

Effects of red light camera enforcement on fatal crashes in large
US cities

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ABSTRACT

Objective: To estimate the effects of red light camera enforcement on per capita fatal crash rates at intersections with signal lights.

Methods: From the 99 US cities with more than 200,000 residents in 2008, 14 cities were identified that had red light camera enforcement during 2004-08 but not during 1992-96, and 48 cities were identified that did not use red light cameras during either period. The analysis compared the citywide per capita rate of red light running fatal crashes and the citywide per capita rate of fatal crashes at signalized intersections in these two periods, and then the rate changes were compared for cities with and without cameras. Poisson regression was used to model crash rates as a function of red light camera enforcement, land area, and population density.

Results: The average annual rate of fatal red light running crashes declined in both study groups, but the decline was larger for the cities with red light camera programs than for the cities without cameras (35 percent vs. 14 percent). The average annual rate of fatal crashes at signalized intersections decreased by 14 percent in the cities with camera programs and increased slightly (2 percent) in the cities without cameras. After controlling for population density and land area, the fatal red light running crash rates during 2004-2008 in the cities with cameras were estimated to be 24 percent lower than the rates that would have been expected without cameras. The rates of fatal crashes at signalized intersections during 2004-2008 were estimated to be 17 percent lower in the cities with cameras than the rates that would have been expected without cameras.

Conclusions: Red light cameras reduce citywide fatal red light running crash rates and, to a lesser but still significant extent, the rate of fatal crashes at signalized intersections. Cities wishing to reduce fatal crashes at signalized intersections should consider red light camera

enforcement.

INTRODUCTION

More than 2.2 million police-reported motor vehicle crashes occurred at intersections or were intersection-related in the United States in 2009, accounting for about 41 percent of all police-reported crashes. These crashes resulted in 81,112 serious non-fatal injuries and 7,358 deaths. About a third of the deaths occurred at intersections with signal lights (NASS GES, 2009; Fatality Analysis Report System, 2009).

Running a red light is a common traffic violation. A study of traffic at 19 intersections in 4 states found 3.2 red light running events per hour per intersection, on average (Hill and Lindly, 2003). In a national telephone survey conducted in 2010, 93 percent of drivers said it is unacceptable to go through a red light if it is possible to stop safely, but one-third reported doing so in the past 30 days (American Automobile Association Foundation for Traffic Safety, 2010).

The safety consequences of running red lights are considerable. A study of urban crashes found that running red lights and other traffic controls was the most common type of crash (22 percent). Injuries occurred in 39 percent of crashes in which motorists ran traffic controls (Retting et al., 1995). In 2009, 676 people were killed and 113,000 were injured in crashes in which police were able to establish that drivers ran red lights. Sixty-four percent of these deaths were people other than the red light runners, including passengers in the red light running vehicles, occupants of the other vehicles, pedestrians, and bicyclists. Compared to the drivers involved in these crashes who did not violate the signal, the red light runners were more likely to be younger than 30 and male and to have prior crashes, alcohol-impaired driving convictions, and citations for speeding and other moving violations. The violators also were much more likely

to have been speeding or alcohol-impaired at the time of the crash, and less likely to have a valid driver's license (Fatality Analysis Report System, 2009).

A high likelihood of apprehension helps convince motorists to comply with traffic laws, but many enforcement agencies have insufficient personnel to mount effective enforcement programs using traditional police patrols. Red light cameras can supplement traditional methods of enforcement at intersections, including at times of the day and on roads where traditional enforcement can be difficult or hazardous. Studies have found reductions in red light violations of 40-96 percent after the introduction of red light cameras (Retting et al., 1999a, 1999b; Retting et al., 2008), and the reductions occurred not only at camera-equipped sites, but also at signalized intersections not equipped with cameras. A study of the impact of red light camera enforcement on crashes in Oxnard, California, one of the first US communities to employ such cameras, reported significant citywide reductions in crashes at intersections with traffic signals, with injury crashes reduced by 29 percent (Retting and Kyrychenko, 2002). Right-angle collisions — the crash type most closely associated with red light running — at these intersections declined by 32 percent, and right-angle crashes involving injuries fell 68 percent.

