Mitchell, 2012)

- Cameras have a proven effectiveness in cutting speeding and RTIs.
- On average, the number of killed and seriously injured casualties fell by around 50 per cent at fixed sites, and by around 35 per cent at mobile sites.

(CIHT, 2009)

- A comprehensive study undertaken by RAC Foundation & Road Safety Analysis on the levels of occurrence of collisions before and after average speed camera (ASC) systems' installation (with consideration for site-selection period, regression-to-mean and trend effect) found:

- A 36.4% reduction in the mean rate of fatal and serious collisions (FSC) after the system's installation;
- A 16% reduction in the mean rate of personal injury collisions (PIC) after the system's installation;
- A 42.2% reduction in the mean rate of FSCs for low speed sites and a 32.3% reduction in the mean rate of FSCs for high speed sites;
- A 25% reduction in the mean rate of PICs at the low speed sites and a 7.9% reduction in the mean rate of PICs for high speed sites.

(R. Owen, G. Ursachi and R. Allsop, 2016)

- At camera sites, there had been found a significant 30% reduction in the number of accidents.

(D. J. Graham, et al., 2017)

Funding and Public Perception of Cameras

The use of safety cameras is a contentious topic with some motorists feeling that they are used as part of the 'war on motorists' to increase the cost of motoring and generate revenue for the Treasury. Therefore, studies which include reviews of public perception or funding mechanism are an important aspect of the synthesis.

- The majority of the public support the use of safety cameras for targeted enforcement.
- The level of public support for the use of cameras has been consistently high with 80 per cent of drivers polled finding "the use of speed cameras acceptable or very acceptable."
- 79 per cent of the drivers surveyed thought that speed cameras have contributed to reduced road deaths in recent years whilst 75 per cent of drivers supported the use of speed awareness courses instead of fines for drivers caught speeding with a clean licence. This support for speed awareness courses increased to 84 per cent amongst 17 to 24 year olds.

(IAM, 2013)

- Despite numerous studies showing the effectiveness of speed enforcement, especially automated speed enforcement, in reducing RTIs, public debate still continues in regard to revenue-raising aspects of speed enforcement.
- A Canadian study found that without issuing fines the safety effect of the speed camera programme was not maximised. The penalties and fines serve as a very critical component to improve the efficiency of the speed camera programme.

- This suggests that speed camera programmes are not operated solely to raise revenue as suggested by some advocates. (R. Tay, 2010)
- Public acceptance of cameras was generally widespread at the height of the national camera safety programme. Subsequent annual surveys by the AA indicate that it has remained so.
- Data for 2006–07 showed that the cost of camera enforcement was being covered by penalties paid by detected offenders, with only a modest surplus to the Treasury of less than £4 out of each £60 penalty paid. (R. Allsop, 2010)
- Public opinion surveys around the world have indicated that speed cameras are supported by the majority of drivers, but are not as popular as cameras that detect and photograph vehicles in breach of a red light. (A. Delaney *et al.*, 2005)
- Recent research says that about 78 per cent of the public support speed cameras. (CIHT, 2009)
- Around 71 per cent of respondents to the Scottish Crime and Justice Survey 2010-11 agree that safety cameras help discourage dangerous driving and help prevent RTIs. 82 per cent think that people should see the use of road safety cameras as a good thing. (Scottish Safety Camera Partnership, 2012)

Other Cameras

Research into the effectiveness of red light cameras (particularly in a UK context) is very limited. However, these cameras are commonly employed throughout the UK so it is useful to discuss their effectiveness even if it is based on international data. The Cochrane Review was the most comprehensive research identified which evaluated the effectiveness of red light cameras. The findings from the review are presented below.

- Red-light cameras are effective in reducing total casualty crashes.
- The strongest evidence came from a study that used gateway signing and did not install warning notices at camera sites, and whose evaluation included a comparison with nearby cities in order to adjust for spill over effects.
- The evidence is less conclusive on total collisions, specific casualty collision types and violations, where reductions achieved could be explained by the play of chance. Larger and better controlled studies are needed.

- Although red-light cameras have been used for over 20 years, there have been very few studies which met the inclusion criteria of the Cochrane review.
- Studies included in the review came from only three countries, none of them in Europe, where red-light cameras have been used extensively. The most recent seven studies were from the U.S.A, six of which reported on total collisions only.

(A. Aeron-Thomas and S. Hess,2009)

Two studies from Belgium, applicable to Great Britain, looked at the effect of combined speed and red light cameras at junctions.

- The first study used real-world observations and driver simulators to analyse driver behaviour where speed and red light cameras are installed. The study found that red and amber light violations reduced but that the risk of rear-end collisions increased by up to 44 per cent. The potential increase in rear end shunts could potentially be ameliorated by installing warning signs.

(Polders et al., 2015)

- The second study evaluated the safety effect of combined speed and red light cameras at 253 signalised junctions in Flanders, installed between 2002 and 2007. It found a decrease in severe crashes of 14 per cent but also identified an increase of 44 per cent in rear-end crashes. The reductions in severe crashes were mainly attributable to the effect on side crashes and the study concluded that future research should examine how rear-end crashes could be managed.

(De Pauw et al., 2014)

With advances in technology, other uses for cameras have been identified to help enforce law on the roads. The study summarised below outlines the use of Automatic Number Plate Recognition (ANPR) cameras to monitor overweight vehicles using Tower Bridge in London.

- Induction loop and piezo-electric sensors in the road surface measure the length, number of axles, axle spacing and chassis height of each vehicle.
- The data is collected by classification unit. The classification equipment is used to trigger ANPR and context image cameras which record a sequence of frames to provide proof-of-presence of overweight vehicles.
- Vehicle classification data and images are written to disk and processed in a similar way to the speed violations using type approved software.
- Transport for London verify the plated weight of each vehicle and, if found to be in breach of the weight limit, a penalty notice is issued to the driver

- The number of overweight vehicles crossing the bridge has reduced considerably and the damage to the roadside furniture caused by RTIs has almost disappeared.
- The number of overweight vehicles crossing the bridge has fallen from six per hour to six per day.

(Speed Check Services, nd)

In Canada, mobile photo enforcement (MPE) programs are explored in relation to enforcement guidelines and road policing priorities. GIS-based guidance materials are also used for resource allocation in MPE programs and other automated speed enforcement (ASE) programs.

(Y. Li, et. Al., 2016)

How Effective?

This section provides some details of how effective safety camera interventions can be.

Impact on speed reduction

Increased vehicle speeds increase the risk of RTIs and the severity of these RTIs when they occur. Therefore, the effectiveness of safety cameras in reducing vehicle speeds plays an important role in preventing RTIs.

- The introduction of speed cameras has reduced excessive speeding. This conclusion is based on a substantial body of evidence across a large number of partnership areas. Speed surveys also confirmed that these reductions were sustained over time.
- At the vast majority of sites where safety cameras were introduced there was a reduction in vehicle speed. The reduction in vehicle speed was particularly noticeable in urban areas (30 mph or 40 mph limits) where average speed fell by around 7 per cent. Speed in rural areas (over 40 mph) fell by 3 per cent on average.
- There was a 31 per cent overall 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 70 per cent, compared to 18 per cent at mobile sites.

(A. Gains *et al.*, 2005)

- Cameras are a very effective way of persuading drivers not to speed, and thereby reducing the number of people killed and seriously injured. An evaluation of their effectiveness in 2005 showed that they were saving around 100 lives a year, and preventing over 1,600 serious injuries.

(RoSPA, 2011)

- The Cochrane Review found that post installation of cameras, there was a reduction in the proportion of speeding vehicles (drivers) over the accepted posted speed limit ranging from 8 per cent to 70 per cent.
- Most countries reported reductions in speed in the 10 to 35 per cent range.

(C. Wilson *et al.*, 2011)

- Although the free flow speed measurements have been made at a rather small number of sites, they do clearly indicate the improving compliance with speed limits on built-up roads since 1998 and on motorways since 2003.
- This suggests that a combination of enforcement and education is gradually changing attitudes to speeding, particularly in urban areas, in the same way that attitudes to drinking and driving were changed in the 1970s and 1980s.

(C. Mitchell, 2012)

Owen (2010) reviewed the impact of widely publicising the speed camera switch-off in Oxfordshire.

- The results, although only at a limited number of locations for a short period of time, indicate that motorists do alter their speed choices when they know a fixed speed camera is not loaded.
- Even the most conservative analysis shows a 2.9 to 4 times increase in offending at sites only one month after the switch-off.
- If seasonal variations and more recent offence rates are taken into account then the increases are significantly higher.
- Local authorities around the country should bear these results in mind if they are considering a similar approach to Oxfordshire as the deterrent effect of the housing alone is diminished by public announcements regarding their operational capacity.

(R. Owen, 2010)

In a later study, the same author found that the positive safety effect of speed cameras extends even post cameras being switched off.

(R. Owen, 2015)

One experiment used a driving simulator to try to identify an optimal enforcement approach.

- It looked at four different scenarios: overt cameras with a delay to receiving the fine; overt cameras with immediate feedback; covert cameras with a delay to receiving the fine; and covert cameras with immediate feedback.

- The results shows that both median speed and speed variance were higher with overt rather than covert cameras. Moreover, implementing a covert camera system with immediate feedback was more conducive to drivers maintaining steady speeds at the permitted levels from the very beginning.
- Finally, both 'overt cameras' groups exhibited more kangaroo effect in driving patterns throughout the experiment. The study concluded that an implementation strategy consisting of covert speed cameras combined with immediate feedback to the offender is potentially an optimal way to motivate drivers to maintain speeds at the speed limit. However, this approach is more resource-intensive than an automated processing system.

