INTRADEPARTMENTAL CORRESPONDENCE BPC #10-0480

November 30, 2010
16.2
CB# 10-0010
OCOP# 2010-09-03

TO: The Honorable Board of Police Commissioners

FROM: Chief of Police

SUBJECT: CITY COUNCIL MOTION RELATIVE TO CONTROLLER'S AUDIT OF THE PHOTO RED LIGHT PROGRAM (CITY COUNCIL FILE NO. 10-1502)

RECOMMENDED ACTIONS

1. That the Board of Police Commissioners (Board) REVIEW and APPROVE this report in response to the City Council Motion (Hahn) relative to the City Controller's Audit of the Photo Red Light Program (PRLP), Council File (CF) No. 10-1502;

2. That the Board TRANSMIT the report to the Audits and Governmental Efficiency and Public Safety Committees; and,

3. That the Board APPROVE the continuance of the City's Photo Red Light Program.

BACKGROUND

On September 29, 2010, Councilwoman Janice Hahn moved that the Los Angeles Police Department (Department), with the assistance of the Los Angeles Department of Transportation (LADOT) and the City Administrative Officer, be directed to report on the findings of the City Controller's audit relative to the PRLP and on possible recommendations to terminate the Program.

The motion raised three areas of concern:

1. The PRLP's impact on public safety;
2. The PRLP's impact on City finances; and,
3. The intersection selection process.

DISCUSSION

PART 1: THE PHOTO RED LIGHT PROGRAM'S IMPACT ON PUBLIC SAFETY

The Benefits of Automated Enforcement

The Department supports the continued use of the PRLP as part of an overall strategy to reduce the incidence of serious injury and fatal traffic collisions resulting from red light violations in the City. Traditional field enforcement has been unable to sufficiently address this problem as only seven percent of moving violations written by field personnel are for red light violations.

With the operation of 32 PRL intersections, the Department's PRLP more than quadrupled the number of citations issued from 14,000 to 59,000 citations annually. In addition to providing efficient and accurate enforcement, the PRLP also serves as a high visibility public awareness campaign, putting drivers on notice that *the City of Los Angeles does not tolerate red light running.* The Department believes that the increased driver compliance that accompanies better enforcement leads to a decrease in traffic related accidents.

Measuring Effectiveness

The Department traffic collision analysis has shown an overall decrease in red light collisions at PRL intersections since their deployment. From 2004 to 2009, the Department noted an overall 63 percent decrease in red light related traffic collisions at PRL intersections, as well as an overall decrease of 10 percent in all types of collisions. Additionally, there have been no red light related fatalities since program activation (compared to five fatalities in the three years prior to PRL enforcement, from 2004-2006).

The reduction in red light related traffic collisions is consistent with numerous published studies of PRLPs by research scientists who have conducted extensive statistical analysis far beyond law enforcement capabilities. For example, a meta-analysis on the effectiveness of red light cameras was recently published in the Journal of the Institute of Transportation Engineers *Effectiveness of Red Light Cameras,* Brian Bochner and Troy Walden, ITE Journal, May 2010, (Attachment 2).

This study analyzed hundreds of PRL intersections over various time frames from dozens of different localities and concluded that "red light cameras substantially reduce red light violation rates" and "reduce crashes that result from red light running." It also concluded that red light cameras "usually reduce crash severity by virtue of reducing the more severe right angle crashes."

On June 30, 2010, Michael Geraci, Director of the Office of Safety Programs for the National Highway Traffic Safety Administration (NHTSA), testified before the United States House of Representatives that approximately 1,000 people die in red light related traffic collisions every year in the United States. Mr. Geraci stated that red light cameras have been shown to reduce collisions by 30 to 50 percent. He concluded that "Automated enforcement programs can be an effective countermeasure for reducing crashes at high-risk locations."

The Controller's Assessment of Department Collision Statistics

The Controller's audit contains a discussion of Department traffic collision statistics and recommends several improvements to the gathering and analyzing of statistical data (Attachment 3). The audit states that a definitive conclusion about public safety cannot be made based solely on the Department's location-specific statistical analysis of collision reports.

The audit raised two main areas of concern: 1) The thorough and accurate capturing of collision data; and 2) The proper analysis of the data.

1. **Thorough and Accurate Capturing of Collision Data.** The audit pointed to several areas that raised questions about the ability of Department statistics to be conclusive:

The Department acknowledges the limitations of current data capturing methods and has committed to making improvements where possible. A plan to increase the number of fields captured by divisional databases is underway and a more integrated statistical tracking system is being investigated.

2. **Proper Analysis of the Data.** The audit recognized that there are many factors that can affect collision rates and suggested that Department statistical analysis incorporate variables such as Citywide collision trends, changes in fuel prices, fluctuations in traffic volume, and weather patterns (Attachment 3, Pages 32-34).

Presently, the Department does not have the resources to complete the level of analysis being recommended. Location-specific statistics are monitored in terms of general trends, primarily to watch for unintended consequences, such as a dramatic spike in rear-end traffic collisions (which the City has not experienced).

Traffic Collision Increases at PRL Intersections

In November 2009, in response to a media report, the Department conducted an in-depth analysis of traffic collision statistics six months before and six months after the installation of PRL equipment. Over six hundred traffic collision reports were manually reviewed to determine their relevancy to the PRLP. The results of this shortened study period showed a decrease in only half of the intersections, with the other half either exhibiting no change or a slight increase. The

Department agrees with the auditor's assessment that the time period of this particular study was insufficient to make conclusions about the impact of the PRLP.

As stated earlier, from 2004 to 2009, there has been an overall decrease of 63 percent in red light collisions at PRL intersections. Additionally, there has been an overall decrease of 10 percent in all types of collisions and no red light related fatalities since program activation (compared to five fatalities in the three years prior to PRL enforcement from 2004-2006).

PART 2: THE PRL PROGRAM'S IMPACT ON CITY FINANCES

The Controller's audit found that the PRLP has not covered its operational costs and cites a $2.5 million net loss over the last two years (Attachment 3, Page 40). Revenues from the PRLP have been lower than expected due to a lower collection rate on PRL citations. Unfortunately, discussion with the Los Angeles Superior Court to modify their procedures to increase collections on outstanding PRL citations has not proven successful.

Court Collections

The Department believes receipts from the PRLP have been lower than expected due to the decision of the Los Angeles County Courts not to use administrative collection tools such as a Department of Motor Vehicle (DMV) hold for failures to appear or the Franchise Tax Board (FTB) in the collection of outstanding PRL cases. While the court currently refers outstanding PRL citations to their contracted collection agency, GC Services, approximately 56,000 PRL citations remain open and unresolved in the court system. These outstanding citations represent over $7 million in potential revenue to the City. The collection rate for fiscal year 2009/2010 was 23 percent.

The DMV hold is an important element to the successful operation of a PRLP. The State legislature recognized this in 1999 when Section 40509 of the California Vehicle Code was amended to specifically allow for notification to the DMV for failure to appear on PRL cases. Without a DMV hold, there is effectively no legal leverage to compel violators to respond to the court order.

Additionally, the FTB is a valuable collection resource that has proved to be highly effective in other counties. For example, when the County of San Diego instituted an aggressive FTB program, they collected over $30 million in outstanding court-ordered debt in the first year.

The DMV hold and FTB programs are currently being utilized for PRL citations in San Bernardino, Riverside, San Diego, and Ventura County courts with highly successful results.

The Department, LADOT, and the City Attorney's Office, have had discussions with senior Los Angeles County Court officials in order to address the low collection rate of PRL citations. Court leadership has decided to stay with the current policy.

PART 3: INTERSECTION SELECTION

The Controller's audit notes that the method used to select the PRL intersections eliminated some intersections that had higher collision rates. The intersection selection criteria were developed in cooperation with the LADOT under the direction of the City Council. Efforts were made to place public safety as a top priority, while also balancing the practicality of implementation and Citywide coverage.

The concerns raised in the report regarding infrastructure funding have been addressed in the recently released PRL Request for Proposals (RFP). The LADOT has also committed to working with Caltrans for the upcoming contract and to allow for a reasonable time schedule.

Citywide Implementation

The audit notes that City Council emphasized the importance of placing at least one PRL in each Council District. The Department sought to accommodate the Council, while still prioritizing public safety, by selecting the most "accident-prone" intersections in their respective districts. Thus, the need for targeted enforcement was balanced with the desire for a broader implementation of the PRLP.