Some studies have reported that even as red light cameras reduce front-into-side collisions and overall injury crashes, they can increase rear-end crashes. A study evaluating red light camera programs in 7 communities found a 25 percent reduction in right-angle crashes while rear-end crashes increased 15 percent. Because the types of crashes prevented by red light cameras tend to be more severe and more costly than the additional rear-end crashes that can occur, the study estimated a positive social benefit of more than \$18.5 million in the 7 communities (Council et al., 2005). Not all studies have reported increases in rear-end crashes. The Cochrane Collaboration, an international public health organization, reviewed 10 controlled

before-after studies of red light camera effectiveness. Based on the studies that adjusted for regression-to-the-mean, spillover effects, or both, there was an estimated 13-29 percent reduction in all types of injury crashes, a 24 percent reduction in right-angle injury crashes, and a non-significant 18 percent reduction in rear-end injury crashes (Aeron-Thomas and Hess, 2005).

Cameras have proven to be controversial in some communities in the United States, but the number of communities that use red light cameras increased dramatically from 1992 to 2010 (Figure 1). In 1992, there were no communities using red light cameras. In 2000, only 25 communities used red light cameras. In 2010, 501 communities used them.

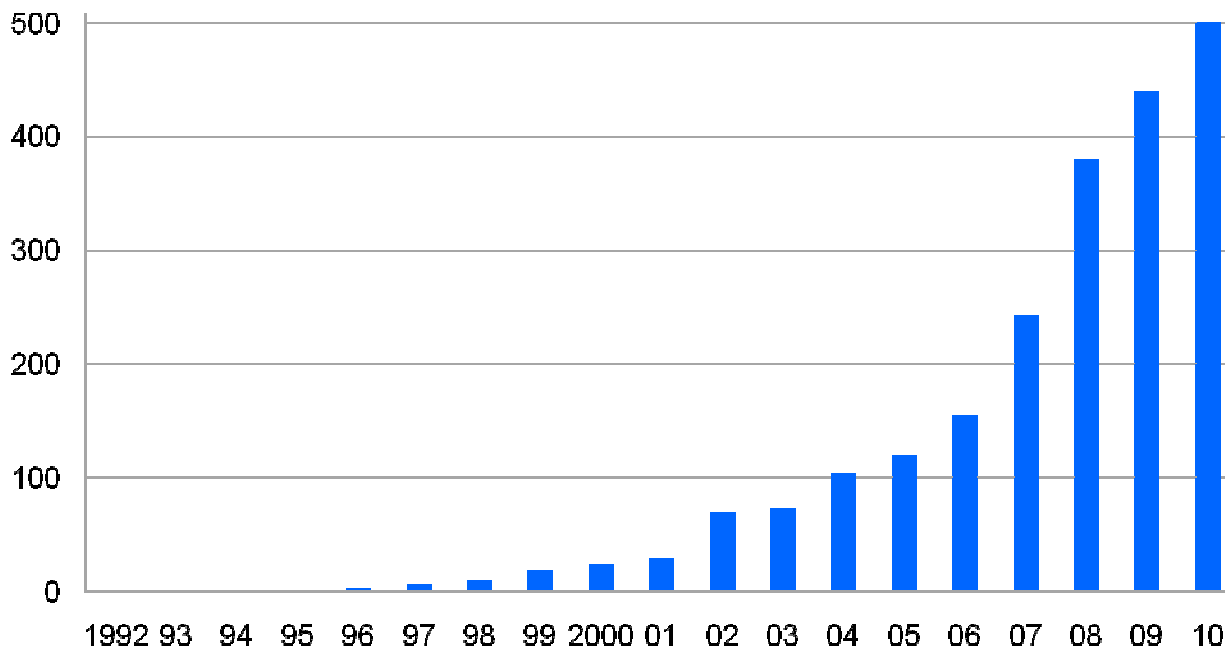


Figure 1. US communities using red light camera enforcement, 1992-2010

Although numerous studies have examined the effects of red light camera enforcement on all crashes or crashes involving injury, few – if any – studies have examined the effects on fatal crashes. The present study evaluated the effect of red light camera enforcement on per capita

fatal crash rates in large US cities. Changes in per capita rates of fatal red light running crashes were compared in cities with and without red light camera enforcement programs. As prior research found citywide effects of red light cameras on all crashes at signalized intersections, the study also examined changes in the rates of all fatal crashes at signalized intersections in these cities.

METHOD

The current study focused on large cities, defined as those with more than 200,000 residents; there were 99 such cities in 2008 (US Census Bureau, 2008). Information on the use of red light cameras in these 99 cities was obtained from news reports and calls to city police departments or public works departments. For cities that had used red light cameras, the program start and end dates were obtained. Other historical information was sought but was not available for all cities, including the counts of cameras and the numbers of signalized intersections over time.