(Marciano et al., 2015)

Impact on injury reduction

- In a systematic review of 28 studies, all the studies included found a lower number of RTIs in the speed camera areas after implementation of the programme.
- In the vicinity of camera sites, the reductions ranged from 8 per cent to 49 per cent for all RTIs, with reductions for most studies in the 14 per cent to 25 per cent range.
- For injury RTIs, the decrease ranged between 8 per cent and 50 per cent, and for RTIs resulting in fatalities or serious injuries the reductions were in the range of 11 per cent to 44 per cent.
- Effects over wider areas showed reductions for all RTIs ranging from 9 per cent to 35 per cent, with most studies reporting reductions in the 11 per cent to 27 per cent range. For RTIs resulting in death or serious injury, reductions ranged from 17 per cent to 58 per cent, with most studies reporting this result in the 30 per cent to 40 per cent reduction range.

(C. Wilson *et al.*, 2011)

- Safety cameras are one of the reasons why fatalities on the road have fallen from around 5,000 a year at the start of the 1990s to fewer than 2,000 in 2010, and they must continue to play their part in the UK's future road safety strategy.
- A further review of the evidence of the effectiveness of speed cameras, taking into account other factors, concluded that in the year ending March 2004, cameras at more than 4,000 sites across Great Britain prevented some 3,600 personal injury RTIs, saving around 1,000 people from being killed or seriously injured.

(RoSPA, 2011)

- The number of people killed or seriously injured at safety camera sites is 68 per cent lower after camera enforcement. The number of personal injury RTIs at safety camera sites is 48 per cent lower after enforcement.

(Scottish Safety Camera Partnership, 2012)

- In a study in England, there had been found a significant 30% reduction in the number of accidents at camera sites,

(D. J. Graham, et al., 2017)

- A review of average speed camera effectiveness at a number of sites throughout the UK showed a positive impact on injury reduction:
 - In Nottinghamshire, KSI figures reduced by an average of 65 per cent (across eleven roads equipped with average speed enforcement in 2000);
 - In Northamptonshire, KSI figures reduced by 60 per cent on the A43 Lumbertubs Way and 85 per cent on the A428 (equipped in 2001);
 - In South Yorkshire, KSI figures reduced by 82 per cent on the A616 Stocksbridge Bypass Trans-Pennine Route (equipped in 2003); and
 - In Strathclyde (Scotland), KSI figures reduced by 37 per cent across the A77, where there is an entire 32 mile controlled zone (equipped in 2005).
- The experience gathered so far indicates that average speed enforcement is an efficient speed enforcement method, leading to reductions in speeds across entire sections of roads and reductions in the number of RTIs and casualties.

(ETSC, 2009)

- A comprehensive study undertaken by RAC Foundation & Road Safety Analysis on the levels of occurrence of collisions before and after average speed camera (ASC) systems' installation (with consideration for site-selection period, regression-to-mean and trend effect) found:
 - A 36.4% reduction in the mean rate of fatal and serious collisions (FSC) after the system's installation;
 - A 16% reduction in the mean rate of personal injury collisions (PIC) after the system's installation;
 - A 42.2% reduction in the mean rate of FSCs for low speed sites and a 32.3% reduction in the mean rate of FSCs for high speed sites;
 - A 25% reduction in the mean rate of PICs at the low speed sites and a 7.9% reduction in the mean rate of PICs for high speed sites.

(R. Owen, G. Ursachi and R. Allsop, 2016)

Meta-analysis of 19 speed camera studies (fixed and average) found a total reduction in crash numbers of about 20 per cent.

- It found that the effect declines with increasing distances from the camera location. Fatal crashes were found to be reduced by 51 per cent although this result may be affected by regression to the mean. The results indicate that kangaroo driving (braking and accelerating) occurs, but no adverse effects on speed or crashes were found.
- It also found that crash migration may occur but is not common.

(Høye, 2014)

- The DfT camera review found that there has been a significant reduction in casualties at camera sites.
- There was a 42 per cent reduction in the number of KSIs at sites where safety cameras were introduced. Overall, this equates to around 1,745 fewer KSI casualties per annum, though this is subject to some reduction due to regression-to-mean effects.
- There was a 22 per cent reduction in the number of personal injury RTIs at camera sites. Overall, this equates to around 4,230 fewer personal injury RTIs per annum, though this is subject to a reduction due to regression-to-mean that is probably modest in scale.
- There were reductions in personal injury RTIs 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 or serious injuries fell by around 50 per cent at fixed sites, and by around 35 per cent at mobile sites. These results were found to be consistent with speed surveys.
- There were over 100 fewer people killed per annum at camera sites after implementation.
- There was a 32 per cent reduction in the number of child KSIs at camera sites.
- There was a 29 per cent reduction in the number of pedestrians KSIs at camera sites.

(A. Gains *et al.*, 2005)

- Percentage reductions in RTIs and casualties differ between fixed and mobile, and between urban and rural camera sites. Judging from the evidence, the operation of cameras at over 4,000 sites of all types resulted in around 1,000 fewer KSIs in the vicinity of cameras in the year ending March 2004.

(R. Allsop, 2010)

- Existing research consistently shows that speed cameras are an effective intervention in reducing RTIs and related casualties.
- The level of evidence is relatively poor, however, as most studies did not have satisfactory comparison groups or adequate control for potential confounders.
- Controlled introduction of speed cameras with careful data collection may offer improved evidence of their effectiveness in the future.

(P. Pilkington, and S. Kinra, 2005)

- The contribution of safety cameras shows up particularly clearly in highly urbanised and high injury risk areas but there is little evidence of any statistically significant impact elsewhere.

(G. Hindle and T. Hindle, 2011)

- One study controlling for regression to the mean was a before-after Empirical Bayes study looking at the safety effects of 223 fixed speed cameras installed between 2000 and 2010 in Norway.
- It found a statistically significant reduction in the number of injury collisions of 22 per cent up to 1km downstream of the camera.

(Høyve, 2015)

Another study published recently looked to evaluate the impacts of speed limit enforcement cameras on reducing accidents in the UK by accounting for both confounding factors and the selection of proper reference groups.

- They used the propensity score matching (PSM) method as well as a naïve before and after approach and Empirical Bayes (EB). They observed 771 treatment and 4787 potential reference sites over 9 years in England.
- The study found that both the PSM and EM methods show similar results that there are significant reductions in the number of accidents of all severities at speed cameras sites. Speed cameras were found to be most effective in reducing accidents up to 200 metres from camera sites and no evidence of collision migration was found.

(Li et al., 2013)

Economic value of cameras

- The DfT four year evaluation of safety cameras estimated that the annual economic benefit of cameras in place at the end of the fourth year was over £258 million, compared with enforcement costs of about £96 million.

(RoSPA, 2011)

- In the past local authorities and the police often had insufficient funds to make fullest use of cameras to deal with the problem of speeding.
- Enforcement had to compete with other priorities from their limited budget allocations and some areas could not afford any automatic enforcement.
- In 1998 the Government decided to resolve this by changing HM Treasury rules to allow penalties from speeding and traffic signal offences to be “netted-off” to pay for the costs of purchase, operation and administration of safety camera enforcement.
- The pilot project was designed to test the funding system and to show that cameras continued to be an effective road safety intervention under the different operational arrangement.
- At fixed camera sites 85th percentile speeds are down by 8 mph, and at mobile sites by 3 mph.
- Overall the pilot areas outperformed the rest of Great Britain by about 2:1 in casualty reduction.
- These results suggest that the safety camera partnership funding mechanism was successful.

(A. Waddams, 2003)

Since the above paper was written many local authorities have now taken over the management of safety cameras in various regions but the funding mechanism is still essentially the same.

- The new funding mechanism and partnership arrangements for safety cameras were found to have worked well.
- In the fourth year, the programme had released around £96 million per annum (in England, Wales and Scotland) for local partnerships to invest in safety camera enforcement and supporting education.

(A. Gains *et al.*, 2005)

Since the Gains *et al.* paper was published in 2005, there have been further changes, and decisions about enforcement are now made locally, rather than nationally. In some areas this has resulted in a substantial reduction in enforcement activity.

While the papers above show the effect of reduced enforcement on speed, there is no solid evidence available relating to the effect on casualties. Given the long-standing relationship that has been proved between speed and casualty rates and severity, it might be expected that the number and severity of RTIs would increase in those areas where enforcement is reduced substantially. For example, Northamptonshire stopped all fixed enforcement and in the following year fatalities approximately doubled from 19 to 36. However, the data set is too small and complex, and of short duration, to draw any definitive conclusions.

Gaps in the research

While numerous reports provide evidence for the reduction in speed and RTIs provided by safety cameras, there are also a number of studies (predominantly academic ones) which call for research using more robust evidence and statistical analysis.

- More studies of a scientifically rigorous and similar nature are necessary to provide the answer to the magnitude of effect.

(C. Wilson *et al.*, 2011)

- The level of evidence is relatively poor, however, as most studies did not have satisfactory comparison groups or adequate control for potential confounders.
- Controlled introduction of speed cameras with careful data collection may offer improved evidence of their effectiveness in the future.

(P. Pilkington, and S. Kinra, 2005)

Strengthening the evidence base with more rigorous data would be an area which might benefit from further effort. Additional academic evidence and analysis may help to finally settle the debate of the effectiveness of speed cameras.

The majority of reports focus on fixed point safety cameras and there appears to be a limited amount of research providing evidence on the safety benefits of red light cameras and average speed cameras (particularly in the UK).