The goal of balanced coverage is also strongly motivated by a public safety awareness component. The PRLP operates as both a high visibility enforcement and educational tool. The ripple effect of a PRL intersection on the surrounding community increases public attention to red light compliance. As such, a PRLP has the maximum public safety benefit when enforced intersections are spread throughout the City.

As a matter of information, selections based on collision history alone would have placed 80 percent of PRL intersections in either the Valley or West Bureaus, leaving little to no coverage for huge swaths of the City and excluding the following five Council Districts entirely: 1, 7, 11, 14, and 15. Uneven distribution can lead to claims that the City is unfairly targeting particular communities. Balanced coverage also provides for equitable distribution of court case load.

The Department acknowledges that limiting the selection region to Council District may have been too narrow to allow for the necessary latitude in intersection selection. For any future contracts, the Department would prefer limiting the selections to the four geographic police bureaus instead of the smaller 15 Council Districts, which would achieve Citywide coverage while allowing for greater latitude to focus on intersections with the greatest collision problems.

CONCLUSION

The Department and the LADOT support the continued use of the PRLP as part of an overall strategy to reduce the incidence of serious injury and fatal traffic collisions resulting from red light violations in the City.

RECOMMENDATIONS

It is requested that the Board approve the aforementioned "Recommended Actions."

If you have any questions regarding this matter, please contact Captain Thomas J. McDonald, Commanding Officer, Emergency Operations Division, at (213) 486-0680.

Respectfully,

CHARLIE BECK
Chief of Police

Attachments

PUBLIC SAFETY

AUDITS & GOVERNMENTAL EFFICIENCY

MOTION

The Controller has just released an audit which concludes that red-light cameras have not improved safety. The audit indicates that the red-light camera program has bypassed some of the City's most dangerous intersections, cost more than $2.5 million over the last two years and failed to adequately demonstrate an improvement in safety.

The audit advises that while the camera program was supposed to reduce accidents at the highest-risk intersections, some of the most accident-prone corners were passed over, and only half of the intersections equipped with cameras showed a reduction in accidents.

The audit also advises that the Police Department operators of this program as well as the Department of Transportation have been unable to conclusively document safety improvements, and that a more comprehensive means of evaluating the effectiveness of red-light cameras is needed.

I THEREFORE MOVE that the Police Department with the assistance of the Transportation Department and the City Administrative Officer be directed to report on the findings of the Controller's audit relative to the photo red-light program and on possible recommendations to terminate this program if the findings warrant termination.

PRESENTED BY: _____
JANICE HAHN
Councilwoman, 15th District

SECONDED BY: _____

September 29, 2010
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Traffic-law enforcement and risk of death from motor-vehicle crashes: case-crossover study

Donald A Redelmeier, Robert J Tibshirani, Leonard Evans

Summary

Background Driving offences and traffic deaths are common in countries with high rates of motor-vehicle use. We tested whether traffic convictions, because of their direct effect on the recipient, might be associated with a reduced risk of fatal motor-vehicle crashes.

Methods We identified licensed drivers in Ontario, Canada, who had been involved in fatal crashes in the past 11 years. We used the case-crossover design to analyse the protective effect of recent convictions on individual drivers.

Findings 8975 licensed drivers had fatal crashes during the study period. 21 501 driving convictions were recorded for all drivers from the date of obtaining a full licence to the date of fatal crash, equivalent to about one conviction per driver every 5 years. The risk of a fatal crash in the month after a conviction was about 35% lower than in a comparable month with no conviction for the same driver (95% CI 20–45, p=0·0002). The benefit lessened substantially by 2 months and was not significant by 3–4 months. The benefit was not altered by age, previous convictions, and other personal characteristics; was greater for speeding violations with penalty points than speeding violations without points; was no different for crashes of differing severity; and was not seen in drivers whose licences were suspended.

Interpretation Traffic-law enforcement effectively reduces the frequency of fatal motor-vehicle crashes in countries with high rates of motor-vehicle use. Inconsistent enforcement, therefore, may contribute to thousands of deaths each year worldwide.

Lancet 2003; **361:** 2177–82
See Commentary

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Introduction

Motor-vehicle crashes are a common cause of death, disability, and demand for emergency medical care. Globally, about 1 million people die each year from traffic crashes and about 25 million are permanently disabled.[1] Unlike many common diseases, the victims are frequently young and need substantial related care for decades. Most crashes are unintended, unexpected, and could have been prevented by small differences in driver behaviour.[2] Prevention is particularly important for protecting health, given that most drivers will be in at least one crash during their lifetime. Moreover, about half of all crash deaths occur at the scene, with no opportunity for life-saving treatment.[3]

An individual's crash risk depends on how that person drives and how other road users behave,[4] yet the public is somewhat sceptical about traffic-law enforcement.[5,6] News exposés and the entertainment industry have suggested some law-enforcement efforts are merely revenue generating in locations with low crash rates, done by biased officers.[7] Any balance between safety and mobility involves trade-offs, and people generally resist efforts that interfere with their driving.[8] Police, themselves, sometimes view traffic enforcement as a duty beneath their skills.[9] Furthermore, the effectiveness of most laws has not undergone scientific scrutiny, and the few available studies are mostly ecological analyses using disputable before-and-after comparisons of intermediate outcomes (adherence) rather than definitive outcomes (death).[10,11]

Rigorous testing of the effectiveness of traffic enforcement for preventing deaths might contribute to better decisions. First, testing could check the popular claim that enforcement yields no lives saved and a contrary net increase in crashes because drivers watch for police instead of hazards[12] would be useful. Second, testing could help to assess the effect of allocation of scarce police resources to traffic safety compared with other community services, and also affect attitudes about charging.[13] Third, results could raise debate on adoption of new enforcement technologies such as photo radar and red-light cameras.[14,15] A shortage of data may underlie inconsistency in enforcement practices globally, which could indirectly contribute to hundreds of preventable deaths each day.[16]

Methods

Setting

Ontario, Canada, in 1993—the study mid point—had a population of about 9·6 million people and 6·8 million drivers; 0·4 million drivers were involved in crashes, and there were 1135 crash deaths.[17] Police were responsible for 6·0 million licensed vehicles, 20 000 km of roads, and 1·0 million traffic convictions, but used no special enforcement technologies.[18] Licences were graduated for the first 2 years of driving (restrictions on highway

ATTACHMENT 1

driving and other limitations), and general licences could be suspended after accumulation of nine penalty points (the annual rate of suspension was about 0·6% of drivers). A conviction for speeding at 20 km per h higher than the limit, for example, involved a Can$100 fine (around UK£42) and three penalty points. Ontario had no programmes for dismissing convictions if a person completed a driver improvement course.

Drivers and driving records

We identified all drivers involved in fatal crashes between Jan 1, 1988, and Jan 1, 1999, in Ontario. A fatal crash was defined as causing death of any person at the scene, on arrival at hospital, or within 1 month of the event. We included drivers irrespective of whether they survived, were at fault, or held special diplomatic immunity from prosecution. We excluded drivers who were unidentified by police, whose licences were not registered in Ontario, or who had held licences for less than 2 years, because of graduated licence restrictions. Duplicate records were deleted if they showed identical time, place, and driver. The primary analyses focused on drivers whose driving permit was maintained during the study period; we assessed drivers whose permits were suspended in secondary analyses.

Ontario drivers' records were traceable to individual-driver level and accessible for research purposes.[17,18] Such research did not require voluntary consent and covered a person's full driving record. These databases were identical to the official files on drivers, serious crashes, and traffic convictions. Individual convictions could be removed from the public record after 2 years, but were not erased from computer files; hence, drivers' lifetime histories were available for analysis. The available data did not include parking violations or driving violations on roads outside Ontario. Similarly, the information on the date of obtaining a full licence reflected Ontario residency and did not include earlier licences elsewhere.

Records were linked by use of the encrypted licence number to data on the person, vehicle, and roadway conditions, with the following stipulations. Age, years of licensed driving, and previous convictions were current on the day of the crash. Licence class was simplified to the highest certification for people holding multiple licences. Data on alcohol were based on police reports, and missing values were coded as negative. Vehicles were classified as car, truck, or other because of small numbers of specific types. Road surface conditions were classified as dry, wet, or snowy (including ice, sleet, slush, and similar winter conditions). Crash locations were described as related or unrelated to an intersection, as recorded in the police report.