The years 2004-08 represented the “after” study period; these years represented the latest five years for which data on fatal crashes were available. The years 1992-96 represented the “before” study period; very few US communities used red light cameras during these years, as indicated in Figure 1. The 14 cities that used red light cameras during 2004-08 but did not use cameras during 1992-96 constituted the camera group. The 48 cities that did not use camera enforcement during either time period comprised the comparison group. Of the remaining cities, 4 cities began to use red light cameras prior to 1997, and 33 cities used red light cameras for some but not all of the period 2004-08. These 37 cities were excluded from the analyses.

Data on fatal crashes at intersections with signal lights were extracted for 1992-96 and 2004-08 from the Fatality Analysis Reporting System (FARS), which contains detailed

information on all fatal motor vehicle crashes occurring on public roads in the United States (National Highway Traffic Safety Administration, 1992-2008). Fatal red light running crashes were defined as the subset of these crashes that involved a driver traveling straight who was assigned the driver level contributing factor of 'failure to obey traffic control devices.' This definition was developed jointly by the Insurance Institute for Highway Safety and the Federal Highway Administration so that consistent estimates of red-light running crash losses would be produced (Retting, 2006).

Annual population estimates were obtained for each city from the US Census (US Census Bureau, 1997, 2009). For each city in each study period and for each crash measure, the average annual per capita fatal crash rate (crashes per million population) was calculated by summing fatal crashes over the five-year period and then dividing by the sum of the annual population counts. This resulted in two observations (one each for the before and after study periods) per city for the fatal red light running crash rate and for the rate of all fatal crashes at signalized intersections. To study the citywide effect of red light cameras on fatal crash rates, per capita crash rates were computed for each study group for the period 2004-2008, aggregating crashes and population across the cities in each group, and these rates were compared to the rates during 1992-96.

Using the city-specific data, Poisson models were used to more rigorously examine the relationship of red light camera programs and other variables with fatal crash rates. The Poisson models accounted for the covariance structure due to repeated measures, since each independent unit of analysis (city) had two observations (before and after periods). Separate models were developed for the rate of fatal red light running crashes and the rate of all fatal crashes at signalized intersections. Independent variables in the model were population density (thousands

of people per square mile in each study period), land area (in square miles in each study period), study period (after vs. before), and city group (cities that implemented cameras in after period vs. cities that did not implement cameras). Land area was included because large area changes could potentially confound the relationship between camera programs and fatal crash rates. US Census information on cities' land area is available only from the decennial reports (US Census Bureau, 1990, 2000). Therefore, the 1990 land area data were used for the before study period and 2000 data were used for the after study period. The population density during the before study period was calculated as the average annual population during 1992-1996 divided by the 1990 land area, and the population density during the after study period was calculated as the average annual population during 2004-2008 divided by the 2000 land area. An interaction variable for study period and city group tested whether crash trends were different for cities that did or did not implement camera programs. The difference in modeled crash trend between cities that implemented red light camera enforcement and those that did not was taken as the primary measure of effectiveness. It was interpreted as the change in fatal crash rate for cities that implemented red light camera enforcement programs beyond what would have been expected in the absence of these programs. Variables with p-values less than 0.05 were taken as statistically significant.

RESULTS

The 62 study cities accounted for 10 percent of the US population, 14 percent of all fatal red light running crashes, and 15 percent of all fatal crashes at signalized intersections in 2008.

Figure 2 and Figure 3 show the percentage changes in the average annual fatal crash rates in each of the cities with red light camera programs and each of the cities without red light camera programs, respectively. Appendix A provides the detailed population and crash data for

each city. All but two of the 14 cities with red light camera programs experienced reductions in the red light running fatal crash rate; all but three experienced reductions in the rate of all fatal crashes occurring at signalized intersections (Figure 2). Among all but one of the cities with camera programs that experienced reductions in both crash rates, the percentage reductions in the fatal red light running crash rate were larger than the percentage reductions in the rate of all fatal crashes at signalized intersections. Among the 48 cities without red light camera programs, the pattern of changes in crash rates was much more variable. With regard to the rate of fatal red light running crashes, about half of the cities experienced reductions and about half experienced increases. Nineteen of the 48 cities experienced reductions in the rate of all fatal crashes at signalized intersections (Figure 3).