References

Department for Transport research and statistics

Title: The national safety camera programme: Four-year evaluation report
Author / organisation: A. Gains, M. Nordstrom, M. Heydecker and J. Shrewsbury. (PA Consulting) Date: 2005 Format: Pdf Link: http://www.hertsdirect.org/docs/pdf/safecam/15733343/The_national_safety_camera_programme.pdf Free / priced: Free
Objectives: To evaluate the effectiveness of safety camera partnerships in the 4 years following changes to their funding mechanisms.
Methodology: Each partnership (38 reviewed in total) provided regular monitoring information to a national programme board. This data was independently analysed to assess the success of the cameras, the partnerships and the funding mechanism
Key Findings: <ul style="list-style-type: none">• There has been a significant reduction in speeds at camera sites• 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 6 per cent or 2.2 mph.• The reduction in vehicle speed was particularly noticeable in urban areas (30 mph or 40 mph limits) where average speed fell by around 7 per cent. Speed in rural areas (over 40 mph) fell by 3 per cent on average.• There was a 31 per cent overall 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 70 per cent, compared to 18 per cent at mobile sites.• The introduction of speed cameras has reduced excessive speeding. This conclusion is based on a substantial body of evidence, based on a large number of sites across a large number of partnership areas. Speed surveys also confirmed that these reductions were sustained over time.• There has been a significant reduction in casualties at camera sites• There was a 42 per cent reduction in the number of people killed or seriously injured (KSI) at sites where safety cameras were introduced. Overall, this equates to around 1,745 fewer KSI casualties per annum, though this is subject to some reduction due to regression-to-mean.• There was a 22 per cent reduction in the number of personal injury RTIs at camera sites. Overall, this equates to around 4,230 fewer personal injury RTIs per annum, though this is subject to a reduction due to regression to- mean that is probably modest in scale.

- There were reductions in personal injury RTIs 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 or serious injuries fell by around 50 per cent at fixed sites, and by around 35 per cent at mobile sites. These results were found to be consistent with speed surveys.
- There were over 100 fewer people killed per annum at camera sites (32per cent fewer).
- There was a 32 per cent reduction in the number of children killed or seriously injured at camera sites.
- There was a 29 per cent reduction in the number of pedestrians killed or seriously injured at camera sites.
- There was a positive association between the fall in speed and the fall in personal injury collisions at camera sites.
- The majority of the public support the use of safety cameras for targeted enforcement
- The level of public support for the use of cameras has been consistently high with 82 per cent of people questioned agreeing with the statement that ‘the use of safety cameras should be supported as a method of reducing casualties’.
- 71 per cent of people surveyed agreed that the primary use of cameras was to save lives.
- The funding mechanism and partnership arrangements have worked well
- In the fourth year, the programme had released around £96million per annum (in England, Wales and Scotland) for local partnerships to invest in safety camera enforcement and supporting education
- In the fourth year, we have estimated that the benefits to society, in terms of the value of casualties saved, were in the region of £258 million per annum.

Themes: Safety cameras, Effectiveness, Speed and casualty reduction

Comments: Pivotal DfT research demonstrating the significant impacts that safety cameras can have.

Title: Cost Recovery System for Speed Camera Enforcement - How it Works to Reduce Casualties
Author / organisation: A. Waddams (DfT) Date: 2003 Format: Pdf Link: www.ictct.org/dlObject.php?document_nr=207&/Waddams.pdf Free / priced: Free
Objectives: The paper explains how the safety camera partnership funding systems was piloted then rolled out across Great Britain.
Methodology: The paper is a summary document of the process by which safety camera partnerships operate.
Key Findings: <ul style="list-style-type: none"> • In the past local authorities and the police often had insufficient funds to make fullest use of cameras to deal with the problem of speeding. • Enforcement had to compete with other priorities from their limited budget allocations and some areas could not afford any automatic enforcement. • In 1998 the Government decided to resolve this by changing HM Treasury rules to allow penalties from speeding and traffic signal offences to be “netted-off” to pay for the costs of purchase, operation and administration of safety camera enforcement. • Initially eight pilot schemes were undertaken in rural and urban locations across the UK. • The pilot project was designed to test the funding system and to show that cameras continued to be an effective road safety intervention under the different operational arrangement. • At fixed camera sites 85th percentile speeds are down by 8 mph and at mobile sites by 3 mph. • Overall the pilot areas have outperformed the rest of GB by about two to one in casualty reduction. We expect the national rollout to cover all areas of GB next year and that will contribute to achieving our casualty targets by 2010. • These results suggest that the safety camera partnership funding mechanism was successful. Since this paper was written many local authorities have now taken over the management of safety cameras in various regions.
Themes: Safety camera funding, Safety camera effectiveness
Comments: Includes the funding aspect of camera installation and use.

Other works

Title: The effect of speed cameras on the incidence of road traffic accidents
Author / organisation: T. K. Utley (1st Civil and Environmental Engineering Student Conference)
Date: 2012
Format: Pdf
Link: https://workspace.imperial.ac.uk/civilengineering/Public/Technical%20papers%20B/6B-Utley-The%20Effect%20of%20Speed%20Cameras%20on%20the%20Incidence%20of%20Road%20Traffic%20Accidents.pdf
Free / priced: Free
Objectives: The aim of this research was to analyze the effect of Speed Limit Enforcement Cameras (SLECs) nationwide across the whole of England and try to categorically prove what effect they have by removing as many sources of confounding data as possible to create a reliable model of how effective the wide variety of cameras are at reducing RTIs
Methodology: Literature review and statistical analysis of accident and speed camera location data.
Key Findings: <ul style="list-style-type: none">• It is clear that speed cameras placed on major roads are more effective at reducing RTIs than cameras on minor roads - installing cameras on minor roads appear to have a limited effect.• Cameras installed on roads with speed limits above 40 mph are also more effective at reducing fatal RTIs.• As expected, the effectiveness of camera reduces as the distance from its installation point increases.• Overall, the cameras reduced all types of RTI by around 30 per cent, which varies significantly depending on class and zone of influence considered. However, it is certain that their introduction has resulted in a negative effect on the occurrence of RTIs in all cases.
Themes: Safety camera effectiveness
Comments: A good academic review attempting to strip away the sources of confounding data to give a definitive answer. No definition of 'major' and 'minor' roads given.

Title: Key Scottish Safety Camera Programme Statistics, 2011
Author / organisation: Scottish Safety Camera Partnership. Date: 2012 Format: Pdf Link: http://www.scotland.gov.uk/Resource/0039/00398164.pdf Free / priced: Free
Objectives: The two main objectives of the Scottish Safety Camera Programme are: To reduce the number of people killed or injured on Scotland's roads; and To engender a culture of speed limit and red light signal compliance
Methodology: This bulletin presents provisional key statistics relating to the activity of the Scottish Safety Camera Programme for the calendar year 2011.
Key Findings: <ul style="list-style-type: none"> • The number of people killed or seriously injured at safety camera sites is 68 per cent lower after camera enforcement. The number of personal injury RTIs at safety camera sites is 48 per cent lower after enforcement. • Changes in average speeds and the number of people exceeding the speed limit vary depending on speed limit and camera type. • From 2009-10 there has been a 16 per cent increase in the number of people issued with a fixed penalty after being caught exceeding the speed limit or running a red-light at a safety camera site. This is a reduction of 21 per cent from 2007-08 figures. • Around 71 per cent of respondents to the Scottish Crime and Justice Survey 2010-11 agree that safety cameras help discourage dangerous driving and help prevent RTIs. 82 per cent think that people should see the use of road safety cameras as a good thing.
Themes: Safety camera effectiveness
Comments: Useful statistics providing evidence of the impact which safety cameras can have.

Title: Speed and Safety Evidence from published data
Author / organisation: C. Mitchell (RAC Foundation)
Date: 2012
Format: Pdf.
Link: http://www.pacts.org.uk/2012/08/speed-and-safety-evidence-from-published-data/
Free / priced: Free
Objectives: To provide an evidence based review of the impact of speed cameras on road safety in the UK.
Methodology: A review of existing published data to assess the impact of cameras on road safety.
Key Findings: <ul style="list-style-type: none"> • Although the free flow speed measurements have been made at a rather small number of sites, they do indicate clearly the improving compliance with speed limits on built-up roads since 1998 and on motorways since 2003. • This suggests that a combination of enforcement and education is gradually changing attitudes to speeding, particularly in urban areas, in the same way that attitudes to drinking and driving were changed in the 1970s and 1980s. • The reduction in cars exceeding 35 mph in 30 mph areas is particularly impressive. • At least part of the reduction in speed limit offences since 2005 does seem to reflect real reductions in speeding, as well as possibly better awareness of the locations of speed enforcement cameras and the introduction of speed awareness courses in place of penalties. • The high correlation between the fatality and all severity casualty rates for pedestrians on built-up roads and the percentage of cars exceeding the limit in 30 mph areas demonstrates an association between casualties and speeds, though it cannot prove a causal link. • The moderately high correlations between car occupant fatalities and the percentage of cars exceeding 80 mph on motorways, and between RTIs per vehicle kilometre and the percentage of cars exceeding 80 mph on motorways, reinforces this association. • The higher correlations with the percentages of cars exceeding 80 mph than those exceeding 70 mph emphasises that it is the faster vehicles that are associated with RTIs and casualties. • Other research, such as that reported in Taylor <i>et al.</i> (2002), confirms the relationship between speed and RTI or casualty rates.
Themes: Safety camera effectiveness
Comments: Some good statistics on the changes that have been seen in RTIs since the introduction of speed cameras.

