

Two Decades of Photo Enforcement in the United States: A Brief Summary of Experience and Lessons Learned

PHOTO ENFORCEMENT TECHNOLOGY IS INCREASINGLY USED IN U.S. COMMUNITIES TO SUPPLEMENT TRADITIONAL TRAFFIC ENFORCEMENT METHODS. THIS PAPER PROVIDES A BRIEF OVERVIEW OF DOCUMENTED EXPERIENCE AND LESSONS LEARNED FROM TWO DECADES OF EXPERIENCE WITH RED LIGHT CAMERAS AND SPEED CAMERAS.

BY RICHARD A. RETTING

HISTORY

The first U.S. application of red light cameras (RLCs) was implemented in New York City in 1991.¹ It would be several years before a second program began, in San Francisco, CA following enactment of a statewide RLC law that took effect in 1996. Many other states followed. As of October 2010 an estimated 484 RLC programs were operating in 26 states and Washington, DC (Table 1).² About half of these programs were located in just three states: California, Texas, and Illinois.

The first use of automated speed enforcement (ASE) was implemented in 1987 in Paradise Valley, AZ.³ Since then, the number of U.S. communities using ASE has grown to 69 located in 13 states (Arizona, Colorado, Illinois, Iowa, Louisiana, Maryland, Massachusetts, New Mexico, Ohio, Oregon, South Carolina, Tennessee, and Washington), plus the District of Columbia.² In addition to community use, Illinois and Maryland use ASE statewide in work zones.

Other violations targeted by photo enforcement include motorists passing stopped school buses, obstructing street sweeping, toll violations, and grade crossing violations. Except for automated toll enforcement, these other photo enforcement applications have been limited.

EVALUATIONS

Effects on Violations

RLCs substantially reduce red light violations. Evaluations in Fairfax, VA, and Oxnard, CA, reported reductions of about 40 percent at camera-enforced sites.^{4,5} In addition, violation reductions in both communities carried over to signalized intersections not equipped with cameras, indicating communitywide changes in driver behavior. A significant

Table 1. Red light camera programs by state (as of October 2010).

State	Number of Communities
CA	100
IL	72
TX	63
FL	37
MD	33
MO	32
WA	22
TN	16
GA	15
AZ	13
CO	11
DE	10
OH	10
LA	9
OR	7
NY	6
VA	6
IA	5
NJ	5
NC	4
NM	3
AL	1
DC	1
PA	1
RI	1
SD	1

reduction was reported in the percent of drivers entering more than two seconds after onset red in Raleigh and Chapel Hill, NC.⁶ Camera enforcement in Virginia Beach, VA was associated with a 78 percent reduction in violations.⁷ In Clive, IA, approaches without RLCs experienced

25 times more violations than approaches with cameras.⁸ A Philadelphia, PA study examined incremental effects of lengthening yellow signal timing, followed by use of RLCs.⁹ Increased yellow timing was associated with a 36 percent decline in red light violations. After accounting for effects of longer yellow timing, camera enforcement was associated with an additional 96 percent reduction.

Likewise, evaluations of ASE show large, significant effects on speeds and speed violations. A citywide evaluation of ASE in Washington, DC, found the proportion of vehicles exceeding speed limits by more than 10 miles per hour (mph) declined 82 percent.¹⁰ Evaluations of ASE on a freeway in Scottsdale, AZ reported reductions in average speeds of about 9 mph¹¹ and up to a 95 percent decrease in the odds that drivers would travel more than 10 mph above the 65 mph speed limit.¹² Implementation of ASE on residential streets and school zones in Montgomery County, MD, was associated with about a 70 percent decrease in drivers exceeding speed limits by more than 10 mph.¹³ In Charlotte, NC, the percentage of drivers traveling more than 10 mph above speed limits was 1.55 times higher in the before period than one month after the start of enforcement and 1.23 times higher in the before period.¹⁴ In work zones on Illinois interstate highways, implementation of ASE was associated with reductions in average speeds that ranged from 4.3 to 8.0 mph.¹⁵

Effects on Crashes

RLC programs have been subject to numerous crash-based evaluations, which vary widely in terms of study quality and research methods. Due in part to the diversity of research methods, the studies provide mixed findings of crash effects. Some camera evaluations come from comparisons with intersections without cameras in the same community, while others come from more valid comparisons with intersections outside that community. Some studies control, or attempt to control, for regression-to-mean effects, while others do not. These are important considerations given evidence of spillover effects of photo enforcement and biases associated with use of crash countermeasures at high-crash locations.