Figure 2: Percent change in average annual per capita fatal crash rates in 14 large cities with red light camera programs, 2004-08 vs. 1992-96

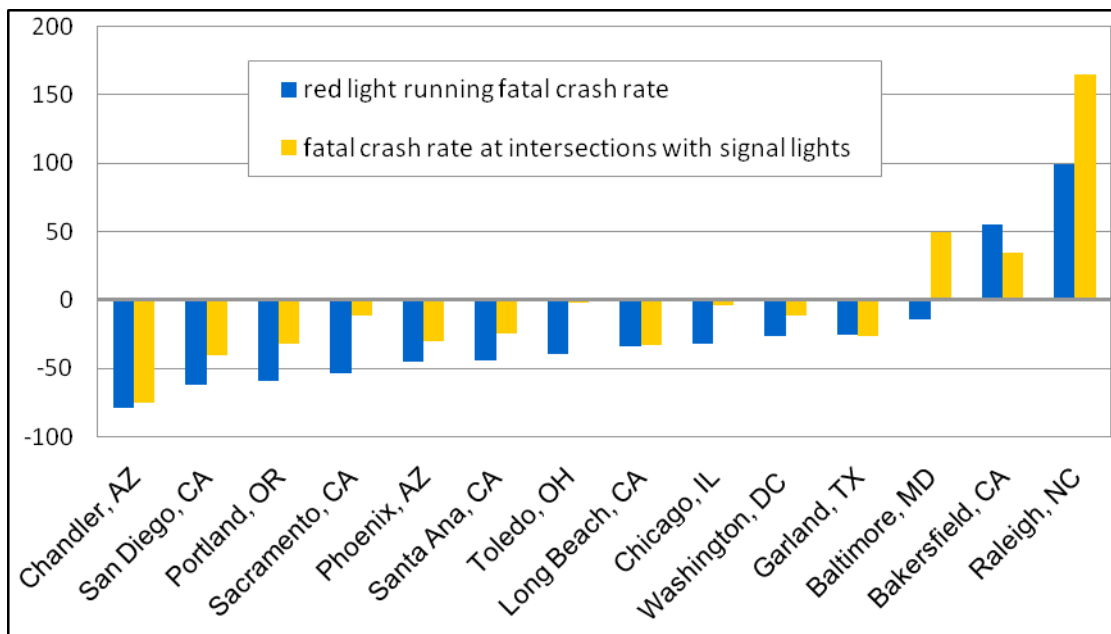


Figure 3: Percent change in average annual per capita fatal crash rates in 48 large cities without red light camera programs, 2004-08 vs. 1992-96