Analysis

We analysed convictions by use of a case-crossover design, a technique for assessing a temporary change in risk associated with a transient exposure.[19] Each person was his or her own control and thereby eliminated confounding due to all fixed characteristics, including genetics, personality, education, lifestyle, and chronic diseases.[20] The primary analysis used a pair-matched analytical approach to contrast a period immediately before the crash with a comparable period substantially before the crash.[21] This analysis would identify a safety benefit if periods with convictions were followed by fewer crashes than would be expected due to chance. Therefore, a benefit is implied if the absence of a conviction is associated with the onset of a crash.

In the primary analysis we assessed licensed drivers and compared the month immediately before the crash with the same month 1 year before. For example, for a crash on July 1, 1995, we compared the month of June, 1995, with June, 1994. Supplementary analyses compared the same immediate previous period to five alternative control periods to check the robustness of our findings: with the month 11 months previously, 13 months previously, 24 months previously, 36 months previously, or an extended full-year span centred 12 months previously. For example, we compared the control month of June, 1994, with July, 1994, May, 1994, June, 1993, June, 1992, and the 1-year period with July 1, 1994, as the central date. We repeated the analysis for suspended drivers to test whether smaller safety benefits were observed where smaller safety benefits would be anticipated.[22,23]

We assessed further issues by stratification. The first approach relied on grouping drivers by personal characteristics or crash features and testing for discrepancies across major subgroups. We analysed crash severity by two separate methods. First, fatal crashes were investigated by police who estimated the damage to drivers' vehicles. Second, a fatal crash did not always kill all persons involved and we assessed benefits among drivers who survived admission to hospital, were discharged into the community, and returned to active driving by analysis of their driving records after the crash. In addition, we explored how long a potential association might persist, denoted as a persistence analysis, by examining hazard intervals shifted progressively backward in time from the crash day (with corresponding displacements of control intervals). For

	Number (% [n=8975])
Characteristics	
Age (years)*†	
<30	2229 (25)
30–50	3921 (44)
>50	2800 (31)
Sex	
Male	6512 (73)
Female	2463 (27)
Years of licensed driving*†	
≤9	4032 (45)
≥10	4918 (55)
Corrective eyewear	
Yes	3224 (36)
No	5751 (64)
Licence class	
General	7110 (79)
Advanced‡	1865 (21)
Previous driving convictions*	
≤3	6853 (76)
≥4	2122 (24)
Alcohol detected	
Yes	634 (7)
No	8341 (93)
Road surface condition	
Dry	5822 (65)
Wet	1636 (18)
Snowy	1517 (17)
Road configuration	
Intersection	2836 (32)
Non-intersection	6139 (68)
Vehicle type	
Car	5689 (63)
Truck§	2649 (30)
Other¶	637 (7)

*Updated to time of fatal crash. †Excludes 25 drivers with missing birth dates. ‡Includes permits for motorcycles, trucks, and special vehicles. §Includes passenger vans or sports utility vehicles (n=605) and delivery vans (n=165). ¶Includes motorcyles (n=227), buses (n=137), bicycles (n=58), and 17 other types (n=215).

Table 1: **Selected characteristics of drivers and crashes**

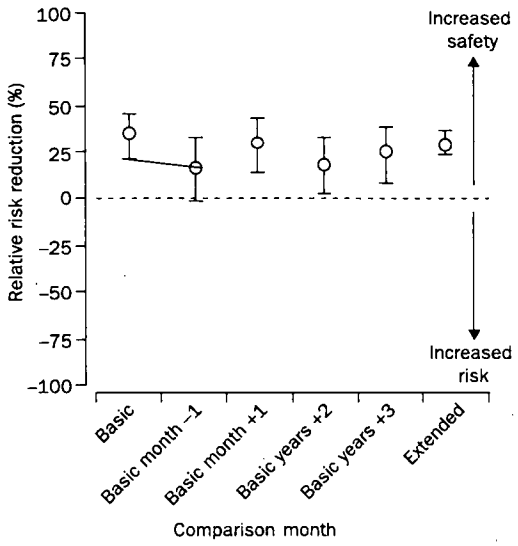

Figure 1: **Estimated relative risks (95% CI) for six different control intervals**

Basic=1-month control periods before collision separated by 12 months. Basic −1 month=separation of 11 months. Basic +1 month=separation of 13 months. Basic +2 years=separation of 24 months. Basic +3 years=separation of 36 months. Extended=1-year control period centred on date 12 months before collision.

example, a 1-month persistence interval would include May 1994 and May 1995 when assessing a crash on July 1, 1995.

Statistical analysis

We calculated the sample size to provide an 80% chance of detecting a 15% increase or decrease in crash rates. Relative risks were estimated with methods for matched-pairs studies on the basis of exact binomial tests and conditional logistic regression. Analogous methods were applied when the control interval was 12 months rather than 1 month in length. In all analyses, the time immediately before the crash was 1 month in length (estimates based on intervals of 2, 6, and 8 weeks yielded similar results and are not shown). Each month before the fatal crash was assessed as an independent hazard time period. All p values were two-tailed, all relative risks calculated with 95% CI, all analyses drawn from all data available. Relative risk reductions greater than zero show a safety benefit, and CI that exclude zero are significant. We did all analyses on S-PLUS (version 3.4) and Statview (version 5.0) software.

Role of the funding source

The study sponsors had no role in the study design, data collection, data analysis, data interpretation, the writing of the report, or in the decision to submit the paper for publication.

Results

8975 licensed drivers were involved in fatal crashes during the 11-year study period. In addition, 4861 suspended drivers were involved in fatal crashes. Data on convictions showed no anomalous entries or gaps related to licence numbers or to date, description, and demerit points for each offence. Data on crashes also showed no irregularities over the critical data on drivers' licence numbers and dates. Data on sex, licence class, road surface, road configuration, and vehicle type had no irregularities. Data on corrective eyewear and alcohol consumption were assumed complete with missing values interpreted as negative. Data on previous convictions were derived directly from the file of each individual. Data on birth date and first licensing date were missing for 25 individuals; these individuals appear in the primary analysis but are excluded from the subanalyses of driver age and experience.

The typical licensed driver was a man aged 43 years holding a general permit, and who drove a car in dry road conditions (table 1). Most of the crashes did not involve alcohol and were not at intersections. Before the crashes, the lifetime driving-conviction history of the entire group of licensed drivers accounted for 21 501 convictions, most commonly for speeding without penalty points (6682 convictions) or speeding with penalty points (6493 convictions). There was a notable seasonal pattern; crashes and convictions were more common in the summer than the winter.

135 licensed drivers had had driving convictions in the month before the fatal crash, 204 had had convictions in the same month 1 year before, and six had had convictions in both months. The primary analysis indicated that convictions were associated with a 35% reduction in the relative risk of a crash (95% CI 20–45, p=0·0002). Analyses based on alternative control time periods yielded similar findings (figure 1). As expected, the analysis of the extended control time of 1 year resulted in a minor drift of the point estimate and narrowing of the CI. For suspended drivers, however, there was no significant decrease in risk associated with

	Number with conviction in previous month	Relative risk reduction (95% CI)*
Complete cohort	135	35 (20 to 45)
Age (years)		
<30	58	34 (10 to 52)
30–50	62	28 (2 to 48)
>50	15	55 (13 to 75)
Sex		
Male	111	37 (20 to 50)
Female	24	19 (−47 to 50)
Years of licensed driving†		
≤9	66	39 (17 to 54)
≥10	69	30 (6 to 48)
Corrective eyewear		
Yes	47	26 (−6 to 48)
No	88	39 (20 to 52)
Licence class		
General	104	32 (13 to 45)
Advanced	31	42 (10 to 61)
Previous driving convictions		
≤3	64	33 (10 to 50)
≥4	71	37 (17 to 52)
Alcohol detected		
Yes	15	42 (−15 to 68)
No	120	34 (17 to 45)
Road surface condition		
Dry	90	35 (17 to 50)
Wet	25	31 (−15 to 57)
Snowy	20	38 (−15 to 62)
Road configuration		
Intersection	31	48 (20 to 64)
Non-intersection	104	29 (10 to 43)
Vehicle type		
Car	83	26 (2 to 43)
Truck	42	47 (23 to 62)
Other	10	36 (−54 to 70)

*Indicates decrease in chance of a fatal crash during month after conviction compared with month after no conviction. †Positive values indicate increased safety, negative values indicate increased risk.