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A study in Oxnard, CA examined citywide effects at signalized intersections.¹⁶ Following introduction of RLCs, injury crashes declined 29 percent; front-into-side collisions declined 32 percent overall, and front-into-side crashes involving injuries declined 68 percent. The analysis reported a nonsignificant 3 percent increase in rear-end crashes. In a study sponsored by FHWA that evaluated RLCs in 7 cities, overall, right-angle crashes decreased by 25 percent, and rear-end collisions increased by 15 percent.¹⁷ Results showed a positive aggregate economic benefit of more than \$18.5 million over 370 site years, which translates into a benefit of approximately \$39,000 per site year. 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.

Before-after analysis in two Arizona cities reported decreases in angles crashes, increases in rear-end crashes, and overall economic benefits from the decrease in right-angle crashes.¹⁸ For targeted approaches at 10 intersections in Phoenix, AZ, angle crashes declined 42 percent, left-turn crashes declined 10 percent, rear-end crashes increased 51 percent, and the estimated net

crash benefit was \$4,504/year. For targeted approaches at 14 intersections in Scottsdale, AZ, angle crashes declined 20 percent, left-turn crashes decreased by 45 percent, rear-end crashes increased by 41 percent, and the estimated net crash benefit was \$684,134/year. Analysis in Raleigh and Chapel Hill, NC using matched treatment and comparison sites found total crashes, red light running crashes, angle, and rear-end crashes all decreased by 14 to 35 percent.⁶ Analysis of RLCs in Davenport, IA reported red light running-related crashes decreased by 40 percent at camera-enforced sites and increased by almost 20 percent at controls.⁸

Three additional RLC crash evaluations were identified, but because of methodological problems or limitations are not described in detail in the present paper. A RLC evaluation in Greensboro, NC¹⁹ included two major flaws—the selection of controls that were signalized intersections in the same community, and construction of an erroneous statistical model.²⁰ A 2007 study of six Virginia communities²¹ suffered from problems with the methods of analysis and data quality.²² A before-after study in Fairfax County, VA, was limited by selection of a small number of controls (four) that were signalized intersections in the same community.²³

ASE programs have been subject to more limited crash-based evaluations. Two short-term analyses were identified. A before-after evaluation of nine-month pilot fixed-cameras along Loop 101 in Scottsdale, AZ estimated a 63 percent reduction in single-vehicle crashes, a 48 percent reduction in sideswipe (same direction) crashes, a 26 percent reduction in rear-end crashes, and a 54 percent reduction in total crashes.¹¹ A before-after evaluation of mobile ASE on five targeted corridors in Charlotte, NC estimated a 15 percent reduction in total crashes.¹⁴

CRASH TRENDS

Table 2 provides estimated numbers of nationwide red light running crashes for 1997 to 2007, based on methodology developed by FHWA and IIHS.²⁴ To provide a relatively simple comparison, Table 2 also presents national estimates of total motor vehicle crashes and total injury crashes of all types.²⁵ From 1997 to 2007, the annual estimated number

Table 2. Estimated numbers of nationwide red light running crashes and total crashes.

	Red Light Crashes	Total Crashes	Red Light Running Injury Crashes	Total Injury Crashes
1997	252,000	6,624,000	126,000	2,149,000
1998	227,000	6,635,000	104,000	2,029,000
1999	215,000	6,279,000	107,000	2,054,000
2000	231,000	6,394,000	109,000	2,070,000
2001	219,000	6,323,000	105,000	2,003,000
2002	207,000	6,316,000	101,000	1,929,000
2003	206,000	6,328,000	101,000	1,925,000
2004	196,000	6,181,000	94,000	1,862,000
2005	192,000	6,159,000	93,000	1,816,000
2006	171,000	5,973,000	83,000	1,746,000
2007	186,000	6,024,000	87,000	1,711,000

of red light crashes declined 26 percent, compared to a 9 percent decline in total crashes of all types. The annual estimated number of red light running injury crashes declined 31 percent, compared to a 20 percent decline in total injury crashes of all types. To test for statistical significance in the differences in red light crash frequency between the two periods relative to crashes of all types, the proportion of red light crashes was used. For total crashes, the difference in proportions was 0.007167 with a standard deviation of 0.000102, which translates into a p-value of <0.0001. For injury crashes, the difference in proportions was 0.007784 with a standard deviation of 0.000232, which translates into a p-value of <0.0001. Given the more limited nature of ASE use, nationwide trends in speeding-related crashes were not examined.