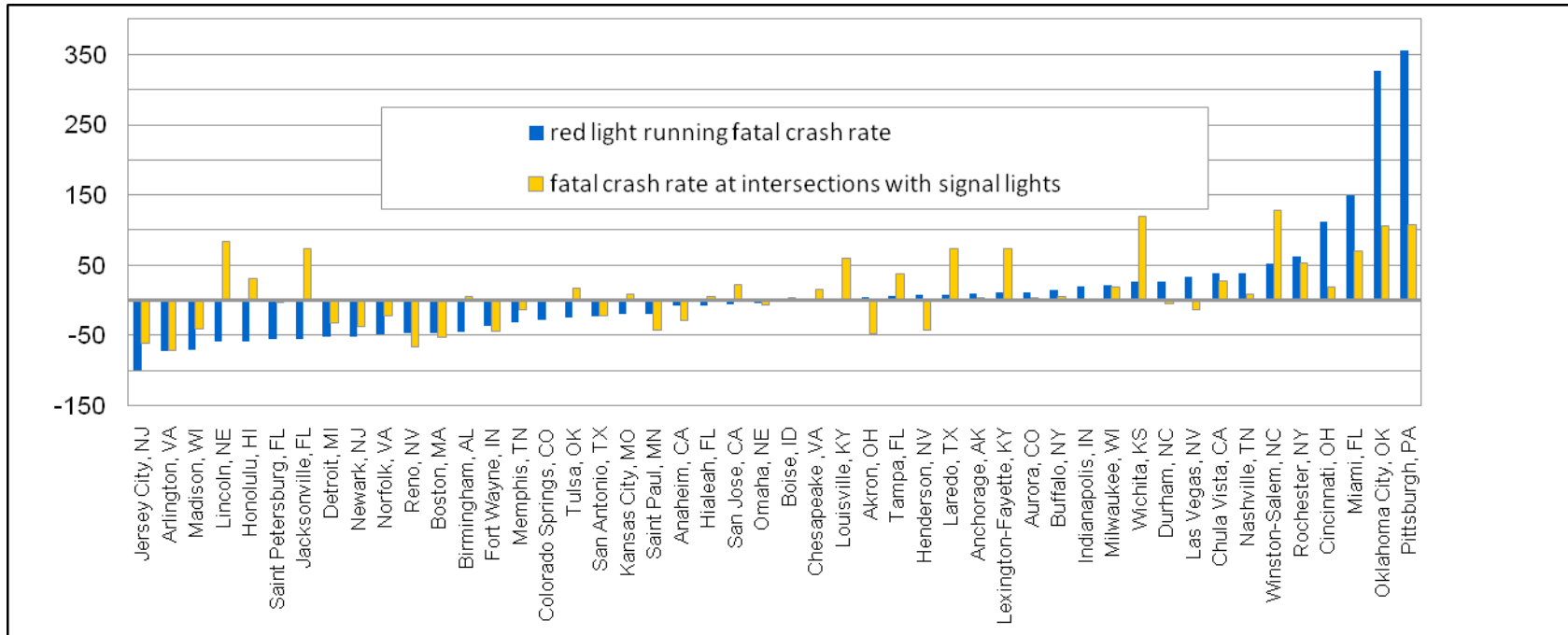


Table 1 shows the combined results for the two study groups. The average annual rate of fatal red light running crashes declined in both study groups, but the decline was larger for the cities with red light camera programs than for the cities without cameras (35 percent vs. 14 percent). In terms of the average annual rate of all fatal crashes at signalized intersections, there was a decrease of 14 percent in the rate for the cities with camera programs and a small increase (2 percent) in the rate for the cities without cameras. For the cities with camera programs, the percentage decline in the annual average rate of fatal red light running crashes was much higher than the decline in the rate of all fatal crashes at signalized intersections (35 percent vs. 14 percent).

Table 1. Average annual per capita rates of fatal red light running crashes and all fatal crashes at signalized intersections for the cities with and without red light cameras, 1992-96 and 2004-08

	14 cities with camera programs			48 cities without camera programs		
	1992-96	2004-08	Percent change	1992-96	2004-08	Percent change
Average annual population (million)	9.02	10.08	11.7	17.07	19.08	11.7
Number of fatal red light running crashes	323	235	-27.2	409	391	-4.4
Number of all fatal crashes at signalized intersections	739	707	-4.3	1112	1266	13.8
Average annual rate of fatal red light running crashes per million population	7.16	4.66	-34.9	4.79	4.10	-14.4
Average annual rate of all fatal crashes at signalized intersections per million population	16.38	14.02	-14.4	13.02	13.27	1.9

Table 2 presents the results of the Poisson model that estimates the effects of red light camera enforcement and other predictors on the per capita rate of fatal red light running crashes. The model found no significant effect associated with land area. After accounting for the effects of the other predictors, the model indicated that an increase in population density in thousands of

persons per square mile reduced the fatal red light running crash rate by an estimated 4 percent ($[\exp(-0.0371)-1]\times 100$), a marginally significant difference. After accounting for the interaction of study period and city group, the crash rates during the before period were an estimated 65 percent higher ($[\exp(0.4998)-1]\times 100$) in the cities that later implemented red light camera programs, compared to the cities that did not. The model estimated a reduction in crash rates from 1992-96 to 2004-08 of 16 percent ($[\exp(-0.1709)-1]\times 100$) in the cities without cameras throughout, and a reduction of 36 percent ($[\exp(-0.1709-0.2809)-1]\times 100$) in the cities that implemented red light camera enforcement. The estimated effect of red light camera enforcement on the rates of fatal red light running crashes was obtained by interpreting the interaction term for study period and red light camera use directly. Based on this parameter, the fatal red light running crash rates during 2004-2008 in the cities with cameras were 24 percent lower ($[\exp(-0.2809)-1]\times 100$) than the rates that would have been expected without cameras.

