Red Light Running in Iowa

The Scope, Impact, and Possible Implications

Crashes related to red light running account for more than 800 deaths and thousands of injuries each year in the United States. Many states and local jurisdictions have undertaken studies and enacted programs in reaction to this major transportation safety concern. This research study examined the scope of this phenomenon in Iowa, reviewed red light running reduction studies and programs nationwide, and proposed countermeasures to address significant violation problems.

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INTRODUCTION

Driver noncompliance with traffic control devices in the form of red light running is a serious violation with potentially hazardous implications. Every year drivers in the United States are involved in approximately 260,000 red light running crashes, resulting in about 800 fatalities and 150,000 injuries.[1] Injuries occur in 45 percent of all red light running crashes, whereas only 30 percent of all other crash types result in injuries.[2] Fatalities associated with red light running often involve innocent drivers and pedestrians since this crash type often occurs suddenly and unexpectedly.

Motorists' disregard for red lights at signalized intersections has become an increasingly common problem in many Iowa cities. A major objective of this research was to evaluate the impact and scope of this practice in the state of Iowa. This was achieved through a three-part effort:

1. Field recordings of actual traffic signal violations at intersections in selected Iowa communities using specially designed video cameras provided an insight into the scope of incidence in these locations.

2. Analysis of crash records from Iowa's extensive Accident Location and Analysis System resulted in a compilation of the factual impacts of red light running on the lives and well being of Iowans.

3. Surveys taken of selected professional groups and the general public revealed significant concern about this potentially dangerous practice and good support for automated enforcement measures in Iowa.

This study found an occurrence of signal violations with significant impacts in Iowa, most notably in crash histories.

This project also included an examination of programs and related studies undertaken in other states to counter the phenomenon of red light running. A considerable volume of data on automated enforcement equipment used successfully in mitigation efforts nationwide was obtained and reviewed. Potential benefits and concerns regarding automated enforcement and enabling legislation, if undertaken in Iowa, are described in the report. In addition to the use of cameras to detect violators, this research also identified and described several other countermeasures that local communities can apply to confront a high incidence of signal violations.

Potential benefits from this research effort include an increased awareness of this practice, familiarization with available mitigation tools, and changed driver behavior that will result in safer conditions in Iowa's communities. The reader is invited to fully review this summary as well as the complete research report to gain a better understanding of the scope and effects of red light running in this state.

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IMPACT AND SCOPE IN IOWA

Signal Violation Observations in Iowa

As part of the effort to assess the scope and impact of red light running in Iowa, 12 intersections in seven cooperating Iowa communities were selected for data collection. Selected sites offered a variety—in location, traffic volumes, and geometry—of observation conditions.

Camera Selection and Operation
The Iteris wireless Vantage camera, distributed by Brown Traffic Products, Inc., Davenport, Iowa, was selected for use in this research. The Vantage camera provides videotaping capabilities and excellent mobility. Two Vantage cameras with supporting equipment were purchased. The vendor, Brown Traffic Products, Inc., was responsible for installation, transportation, and maintenance of the cameras at the 12 selected intersections.

The two cameras were synchronized with traffic signals to detect red light running violations. One camera was usually mounted on a street light mast arm, and the other was attached to a traffic signal mast arm. The street light camera recorded the signal operation of an intersection approach, and the other camera recorded vehicles approaching the intersection's stop line (called the stop bar). The video output from each camera was combined in a split-screen format. The cameras communicated with the traffic signal controller to synchronize video recording with signal phasing. All approaching traffic during the yellow and a portion of the red phases was recorded. Data were collected on videotape over a period of several days at each site.

Red Light Violation Data
The initial observation process anticipated that the participating vendor, Brown Traffic Products, would provide a summary of the number and time of occurrence for violations at each intersection using an automatically generated report system. Brown Traffic Products furnished this summary information from the initial locations; however, the data were found to be inconsistent with manual tape observations. With normal traffic flows, the capacity of the report was filled much more quickly than local staff could retrieve the tapes and reset the counters. For these and other reasons, it was necessary to actually view the tapes to obtain the data.

The videotapes were reviewed, and the time and number of red light running violations were recorded. A red light violation was defined as the movement of a vehicle across the stop line after the signal phase changed from yellow to red. Vehicles passing over the stop line as the traffic signal changed from yellow to red were not identified as violators. Data were summarized in tables for each intersection. Red light running violations for all selected intersections are summarized in Table 1.

To more completely analyze the phenomenon of traffic signal violations, it may be useful to consider when the highest level of incidence occurs and from that deduce possible contributing factors. To that end, data gathered in the incidence measurement effort were summarized into time of day and day of week. The analysis indicates a higher level of incidence on weekdays and from 3:00 p.m. to 5:00 p.m. daily. It appears that indeed driver frustration and impatience may be important factors in signal violations during these periods.

Table 1 Summary of Violation Data

Intersection	Leg(s) Inspected	Duration (hours)	Traffic Volume*	Number of Violations	Violations per Hour	Violations per Volume**
Bettendorf:						
I-74 off ramp and State St.	I-74 N off ramp	118	14,400	196	1.66	2.77
53d St. and 18th St.	N bound of 18th St.	112	6,500	56	0.50	1.85
Davenport::						
Kimberly Rd. and Brady St.	N bound of Brady St.	126	20,700	284	2.25	2.61
Co. Rd. Y-48 and U.S. 61***	E bound of U.S. 61	51	5,900	8	0.16	0.64
Dubuque:						
Locust St. and Dodge St.	E to N left-turn lane of Dodge St.	65	6,100	636	9.78	38.50
JFK Rd. and Pennsylvania Ave.	N bound of JFK Rd.	76	7,100	73	0.96	3.25
14th St. and Central Ave.	E bound of 14th St.	94	5,700	10	0.11	0.45
Fort Dodge:						
Ave. O and U.S. 169****	N bound of U.S. 169	152	3,000	14	0.09	0.74
Iowa City:						
IA 1/U.S. 6 and Riverside Dr.	S bound of Riverside Dr.	77	12,400	242	3.14	6.08
Sioux City:						
14th St. and Douglas Ave.	E bound of 14th St.	101	4,500	15	0.15	0.79
14th St. and Douglas Ave.	W bound of 14th St.	101	6,900	20	0.20	0.69
U.S. 75 and 18th St.	S bound of U.S. 75	86	10,300	193	2.24	5.23
West Des Moines:						
35th St. and University Ave.	N bound of 35th St.	148	9,600	103	0.70	1.74