PUBLIC OPINION

Studies generally show a majority of drivers support ASE and RLCs. The first such formal study assessed public opinion regarding ASE in Paradise Valley, AZ and Pasadena, CA.³ In both communities, 62 percent of drivers approved of ASE. In Washington DC and Montgomery County, MD, the proportions of drivers in favor of ASE were 51 percent and 62 percent, respectively.^{10, 13} In Scottsdale, AZ, 77 percent of drivers surveyed supported the use of ASE on Loop 101 several months after ASE became operational.¹² For a separate study in which Scottsdale

drivers were asked if they either support or oppose the use of both ASE and RLCs, 77 percent were in support.²⁶

The first formal studies of public opinion regarding RLCs were conducted in Fairfax, VA and Oxnard, CA.^{5, 4} In Fairfax, 84 percent of respondents favored camera use one year after enforcement began; in Oxnard, 80 percent of respondents favored camera use six months after enforcement began. A 2000 survey in 10 cities—five with cameras and five without—reported that more than 75 percent of drivers supported camera enforcement.²⁷ In a survey of drivers in Fairfax County, VA prior to camera installation, 81 percent of respondents favored the use of RLCs in general, and 84 percent favored cameras in high commuter traffic areas.²⁸ A North Carolina study found many focus group participants voiced unequivocal support for automated enforcement, whereas others expressed concerns.²⁹ A survey in five Virginia communities, including some with and without RLC enforcement, found that overall, 66 percent of respondents supported RLCs, and 80 percent said RLCs improve safety.³⁰ A 2002 nationwide survey conducted by the Gallup Organization found that 75 percent of drivers favored the use of RLCs.³¹

MAJOR LEGAL CHALLENGES AND COURT RULINGS

Although no U.S. court has ruled the concept of photo enforcement to be un-

constitutional, some legal challenges have produced judicial findings that negatively affect camera programs. Other rulings have affirmed the legality of photo enforcement. Table 3 briefly summarizes several major legal challenges and court rulings.³² More complete information on these cases, as well as additional legal issues and cases not included in the following summary, can be found at referenced source.

CONCLUSIONS AND LESSONS LEARNED

Numerous studies provide evidence of the effectiveness of photo enforcement in reducing targeted violations and crashes. Studies conducted using appropriate methods generally show that RLC enforcement is associated with large reductions in red light violations and significant reductions in injury crashes, and in some cases, increases in rear-end crashes. ASE can substantially reduce speed violations, and there is some evidence of reduced crashes. But despite evidence of effectiveness of photo enforcement, and relatively high levels of public support, camera programs remain controversial. Media coverage, and increasing use of the Internet as a communication tool, can magnify even moderate levels of opposition to camera enforcement. In light of the controversial nature of RLCs and ASE, the following “lessons learned” are offered from two decades of U.S. photo enforcement experience.

Focus on safety: Like all limited traffic safety resources, photo enforcement should be deployed at locations where safety benefits are likely to be realized. Select enforcement sites based on violations, crash histories, and other safety factors; site selection should be determined by government officials and not photo enforcement vendors; select problem corridors as well as “black spots” for targeted enforcement; and compile documentation regarding the site selection process.

Emphasize fairness in program design and operations: It is important that photo enforcement programs be perceived as fair. Ensure governmental control over all major aspects of camera enforcement, including selection of enforcement sites and final say over which photos result in citations; emphasize deterrence through signing and public information; avoid excessive penal-