Title: Speed Cameras
Author / organisation: RoSPA Date: 2011 Format: Pdf Link: http://www.rospa.com/roadsafety/info/speed_camera_factsheet_1211.pdf
Free / priced: Free
Objectives: To assess the impact of speed cameras based on existing research/reports.
Methodology: A review of published literature was undertaken.
Key Findings: <ul style="list-style-type: none"> • Drivers travelling at higher speeds have less time to identify and react to what is happening around them. It takes longer for the vehicle to stop. And the RTI will be more severe, causing greater injury to the occupants and any pedestrian or rider hit by the vehicle. • Higher speeds also increase the severity of an injury in a RTI. Approximately two-thirds of all RTIs in which people are killed or injured happen on roads with a speed limit of 30 mph or less. • Inappropriate speed contributes to 14 per cent of all injuries, 15 per cent of serious injuries and 24 per cent of deaths on the road. Almost 500 people are killed each year on Britain's roads, and 3,000 are seriously injured, because drivers and riders travel too fast. • On its own, exceeding the speed limit, contributes to 7 per cent of all seriously injured road casualties and 14 per cent of all road fatalities, resulting in the deaths of 241 people, and serious injuries to almost 1,500 more people, in 2010. • Unfortunately, most drivers exceed the speed limit at some time. Around half (46 per cent) of car drivers exceed the 30 mph limit in urban areas during free flowing traffic and on 40 mph roads, 23 per cent speed. • The evidence for speed cameras shows that they are effective at reducing speeds and preventing RTIs, especially in preventing more serious and fatal RTIs. • The UK evidence shows large reductions in deaths and injuries where speed cameras have been deployed. • The magnitude and consistency of the results across different countries and types of road provides a high level of confidence that the introduction of speed cameras does reduce RTIs at the sites where they are located. • While more research would strengthen the evidence base, the studies demonstrating their effectiveness are the strongest evidence available and must be used to inform decision making.
Themes: Speed camera effectiveness
Comments: A short review of available literature. Covers some of the reports already included but also provides some new statistics/information.

Title: Speed Cameras For The Prevention Of Road Traffic Injuries And Deaths
Author / organisation: C. Wilson, C. Willis, J. Hendrikz, R. Le Brocque, and N. Bellamy. (Cochrane Database of Systematic Reviews) Date: 2011 Format: Pdf Link: http://www.abc.net.au/mediawatch/transcripts/1133_cochrane.pdf Free / priced: Free
Objectives: To assess whether the use of speed cameras reduces the incidence of speeding, RTIs, injuries and deaths.
Methodology: Researchers analysed 35 suitable studies for the effect of speed cameras on speeding, RTIs, injuries and deaths by comparing what was happening in road areas before the introduction of speed cameras and after their introduction, and by analysing comparable road areas where no speed cameras were introduced were also compared.
Key Findings: <ul style="list-style-type: none"> • All studies reporting speed outcomes reported a reduction in average speeds post intervention with speed cameras. • A reduction in the proportion of speeding vehicles (drivers) over the accepted posted speed limit, ranged from 8 per cent to 70 per cent with most countries reporting reductions in the 10 to 35 per cent range. • Twenty eight studies measured the effect on RTIs. All 28 studies found a lower number of RTIs in the speed camera areas after implementation of the program. • In the vicinity of camera sites, the reductions ranged from 8 per cent to 49 per cent for all RTIs, with reductions for most studies in the 14 per cent to 25 per cent range. • For injury RTIs the decrease ranged between 8 per cent to 50 per cent and for RTIs resulting in fatalities or serious injuries the reductions were in the range of 11 per cent to 44 per cent. • Effects over wider areas showed reductions for all RTIs ranging from 9 per cent to 35 per cent, with most studies reporting reductions in the 11 per cent to 27 per cent range. For RTIs resulting in death or serious injury reductions ranged from 17 per cent to 58 per cent, with most studies reporting this result in the 30 per cent to 40 per cent reduction range. • The studies of longer duration showed that these positive trends were either maintained or improved with time. • The quality of the included studies in this review was judged as being of overall moderate quality at best, however, the consistency of reported positive reductions in speed and RTI results across all studies show that speed cameras are a worthwhile intervention for reducing the number of road traffic injuries and deaths. • To affirm this finding, more studies of a scientifically rigorous and homogenous nature are necessary, to provide the answer to the magnitude of effect. • As none of the studies were conducted in low-income countries, research in such settings is also required.
Themes: Speed camera effectiveness, Injury and speed reduction
Comments: Good range of studies reviewed for different aspects of safety.

Title: Safety Cameras and Road Accidents: Effectiveness in Local Authority Areas in England
Author / organisation: G. Hindle and T. Hindle (J. Operational Research Society, 62(7), 1181-1188). Date: 2011 Format: Pdf. Link: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1830999## Free / priced: Priced
Objectives: To investigate the effectiveness of safety cameras, specifically at the camera sites rather than wider area effects.
Methodology: The work explored the rates of personal injury RTIs on English Local Authority roads and investigated relationships between area characteristics including levels of safety camera introductions and RTIs improvements reported.
Key Findings: <ul style="list-style-type: none"> • Safety cameras have been central to strategy for improving road safety in the UK (and other countries) over the past decade. • Changes in funding now mean that local authorities and safety camera partnerships (with input from the police) are now largely responsible for making decisions on the placement, expansion, maintenance or scaling back cameras. • Overall, safety cameras over the recent past appear to have contributed to a limited extent to observed reductions in road traffic injury RTIs. • The contribution of safety cameras shows up particularly clearly in highly urbanised and high injury risk areas but there is little evidence of any statistically significant impact elsewhere. • The likely impact of cameras appears to be strongly influenced by prior injury RTI rates and in particular, in overall terms, at sites where fewer than 10 incidents per 3 year period are expected an impact has not been detected statistically. • Many areas (and especially more rural areas) already have a very high proportion of sites at which estimated impact has been very low or non-existent, where decommissioning should clearly be considered. • Although government pronouncements still encourage a belief in the benefits of safety cameras, there has been a detectable change of emphasis away from reliance on fixed point and mobile cameras towards exploring the safety potential of new technology associated with average speed cameras. • It is difficult to escape the conclusion that the era of the fixed point and mobile speed camera expansion has ended, that the peak has been reached and that the overall strategic direction is one of 'rolling back'.
Themes: Safety camera effectiveness
Comments: A frank review of the potential of safety cameras and how focus may shift in the future from fixed point to average/section cameras.

<p>Title: Speed Cameras: Improving Safety or Raising Revenue</p> <p>Author / organisation: R. Tay (Journal of Transport Economics and Policy, 44(2), 247-257)</p> <p>Date: 2010</p> <p>Format: Pdf</p> <p>Link: http://trid.trb.org/view.aspx?id=917441</p> <p>Free / priced: Priced</p>
<p>Objectives: To investigate whether RTIs can be reduced simply by the presence of enforcement without the need to issue tickets. Do offenders need to be caught in order for enforcement to be effective?</p>
<p>Methodology: Two primary sources of data were used for this study – the first was Edmonton Police RTI data and the second was economic data from Statistics Canada. These were used to compile performance indicators, with the main indicator being total number of injury RTIs per month.</p>
<p>Key Findings:</p> <ul style="list-style-type: none"> • RTIs are a major cause of deaths and injuries in many countries and inflict enormous economic and social costs on society. • Although the factors contributing to RTIs are numerous and diverse, speeding is widely considered to be a major determinant. • Despite numerous studies showing the effectiveness of speed enforcement, especially automated speed enforcement, in reducing RTIs, public debate still continues in regard to revenue-raising aspect of speed enforcement. • This study found that both the number of (mobile) speed camera operating hours and the number of drivers apprehended per month had statistically significant effects in reducing the number of injury RTIs per month. • The study also showed that the number of tickets issued has a significant independent effect in reducing the number of injury RTIs above the deterrent effect provided by police presence alone. • The speed camera programme is therefore not operated solely to raise revenue as suggested by some advocates. • It was found that without issuing fines, the safety effect of the speed camera programme was not maximised. The penalties and fines serve as a very critical component to improve the efficiency of the speed camera programme.
<p>Themes: Speed cameras, RTI reduction, Fine effectiveness</p>
<p>Comments: Takes a different approach by investigating whether cameras would be effective without the associated fines/penalties.</p>

Title: The effectiveness of speed cameras – a review of evidence
Author / organisation: R. Allsop. (RAC Foundation) Date: 2010 Format: Pdf Link: http://www.racfoundation.org/assets/rac_foundation/content/downloadables/efficacy_of_speed_cameras_allsop_181110.pdf
Free / priced: Free
Objectives: To assess the effectiveness of speed cameras based on existing evidence.
Methodology: This report pulls together a range of analyses of the effectiveness of speed cameras, and some more recent data, to provide a considered and comprehensive assessment of their contribution to road safety.
Key Findings: <ul style="list-style-type: none"> • Deployment of speed cameras leads to appreciable reductions in speed in the vicinity of the cameras, and substantial reductions in RTIs and casualties at those locations over and above that which is attributable to regression-to-mean effects. • Percentage reductions in RTIs and casualties differ between fixed and mobile, and between urban and rural camera sites. Judging from the evidence, the operation of cameras at over 4,000 sites of all types resulted in around 1,000 fewer people being killed or seriously injured in the vicinity of cameras in the year ending March 2004. • National surveys indicate clear and sustained falls in the average speeds of cars on 30 mph roads, and in the proportion of cars exceeding the limit • The evidence from a study in West London is that speed cameras led to a reduction in casualties not only at camera sites, but across the wider road network also. • Majority public acceptance of cameras was widespread at the height of the national camera safety programme. Subsequent annual surveys by the AA indicate that it has remained so. • Increases in speeds and speeding at various sites where cameras were visibly out of action have been recorded over the years since 2004. • Data for 2007–2009 supplied by a number of road safety partnerships, while not covering the whole country, suggest that big falls in fatal or serious casualties at camera sites have persisted over time. • National decommissioning of cameras could result in about 800 extra people across Great Britain being killed or seriously injured each year. • Data for 2006–07 show that the cost of camera enforcement was being covered by penalties paid by detected offenders, with only a modest surplus to the Exchequer of less than £4 out of each £60 penalty paid
Themes: Speed camera effectiveness, Speed reduction, Casualty reduction
Comments: Reviews a selection of high profile guidance to offer a more holistic view of speed camera effectiveness.

