A Point-by-Point Response to “Speed or Greed: Does Automated Traffic Enforcement Improve Safety or Generate Revenue?”

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In December of 2015, the Frontier Centre for Public Policy released a policy paper authored by Hiroko Shimizu and Pierre Desrochers entitled "Speed or Greed: Does Automated Traffic Enforcement Improve Safety or Generate Revenue?" The report concludes that automated enforcement programs often are unnecessary for improving road safety.

The report, however, is biased toward apparently preconceived positions on the acceptability of automated enforcement. It ignores numerous peer-reviewed studies that have found real-world benefits in the communities that use automated enforcement — cameras deter would-be violators, reduce crashes, and save lives. The authors provide relatively few citations of research from peer-reviewed journals, and some of the research they cite was either misinterpreted or misrepresented. As such, this so-called "concise summary of the key facts" can only be viewed as incomplete.

Solid, published research by a number of experts demonstrates that red light cameras save lives, and speed cameras substantially reduce speeding and speed-related crashes. National surveys indicate widespread support for automated enforcement.

The following lists a number of quotes from the paper (in italics) along with opposing views, research, and details that the authors failed to include. Section headings are as given by Shimizu and Desrochers.

Introduction

The goal of this policy paper is to provide a relatively concise summary of the key facts and debates on this topic.

The stated objective of this report is to "provide a relatively concise summary of the key facts and debates" on automated traffic enforcement (ATE). Instead, the report provides a very selective review supporting the authors' preconceived notion that automated enforcement programs are primarily focused on generating revenue. The report ignores a body of peer-reviewed research findings that run counter to the authors' viewpoints.

Questionable Implementation of ATE

The main points raised by ATE critics can be summarized as follows.

The authors list the points raised by critics but fail to list any of the counterpoints ATE supporters provide. Counterpoints are included here.

1. Despite being marketed as a safety program, ATE is really about revenue generation for the benefit of municipal and law enforcement coffers.

Photo enforcement is intended to improve traffic safety by modifying the driver behaviors that lead to crashes, and it is reasonable to expect that people who break the law should pay for enforcing it. Guidelines published in 2012 by the National Cooperative Highway Research Program (NCHRP), funded by U.S. state departments of transportation and administered by the Transportation Research Board, recommend that money from citations be used to pay for the cameras, and any excess should go to other highway safety programs.[1] Ideally, ticket revenue should decline over time as the cameras succeed in deterring would-be speeders and red light runners.

A few well-publicized cases involving elected officials who accepted cash and perks from a camera vendor in exchange for help in securing automated enforcement contracts have stirred controversy and highlight the potential for abuse.[2,3] However, these corruption cases should not overshadow the demonstrated safety benefits of automated enforcement. It makes no sense to ban a life-saving program because of several corrupt individuals. Rather, the program should receive sufficient oversight that such corruption cannot occur.

2. Many infractions occur in the context of questionable infrastructure setting (e.g., insufficient yellow light duration, insufficient road signage, improper speed limit setting).

For red light cameras, the NCHRP report emphasizes the importance of a thorough engineering study of each intersection to make sure the red light running problem is not the result of poor signal timing or visibility. Signals must have an adequate yellow time and, if allowed under state law, an all-red phase. Providing adequate yellow signal time is important and can reduce crashes. Studies have shown that increasing yellow timing to values associated with guidelines published by the Institute of Transportation Engineers[4] can significantly decrease the frequency of red light violations and reduce the risk of total crashes, injury crashes, and right-angle crashes.[5,6,7] However, adjusting yellow signal time alone does not eliminate the need for enforcement of red light violations. A study conducted in Philadelphia evaluated effects on red light running of first lengthening yellow signal timing by about a second and then introducing red light cameras.[8] While the longer yellow reduced red light violations by 36 percent, adding camera enforcement further cut red light running by another 96 percent.

3. Many infractions occur in the context of questionable locations, such as when ATE cameras are positioned in transition zones between maximum allowed driving speeds, in areas where the maximum speed limit is set artificially and arbitrarily low (e.g., construction and school zones), and hidden under bridges or at the tops of hills.