Table 3. Major Court Rulings Related to US Photo Enforcement Programs

Legal Issue	Case	Brief Summary
Program control and oversight	State v. John Allen, et al.	San Diego's RLC program was found to violate CA law by allowing a private company to have an excessive role in program operation. The court rejected evidence because of the city's lack of oversight and method of compensation of its contractor. Consequently 292 citations were invalidated. Changes were subsequently made to operation of the program. The court declined to declare unconstitutional the CA law permitting cameras, including a provision that requires registered vehicle owners to identify the drivers. The court allowed the practice of delegating to contractors the screening of photos and referral to police for determination about whether citations should be issued.
Conflict of laws and preemption	State v. Kuhlman	The MN Court of Appeals held that a Minneapolis RLC ordinance was preempted by state law. Minnesota had no state camera enforcement law. The MN Highway Traffic Regulation Act preempts local ordinances that conflict with state law. The court found a conflict existed because both the requirements of state and local law must be uniform. MN law does not permit cities to unilaterally regulate traffic. Consequently, the Minneapolis program was terminated. However, the court emphasized that the decision did not determine the general validity of photo enforcement.
	Shavitz v. City of High Point	Dedication of fine revenue was the subject of litigation between the Guilford County Board of Ed. and the City of High Point, NC. The NC Constitution provides that after deductions up to 10% for collection costs, fine revenue is to be turned over to the county Board of Ed to support public schools. The ordinance provided that after deduction for cost, fine revenue was payable to the City of High Point. The NC Court of Appeals held that proceeds fell under the constitutional provision allocating fines to schools. Consequently, several NC photo enforcement programs were terminated.
	Mendenhall et al. v. City of Akron et al.	The OH Supreme Court held that a municipality does not exceed home rule authority by passing an ordinance authorizing photo enforcement and a civil sanction for violations, provided the municipality does not alter statewide traffic regulations. The court noted photo enforcement supplemented rather than replace traditional enforcement, and that the ordinance specifically stated no photo enforcement citation would be valid if a traditional citation was issued for the same offense.
Presumption	Agomo v. Williams	A DC trial judge upheld the presumption that the driver was the registered owner. The opinion noted that in civil cases, the owner of a vehicle is liable for the negligence of any person driving the vehicle with the owner's consent and that vehicle owners are routinely held liable for parking infractions and abandoned vehicles.
	State v. Dahl	The OR ASE law gives the state the benefit of a presumption that the registered owner is the violator if a civil citation is properly issued to the registered vehicle owner. The presumption was upheld by the OR Supreme Court, noting that a traffic violation is a civil offense.
Decriminalization	Mendenhall et al. v. City of Akron et al., Ohio Supreme Court	The OH Supreme Court ruled that Akron's ordinance imposing a civil, rather than a criminal, sanction for speeding did not conflict with state law. The ordinance does not change the ability of police to cite offenders. After enactment of the ordinance, a person who speeds and is observed by police remains subject to usual traffic laws. Only when no officer is present and the camera captures an infraction does the ordinance apply. The ordinance complements rather than conflicts with state law.
Notice	Agomo v. Williams	Over several months, the plaintiff's vehicle was photographed speeding 16 times in DC. Although the plaintiff received notice and appeared at hearings to contest several citations, the citations were mailed to an address in TX where the vehicle was registered. The court stated it is the obligation of the registered owner to check for mail sent to him.
Delegation of Powers	City of Knoxville v. Kimsey	The TN Court of Appeals held that Knoxville's ordinance permitting contractors to gather and process photos used in camera enforcement is not an improper delegation of police power. Under the contract, private companies gather photos and data, and then a police officer reviews the evidence to determine if a citation should be issued. The contractor's activity was deemed not to constitute an exercise of police powers.

ties and late fees; provide adequate enforcement tolerance levels; and include a variety of stakeholders in the planning and design of enforcement programs.

Get the engineering right: Prior to implementation camera enforcement, consider engineering measures to reduce persistent traffic violations and crashes. Evaluate yellow signal timing, posted speed limits, and other engineering factors related to driver behavior and camera enforcement.

Avoid the appearance of a revenue motive: Avoid “revenue sharing” methods of vendor payment; provide adequate government funding of camera infrastructure and operations to avoid reliance on fine revenue; post traffic signs alerting drivers to the use of photo enforcement; install supplemental plaques on speed limit signs along enforced routes; for the first few weeks of new camera locations, display portable signs in advance of each deployment; and conduct periodic financial audits.

Anticipate and avoid legal setbacks: Court rulings that result in suspension or termination of photo enforcement reinforce the importance of subjecting program development and details to comprehensive legal review. Legal setbacks have largely been in relation to program control and oversight, and preemption of ordinances by state laws. Photo enforcement planning and implementation efforts should include a broad spectrum of state and local law officials, judges, and others with appropriate legal expertise.

Employ effective communications: Provide adequate publicity of camera enforcement to deter violations; conduct intensive public information and education campaigns well in advance of enforcement, and on an ongoing basis; do not rely entirely on earned (free) media for communications.

Evaluate Program Performance and Outcomes: ASE and RLC programs should incorporate procedures to periodically evaluate program performance and outcomes. These include effects on violations, effects on crashes, and public attitudes. Care must be taken to apply appropriate methodological approaches and statistical procedures. Agencies that lack sufficient research expertise should include analysis of program effects by qualified outside researchers. ■

PRIOR TO IMPLEMENTATION CAMERA ENFORCEMENT, CONSIDER ENGINEERING MEASURES TO REDUCE PERSISTENT TRAFFIC VIOLATIONS AND CRASHES.

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