Title: Guidance on Use of Speed Camera Transparency Data (Updated November 2013)
Author / organisation: R. Allsop. (RAC Foundation) Date: 2013 Format: Pdf Link: http://www.racfoundation.org/assets/rac_foundation/content/downloads/speed_camera_data_revised-allsop-nov2013.pdf Free / priced: Free
Objectives: To provide guidance to users of published speed camera data in the analysis of the effectiveness of speed cameras
Methodology: Uses publicly available data of year-by-year numbers of collisions and casualties in the vicinity of speed cameras between 1990 and 2010; observations of the speed of traffic near the cameras; and information about the numbers of offences. Provides guidance for the general public, the media and road safety practitioners on interpreting data for individual cameras or cameras in local areas.
Key Findings: <ul style="list-style-type: none"> • This study revisits Professor Allsop's both previous work from November 2010 and guidance issued in June 2013 on the interpretation of publicly available speed camera data • The revisions are founded on extensive feedback and debate on the guidance and the original investigation into the effectiveness of speed cameras • The revisions shows a smaller, but still sizeable, benefit from the use of speed cameras in the areas where data were analysed • Analysis of data for 551 fixed speed cameras in 9 different areas shows that, on average, the number of fatal and serious collisions in their vicinity fell by 22% after their installation. • There was also an average reduction of 14% in personal injury collisions in the vicinity of the 551 cameras. • However, the research also highlighted 21 camera sites in these areas where the number of collisions appears to have risen enough to make the cameras worthy of further investigation.
Themes: Speed camera effectiveness, Speed reduction, Casualty reduction
Comments:

Title: The speed camera switch off: One month on
Author / organisation: R. Owen (Thames Valley Safer Roads Partnership)
Date: 2010
Format: Pdf
Link: http://www.saferroads.org/wpcms/wp-content/uploads/The-Speed-Camera-Switch-Off-August-2010.pdf
Free / priced: Free
Objectives: To investigate what happens when it is announced to the public that speed cameras are no longer in operation.
Methodology: This report looks at the evidence retrieved from four sites (six 'locations') in Oxfordshire in the 32 days following the well publicised speed camera switch-off.
Key Findings: <ul style="list-style-type: none"> • The results, although only at a limited number of locations for a short period of time, indicate that motorists do alter their speed choices when they know a fixed speed camera is not loaded. • Even the most conservative analysis shows a 2.9 to 4 times increase in offending at sites only one month after the switch-off. • If seasonal variations and more recent offence rates are taken into account then the increases are significantly higher. • Local authorities around the country should bear these results in mind if they are considering a similar approach to Oxfordshire as the deterrent effect of the housing alone is diminished by public announcements regarding their operational capacity.
Themes: Speed camera effectiveness
Comments: A small scale piece of research in terms of time, but already shows a change in behaviour following camera switch off.

Title: Red Light Cameras For The Prevention Of Road Traffic Crashes (Review)
<p>Author / organisation: Amy Aeron-Thomas, Stephane Hess (Cochrane Database of Systematic Reviews)</p> <p>Date: 2009</p> <p>Format: Pdf</p> <p>Link: http://www.thecochranelibrary.com/userfiles/ccoch/file/Safety_on_the_road/C003862.pdf</p> <p>Free / priced: Free</p>
Objectives: To quantify the impact of red-light cameras on the incidence and severity of road crashes and casualties, and the incidence of red-light violations.
Methodology: Two reviewers independently extracted data on study type, characteristics of camera and control areas, and data collection period. Before-after data were collected on number of crashes by severity, collision type, deaths and injuries, and red-light violations.
<p>Key Findings:</p> <ul style="list-style-type: none"> • Red-light cameras are effective in reducing total casualty crashes. • The strongest evidence comes from a study that used gateway signing and did not install warning notices at camera sites, and whose evaluation included a comparison with nearby cities in order to adjust for spillover effects. • The evidence is less conclusive on total collisions, specific casualty collision types and violations, where reductions achieved could be explained by the play of chance. Larger and better controlled studies are needed. • The limited evidence available is less conclusive as to whether red light cameras are able to reduce right-angle or rear-end casualty crashes or total crashes (including property damage only crashes) and traffic violations. • Although red-light cameras have been used for over 20 years, there have been very few studies which met the inclusion criteria of the Cochrane review and the majority of these suffered from lack of adjustment for regression-to-mean and spillover effects. • Included studies came from only three countries none of them in Europe, where red-light cameras have been used extensively. The most recent seven studies were from the US, six of which reported on total collisions only.
Themes: Red light camera effectiveness, RTI reduction
Comments: Provides an overall picture of the positive effect red light cameras can have but also demonstrates that more research is required.

Title: Camera Enforcement - Network Management Note
Author / organisation: Chartered Institute of Highways and Transportation
Date: 2009
Format: Pdf
Link: http://www.ciht.org.uk/download.cfm/docid/50843747-4A18-458F-B2C226E82C42967B
Free / priced: Free
Objectives: To summarise the methods and processes by which cameras are used to enforce motoring law.
Methodology: Summary report of general practices, technology and existing work on enforcement cameras
Key Findings: <ul style="list-style-type: none"> • Red light running has been reduced significantly at monitored sites in Nottingham and West London. In West London, improving obedience has permitted the thresholds for over-running red lights to be reduced from 1.8 sec to 1.2 sec. • RTI reductions have been reported. • Cameras have a proven effectiveness in cutting speeding and RTIs. • On average, the number of killed and seriously injured fell by around 50 per cent at fixed sites, and by around 35 per cent at mobile sites. • The number of vehicles exceeding the speed limited fell by 70 per cent at fixed camera sites. • Recent research says that about 78 of the public support speed cameras.
Themes: Safety camera effectiveness
Comments: One of the few reports to specifically mention red light cameras.

Title: Section Control: towards a more efficient and better accepted enforcement of speed limits?
Author / organisation: European Transport Safety Council (ETSC) Date: 2009. Format: Pdf Link: http://www.etsc.eu/documents/copy_of_copy_of_Speed%20Fact%20Sheet%2005.pdf
Free / priced: Free
Objectives: To provide an overview of the effectiveness of average speed cameras.
Methodology: An evaluation of international trial data.
Key Findings: <ul style="list-style-type: none"> • The basis for introducing section control (another name for Time over Distance, or Average Speed cameras) is that it encourages drivers to reduce their speed across an entire section of road and greater levels of behaviour changes can therefore be obtained. • The majority of evaluations of sites using section control show evidence of reductions in average and 85th percentile speeds, most often indicating that these speeds were reduced at, or below, the posted speed limit. • In England and Scotland a number of evaluations are published by Speed Check Services, the provider of this technology to the Police and highways authorities. The case studies include (comparing figures from the three years prior to installation with the three years+ post installation): <ul style="list-style-type: none"> ○ in Nottinghamshire, killed and seriously injured figures reduced by an average of 65 per cent (across eleven roads equipped with section control in 2000); ○ in Northamptonshire, killed and seriously injured figures reduced by 60 per cent on the A43 Lumbertubs Way and 85 per cent on the A428 (equipped in 2001); ○ in South Yorkshire, killed or seriously Injured figures reduced by 82 per cent on the A616 Stocksbridge Bypass Trans-Pennine Route (equipped in 2003); ○ in Strathclyde (Scotland), killed and seriously injured figures reduced by 37 per cent across the A77, where there is an entire 32 miles controlled zone (equipped in 2005). • The experience gathered so far indicates that Section Control is an efficient speed enforcement method, leading to reductions in speeds across entire sections of roads and reductions in the number of RTIs and casualties.
Themes: Average speed cameras, Effectiveness
Comments: Only review which concentrates solely on average speed cameras.