Photo enforcement sites generally are well-publicized, which is key to their strong deterrent effect. Speed cameras should not be confused with so-called “speed traps" and “secret” enforcement. Unlike speed traps, photo enforcement is fair. Only violators who meet objective criteria specifically designed to omit minor, unintended infractions are ticketed. Speed cameras usually are programmed so they will not be activated unless a vehicle is traveling significantly faster than the posted limit, typically 10 or 11 mph faster, although in certain places such as school zones the tolerance may be lower. Photo enforcement programs also are designed to distinguish legal maneuvers, such as turning right on red or being caught in the intersection when the light changes, from red light violations. Photo enforcement also reduces the potential for impermissible profiling or discriminatory enforcement.

Speed limits are lower in school zones, construction zones, and residential neighborhoods for safety, not to inconvenience drivers. School zones and residential neighborhoods have higher amounts of pedestrian traffic, and both traffic engineers and the general public recognize the need for lower speed limits in these

areas.[9] A 2015 national survey of drivers ages 16 and older indicated that 35 percent supported the use of speed cameras on freeways or interstates, 45 percent supported their use on residential streets, and 55 percent supported their use in school zones.[10] Support is even more striking among those in jurisdictions with cameras. A 2012 survey of 801 District of Columbia residents found strong support for speed cameras.[11] The District has used speed cameras since 2001. In the survey, 88 percent of residents said that speeding was a serious threat to their personal safety. A 2014 survey of 900 licensed drivers ages 18 and older residing in Montgomery County, Md., found that 62 percent of drivers favored automated speed enforcement on residential streets about 7½ years after camera ticketing began.[12]

4. There is improper and insufficient public notice before the introduction of ATE programs.

The objective of photo enforcement is to deter violations, not to surreptitiously catch violators. The more public the enforcement is, the better. Photo-enforcement cameras are in plain view, not hidden. There typically are signs and publicity campaigns warning drivers that photo enforcement is in use. The NCHRP guidelines recommend conducting a public information campaign to explain the dangers of speeding and red light running and how the camera program will work before activating the cameras.[1] It also is common for jurisdictions to introduce new ATE programs with a 30-day period during which only warning notices are issued.

5. Unnecessarily strict enforcement targets a majority of otherwise good drivers rather than the small minority of really dangerous drivers.

Speeding and red light running increase the risk to all road users — motorists, motorcyclists, bicyclists, and pedestrians. Enforcing traffic laws makes roads safer. Although automated traffic enforcement is more persistent than traditional police enforcement, it is no more strict in its interpretation of violations.

Speed cameras usually are programmed so they will not be activated unless a vehicle is traveling significantly faster than the posted limit, typically 10 or 11 mph faster. An observational study conducted on roads with speed limits ranging from 40 to 55 mph compared drivers traveling at least 15 mph above posted speed limits with drivers of adjacent vehicles traveling no more than 5 mph above the speed limit.[13] Speeders were younger than drivers in the comparison group and had more violations and crashes on their driving records.

Many red light camera programs provide motorists with grace periods of up to half a second after the light switches to red. A 1996 study of red light runners at one Arlington, Va., intersection found that, as a group, they were younger and less likely to use safety belts and had poorer driving records than drivers who stopped for red lights.[14] Red light runners were more than three times as likely to have multiple speeding convictions on their driver records.

6. Equipment may or may not be accurate.

It is standard practice for trained police officers or authorized civilian employees to review every picture to verify vehicle information and ensure the vehicle is in violation. A ticket is issued only if there is clear evidence the vehicle was speeding or ran a red light.[15]

7. Issuance of tickets is unduly delayed.

In some circumstances, even traditional enforcement methods do not provide immediate notice. An officer who observes a violation can cite the violator at a later time. In crash situations, citations often are

issued after the investigation is completed, days or weeks after the crash. According to the NCHRP guidelines, jurisdictions should require that a violation notice be served within 14 days of the alleged violation.[1] Some jurisdictions impose even tighter time limits. For example, Portland, Ore., requires that the notice be mailed within six business days of the alleged violation.

8. Taking dangerous drivers' pictures does not change their behaviour, nor does photo enforcement get seriously impaired, reckless, or otherwise dangerous drivers off the road when they are a threat to others.