Table 2. Poisson model of the effects of red light camera enforcement on the average annual per capita rate of fatal red light running crashes

Parameter	Estimate	Standard error	p Value
Intercept	1.7050	0.1547	<0.0001
Land area in square miles	0.0001	0.0003	0.6391
Population density (thousands of persons per square mile)	-0.0371	0.0191	0.0527
After period (2004-08) vs. before period (1992-96)	-0.1709	0.0678	0.0117
Cities that implemented red light cameras vs. cities that did not	0.4998	0.1436	0.0005
Interaction of study period and city group	-0.2809	0.1079	0.0092

Table 3 summarizes the results of the Poisson model that estimates the effects of red light camera enforcement and other predictors on the per capita rate of all fatal crashes at signalized intersections. After accounting for the other predictors, neither land area nor population density

was significantly associated with the crash rate. After accounting for the interaction of study period and city group, the per capita fatal crash rates at signalized intersections during the before period were an estimated 32 percent higher ($[\exp(0.2812)-1]\times 100$) in cities that implemented red light camera programs later, compared to the cities that did not. With regard to the estimated change in the crash rate from 1992-96 to 2004-08, the model found only a minimal change in fatal crash rate in the cities without cameras, whereas an estimated reduction of 16 percent was found in the cities with cameras ($[\exp(0.0112-0.1822)-1]\times 100$). Based on the interaction term for study period and red light camera use, the actual per capita fatal crash rates at signalized intersections during 2004-2008 in the cities with cameras were 17 percent lower ($[\exp(-0.1822)-1]\times 100$) than the rates that would have been expected without cameras.

Table 3. Poisson model of the effects of red light camera enforcement on the average annual per capita rates of all fatal crashes at signalized intersections

Parameter	Estimate	Standard error	p Value
Intercept	2.5994	0.1314	<0.0001
Land area in square miles	0.0002	0.0002	0.3805
Population density (thousands of persons per square mile)	-0.0187	0.0160	0.2428
After period (2004-08) vs. before period (1992-96)	0.0112	0.0564	0.8426
Cities that implemented red light cameras vs. cities that did not	0.2812	0.1284	0.0285
Interaction of study period and city group	-0.1822	0.0914	0.0462

The land areas of 19 of the 62 study cities (4 of the camera cities and 15 of the non-camera cities) increased by more than 10 percent from 1990 to 2000. Additional Poisson regression models were run that excluded these cities. The results changed little.

DISCUSSION

Red light running is a frequent traffic violation and the safety consequences have been established. Enforcing red light laws is important, but many communities do not have the resources for police to patrol intersections as often as would be needed to ticket most motorists who run red lights. Traditional police enforcement also poses special difficulties for police, who in most cases must follow a violating vehicle through a red light to stop it. This can endanger motorists and pedestrians as well as officers.

Before/after studies in communities that have implemented red light camera enforcement have found reductions in red light running, not only at intersections with cameras but at other signalized intersections without cameras (Retting et al., 1999a, 1999b), and citywide crash reductions at signalized intersections (Retting and Kyrychenko, 2002). The current study extends this research by examining the effects of red light camera programs on fatal crashes in large cities. Based on Poisson regression modeling, red light camera programs were associated with statistically significant citywide reductions of 24 percent in fatal red light running crash rates and 17 percent in the rate of all fatal crashes at signalized intersections, when compared to the rates that would have been expected without cameras. The larger effect of cameras for fatal red light running crashes would be expected because these are the crashes targeted by cameras. The significant reduction in the all types of fatal crashes at signalized intersections indicates that cameras have a generalized effect on motorists' behaviors at intersections that extends beyond running red lights.

Other factors also were found to influence fatal crash rates. Higher population densities were associated with lower fatal crash rates. A possible explanation is that denser populations generally lead to lower traveling speeds and thus fewer fatal crashes (Cerrelli, 1997). Fatal crash

rates during the baseline period were higher in cities that subsequently implemented red light camera programs than in cities that did not implement camera programs. It is to be expected that cities with larger red light running problems should have been more likely to implement red light camera enforcement.

Several limitations of the study are worth noting. The definition of red light running crashes excluded some crashes, such as those involving a driver making an illegal turn on red. Other factors not considered may have influenced fatal crash rates in these cities but could not be examined due to limitations in the data. Although attempts were made to obtain historical information on the number of red light cameras in the study cities, information on the scope of red light programs could not be obtained for many of the cities. Historical information also was sought on the number of signalized intersections but was unavailable in many cities.

Red light cameras are not the only countermeasure for reducing crashes at signalized intersections. Converting traditional intersections to roundabouts eliminates the need for traffic signals as well as cameras. It has been reported that conversion of traditional intersections to roundabouts reduces fatal crashes by 81-90 percent, injury crashes by 25-87 percent, and overall crashes by 37-61 percent (Federal Highway Administration, 2000; Persaud et al., 2001; Schoon and Minnen, 1994; Troutbeck, 1993). However, it is not feasible to replace every traffic light with a roundabout, and not every intersection is appropriate for a roundabout. Better enforcement of traffic signals using cameras is a solution that can quickly be implemented on a large scale.