<p>Title: Effectiveness Of Speed Cameras In Preventing Road Traffic Collisions And Related Casualties: Systematic Review</p>
<p>Author / organisation: P. Pilkington, and S. Kinra (University of West of England)</p> <p>Date:2005 Format: Pdf</p> <p>Link: http://www.bmj.com/highwire/filestream/331789/field_highwire_article_pdf/0/331</p> <p>Free / priced: Free</p>
<p>Objectives: To assess the effectiveness of speed camera on any or all of the following outcomes - RTIs, injuries and deaths.</p>
<p>Methodology: A meta-analysis of data from controlled trials and observational studies assessing the impact of fixed or mobile speed cameras on any of the selected outcomes.</p>
<p>Key Findings:</p> <ul style="list-style-type: none"> • RTIs are an important cause of death and disability worldwide. Every year around the world 1.2 million people are killed and up to 50 million are injured or disabled as a result of RTIs. • Morbidity from RTIs is expected to increase in future years, and it is estimated that RTIs will move from ninth to third place in the global burden of disease ranking, as measured in disability adjusted life years. • Measures to reduce traffic speed are considered essential to reducing casualties on the road. • Speed cameras are increasingly used to help to reduce traffic speeds in the belief that this will reduce RTIs and casualties, and an expansion in the use of speed cameras is under way in many countries, most notably the United Kingdom. • The use of speed cameras is controversial, however. Vociferous opponents, including some motoring associated organisations, oppose their use, and cameras are often criticised in the media. • The lack of readily available evidence of the effectiveness of cameras has made it difficult for road safety and health professionals to engage in an informed debate about the effectiveness of speed cameras. • 14 observational studies met the inclusion criteria; no randomised controlled trials were found. • Most studies were before-after studies without controls (n = 8). • All but one of the studies showed effectiveness of cameras up to three years or less after their introduction; one study showed sustained longer term effects (4.6 years after introduction). • Reductions in outcomes across studies ranged from 5 per cent to 69 per cent for RTIs, 12 per cent to 65 per cent for injuries, and 17 per cent to 71 per cent for deaths in the immediate vicinity of camera sites. • The reductions over wider geographical areas were of a similar order of magnitude. • Existing research consistently shows that speed cameras are an effective intervention in reducing RTIs and related casualties. • The level of evidence is relatively poor, however, as most studies did not have satisfactory comparison groups or adequate control for potential confounders.

<ul style="list-style-type: none"> Controlled introduction of speed cameras with careful data collection may offer improved evidence of their effectiveness in the future.
Themes: Speed camera effectiveness, Casualty reduction
Comments: Systematic review of data which provides an objective view of the results.

Title: Controversies and Speed Cameras: Lessons Learned Internationally
<p>Author / organisation: A. Delaney, H. Ward, M. Cameron, A. Williams (Journal of Public Health)</p> <p>Date: 2005</p> <p>Format: Pdf</p> <p>Link: http://www.ncbi.nlm.nih.gov/pubmed/?term=Controversies+and+Speed+Cameras%3A+Lessons+Learned+Internationally</p> <p>Free / priced: Priced</p>
Objectives: To describe the development of camera programmes in Victoria (Australia) and the UK in order to discuss the types of controversies that have arisen and how they could benefit the use of safety cameras in the US.
Methodology: Reviews of international practice were undertaken via a literature search.
<p>Key Findings:</p> <ul style="list-style-type: none"> Speeding increases the likelihood of RTIs and the severity of RTIs that do occur. Speed limits, intended to control top speeds, often are ignored and vehicle speed capabilities far exceed posted speed limits, and thus enforcement is important. Studies in North America, Australia and Europe have found speed cameras to be effective in reducing speeds and RTIs Public opinion surveys around the world have indicated that speed cameras are supported by the majority of drivers, but are not as popular as cameras that detect and photograph vehicles in breach of a red light. Research from New Zealand suggests that the use of covert cameras can result in greater reductions in casualty RTIs than overt cameras. Despite widely different styles in camera use, studies in Australia and the UK indicate that vehicle speeds and casualty RTI frequencies have been reduced. These reductions have occurred both at camera sites and across the road network.
Themes: Speed camera effectiveness
Comments: Provides some interesting international findings to give a broader picture of effectiveness.

Title: Speed and Weight Limit Enforcement - Tower Bridge
Author / organisation: Speed Check Services Date: [no date] Format: Pdf Link: http://www.speedcheck.co.uk/images/Tower_Bridge_Case_Study.pdf Free / priced: Free
Objectives: To the address Transport for London's problem of high numbers of vehicles travelling at excess speed across Tower bridge as well as large numbers of overweight goods vehicles using the crossing.
Methodology: SPECS average speed enforcement cameras were used to measure speeds across the bridge. A weight system was used to identify vehicles in excess of the weight limit (18t), with those violating the limit captured on ANPR for additional verification.
Key Findings: <ul style="list-style-type: none"> • Induction loop and piezo-electric sensors in the road surface measure the length, number of axles, axle spacing and chassis height of each vehicle. • The data is collected by classification unit. The classification equipment is used to trigger ANPR and context image cameras which record a sequence of frames to provide proof-of-presence of overweight vehicles. • Vehicle classification data and images are written to disk and processed in a similar way to the speed violations using unique software developed by SCS. • Transport for London verify the plated weight of each vehicle and, if found to be in breach of the weight limit, a penalty notice is issued to the driver • The number of overweight vehicles crossing the bridge has reduced considerably and the damage to the roadside furniture caused by RTIs has almost disappeared. • The number of overweight vehicles crossing the bridge has fallen from 6 per hour to 6 per day.
Themes: Speed reduction, Overweight vehicles,
Comments: Demonstrates that ANPR can be used successfully for monitoring overweight vehicles.

Title: Safety Cameras and Road Safety Funding Cuts
Author / organisation: Royal Society for the Prevention of Accidents (RoSPA)
Date: 2011
Format: Pdf
Link: http://www.rosipa.com/roadsafety/info/safetycameras-funding.pdf
Free / priced: Free
Objectives: To summarise the benefits of speed cameras for road safety
Methodology: A review of available literature.
<p>Key Findings:</p> <ul style="list-style-type: none"> • Drivers and riders who exceed speed limits cause more RTIs, and kill and injure more people, than drivers who do not exceed speed limits. • This is why speed management is a major part of the UK's road safety strategy, with safety cameras being one tool of this speed management strategy. Over the last 10 to 15 years safety cameras, in particular, have become an important and cost-effective method for reducing road casualties. • Safety cameras are one of the reasons why deaths on the road have fallen from around 5,000 a year at the start of the 1990s to fewer than 2,000 in 2010, and they must continue to play their part in the UK's future road safety strategy. • Cameras are a very effective way of persuading drivers not to speed, and thereby reducing the number of people killed and seriously injured. An evaluation of their effectiveness in 2005 showed that they were saving around 100 lives a year, and preventing over 1,600 serious injuries. • A further review of the evidence of the effectiveness of speed cameras, taking into account other factors, concluded that in the year ending March 2004, cameras at more than 4,000 sites across Great Britain prevented some 3,600 personal injury RTIs, saving around 1,000 people from being killed or seriously injured (KSI). • Cameras enable a much higher level of speed enforcement to be conducted than is possible using police officers on their own. • In 2009, cameras provided evidence for 85 per cent of the 1.1 million fixed penalty notices issued for speeding offences. Without cameras, the level of enforcement would almost certainly dwindle to a very low level. • The DfT four year evaluation of safety cameras estimated that the annual economic benefit of cameras in place at the end of the fourth year was over £258 million, compared with enforcement costs of about £96 million. • Cameras are an effective way of identifying drivers who would benefit from attending a Speed Awareness Course, and so they provide a good opportunity to re-educate, and not just punish, drivers.
Themes: Speed camera effectiveness
Comments: Some useful statistics on cameras impacts.

Title: Speed cameras: A snapshot of drivers' opinions
Author / organisation: Institute of Advanced Motorists (IAM)
Date: 2013
Format: Pdf
Link: http://iam.org.uk/images/stories/policy-research/cameras-191113.PDF
Free / priced: Free
Objectives: To track drivers' opinions in relation to speed cameras over time
Methodology: Survey of drivers
Key Findings: <ul style="list-style-type: none"> • 80 per cent of drivers find the use of speed cameras acceptable or very acceptable • Women are more supportive of speed camera use than men. • 79 per cent of drivers think speed cameras have contributed to reduced road deaths in recent road deaths in recent years. • 75 per cent of drivers supported speed awareness courses instead of fines for drivers caught speeding with a clean license. • 84 per cent of 17-24 year old supports speed awareness courses
Themes: Popularity of speed cameras
Comments: Over 1,000 responses from drivers

Title: Effects of average speed enforcement on speed compliance and crashes: A review of the literature
Author / organisation: D. W. Soole, B. C. Watson, J. J. Fleiter
Date: 2013
Format: Pdf
Link: http://www.sciencedirect.com/science/article/pii/S0001457513000432
Free / priced: Priced
Objectives: To review the evidence regarding the impact of average speed cameras on vehicle speeds, crash rates and a number of additional road safety and public health outcomes.
Methodology: Literature review
Key Findings: <ul style="list-style-type: none"> • An international literature review of both published and grey literature was conducted. • The review found that average speed enforcement, is a more network-wide approach to managing speed that can reduce the impact of time and distance halo effects associated with other automated speed management approaches. • While there is evidence of reductions in both vehicle speed and crash rates in the immediate vicinity of the enforced section, the diffusion of these benefits to the overall network has not yet been fully assessed. • Improvements in traffic flow, journey time reliability and vehicle emissions add to the social utility of the approach and are likely to contribute to high levels of driver acceptance. • Although comparatively expensive, average speed enforcement is a highly reliable and cost-effective approach to speed enforcement that is able to produce considerable returns on investment through reduced social and economic costs associated with crashes.

- It is important to acknowledge the relatively poor levels of scientific rigour associated with the current body of literature evaluation average speed enforcement. Specifically, comparison/control sites have not been employed in any evaluations including in the literature review, confounding factors (e.g. exposure, regression-to-the-mean) are rarely controlled for and statistical significance testing is typically not performed.
- Moreover, many studies represent non-independent research conducted by equipment manufacturers or the organisations responsible for the operation and management of the system.

Themes: Speed camera effectiveness

Comments: Road safety benefits of average speed enforcement were identified but there are methodological shortcomings in the current literature.