Automated speed enforcement can substantially reduce speeding on a wide range of roads. Studies of cameras on residential roads in Maryland, on a high-speed roadway in Arizona, and on city streets in the District of Columbia found that the proportion of drivers exceeding speed limits by more than 10 mph declined by 70, 88 and 82 percent, respectively, 6-8 months after cameras were introduced.[16,17,18] A 2015 study in Montgomery County, Md., found that about 7½ years after the speed camera program began, the cameras were associated with a 10 percent reduction in mean speeds and a 59 percent reduction in the likelihood that a vehicle was traveling more than 10 mph above the speed limit on camera-eligible roads, almost all of which had cameras.[12]

A 2010 review published by the Cochrane Collaboration, an international public health organization, examined 35 studies from various countries. The authors concluded that speed cameras — including fixed, mobile, overt, and covert devices — cut average speeds by 1-15 percent and the percentage of vehicles traveling above the speed limits or designated speed thresholds by 14-65 percent compared with sites without cameras.[19]

Red light runners cause hundreds of deaths and tens of thousands of injuries in the United States each year. In 2014, 709 people were killed and an estimated 126,000 were injured in crashes that involved red light running. More than half of those killed were pedestrians, bicyclists, and people in other vehicles who were hit by the red light runners.

A series of studies in different communities found that red light violations are reduced significantly with cameras. Studies in Oxnard, Calif., and Fairfax, Va., reported reductions in red light violation rates of about 40 percent after the introduction of red light cameras.[20,21] In addition to the decrease in red light running at camera-equipped sites, the effect carried over to nearby signalized intersections not equipped with red light cameras. A review of international red light camera studies concluded that cameras lower red light violations by 40-50 percent.[22]

A more recent study in Arlington, Va., also found significant reductions in red light violations at camera intersections 1 year after ticketing began.[23] These reductions were greater the more time had passed since the light turned red, when violations are more likely to result in crashes. Violations occurring at least a half second after the light turned red were 39 percent less likely than would have been expected without cameras. Violations occurring at least 1 second after were 48 percent less likely, and the odds of a violation occurring at least 1.5 seconds into the red phase fell 86 percent.

9. No independent credible evidence proves that ATE actually improves highway and road safety, reduces overall accident numbers, or improves traffic flow.

On the contrary, there is overwhelming evidence that automated enforcement improves highway safety. Research in Oxnard, Calif., found significant citywide crash reductions followed the introduction of red light cameras, and injury crashes at intersections with traffic signals were reduced by 29 percent.[24] Front-

into-side collisions — the crash type most closely associated with red light running — at these intersections declined by 32 percent overall, and front-into-side crashes involving injuries fell 68 percent.

A review of international red light camera studies concluded that cameras reduce injury crashes by 25-30 percent.[22] In 2005, the Cochrane Collaboration reviewed 10 controlled before-after studies of red light camera effectiveness.[25] Based on the most rigorous studies, there was an estimated 13-29 percent reduction in all types of injury crashes and a 24 percent reduction in right-angle injury crashes. The review did not find a statistically significant change in rear-end injury crashes.

A study sponsored by the Federal Highway Administration evaluated red light camera programs in seven cities.[15] The study found that, overall, right-angle crashes decreased by 25 percent while rear-end collisions increased by 15 percent. Results showed a positive aggregate economic benefit of more than $18.5 million in the seven communities. The authors concluded that the economic costs from the increase in rear-end crashes were more than offset by the economic benefits from the decrease in right-angle crashes targeted by red light cameras.

A 2011 study comparing large cities with red light cameras to those without found that the devices reduced the fatal red light running crash rate by 24 percent and the rate of all types of fatal crashes at signalized intersections by 17 percent.[26]

In 2010, the Cochrane Collaboration reviewed 28 studies that reported the effect of speed cameras on crashes and found reductions of 8-49 percent for all crashes, 8-50 percent for injury crashes, and 11-44 percent for crashes involving fatalities and serious injuries, in the vicinity of camera sites.[19] Over wider areas, the review found reductions of 9-35 percent for all crashes and 17-58 percent for crashes involving fatalities and serious injuries. Reviewed studies with longer duration showed that these trends were either maintained or improved with time.

A 2015 study in Montgomery County, Md., found that speed camera enforcement was associated with a 12 percent reduction in the likelihood that a crash on a camera-eligible road was speeding-related and a 19 percent reduction in the likelihood that a crash involved an incapacitating or fatal injury.[12] A corridor approach, in which cameras were periodically moved along the length of a roadway segment, provided an additional 30 percent reduction in the likelihood that a crash involved an incapacitating or fatal injury over and above the effect of the cameras.