In tallying the costs and benefits of camera enforcement, communities should factor in the considerable social and economic benefits of successfully reducing crashes. Besides foregone medical costs, car repair bills, travel delays, and lost income, citizens in communities with

cameras experience direct savings in terms of reduced police time to investigate and report crashes, lessened need for emergency response service, and lower roadway cleanup costs.

National surveys of drivers and surveys conducted in cities with and without red light cameras have found that a large majority support red light camera enforcement (Retting and Williams, 2000; NHTSA, 2004; Garber et al., 2005). Despite the widespread support and the safety benefits of red light camera enforcement, cameras remain controversial in some communities where opponents raise concerns about “big brother” government tactics and claim that violators are victims of revenue-generating government schemes. In the current study the cities that implemented red light camera programs had higher baseline crash rates, suggesting that government officials were motivated by safety concerns. Although automated traffic enforcement is not a panacea, the current study adds to the large body of evidence that red light cameras can prevent the most serious crashes. This evidence should be considered by communities seeking to reduce crashes at intersections.

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Appendix A: Population, crash counts, per capita crash rates, and changes in per capita crash rates in each study city for fatal red light running crashes and all fatal crashes at signalized intersections, 2004-2008 vs. 1992-1996

	Average annual population		Fatal red light running crashes					All fatal crashes at signalized intersections				
			5-year total crash counts		Annual crash rate per 100,000 population		Percent change in crash rate	5-year total crash counts		Annual crash rate per 100,000 population		Percent change in crash rate
	1992-96	2004-08	1992-96	2004-08	1992-96	2004-08		1992-96	2004-08	1992-96	2004-08	
Cities with red light camera programs												
Bakersfield, CA	203,797	301,102	7	16	0.69	1.06	55	14	28	1.37	1.86	35
Baltimore, MD	699,943	640,054	14	11	0.40	0.34	-14	32	44	0.91	1.37	50
Chandler, AZ	119,198	241,729	7	3	1.17	0.25	-79	16	8	2.68	0.66	-75
Chicago, IL	2,799,671	2,824,206	69	47	0.49	0.33	-32	175	170	1.25	1.20	-4
Garland, TX	187,241	215,403	7	6	0.75	0.56	-25	13	11	1.39	1.02	-26
Long Beach, CA	430,595	464,451	14	10	0.65	0.43	-34	32	23	1.49	0.99	-33
Phoenix, AZ	1,098,702	1509,114	100	76	1.82	1.01	-45	197	190	3.59	2.52	-30
Portland, OR	497,777	541,682	18	8	0.72	0.30	-59	42	31	1.69	1.14	-32
Raleigh, NC	241,617	364,026	3	9	0.25	0.49	99	6	24	0.50	1.32	165
Sacramento, CA	400,480	452,320	15	8	0.75	0.35	-53	24	24	1.20	1.06	-11
San Diego, CA	1,161,107	1,291,335	26	11	0.45	0.17	-62	76	51	1.31	0.79	-40
Santa Ana, CA	298,297	336,783	11	7	0.74	0.42	-44	21	18	1.41	1.07	-24
Toledo, OH	322,241	316,835	10	6	0.62	0.38	-39	25	24	1.55	1.51	-2
Washington, DC	563,014	584,461	22	17	0.78	0.58	-26	66	61	2.34	2.09	-11
Cities without red light camera programs												
Akron, OH	218,976	209,668	2	2	0.18	0.19	4	8	4	0.73	0.38	-48
Anaheim, CA	282,074	330,345	12	13	0.85	0.79	-7	24	20	1.70	1.21	-29
Anchorage, AK	249,365	278,125	9	11	0.72	0.79	10	20	23	1.60	1.65	3
Arlington, VA	173,359	202,500	3	1	0.35	0.10	-71	9	3	1.04	0.30	-71
Aurora, CO	242,283	303,791	5	7	0.41	0.46	12	17	22	1.40	1.45	3
Birmingham, AL	256,388	231,578	14	7	1.09	0.60	-45	25	24	1.95	2.07	6