Table 2: **Relative reduction in crash risk associated with a conviction**

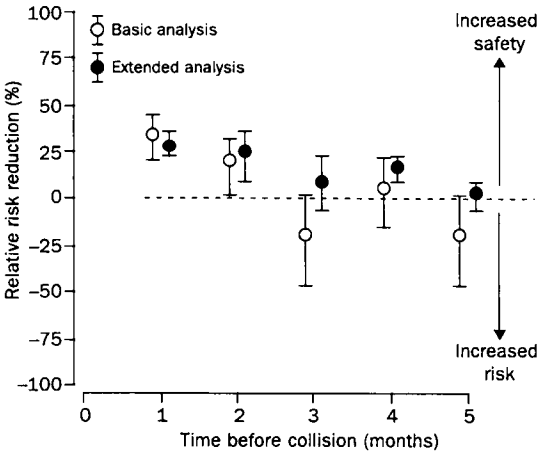

Figure 2: **Relative risks (95% CI) for different persistence intervals**

Basic analysis=1-month control periods before collision separated by 12 months. Extended analysis=1-year control period centered on date 12 months before collision.

convictions (relative risk reduction −16% [−36 to 2], p=0·12).

The relative risk reduction associated with traffic convictions was consistent among subgroups of licensed drivers. In no group were traffic convictions associated with a harmful effect (table 2). The smallest relative risk reduction was for women, although the inconsistency between women and men was not significant (p=0·39) and women were generally under-represented in fatal crashes. The relative risk reduction was almost the same for drivers with four or more and for those with three or fewer previous convictions and almost the same for drivers with alcohol and with no alcohol detected by police. Analyses of each of the 11 separate years showed a relative risk reduction in all but 1 year and no significant increasing or decreasing trends.

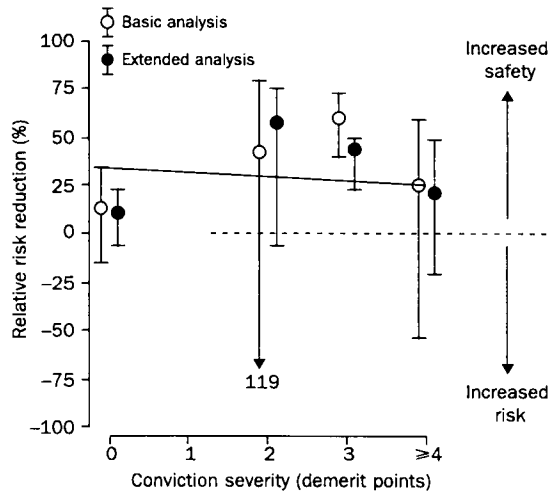

Figure 3: **Relative risks (95% CI) for different types of convictions**

Basic analysis=1-month control periods before collision separated by 12 months. Extended analysis=1-year control period centered on date 12 months before collision. Drivers with no convictions excluded. Relative risks undefined at severity=1 because no driver accumulated exactly 1 point, and do not increase proportionately with conviction severity.

The decrease in risk was greatest for convictions made close to the time of the crash. In the analysis of persistence of effect, for control periods of 1 month's duration the decrease in risk was greatest for convictions made less than 1 month before the crash and was not significant for convictions made 3 or more months before the crash (figure 2). The same analysis with control periods of 12 months' duration indicated that a decrease in risk did not persist for convictions 5 or more months into the past. In no analysis did we find a significant increase in risk. In addition, we found a consistent relative risk reduction after convictions, irrespective of hour of day (range 24–55%), day of week (24–53%), or season of year of the crash (17–52%).

Analysis of crashes according to police estimates of damage, showed marginally inconsistent higher relative risk reduction for drivers whose vehicles were demolished compared with those whose were not (42 *vs* 23%, p=0·22). Relative risk reductions were similar for drivers who did or did not have objective evidence of subsequent driving activity (35 *vs* 34%, p=0·95). Together these findings suggest that safety benefits extended to crashes of greater or lesser severity.

In the subgroups of convictions, speeding convictions in which the driver received penalty points were associated with a larger relative risk reduction than speeding convictions with no penalty points (51 *vs* 0%, p=0·011). Convictions related to administrative errors, careless driving, seatbelt failure, and disobeying of a traffic signal were all associated with similar relative risk reductions (range 31–57%). When based on severity of punishment rather than the type of offence, convictions for which two to three penalty points were awarded showed generally more safety benefit than did convictions with no penalty points (figure 3).

We tested for adverse effects related to enforcement by review of coroners' data on all deaths involving police activity. We found 24 deaths related to traffic enforcement during the study period. These deaths included 17 drivers suspected of criminal activity, five bystanders, and two police officers. The typical driver who died was a man aged 26 years pursued by police after fleeing a spot check for alcohol or a speeding violation. Four of the five bystanders were passengers in a vehicle fleeing a spot check, four had positive toxicology at autopsy (alcohol or illicit drugs), and four were teenagers. The two police officers who died (separate events) were each hit by drivers while writing a speeding ticket for another motorist.

Discussion

Almost no driver wants to be in a serious crash, yet almost all drivers violate traffic laws at some time, such as by intermittent speeding.[24] We studied more than 10 million people for longer than a decade and found that convicting drivers for traffic offences reduces the rate of fatal crashes. Each conviction leads to a 35% decrease in the relative risk of death over the next month for drivers and other road users; conversely, each conviction not issued would lead to a corresponding increase in risk. Our findings also imply that increasing the frequency of traffic enforcement might further reduce total deaths, that emphasis of moderate penalties (around three points) is useful, and that past procedures led to some deaths that might not have otherwise occurred.

Our findings extend past research because the individual rather than the region is the unit of analysis

and because each person is their own control rather than using statistical models to adjust for confounding. A meta-analysis of past ecological data implied a 2% risk reduction from manual speed enforcement, a 19% reduction from automated speed enforcement, an 11% reduction from red-light violation enforcement, and a 4% reduction from enforcement of drink-driving laws.[25] The results of individual reports varied even more, presumably because of difficulties in separating the effects of enforcement from publicity campaigns, fallible implementation, statistical artifact, and unmeasured ecological bias.

The major impediment to general traffic-law enforcement is a lack of public support. Unlike when receiving preventive health care, individuals commonly resist convictions with deception or argument.[23,26] Enforcement can reduce civil liberties, disrupt traffic flow, restrict mobility, or have other unintended consequences on quality of life and economic prosperity. Enforcement strategies are also inconsistent, since many drivers have violations, but few are apprehended, and even fewer have malicious intent.[7] Finally, police resources are scarce and apprehending other types of offenders may be a higher societal priority because one murder may draw more attention than the thousands killed daily in motor-vehicle crashes worldwide.

Traffic enforcement has potential indirect effects on health of uncertain importance. A road-safety programme may intercept other unlawful activity because criminals frequently drive to and from their illegal operations, including the traffic of illicit drugs. Visible police presence might deter violent behaviour or stop repeat offenders; for example, the convicted Oklahoma City bomber was apprehended at an incidental traffic stop. In addition, crashes are an economic drain on society—costs are about US$200 billion yearly in the USA[27]—that the public cannot escape because of insurance premiums or other market forces, and that ultimately decreases the funding available for medical care.

Our research has limitations. The intermittent nature of driving and the potential for out-of-region activity leads to spurious positive correlations in case-crossover analysis and causes us to underestimate the risk reduction. Selection bias may cause further underestimation because enforcement targets drivers who are predisposed to crashes and thereby may further obscure potential protective associations.[20,28] Our estimates do not imply that every conviction is effective and do not predict how results might change at extremes of enforcement or with cultural adaptation. Finally, we once more raise the issue of hard-core problem drivers, who drive despite having suspended licences, but we can provide no headway on this issue.[29]

Our research is prone to misinterpretation. We have not assessed other deterrents, such as being charged but not convicted, being stopped but not charged, or being an observer when others are stopped. We have not definitively proved causality, yet a randomised experiment of individual drivers would be very difficult. We have not shown that traffic-law enforcement is the only way to reduce motor-vehicle deaths since gains may also be possible through advances in information, incentives, technology, or culture. We have not tested highly specific questions about road safety because we have limited statistical power and imperfect direct data on alcohol or other disturbances, as is typical in studies of human behaviour.