Increased Safety or Revenue Generation?

As expected by some critics and cynics, a 2009 study that examined data over a 13-year period in North Carolina counties found a statistically significant correlation between a drop in local government revenue and a subsequent (following year) increase in the number of traffic tickets, thus suggesting that the primary goal of traffic tickets is sometimes revenue generation rather than public safety.[27]

The North Carolina study failed to consider changes over time in the amount of vehicle travel. Vehicle travel typically increases during periods of economic recovery. In particular, there tends to be an increase in the type of travel that leads to more crashes and traffic violations.[28,29]

Among the benefits claimed by proponents of traffic enforcement are modifying aggressive drivers' behavior and deterring driving infractions. One must then wonder whether traffic tickets are effective in this respect. A detailed U.S. empirical study of more than three million Maryland drivers found that

speeding citations by traditional police enforcement have limited deterrent effects in the context of the current traffic enforcement system.[30]

Among other observations, the authors found that drivers who received a speeding citation in May 2002 were more likely to be young males and to be cited for driving under the influence or driving while intoxicated (DUI/DWI) during follow-up periods. They concluded: "Drivers who received a speeding citation during May 2002 had almost twice the risk of receiving a speeding citation during the follow-up period than drivers who did not receive a speeding citation during that month . . . Receiving fines and points had no significant impact on the risk of repeat citations."

The quoted statement that fines and points had no significant impact was taken out of context. Of the 15,716 studied drivers that received speeding citations during May 2002, 9,527 received both fines and points, 4,584 received fines without points, and 1,602 received no legal consequences (control group). The risk of a subsequent speeding citation was 7 percent higher for drivers that received both fines and points compared with the control group, but this difference was not statistically significant. However, the risk of a subsequent speeding citation was 19 percent lower for drivers that received fines without points compared with the control group. So there was some evidence for the effectiveness of the punishment system to deter speeders from re-offending.

The quoted statement also confuses the general and specific deterrent effects of any law enforcement. While it is a goal that those caught and punished for an offense should be less likely to re-offend, the larger goal is general deterrence, where people do not offend in the first place. The primary benefits for automated enforcement lie in the proven, general deterrent effect of increasing the perceived likelihood of detection and punishment.[31] Whether or not the punishment administered for a violation deters the specific offender from re-offending is a different question related to the effectiveness of the specific punishments.

The authors suggest the possibility that ATE programs would increase drivers' awareness of being caught and that this perception may have greater deterrence potential. However, it could be argued that since in Maryland automated speed enforcement violations are considered civil violations, and no license points are deducted in the wake of ticketing, it seems reasonable to assume that ATE citations would have almost no deterrent effect on repeat traffic law offenders.

Again, the goal of automated enforcement is general deterrence. ATE programs (which now exist in a number of Maryland jurisdictions) greatly increase the likelihood of punishment, and therefore are deterring drivers from speeding and running red lights. It is unknown whether increasing the punishment to include points in addition to fines would increase its effectiveness. However, it is well-established that the key factor in the general deterrence of laws is the perceived likelihood of detection and punishment, while the severity of punishment has much less effect.[32]

Speed Limits

"Speed kills" is a slogan that has long been accepted rather uncritically outside of traffic engineering circles. Yet, while relatively low speed limits are sensible in areas such as school zones, increased speed in itself is not necessarily problematic. If this were the case, highways with the highest speed limits would have the worst fatality rates. This, however, is not so as was amply documented in the (extreme) case of the German Autobahn system (the federally controlled access highway system).

The effects of speed on injury/fatality risk cannot be determined by comparing crashes on vastly different roadways. Engineering design, including separation of traffic, improved visibility, and the removal of roadside hazards will lower the risk of a crash. However, all else being equal, increased speed has consistently been shown to lead to increased deaths. Even on the Autobahn, the introduction of speed limits led to declines in serious and fatal injuries.[33]

Studies show that deaths on rural interstates in the United States increased 25-30 percent when states began increasing speed limits from 55 to 65 mph in 1987.[34,35,36] In 1989, about two-thirds of this increase — 19 percent, or 400 deaths — was attributed to increased speed and the rest to increased travel.