Boise, ID	154,806	201,372	0	1	0.00	0.10	N/A	3	4	0.39	0.40	3
Boston, MA	553,977	617,749	5	3	0.18	0.10	-46	21	11	0.76	0.36	-53
Buffalo, NY	316,662	275,641	4	4	0.25	0.29	15	26	24	1.64	1.74	6
Chesapeake, VA	179,792	217,583	0	2	0.00	0.18	N/A	5	7	0.56	0.64	16
Chula Vista, CA	146,629	211,660	2	4	0.27	0.38	39	6	11	0.82	1.04	27
Cincinnati, OH	352,050	332,341	2	4	0.11	0.24	112	8	9	0.45	0.54	19
Colorado Springs, CO	315,112	395,544	11	10	0.70	0.51	-28	27	34	1.71	1.72	0
Detroit, MI	1,007,094	918,776	46	20	0.91	0.44	-52	111	68	2.20	1.48	-33
Durham, NC	160,985	211,713	3	5	0.37	0.47	27	8	10	0.99	0.94	-5
Fort Wayne, IN	200,085	251,663	5	4	0.50	0.32	-36	14	10	1.40	0.79	-43
Henderson, NV	86,311	239,939	1	3	0.23	0.25	8	5	8	1.16	0.67	-42
Hialeah, FL	204,090	220,141	3	3	0.29	0.27	-7	21	24	2.06	2.18	6
Honolulu, HI	390,745	374,348	5	2	0.26	0.11	-58	27	34	1.38	1.82	31
Indianapolis, IN	745,367	793,282	18	23	0.48	0.58	20	48	51	1.29	1.29	0
Jacksonville, FL	664,626	795,745	13	7	0.39	0.18	-55	38	79	1.14	1.99	74
Jersey City, NJ	229,201	237,973	4	0	0.35	0.00	-100	15	6	1.31	0.50	-61
Kansas City, MO	434,600	469,728	15	13	0.69	0.55	-20	33	39	1.52	1.66	9
Laredo, TX	152,870	210,741	2	3	0.26	0.28	9	5	12	0.65	1.14	74
Las Vegas, NV	334,750	550,914	10	22	0.60	0.80	34	33	47	1.97	1.71	-13
Lexington, Fayette, KY	236,005	283,144	6	8	0.51	0.57	11	13	27	1.10	1.91	73
Lincoln, NE	204,472	244,961	4	2	0.39	0.16	-58	5	11	0.49	0.90	84
Louisville, KY	670,350	706,926	17	18	0.51	0.51	0	28	47	0.84	1.33	59
Madison, WI	204,138	226,575	3	1	0.29	0.09	-70	9	6	0.88	0.53	-40
Memphis, TN	619,267	680,035	36	27	1.16	0.79	-32	73	69	2.36	2.03	-14
Miami, FL	362,845	407,606	5	14	0.28	0.69	149	35	67	1.93	3.29	70
Milwaukee, WI	606,704	602,397	14	17	0.46	0.56	22	37	44	1.22	1.46	20
Nashville, TN	502,398	585,422	8	13	0.32	0.44	39	34	43	1.35	1.47	9
Newark, NJ	271,809	276,721	12	6	0.88	0.43	-51	39	25	2.87	1.81	-37
Norfolk, VA	246,229	237,800	4	2	0.32	0.17	-48	8	6	0.65	0.50	-22
Oklahoma City, OK	459,474	539,146	1	5	0.04	0.19	326	12	29	0.52	1.08	106

Omaha, NE	371,308	437,344	15	17	0.81	0.78	-4	29	32	1.56	1.46	-6
Pittsburgh, PA	358,173	314,869	1	4	0.06	0.25	355	12	22	0.67	1.40	109
Reno, NV	148367	209923	4	3	0.54	0.29	-47%	19	9	2.56	0.86	-67%
Rochester, NY	225,908	209,022	2	3	0.18	0.29	62	12	17	1.06	1.63	53
Saint Paul, MN	262,938	277,799	7	6	0.53	0.43	-19	13	8	0.99	0.58	-42
Saint Petersburg, FL	237,878	246,461	13	6	1.09	0.49	-55	28	28	2.35	2.27	-3
San Antonio, TX	1,068,009	1,292,560	27	25	0.51	0.39	-23	68	64	1.27	0.99	-22
San Jose, CA	813,785	921,760	13	14	0.32	0.30	-5	29	40	0.71	0.87	22
Tampa, FL	283,464	330,769	8	10	0.56	0.60	7	26	42	1.83	2.54	38
Tulsa, OK	376,458	383,293	9	7	0.48	0.37	-24	15	18	0.80	0.94	18
Wichita, KS	322,887	358,229	5	7	0.31	0.39	26	9	22	0.56	1.23	120
Winston, Salem, NC	167,987	220,383	1	2	0.12	0.18	52	2	6	0.24	0.54	129