Our data suggest that about one death is prevented for every 80 000 convictions, one emergency department visit for every 1300 convictions (assuming the benefits apply to crashes of all severity), and $1000 in societal costs for every 13 convictions (including property damage and lost time). The observed 35% relative risk reduction in death is greater in magnitude than the roughly 20% relative risk reduction from all mandatory vehicle improvements of the past 50 years, yet enforcement effects are transient.[3,30] Policies of more frequent enforcement could yield more net savings and could also be revenue neutral if designed efficiently. A small relative risk reduction could immediately prevent a large amount of death, disability, and health-care demands.

Contributors

All researchers contributed to the design, analysis, and reporting of this research. D Redelmeier had full access to all of the data in the study, and bears final responsibility for mistakes.

Conflict of interest statement

D Redelmeier draws income from medical practice at Canada's largest trauma centre, Sunnybrook and Women's. R Tibshirani draws earnings as a member of the advisory board of several companies, none of which is involved in traffic safety. Leonard Evans draws a pension from the General Motors Corporation and has earnings from writing, speaking, and consulting on matters related to traffic safety.

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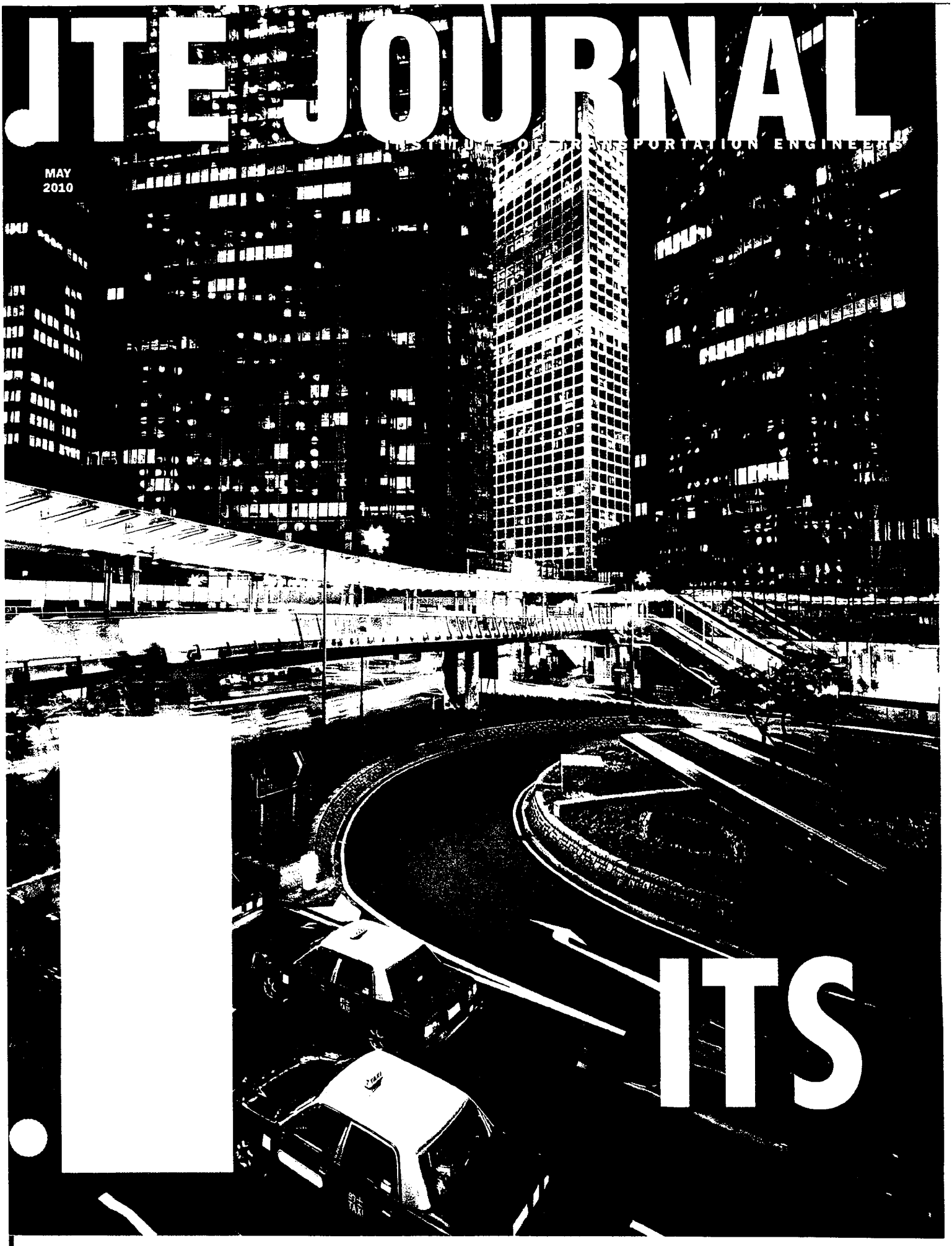

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ATTACHMENT 2

Effectiveness of Red-Light Cameras

WITH RED-LIGHT RUNNING REMAINING ONE OF THE MOST CHALLENGING ENFORCEMENT JOBS, HOW EFFECTIVE ARE RED-LIGHT CAMERAS AT REDUCING THE RATE OF VIOLATIONS? AND EVEN MORE IMPORTANTLY, WHAT EFFECTS DO THEY HAVE ON THE LEVEL AND SEVERITY OF INTERSECTION-RELATED CRASHES? THIS PAPER EXAMINES THE POTENTIAL BENEFITS AND DRAWBACKS OF RED-LIGHT CAMERAS.

BY BRIAN BOCHNER, P.E., PTOE, PTP
AND TROY WALDEN, PH.D.

BACKGROUND

Intersection traffic safety is achieved through a combination of engineering, education and enforcement. This paper addresses only the enforcement component through use of red-light cameras. A comprehensive discussion about the engineering component of signal lights can be found in the *Red-Light Running Handbook: An Engineer's Guide to Reducing Red-Light-Related Crashes.*[1]

Red-light cameras have been used increasingly over the past decade to assist and facilitate enforcement against red-light running at signalized intersections. According to the Insurance Institute for Highway Safety (IIHS), red-light cameras are in use by more than 400 cities in the United States and in at least 22 countries.[2,3]

This paper summarizes the following:

- The purpose of enforcement against red-light running violations;
- Findings from evaluations of the effectiveness of red-light cameras; and
- Conclusions regarding the use of red-light cameras to increase driver adherence to traffic signals.

PURPOSE OF ENFORCEMENT AGAINST RED-LIGHT RUNNING

Enforcement against red-light running violations is an action intended to increase safety by reducing the number of crashes and vehicle conflicts at signalized intersections. An analysis of 1997 U.S. crash data indicated that red-light running crashes accounted for 44 percent of all fatalities at signalized intersections.[4] The city of Toronto, Ontario, Canada, attributes as much as 40 percent of fatalities at its signalized intersections to red-light running.[5] Similarly, statewide in Iowa, about 35 percent of fatal/major injury crashes at signalized intersections between 2001 and 2006 were attributed to red-light running.[6] To understand the importance of enforcement, it is first necessary to understand the safety reasons for which intersections are signalized in the first place.

Purpose of Traffic Signals

Traffic signals are used to assign the right of way to vehicles passing through intersections so conflicting movements (i.e., vehicle paths that cross each other and create crash potential) do not occur. Traffic signals are installed when traffic engineering studies determine that certain conditions (warrants) are met in accordance with the *Manual on Uniform Traffic Control Devices* (MUTCD).[7] Most of the warrants are directly or indirectly associated with preventing conflicts and crashes.

Relationships Between Red-Light Running Violations and Crash Frequency, Severity and Vehicle Conflicts

Traffic signals are installed to separate conflicting traffic movements (called conflicts) through intersections. Those conflicts create crash potential. For example, if a vehicle from each of two crossing streets attempts to enter an intersection at the same time, the paths of the crossing vehicles meet in the intersection and a crash can occur. Figure 1 illustrates the vehicle conflict points that occur within a typical intersection.

Crashes occur when conflicting vehicle movements occur within intersections. Research has shown that the more traffic conflicts that occur, the higher the frequency of crashes. But there is more to the problem of conflicts than just crash frequency. There are different degrees of crash severity. These are most simply characterized as property damage only, injury and fatal crashes. Certain crash types produce a higher degree of severity than others. The two most frequent types of crashes at signalized intersections are angle (vehicle paths from intersecting streets cross each other) and rear-end (one vehicle collides with the vehicle in front of it). Right-angle crashes usually have a higher (more serious) severity than rear-end crashes.