A 1999 study of the effects of the 1995 repeal of the national maximum speed limit indicated this trend had continued.[37] The study estimated a 15 percent increase in fatalities on interstates and freeways in 24 states that raised speed limits.

A 2002 study also evaluated the effects of increasing rural interstate speed limits from 65 mph to either 70 or 75 mph.[38] States that increased speed limits to 75 mph experienced 38 percent more deaths per million vehicle miles traveled than expected, an estimated 780 more deaths. States that increased speed limits to 70 mph experienced a 35 percent increase, resulting in approximately 1,100 more deaths.

A 2009 study examining the long-term effects of the 1995 repeal of the national speed limit found a 3 percent increase in road fatalities attributable to higher speed limits on all road types, with the highest increase of 9 percent on rural interstates.[39] The authors estimated that 12,545 deaths were attributed to increases in speed limits across the U.S. between 1995 and 2005.

A more recent study examined longer-term changes in 41 states. During 1993-2013, a 5 mph increase in the maximum state speed limit was associated with an 8 percent increase in fatality rates on interstates and freeways and a 4 percent increase on other roads.[40] In total, there were an estimated 33,000 more traffic fatalities during these years than would have been expected if maximum speed limits in 1993 had remained in place. In 2013 alone, there were approximately 1,900 additional deaths — 500 on interstates/freeways and 1,400 on other roads.

In the United States, a Federal Highway Administration (FHWA) study reviewed the principles and practices used to set speed limits in all states, and 44 cities and counties. One recommendation was that the "speed limit should be set at the speed driven by 85 to 90% of the free-moving vehicles rounded up to the next 5 mph increment. This method results in speed limits that are not only acceptable to a large majority of motorists, but also fall within the speed range where accident risk is lowest as illustrated in the Solomon curve. Allowing a 5 mph tolerance, enforcement would be targeted at drivers who are clearly at risk."[41]

The speeds of the crash-involved drivers in the Solomon studies were based on self-reports, and drivers exceeding speed limits are likely to deliberately underestimate their speeds.[42] Such underestimation can account for much of the apparent under-involvement of moderately high-speed drivers in crashes. Later research found that simply removing the crashes involving intersections and turning maneuvers from the Solomon data eliminated the over-involvement of slower drivers in crashes.[43] More important, the Solomon research addressed only speed variation, not speed limits.

Both variation and speed are important. Although research conducted in the 1960s on two-lane rural roads indicated that vehicles traveling much faster or much slower than average were more likely to be involved

in crashes, involvement in severe crashes increased with speed.[42] The risk of death and severe injury is a direct exponential function of speed, not speed differences.

Many differences in travel speeds are unavoidable because of the slower speeds of turning or merging vehicles. Higher speeds of other vehicles exacerbate this problem. Besides, many crashes and nearly half of those resulting in occupant deaths are single-vehicle impacts in which differences in vehicle speeds play no role or only a minor one.

However, the FHWA authors pointed out that it is fairly common for state and local governments to set the speed limit much lower than the 85th percentile speed of the free flowing traffic because of a range of subjective considerations and factors like roadside development, accident experience, roadway geometrics, average test run speed, pedestrian (and bicycle) volumes, and (not surprisingly) politics.[44] The most commonly reported lower level of the speed limit is 5 mph (8 km/h) below the 85th percentile, with 10 mph (16 km/h) below being the extreme (Figure 4).[41]

Advocates of the 85th percentile approach argue that it reduces the need for enforcement and, at the same time, reduces crash risk by narrowing variation among vehicle speeds. However, numerous studies of travel speeds have shown that 85th percentile speeds on rural interstate highways increased when speed limits were raised and then continued increasing.[45,46,47,48] Furthermore, there was no evidence that speed variance was reduced.[49] The 85th percentile is not a stationary point. It is, rather, a moving target that increases when speed limits are raised. If speed limits are raised to meet a current 85th percentile speed, a new, higher 85th percentile speed likely will result.