Title: Safety effects of fixed speed cameras – An empirical Bayes evaluation

Author / organisation: A. Høyve

Date: 2015

Format: Pdf

Link: <http://www.sciencedirect.com/science/article/pii/S0001457515002225>

Free / priced: Priced

Objectives: To use a before-after Empirical Bayes study with control for regression to the mean (RTM) to evaluate 223 fixed speed camera in Norway.

Methodology: A before-after Empirical Bayes study with control for regression to the mean

Key Findings:

- The safety effects of 223 fixed speed cameras that were installed between 2000 and 2010 in Norway were investigated in a before-after empirical Bayes study with control for regression to the mean (RTM). Effects of trend, volumes and speed limit changes are controlled for as well.
- On road sections between 100m upstream and 1km downstream of the speed cameras a statistically significant reduction of the number of injury crashes by 22 per cent was found.
- For killed and severely injured (KSI) and on longer road sections none of the results are statistically significant.
- However, speed cameras that were installed in 2004 or later were found to reduce injury crashes and the number of KSI on road sections from 100m upstream to both 1km and 3km downstream of the speed cameras.
- Larger effects were found for KSI than for injury crashes and the effects decrease with increasing distance from the speed cameras. At the camera sites (100m up- and down-stream) crash reductions are smaller and non-significant, but highly uncertain and possibly underestimated.
- RTM is likely to be present (speed cameras are for the most part installed at high-crash locations) and statistically controlled for by use of the EB-methodology.
- Speed cameras that were installed in 2004 or later had more

favourable effects that speed cameras from earlier years. They were found to reduce injury crashes and the number of KSI by 9 per cent and 39 per cent respectively on the long road sections and by 32 per cent and 49 per cent respectively on the medium road sections. The improvement is probably due to changes of the criteria for installing speed cameras and changed camera technology. Results for the short sections are difficult to interpret.

Themes: Speed camera effectiveness

Comments: Robust investigation into the effects of fixed speed cameras on crash rates.

Title: Speed cameras, section control, and kangaroo jumps – a meta-analysis

Author / organisation: A. Høye

Date: 2014

Format: Pdf

Link: <http://www.sciencedirect.com/science/article/pii/S0001457514002577>

Free / priced: Priced

Objectives: To undertake a meta-analysis to determine the effect of speed cameras and section control on crash rates.

Methodology: A meta-analysis of 63 effect estimates from 15 speed camera studies and five effect estimates from four section control studies

Key Findings:

- The effect of speed cameras and section control on crashes were investigated by means of meta-analysis. 63 effect estimates from 15 studies of the effects of speed cameras on crashes and five effect estimates from four studies of the effect of section control on crashes were included in the meta-analysis.
- Speed cameras were found to reduce the total number of crashes by about 20 per cent. The results from meta-analysis and sensitivity analysis do not indicate that this result is likely to be affected by regression to the mean (RTM), publication bias or outlier bias. Sponsorship bias (more favourable effects from studies sponsored by government agencies) may have occurred, but the number of studies sponsored by non-government agencies is so small (two studies) that the results must be treated with caution.
- The effect on total crash numbers was found to decrease with increasing distance from the camera locations. While crashes were found to be reduced by 18 per cent at the camera locations ($\pm 250\text{m}$), the effect was found to decline to a reduction of 4 per cent at a distance of 1km or more from the camera location (in both directions). The overall effect of -20 per cent for total crash numbers refers to unspecified distances from the camera locations.
- For section control, a considerably larger reduction on total crash numbers was found (30 per cent), and a reduction of the number of KSI crashes by 56 per cent. Neither of these results is likely to be affected by RTM.
- A possible explanation for the seeming lack of RTM effects on the results for total crash numbers is that only the most serious crashes

are used as a criterion for choosing camera locations. Total crash numbers would then not necessarily be exceptionally high at camera locations before the installation of speed cameras or speed control. Unfortunately, no detailed information is available from the studies included in the meta-analysis about the criteria for installing speed cameras.
Themes: Speed camera effectiveness
Comments: Robust investigation into the effects of fixed and average speed cameras on crash rates.

Title: Drivers' behavioural responses to combined speed and red light cameras
Author / organisation: E. Polders, J. Cornu, T. De Ceunynck, S. Daniels, K. Brijs, T. Brijs, E. Hermans, G. Wets
Date: 2015
Format: Pdf
Link: http://www.sciencedirect.com/science/article/pii/S0001457515001839
Free / priced: Priced
Objectives: To provide a better insight into possible explaining factors for the increase in rear-end collisions associated with the placement of speed and red light cameras (SRLCs)
Methodology: Real-world observations and driving simulator-based observations were combined.
Key Findings: <ul style="list-style-type: none"> • Video recordings at two signalised intersections where speed and red light cameras (SRLCs) were about to be installed were used to analyse rear-end conflicts, interactions and driver behaviour in two conditions: with and without SRLCs. Furthermore, one of these intersections was rebuilt in a driving simulator equipped with an eye tracking system. At this location, two test conditions (just SRLC and SRLC with a warning sign) and one control condition (no SRLC) were examined. The data of 63 participants were used to estimate the risk of rear-end collisions by means of a Monte Carlo Simulation. • The results of the on-site observation study revealed decreases in the number of red and amber light violations, a shift (closer to the stop line) in the dilemma zone and a time headway reduction after the installation of the SRLC. Based on the driving simulator data, the odds of rear-end collisions (compared to the control condition) for the conditions with SRLC and SRLC plus warning sign are 6.42 and 4.01 respectively. • The driving simulator identified possible adverse effects on road user behaviour, such as stronger decelerations, and a possible increase in the number of rear-end collisions. However, in the case where the presence of SRLCs is announced with warning signs, these adverse effects are somewhat reduced.
Themes: Effect on rear-end collisions of speed and red light cameras
Comments: Robust experiment using driver observation and simulator data.

Title: The traffic safety effect of combined speed and red light cameras
Author / organisation: E. De Pauw, S. Daniels, T. Brijs, E. Hermans, G.Wets
Date: 2014
Format: Pdf
Link: http://tra2014.traconference.eu/papers/pdfs/TRA2014_Fpaper_17759.pdf
Free / priced: Free
Objectives: To evaluate the traffic safety effect of combined speed and red light cameras (SRLCs).
Methodology: Before and after study with control for the trend at 253 signalised intersections with SRLCs in Flanders, Belgium.
Key Findings: <ul style="list-style-type: none"> • The effect of the installation of speed and red light cameras (SRLCs) was analysed through a comparison of the crash numbers from after with before, taking into account different confounding variables. A comparison group was used, which controls for general trend effects. Other traffic safety measures that were implemented at the treated locations throughout the research period were taken into account. It was not, however, possible to control for the regression to the mean effect. • The installation of SRLCs generated a slight increase in the number of injury crashes. This can mainly be attributed to an increase in the number of rear end crashes (+44 per cent). The circumstances of this increase should be examined in future research. • The fatal and serious injury crashes showed a favourable effect (-14 per cent), that was largely the result of a decrease in the severe side crashes (-24 per cent).
Themes: Effect on traffic safety of combined speed and red light cameras
Comments: Large scale analysis of SRLCs and the road safety effects, although all the sites were based in Belgium and regression to the mean was not accounted for.

Title: Overt vs. covert speed cameras in combination with delayed vs. immediate feedback to the offender
Author / organisation: H. Marciano, P. Setter, J.Norman Date: 2015 Format: Pdf Link: http://www.ncbi.nlm.nih.gov/pubmed/25879638 Free / priced: Priced
Objectives: To reach the optimal enforcement design for speed cameras
Methodology: A simulator study tested speed camera concealment and fine timing
Key Findings: <ul style="list-style-type: none"> • Most of the world's speed cameras are covert but there is some evidence that this can cause a 'kangaroo effect' in driving patterns. One suggested alternative to prevent this kangaroo effect is the use of covert cameras. Another issue relevant to the effect of enforcement countermeasures on speeding is the timing of the fine. There is general agreement on the importance of the immediacy of the punishment, however, in the context of speed limit enforcement, implementing such immediate punishment is difficult. An immediate feedback that mediates the delay between the speed violation and getting a ticket is one possible solution. • This study examines combinations of concealment and the timing of the fine in operating speed cameras in order to evaluate the most effective one in terms of enforcing speed limits. • Using a driving simulator, the driving performance of the following four experimental groups was tested: (1) overt cameras with delayed feedback; (2) overt cameras with immediate feedback; (3) covert cameras with delayed feedback; and (4) covert cameras with immediate feedback. Each of the 58 participants drove in the same scenario on the three different days. • The results showed that both median speed and speed variance were higher with overt than with covert cameras. Moreover, implementing a covert camera system along with immediate feedback was more conducive to drivers maintaining steady speeds at the permitted levels from the very beginning. • Both 'overt cameras' groups exhibit a kangaroo effect throughout the entire experiment. • It can be concluded that an implementation strategy consisting of covert speed cameras combined with immediate feedback to the offender is potentially an optimal way to motivate drivers to maintain speeds at the speed limit.
Themes: Effect on speed compliance using overt and covert cameras with immediate and delayed feedback.
Comments: Strong experimental design assessing the impact of different combinations of enforcement strategy.