Conflicts lead to crashes. Certain types of crashes produce more serious results. No crash is a good crash, and traffic signals are installed to help prevent conflicts and crashes. Red-light running violations, in addition to being prohibited by state law, are

dangerous to public health and safety. Enforcement of red-light running violations is intended to reduce crashes by reducing vehicle conflicts within intersections.

Purpose of Red-Light Camera Enforcement

Most drivers obey traffic signals all the time. However, some drivers, due to temporary inattention, distractions, poor decision making, or aggressive driving fail to stop for red lights. Those red-light-violating drivers create crash opportunities at the conflict locations shown in Figure 1.

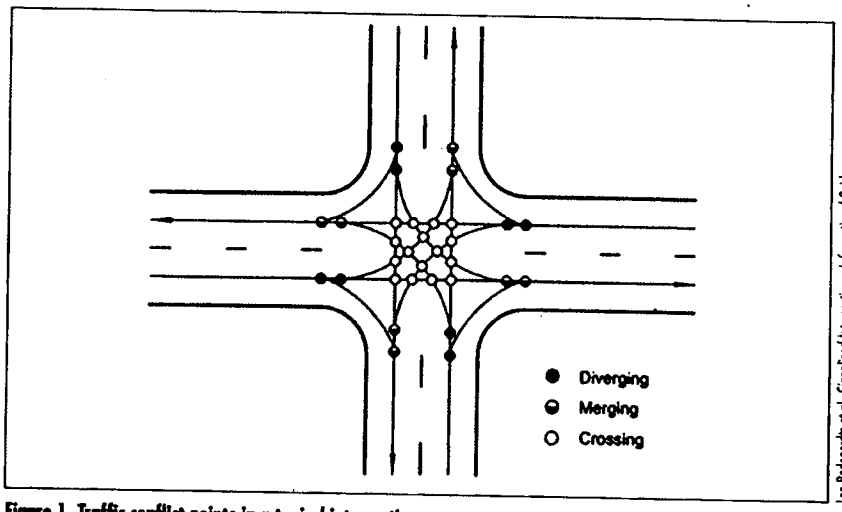
Traffic engineers seek ways to increase compliance with traffic signals at locations where red-light running is higher than normal. Sometimes engineering countermeasures can be used, such as changing signal phasing or timing or modifying signal displays. However, often the problem is driver decision making, and enforcement becomes necessary. The traditional method of enforcement is for police officers to cite violators they observe. This requires police officers to spend their time on the streets and results in an occasional enforcement presence. It also requires police officer time away from other duties.

Red-light cameras were invented to provide more comprehensive enforcement without diverting police officers from other, possibly more important, duties. They are typically used where crashes or violations (which create crash potential) are most frequent. However, they can be used at any signalized intersection. Red-light cameras are normally installed after a traffic engineering evaluation shows that all reasonable and applicable engineering countermeasures have been evaluated and that violations still exist. One advantage of red-light cameras is that they provide continuous coverage and produce a record of the violations that can be reviewed in case of question.

Hence, enforcement by use of red-light cameras is for the purpose of reducing vehicle conflicts and crashes in intersections that experience red-light running violations.

EFFECTIVENESS OF RED-LIGHT CAMERAS

The effectiveness of red-light cameras can be viewed in terms of reductions in crash frequency, crash severity and frequency of red-light running violations. This section provides a cross-section of past findings about the effectiveness of red-light cameras in affecting those three results. It should be noted that, unless otherwise stated, the authors of this summary drew the information from published or Internet summaries and did not have access to the actual data. It also should be noted that many results are based on observations of small numbers of intersections for varying periods and that the intersections may have been selected for red-light camera application based on a variety of existing conditions. Therefore, readers are encouraged to consider general trends and consistency rather than to try to calculate average magnitudes of effectiveness.



Lee Rodegerdts et al., *Signalized Intersections: Informational Guide*, Federal Highway Administration, Washington, DC, August 2004.

Figure 1. Traffic conflict points in a typical intersection.

Crash Frequency

Crash frequency is usually measured in total crashes per year. Some reports separate crashes by whether or not they relate to red-light running or by crash type, usually right-angle or rear-end types.

Crashes at signalized intersections. When a traffic signal is originally installed, one purpose is to reduce right-angle crashes if they make up an inordinately high percentage of the total. It is expected that rear-end crashes may increase if drivers stopping on red are followed too closely by subsequent drivers.

Impact of red-light camera enforcement. Red-light running enforcement is expected to reduce right-angle collisions by virtue of reducing improper entry to the intersection when crossing vehicles are present. At the same time, the additional vehicles stopping when red-light cameras are present may result in an increase in rear-end crashes (or they may not, since drivers should be more cautious and expect drivers in front of them to stop for red).

Numerous studies have been completed to assess the impact of red-light camera enforcement on crash frequency. The examples cited here are before-and-after comparisons at intersections (the only change is the addition of red-light cameras). These provide a good assessment of the impact of red-light cameras since all other factors remain the same. It is assumed that the traffic volumes remain about the same since most data cover 1-2 years before and after installation—in most cases this is rarely enough time for traffic volumes to change significantly.

In one of the most procedurally robust evaluations of red-light camera effectiveness, researchers evaluated 132 sites in seven jurisdictions.[8] Findings included the following:

- Right-angle crashes were reduced by approximately 25 percent overall. Right-angle crashes were reduced by an average of 14 to 40 percent in six of the seven jurisdictions; in one jurisdiction those crashes increased by about 1 percent. Right-angle crashes declined by about 8 percent at other signalized intersections without red-light cameras in the same jurisdictions, indicating that the use of the cameras may produce some effect across the area.

- Rear-end crashes increased in all seven jurisdictions by 7 to 38 percent. The average increase was about 15 percent. At signalized intersections without cameras, the spillover effect was that rear-end crashes increased by about 2 percent.
- The combined total of right-angle and rear-end crashes decreased by less than 1 percent. Total right-angle and rear-end injury crashes declined by about 5 percent.
- The percentage of the respective right-angle and rear-end crashes that resulted in injuries each stayed the same.

Unpublished summaries of Texas Crash Records Information System (CRIS) data for 56 red-light camera-equipped intersections in 10 Texas cities indicate that [9]

- Red-light related crashes decreased by about 17 percent. For red-light related crashes (those attributed to drivers running a red light), six intersections showed decreases, three had increases and one was unchanged. Among the four high-crash locations, three showed decreases and one increased.
- Right-angle crashes declined 18 percent. Right-angle crashes decreased from 67 percent of total crashes before cameras to about 55 percent of the total with camera enforcement.
- Rear-end crashes increased by 56 percent. Only 11 of the 70 (16 percent) rear-end crashes per year before cameras were related to red-light causes. With cameras, 15 of 109 (14 percent) rear-end crashes per year related to red-light causes. Although total rear-end crashes increased, red-light related causes contributed about the same percentage as before cameras.
- Total crashes were virtually unchanged. Total crashes increased at five intersections and decreased at five. Some intersections had very few crashes. However, even among those with more than 20 crashes per year, half showed increases and half showed decreases.

The city of Garland, Texas, USA, compiled 31 months each of before and after data for its six intersections having red-light cameras (one approach each).[10] Two of those intersections are at freeway frontage roads. After adjustment of all data to a monthly basis, the four arterial and one frontage road intersections experienced the following changes:

- Total crashes decreased about 29 percent.
- Red-light running crashes went down 60 percent at the two intersections (down 95 percent on approaches with cameras).
- Rear-end crashes increased by 45 percent.

At the second frontage road intersection, where total traffic increased by almost 50 percent in four years

- Total intersection crashes increased by about 64 percent.
- Red-light running crashes were more than three times as frequent.
- Rear-end crashes declined by about 57 percent (82 percent on camera-equipped approaches).
- Total injuries increased by 29 percent.

The city of Dallas, Texas, installed red-light cameras at 60 sites during the first half of 2007.[11] Preliminary results from data through the beginning of 2009 showed for 17 camera sites with two years implementation that

- Red-light running crashes decreased by an average of about 61 percent (all intersections showing reductions).
- Total crashes were down by 30 percent.