In some cases, setting a higher speed limit delivers safer results. According to the National Motorists Association, "If a speed limit is raised to actually reflect real travel speed, traffic flow improves, and there are fewer accidents. Speed alone is rarely the cause of accidents. Differences in speed are the main problem. Reasonable speed limits help traffic to flow at a safer, more uniform pace."[50] For instance, in 2003 the B.C. government conducted a review of speed settings where speed limits were raised during the years 1997 and 1998 from 90 km/h to 100 km/h. The report concluded that increased speed limits resulted in an 8.6% to 12.9% reduction in crashes.[51]

The B.C. (British Columbia) report also states that it "is possible other factors unrelated to the speed limit influenced the crash reductions." Overall crash counts went down at both the treatment and comparison sites during the period 1997-2001 (there was no analysis of fatal crashes). What were the factors behind the general decline in crashes in B.C., and could those factors have been more prevalent at the sites where speed limits were raised? A relatively simple before-and-after analysis does not answer the question.

Automated Enforcement and Road Safety

Justifying automated enforcement programs by invoking greater road safety is a widespread rhetorical strategy. By and large, however, the evidence on the issue is at best inconclusive.

In 2007, NHTSA published a worldwide review on automated enforcement programs. It concluded that "existing research indicates that automated enforcement systems can result in measurable safety improvements at high crash locations." The authors then added a cautionary note to the effect that "the magnitude of the effect, and how much is due to the desired behavior change (decrease in speed or red light running) versus other behavior changes (e.g., choosing alternate routes), remains uncertain."[52]

When the NHTSA review was published in 2007, there were as yet very few studies of the effects of automated enforcement on crashes. The methodology of these studies often was simplistic and failed to account for the tendency of jurisdictions to initially use automated enforcement only at high crash locations. There were only 13 studies of automated speed enforcement that were given a detailed evaluation, and 10 of those were from Europe and Australia. "All reported decreases in estimated injury crashes, all crashes, or speed-related crashes at camera sites, or system-wide (State or province) following implementation of automated speed enforcement using cameras." However, due to "confounding factors and differences in study methodologies" the authors concluded that "no single number is thought to best represent the safety effect of automated speed enforcement."

A Virginia Transportation Research Council report analyzed seven years of crash data (from January 1, 1998, to December 31, 2004) in six Virginia jurisdictions that operated red light cameras.[53] The authors concluded that "the study did not show a definitive safety benefit associated with camera installation with regard to all crash types, all crash severities, and all crash jurisdictions." The study did show a net safety benefit for some jurisdictions (such as in the cities of Vienna and Alexandria), but not in others (such as Arlington). There is evidence to suggest that this difference might have more to do with variation among intersections than among jurisdictions. Finally, it may be said that the cameras were associated with a clear decrease in red light running crashes and a clear increase in rear-end crashes. The report recommended that red light cameras be implemented on a case-by-case basis and only after a careful review of the crash patterns (rear-end crashes, red light running crashes, and injury crashes) and geometric/operational characteristics (e.g., approach speeds, intersection visibility, signing, and driveways) at each intersection.

A 2008 review of the report by the Virginia Transportation Research Council (VTRC) uncovered problems with the Empirical Bayes (EB) methodology.[54] The review stated that "the VTRC model implied illogically that zero crashes would occur if any of the variables other than traffic volume had a value of zero, regardless of the traffic volume level. One term in the model that easily could equal zero is the difference between the actual duration of yellow signal timing at a given intersection and the recommended duration based on guidelines published by the Institute of Transportation Engineers.[4] If these two values were equal, the model would predict zero crashes. This clearly would not be the case in the real world. Other important problems with the models included the use of a large number of potentially correlated independent variables and small sample sizes of crashes for several crash prediction models. All of these problems likely produced unstable and unreliable parameter estimates for many of the models, such that estimates of expected crashes without camera enforcement, a key ingredient of the EB methodology, likely were incorrect."

In 2009 the City of Winnipeg Police Service contracted with the Traffic Injury Research Foundation to conduct an evaluation of the city's Photo Enforcement Program.[55] The installation of red light running camera locations was said to have decreased dangerous right-angle collisions at intersections by 46%, but less serious rear-end collisions were up by 42%. The red light running camera program was thus said to have had a positive net effect on traffic safety. However, this result was only valid for 12 cameras, while the remaining 36 showed inconclusive results. In the case of speeding cameras, the net effect on injury crashes and property damage only crashes was virtually nil. Interestingly, the report stated that, in terms of photo enforcement effectiveness, speeding cameras might actually be less effective in preventing serious speeding violations. Overall, the report concluded that, due to the lack of information or documentation regarding the criteria used in selecting locations for cameras, it was difficult to determine the portion of observed results attributable to photo enforcement.