Title: The impacts of speed cameras on road accidents: an application of propensity score matching methods
Author / organisation: H. Li, D.J. Graham, A. Majumdar
Date: 2013
Format: Pdf
Link: http://www.sciencedirect.com/science/article/pii/S000145751300314X
Free / priced: Priced
Objectives: To evaluate the impacts of speed limit enforcement cameras on reducing road collisions in the UK by accounting for both confounding factors and the selection of proper reference groups.
Methodology: Using the propensity score matching (PSM) to evaluate the impacts of speed cameras, compared to using the empirical Bayes (EB) method and a naïve before and after approach.
Key Findings: <ul style="list-style-type: none"> • A total of 771 treatment sites and 4,787 potential reference group sites were observed for a period of 9 years in England. • Confounding factors were accounted for using the propensity score matching (PSM), compared to empirical Bayes (EB) and before and after analysis. • Both the PSM and EB methods show similar results that there are significant reductions in the number of collisions of all severities at speed camera sites. • It is suggested that the propensity score can be used as the criteria for selecting the reference group in before-after control studies. • Speed cameras were found to be most effective in reducing collisions up to 200 metres from camera sites and no evidence of collision migration was found. • The analysis found no evidence of 'kangaroo effect' (i.e. no increase in collisions upstream and downstream camera sites). This is an important finding in that it shows that drivers do not alter their behaviour to deliberately decelerate and accelerate abruptly before and after the camera sites. Rather speed cameras have a constant effect on driver behaviour in reducing their speed.
Themes: Speed camera effectiveness using different methodologies
Comments: Large database using different methodological approaches to assess camera effectiveness.

Title: Quantifying the causal effect of speed cameras on road traffic accidents via an approximate Bayesian doubly robust estimator
Author / organisation: D. J. Graham, et al. Date: 2017 Format: Pdf Link: https://arxiv.org/pdf/1703.05926v2.pdf
Free / priced: Free
Objectives: The paper develops an approximate Bayesian doubly-robust (DR) estimation method to quantify the causal effect of speed cameras on road traffic accidents.
Methodology: A causal DR approach combines propensity score (PS) and outcome regression (OR) models to give an average treatment effect (ATE) estimator that is consistent and asymptotically normal under correct specification of either of the two component models. The approach is developed within a novel approximate Bayesian framework to derive posterior predictive distributions for the ATE of speed cameras on road traffic accidents.
Key Findings: <ul style="list-style-type: none"> • The results for England indicate significant reductions in the number of accidents at speed cameras sites (mean ATE = -30%) • The proposed method offers a promising approach for evaluation of transport safety interventions.
Themes: Doubly robust; Bayesian inference; propensity score; average treatment effect; speed cameras; casualties.
Comments:

Title: Northamptonshire Speed Cameras: Post Switch-Off Collision Analysis
Author / organisation: R. Owen, Road Safety Analysis Date: 2015 Format: Pdf Link: http://roadsafetyanalysis.co.uk/wp-content/uploads/2016/03/Northamptonshire-Speed-Cameras-Final-Version.pdf
Free / priced: Free
Objectives: The study aims to review the casualty reduction performance of the Northamptonshire sites post-switch off compared to the period immediately prior to April 2011, and to compare these results with the trends for all other Northamptonshire roads.
Methodology: Information about the location of the cameras was collected from Northamptonshire County Council and site boundaries plotted using a computerised mapping system. Information about collisions was sourced via www.crashmap.co.uk which provides public access to the official DfT dataset of recorded injury collisions, and the collisions were then matched to the individual camera sites. Finally, the data for the whole of Northamptonshire was obtained from MAST Online which is used by local authorities, police forces and other roads safety organisations to review collision and casualty trends.
Key Findings: <ul style="list-style-type: none"> • Given the significant reduction in collisions immediately following the installation of the cameras up to 15 years before, many would expect collisions to rise again once they were switched off • What the results show is the collisions have actually reduced in the post-switch-off period and that the variation in reductions against the Northamptonshire average of all other roads is not significant • It could therefore be said that the cameras have continued to ‘work’ despite their inactivity.
Themes: N/A
Comments:

<p>Title: The Effectiveness of Average Speed Cameras in Great Britain</p> <p>Author / organisation: R. Owen, G. Ursachi, R. Allsop, RAC Foundation & Road Safety Analysis</p> <p>Date: 2016</p> <p>Format: Pdf</p> <p>Link: http://www.racfoundation.org/assets/rac_foundation/content/downloadables/Average_speed_camera_effectiveness_Owen_Ursachi_Allsop_September_2016.pdf</p> <p>Free / priced: Free</p>
<p>Objectives: The research objective of the study was to establish levels of occurrence of collisions before and after ASC installation (with consideration given to site-selection period, pre-installation and post-installation periods).</p>
<p>Methodology: The research introduced an independent methodology for reviewing site boundaries and the collisions that have taken place within them since 1990. Using the official Department for Transport collision records, it has been possible to create, on a month-by-month basis, the collision history for each site. These outputs have been used to review the effectiveness of ASCs in reducing collisions at the combined sites, applying a statistical model adopted by Professor Richard Allsop, in a form adapted from that used in the study of spot speed camera data.</p>
<p>Key Findings:</p> <ul style="list-style-type: none"> • A 36.4% (95% confidence interval: 25-46%) reduction in the mean rate of FSCs was estimated in the post-installation period. The change in PICs was lower, with a 16% (95% confidence interval: 9-22%) reduction; both results classified as highly statistically significant according to the model. These results allow in part for any RTM through the removal of SSP data from the pre-installation period. They also take into account the 'trend' data from the comparison sites. The other effect estimated in the model is the level of collisions in the SSP relative to the level in the rest of the pre-installation period. The results here show an increase in FSCs of 24.9%, and 16.7% for PICs. This supports the view that the SSP typically exhibits higher-than-normal collision numbers; again, both results were highly significant when tested in the model. It should be borne in mind that the SSP effect has already been accounted for in the installation effect analysis. • For FSCs the ASC installation effects at low- and high-speed sites were estimated reductions of 42.2% and 32.3% respectively, both being highly significant. The difference in the two results in itself was not significant, and could well have arisen from random variation. The PIC installation effect at low-speed sites was strong, with a 25% reduction at a high level of significance. The results for high-speed sites was lower at 7.9%, but this was statistically significant only at the 20% level and thus may have arisen through random variation. • For the low-speed sites both the FSC and PIC results were statistically insignificant. The estimated increase of 9% (for FSCs) and 5% (for PICs) compared to the rest of the pre-installation months could therefore have happened through chance. The results at high-speed

<p>sites were significant, and display increases of 30.2% for FSCs and 21.8% for PICs in the SSP compared to other pre-installation periods.</p> <ul style="list-style-type: none"> For sites installed for non-collision-reduction reasons, the estimated FSC reduction of 20% was not statistically significant because of the wide difference between reductions at the two sites, although the 24.2% PIC reduction was highly significant when tested in the model. However, comparison of the 95% confidence intervals for these two estimated reductions with those for the corresponding reductions for the sites installed for collision-reduction reasons provides no evidence that the reductions in collisions at these two sites differ from the reductions at the other 25 ASC sites that were selected based on a high collision record. Conclusions: The results show that ASC systems are effective in reducing collisions, especially those of a high severity. Even after allowing for the effects of trend and regression to the mean, highly significant reductions are noted. There is no evidence for the existence of any optimum speed limit that leads to the installations achieving greater collision reduction – they appear to be as suitable for deployment in higher speed limits as in lower ones.
<p>Themes: Speed-limit enforcement, Average speed cameras, Regression to the mean, Site-selection period.</p>
<p>Comments:</p>

<p>Title: Using GIS to interpret automated speed enforcement guidelines and guide deployment decisions in mobile photo enforcement programs</p>
<p>Author / organisation: Y. Li, et al., Office of Traffic Safety, City of Edmonton</p>
<p>Date: 2016</p>
<p>Format: Pdf</p>
<p>Link:</p>
<p>Free / priced: Priced: \$35.95</p>
<p>Objectives: The paper explores the deployment outcomes of the mobile photo enforcement (MPE) program in Edmonton, in relation to six priorities identified in the provincial enforcement guidelines.</p>
<p>Methodology: Two performance measures, spatial coverage and enforcement intensity, are assessed for priority sites and non-priority sites. Moreover, the distance halo effects of MPE are considered in the review of spatial coverage. All findings are visualized using Geographic Information Systems, such that high priority sites and coverage of these sites in the historical deployment can be visually assessed.</p>
<p>Key Findings:</p> <ul style="list-style-type: none"> GIS-based guidance materials for new and/or improved enforcement resource allocation.
<p>Themes: Automated speed enforcement (ASE) guidelines; Quantitative measures; Mobile photo enforcement (MPE) program; Resource allocation; Geographic Information System (GIS).</p>
<p>Comments: Guiding paper</p>

Title: Do speed cameras reduce speeding in urban areas?
Author / organisation: D. F. de Oliveira, et al.
Date: 2015
Format: Pdf
Link: http://www.scielo.br/pdf/csp/v31s1/0102-311X-csp-31-s1-0208.pdf
Free / priced: Free
Objectives: The observational study aimed to estimate the prevalence of speeding on urban roadways and to analyse associated factors.
Methodology: The study adopted a cross-sectional, observational, roadside-type design, by direct observation of vehicles, drivers, and road conditions in the city of Belo Horizonte from October 24 to November 6, 2012.
Key Findings: <ul style="list-style-type: none"> • The study found that the presence of speed cameras had a great impact on speed at the exact installation points, but failed to ensure compliance with speed limits by a significant share of drivers 200 meters after the cameras • The results show that compliance with speed limits and changing individual and community behaviour require more than structural interventions • Motorcyclists are the group that speeds the most, which aggravates the vehicle's inherent risk by increasing the driver's vulnerability, confirming the need to identify effective and sustainable strategies targeting driving behaviour to improve speed control in developing countries.
Themes: Traffic Accidents; Accident Prevention; Velocity Measurement; Urban Health
Comments:

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