For the other 43 sites with 18 months in place

- Red-light running crashes were down an average of 39 percent (79 percent of intersections have reductions).
- Total crashes were down 23 percent.

Preliminary data obtained from the city of Irving, Texas, indicate that during the first 18 months of operation, red-light camera enforcement resulted in a reduction of total intersection crashes by 56 percent below the 18 months preceding implementation.[12]

IIHS evaluated results of red-light camera effectiveness in Oxnard, California, USA.[13] Eleven of Oxnard's 125 signalized intersections were equipped with red-light cameras. Results reported covered the effects of the cameras on all 125 intersections. They found that

- Total intersection crashes decreased by 7 percent.
- Right-angle crashes decreased by 32 percent.
- Injury crashes declined by about 29 percent.
- Rear-end crashes increased 3 percent.

There was no evaluation focused solely on the red-light camera intersections.

A study of 24 red-light camera intersections in Phoenix and neighboring Scottsdale, Arizona, USA, reported effectiveness of camera enforcement.[14] For 10 intersections in Phoenix

- Total intersection crashes were about unchanged.
- Angle crashes decreased by about 42 percent.
- Left-turn crashes were approximately unchanged.
- Rear-end crashes increased by about 20 percent.

For 14 intersections in Scottsdale

- Total crashes declined by about 11 percent.
- Angle crashes were down by about 20 percent.
- Left-turn crashes declined by about 45 percent.
- Rear-end crashes increased by about 41 percent.

An evaluation of effectiveness of six red-light camera intersections in Mesa, Arizona, another Phoenix area community, showed[15]

- The total crash rate decreased by about 10 percent.
- Half of the intersections experienced small increases in total crashes of 1 to 4 percent while half experienced large decreases (16 to 28 percent).

The same document showed that a North Carolina, USA, study of red-light camera effectiveness in Raleigh and Chapel Hill showed before-and-after comparisons (seven months of after data).

- Red-light related crashes declined by about 32 percent.
- Angle crashes decreased by about 51 percent.
- Total crashes were down by about 30 percent.
- Rear-end crashes increased by an average of about 2 percent.

The researchers cautioned that the seven months of after data might omit some seasonal effects.

The Howard County, Maryland, USA, Traffic Engineering Division reported early results, including that[16]

- Total crashes declined by between 21 and 44 percent at individual camera-enforced intersections.
- Right-angle collisions decreased by an average of 42 percent.
- Rear-end crashes deceased by an average of about 29 percent.

After 10 years of operation with up to 30 camera locations in Howard County[17]

- Total crashes had decreased by 12 to 18 percent (varied by length of service).
- Angle crashes decreased 36 to 57 percent (average 45 percent).
- Rear-end crashes ranged from a long-term 5 percent reduction to shorter-term increases of 2 to 10 percent.

An evaluation of red-light camera experience over 12 to 34 months at 12 intersections in San Diego, California, USA, showed that [18]

- Crashes attributable to red-light running decreased by about 41 percent.
- Rear-end crashes increased by about 37 percent. Rear-end crashes increased at 14 intersections and decreased at five.
- Total crashes increased by about 1 percent. Total crashes declined at 11 of the 19 intersections but increased at the others.
- Right-angle and ran-signal crashes decreased at 12 intersections but increased at two.

Some of the camera-equipped intersections in San Diego had very low crash experience to begin with. One intersection that had about 25 percent of the recorded red-light violations had only 1.5 crashes per year before camera installation. The report cited above referenced a report by the California state auditor that stated that following the introduction of the California red-light camera law

- Crashes attributable to red-light running declined statewide by about 3 percent per month and in cities with red-light cameras those crashes were down 10 percent per month.
- Only one California city showed an increase in red-light running crashes (5 percent).

Finally, the same source stated that following suspension of the San Diego red-light camera program, red-light crashes increased by 14 percent citywide and by 30 percent at former camera intersections.

An evaluation of four to six red-light camera intersections in San Francisco, California, USA, used five years each of before-and-after crash data. The evaluation showed that[19]

- Injury crashes decreased by about 9 percent.
- Fatalities were 50 percent lower (although the numbers are small).

The same source reported that for 17 red-light camera intersections in Baltimore County, Maryland, USA, a comparison of one-year before-and-after crash data showed that

- Total intersection-related crashes decreased by about 57 percent, with 14 intersections experiencing decreases and three experiencing increases.
- Red-light-related crashes decreased by about 21 percent (six intersections decreased, four increased, seven unchanged)
- Injury crashes decreased by about 49 percent (10 intersections had decreases, four had increases, three were unchanged).

The same source also reported an evaluation of Charlotte, North Carolina, USA, experience for 17 red-light camera intersections. There the results were as follows:

- Total intersection crashes were unchanged (10 intersections decreased, seven increased).
- Angle crashes declined by about 37 percent (13 intersections decreased, three increased, one was unchanged).
- Rear-end crashes increased by about 16 percent (six intersections decreased, 10 increased, one unchanged).

On approaches equipped with cameras

- Total crashes decreased about 19 percent (12 approaches decreased, five increased).
- Angle crashed declined by about 60 percent (14 approaches decreased, two increased, one unchanged).
- Rear-end crashes increased by about 4 percent (five approaches decreased, 10 increased, two unchanged).

A report on red-light camera effectiveness in some cities in Georgia, USA, indicated a variety of results from various cities.[20] That report focused on total and rear-end crashes.

- In Rome, where one red-light camera was installed the first year
  - Total crashes decreased by 14 percent.
  - Rear-end crashes decreased by 32 percent.
- In Brunswick (three locations)
  - Rear-end crashes increased by about 70 percent.
- One installation in Duluth showed no clear trend.
- In Snellville, results for two locations showed that
  - Total crashes declined 43 percent at one intersection and increased 2 percent at the other one.
  - Rear-end crashes decreased 36 percent at one and increased 25 percent at the other.
- In Alpharetta, results for two locations showed that
  - Total crashes decreased by about 5 percent.
  - Rear-end crashes increased about 4 percent.

In Seattle, Washington, USA, where red-light cameras were installed on six approaches of four intersections, over the first two years

- Total crashes decreased by 11 percent.
- Angle crashes showed no change.
- There were no red-light-related rear-end crashes.
- Injury crashes decreased by about one-third.[21]

However, the Seattle analysts did not think there were enough data to reach a definite conclusion on effectiveness based on crash frequency.

The city of Calgary, Alberta, Canada, reported in early 2009 that since 2001 when they installed red-light cameras

- Right-angle crashes have decreased at red-light camera locations by about 48 percent.
- Rear-end collisions have dropped by about 39 percent.[22]

A review of 10 controlled before-and-after studies in Australia, Singapore and the United States by The Cochrane Collaboration found that

- Right-angle crashes were reduced by 24 percent.
- There was no significant change in rear-end crashes.[23]

A different canvass of U.S. and international red-light camera evaluations found that

- Angle collisions due to red-light cameras decreased by 10 to 50 percent.
- Rear-end collisions increased from zero to 60 percent.[24]

Crash Severity

Crash severity measures how serious the results of a crash are to those involved. Severity is most often described as a percentage of crashes that involve injuries or fatalities. Sometimes an index is used based on a sliding scale of point values ranging from a high for a fatal crash to a low for no significant damage.

Crash severity at signalized intersections. Some intersection crash types have a higher incidence of injuries and fatalities than others. This results from the angle of vehicle impact and speed of collision. Angle crashes account for more intersection fatalities than any other type (59 percent).[25] They usually involve moderately high speeds and collisions involving the passenger compartment of at least one vehicle. They comprise the majority of red-light running crashes. Rear-end crashes, the other prominent type associated with red-light enforcement, account for only about 4 percent of fatal intersection crashes.

Impact of red-light camera enforcement. In an evaluation of red-light camera effectiveness of 132 sites in seven jurisdictions[26]

- Total of right-angle and rear-end crashes decreased by less than 1 percent.
- Total right-angle and rear-end injury crashes declined by about 5 percent.