The Traffic Injury Research Foundation (TIRF) study is paraphrased as concluding that "due to the lack of information or documentation regarding the criteria used in selecting locations for cameras, it was difficult to determine the portion of observed results attributable to photo enforcement." The correct quote from the TIRF study is "the lack of information or documentation regarding the criteria used in selecting locations for cameras makes it difficult to attribute the results from the time series to important aspects of the photo enforcement program, such as the number of camera locations, the timelines of installing more cameras over time, the specific locations of those cameras, or the combination of increased or enhanced educational efforts with the installation of cameras." In other words, while there was a clear benefit from the overall photo enforcement program, the individual benefits of specific program components could not be determined.

On red light running behaviour, the Traffic Injury Research Foundation report discussed one systematic review that supported the conclusion that photo enforcement reduces right-angle crashes while increasing rear-end crashes, but further suggested that the overall effects on total crashes, specific collision types, and violations data analysis is not conclusive. Variations across studies, the authors explained, could be attributable to several factors, such as the fact that a program's size will often determine the magnitude of the benefits. Typically, the larger the program and the more public awareness results from it, the larger the benefits. Variations among studies in terms of research design and methodology also explained much in terms of conflicting results, most notably that:

1. *Results might be site specific;*
2. *Site selection bias might have resulted in "regression towards the mean" and an overestimation of the effects of camera enforcement on crashes on selected sites; and*
3. *Due to the complexity of the accident, it is often difficult to distinguish target crashes from other collisions caused by alcohol and other factors.*

The TIRF study contained a complete and unbiased summary of the relevant literature, including the "one systematic review" concluding that "red light cameras are effective in reducing total casualty crashes, but the evidence is less conclusive about total crashes, specific collision types, and violations."[25] The TIRF literature review then fully addressed the methodological limitations of all studies, whether or not they reported benefits of automated enforcement. The conclusion of the literature review was that there was "converging evidence showing that photo enforcement leads to a reduction in speeding violations and red light running violations as well as reductions in right angle crashes and injury crashes beyond reductions that can be achieved with engineering measures such as longer yellow light phases."

Conclusion

During the past 40 years in Canada, advances in vehicle engineering and measures other than speeding tickets have contributed to a reduction of road fatalities by a factor of 3 despite a doubling of the population.[56]

While speed limits obviously have their role and ATE can help in this and other (e.g., red light violation) respects, much evidence suggests that they are far from crucial in terms of their contribution to greater road safety, that they are more often implemented on emotional rather than engineering grounds, and that their capacity to generate revenues makes them irresistible to a large number of elected officials. In light of the available evidence, law-abiding and taxpaying citizens have a right to ask for more effective

traffic enforcement methods that target really dangerous drivers and for fines and other penalties to be proportionate to the seriousness of the violations.

While many politicians and citizens view lower speed limits and rigorous traffic enforcement as panaceas for improved road safety, much scientific evidence tells otherwise. Proper engineering (e.g., design and maintenance of the road), education, and proper enforcement (which would include sensible ATE programs) must be a part of a holistic approach whose clear goal must be improved safety rather than revenue generation. From a motorist's perspective, revenue generated from ATE programs should be used on improving infrastructure rather than adding to the municipalities' coffers and expanding ATE programs to punish law-abiding citizens unfairly and unjustifiably.

The authors conclude that there is "much evidence" suggesting automated speed enforcement programs "are far from crucial in terms of their contribution to greater road safety." However, they provide relatively few citations of research from peer-reviewed journals, and some of that research was either misinterpreted or misrepresented. Also, most of the published evidence in support of automated enforcement was excluded. As such, this "concise summary of the key facts" is, at best, incomplete. The claim that ATE programs "…punish law-abiding citizens unfairly and unjustifiably" is simply illogical. If anything, ATE programs improve fairness by reducing the potential for prejudicial enforcement. And, if it is unjustifiable to enforce laws, especially laws with proven safety benefits, then what is the purpose of the laws?

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