The city of Garland, Texas, evaluated four arterial intersections, each with a camera on one approach, and compiled injuries per year before and after implementation.[27] The comparison of 31 month before-and-after periods showed that total injury crashes decreased by about 28 percent. Raw data from Irving, Texas, show that in the first 18 months of red-light camera use, the severity index dropped by 73 percent using a 10-point crash severity scale.[28]

The city of Toronto, Ontario, Canada, reported that red-light cameras resulted in

- Fatal and injury angle crash decrease of about 48 percent.
- Property damage only crash reduction of about 26 percent.[29]

An IIHS review of international red-light camera experience found that with red-light camera enforcement, injury crashes decreased by 25 to 30 percent.[30] Further, a review of 10 controlled before-and-after studies of red-light cameras in Australia, Singapore and the United States showed that total injury crashes decreased by an average of about 16 percent.[31]

Red-Light Violations

Red-light violations result in the possibility that two (or more) vehicles will collide within an intersection. Hence, every red-light running violation creates potential for a crash. Reductions in violations should produce crash reductions, especially in right-angle crashes. However, it is recognized that increased stopping for red lights can cause an increase in rear-end crashes.

The IIHS reported that they found red-light camera enforcement reduces violation rates by about 40 percent.[32] Further, the Garland, Texas, evaluation showed that violations per camera declined by about 56 percent from the first month of implementation to the 31st month.[33] This is about 2.2 percent per month.

In College Station, Texas, the violation rate over the first year of operation for six camera-equipped approaches[34]

- Decreased by about 49 percent; and
- Showed violations by movement type during one four-month period as[35]
  - Through: 50 percent.
  - Right turn: 47 percent.
  - Left turn: 3 percent.

During the first year of red-light camera enforcement, violations were found to have

- Decreased by about 41 percent in Fairfax, Virginia;
- Decreased by over 70 percent in Charlotte, North Carolina;
- Decreased by about 68 percent in San Francisco, California; and
- Decreased by about 92 percent in Los Angeles, California.[36]

During the first year of operation in Georgia

- Violations at one Rome intersection decreased by about 32 percent; and
- Violations at six locations in Alpharetta declined by an average of about 64 percent.[37]

The city of New Orleans, Louisiana, USA, installed red-light cameras at 17 intersections. After seven months of operation, violations dropped by about 85 percent.[38]

The evaluation of red-light camera experience in San Diego showed that at 19 red-light camera intersections

- Violations decreased by a median amount of 3.2 percent per month over 12 to 34 months.
- Violations at 18 of the 19 intersections decreased by at least 2.1 percent per month.
- Violation trend decreases continued throughout the evaluation period, although with a declining rate (32

percent the first year and 54 percent cumulative for two years).[39]

The same evaluation supported confirmed the contention that extension of the yellow change interval will solve most of the red-light running problems; yellow intervals were extended by varying amounts up to about 1.6 seconds, with the result being that

- Violations decreased by 30 to 88 percent with an average of about 50 percent; and
- That still left 50 percent to be addressed by other means, such as enforcement.

Over the first five years of its program involving up to 30 camera locations, Howard County, Maryland, red-light camera citations for red-light running compared violations and found that

- Red-light running citations decreased by 18 to 67 percent.[40]
- Cameras at two locations were retired after daily violations decreased from 114 and 121 to less than three per day each.[41]

A two-year evaluation of red-light camera effectiveness in Seattle, Washington, covered six approaches at four intersections and found that red-light violations decreased by about 44 percent after one year and 59 percent after two years.[42]

A study of red-light camera enforcement in northeastern Virginia compared violation rates between the first and second three-month periods of implementation.[43] It found that red-light camera citations were 21 percent less in the second three months than they had been during the first three.

An international canvass of red-light camera evaluations included violation comparisons for 11 cities. Findings showed that violations declined by between 21 and 75 percent with an average of 46 percent.[44]

The city of Philadelphia implemented a two-phase program to reduce red-light running.[45] First they lengthened the yellow signal interval; then they added six red-light cameras. A study by IIHS found that

- Violations declined by 36 percent with the lengthened yellow interval.
- Red-light camera enforcement reduced the remaining violations by 96 percent.

An IIHS review of international red-light cameras studies revealed that the cameras reduced red-light running violations by 40 to 50 percent.[46] Another IIHS evaluation found that during the first four months of camera use in Oxnard, California, violations declined by about 42 percent.[47]

CONCLUSIONS

The findings described above are the results of many different evaluations performed on differing data of differing sample sizes for differing types of intersections using different evaluation methods. However, the trends are quite clear and undeniable, even if the numerical values may not be fully certain.

If installed at locations with significant red-light running crashes and/or violations, over a group of intersections, red-light cameras

- Substantially reduce red-light violation rates;
- Reduce crashes that result from red-light running;
- Usually reduce right-angle collisions;
- May result in an increase in rear-end collisions;
- May or may not reduce total crashes but rarely result in a substantial increase; and
- Usually reduce crash severity by virtue of reducing the more severe right-angle crashes while sometimes increasing the less severe rear-end collisions.

Red-light cameras are to aid enforcement and should not be considered a substitute for proper traffic engineering of signalized intersections. If a signalized intersection has been analyzed and all reasonably practical measures have been taken to help drivers see the signals, and if red-light running still persists, increased enforcement by red-light cameras or other means will likely be effective. ■

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City of Los Angeles

WENDY GREUEL
CONTROLLER

September 29, 2010

The Honorable Antonio Villaraigosa
The Honorable Carmen Trutanich
Honorable Members of the City Council

The City currently has 32 Photo Red Light cameras, which are designed to cite drivers who break the law by running red lights at intersections throughout Los Angeles. The program's stated primary objective is to improve public safety, by reducing accidents at the City's most dangerous intersections. The LAPD – which oversees the contract along with the City's Department of Transportation (DOT) - has reported that the cameras help to generate millions of dollars for the City, as photo red light violations cost drivers $446 per incident.

The attached audit of the City's Photo Red Light Program (PRLP) found that the program has not been able to document conclusively an increase in public safety due to incomplete data collection. In addition, over the past two years, the City has expended $2.6 million to support the PRLP without full cost recovery. Further, it appears that the red light cameras were not necessarily installed at the City's most dangerous intersections. In fact, the methodology used to select the intersections actually excluded some of the highest risk intersections. This included allowing for at least one red light camera per Council District, weak infrastructure at some locations and not wanting to conduct the additional analyses required for State controlled-locations.

For example the LAPD did not select two intersections – La Brea Avenue & 6th Street, and Hayvenhurst St. & Nordhoff Ave. – where there were a combined 24 accidents and 2 fatalities from 2003-2005. However, they did select Whittier Blvd. and Lorena Street where there were only 2 accidents and no fatalities. If public safety is the number one priority of the PRLP, then the LAPD should select only the most dangerous intersections.

It is important to note that, according to the LAPD, there have been some significant accomplishments of the program. Our audit found that for drivers who dispute their citation through a court trial, less than 1% of the trials end in a "not guilty" verdict. Further, there have been no fatalities at monitored intersections since the current contract was implemented in 2006.

Some of the specific audit findings include:

ATTACHMENT 3

- The PRLP has not conclusively shown to have increased public safety.
    - According to the LAPD's own statistics, 12 of the 32 intersections actually had more accidents after the cameras were activated, 4 had no change and 16 had fewer accidents. However the number of accidents that occurred over the time frame they examined was so small the differences were nearly insignificant.
    - Other factors may have also been responsible for the collisions at the 16 intersections, such as an overall reduction in accidents throughout Los Angeles due to fewer people driving during the economic downturn.

- Rather than choosing PRLP locations based on the highest number of accidents, it appears that other factors including the decision to place at least one camera in every Council District determined where cameras were placed.
    - LAPD and DOT agreed that several political issues were considered in the program implementation. LAPD stated that the City Council "strongly recommended that each {Council} district should have at least one PRL intersection."
    - For some locations, such as City streets that are also State highways (Santa Monica Blvd.), the State requires that an engineering analysis be performed prior to applying for approval of an automated enforcement system. The LAPD believes that the additional time and expense that would be necessary to get approval from the State was not justified for the PRLP. However the California State Auditor said in a July 2002 audit that cities should not omit intersections that require State approval when public safety would benefit.

- Currently the PRLP has cost the City more than $2.6 million to operate over the revenue received.
    - Even though the PRLP costs the City money, not having the cameras would require over 100 motor officers, with combined salaries of more than $10 million to monitor the 32 intersections constantly.

The current PRLP contract is in its final year, and the LAPD is about to issue an RFP to execute a new contract in 2011. It is critical that lessons are learned and improvements are made so that the new contract assures the City's financial interests are protected. In addition, LAPD should ensure effective use of program resources and monitor the program results to maximize public safety.

Sincerely,

Wendy Greuel
City Controller