*Traffic volumes for the observed intersection legs were obtained from the Iowa Department of Transportation (Iowa DOT), the City of Bettendorf, or the City of Sioux City or were calculated using Iowa DOT factors.
**Volume is per 1,000 entering vehicles.
***Only footage captured at night was analyzed.
****Some cycles were omitted because of poor tape quality.

Iowa Red Light Crash Records

The Accident Location and Analysis System (ALAS) contains the location and characteristics of all recorded crashes in Iowa's recent history. The research team queried ALAS for crashes with a "ran traffic signal" notation for the years 1996–1998.

A ran-traffic-signal notation on a crash report generally requires a witness at the scene or the admission of guilt by the party involved in the collision. Therefore, representing red light running crashes only through ran-traffic-signal noted reports probably underestimates the extent of red light running effects at a given intersection; the data are thus considered "true but underestimated."

Table 2 presents the total number of fatalities, personal injuries, and property damage only (PDO) due to ran-traffic-signal crashes for each of the study jurisdictions as well as for the entire state of Iowa. Using nationally accepted cost values for fatalities and injuries, Table 2 also includes total dollar losses in each jurisdiction and the entire state.

A more extensive review of ALAS records has revealed that ran-traffic-signal crashes have occurred in most Iowa cities over the past several years of record, with a quite significant incidence noted in several larger communities.

Table 2 Summary of Costs Linked to Ran-Traffic-Signal Crashes (1996–1998)

Jurisdiction	Fatalities	Injuries*	PDO**	Total Crashes	Total Costs
Bettendorf	0	86	68	129	$1,691,487
Davenport	1	583	279	637	$11,752,603
Dubuque	0	202	65	190	$3,115,509
Fort Dodge	0	84	62	122	$1,198,732
Iowa City	0	150	125	235	$2,364,738
Sioux City	1	322	146	335	$5,369,499
West Des Moines	0	126	70	154	$1,196,000
State of Iowa	12	5,881	3,435	7,138	$110,428,000

* Total injuries.
** Number of property damage only crashes; some jurisdictions do not report all PDO crashes.

Iowa Public Perception Surveys

The use of cameras can be effective in identifying violations, but the use of photographic evidence to cite violators is a controversial issue. Some people believe that having their picture taken while traveling in their vehicles is a violation of their right to privacy. Some legal experts, on the other hand, have argued that automated enforcement programs do not violate a citizen's legal right to privacy as drivers are clearly visible to the public and thus photographing them is not a violation of their privacy.[3]

Regardless, the use of red light cameras has received a high degree of public acceptance nationally. In some jurisdictions, up to 80 percent of the public favors the use of red light cameras.[1] In a nationwide telephone survey, 66 percent of 1,006 people surveyed said they accept the implementation of red light camera systems.[2] As part of the research presented here, two types of surveys were conducted to examine Iowa residents' views with respect to red light running and the possible adoption of automated enforcement in Iowa.

Survey of Professional Groups

The research staff at the Center for Transportation Research and Education (CTRE) gathered input on red light running issues from Iowa professionals selected for potential interest in this topic. The surveys were distributed to 1,710 professionals representing five groups: (1) engineers/administrators, (2) emergency care professionals, (3) driver educators, (4) law enforcement personnel, and (5) Iowa DOT staff. Members of each group were sent a survey that contained questions specific to their professional background and experiences. Because of the small sample of Iowa DOT professionals surveyed, this group's responses were not tabulated in the final data.

Survey of General Population

The second survey, developed at the University of Northern Iowa's (UNI) Center for Social and Behavioral Research, sought to gather opinions and experiences from the general population concerning red light running safety issues. The survey was conducted through telephone interviews of a statistically valid population of Iowa residents at least 18 years of age. Respondents were contacted using a random-digit dialing method. A total of 4,078 telephone numbers were dialed and yielded 1,008 completed interviews. To assure random sampling within each household, interviewers asked to speak with an adult with the most recent birthday.

Survey Results

There is substantial indication that both the selected professional groups and Iowa's general population view red light running as a serious problem in their communities (see Figures 1 and 2). Responses from the surveys agree and indicate that support exists for enabling legislation permitting red light cameras to be used to help reduce red light running (see Figures 3 and 4).

The type of penalty applied with an automated enforcement program can be controversial. Responses to the surveys indicate that opinions on this issue are mixed. Survey participants were asked whether they prefer red light running violations identified with cameras to be cited as civil or criminal. Three out of the four professional groups in the CTRE survey indicated a preference for criminal citations. Responding emergency care professionals preferred civil citations. Support for civil citations is also indicated by results from the UNI survey, which showed 56.1 percent of the general public prefers civil citations.

YES NO Left Blank (Figures 1 and 3)/Don't Know (Figures 2 and 4)

Figure 1 Selected professional response to the question "Is red light running a serious safety problem in your community?"

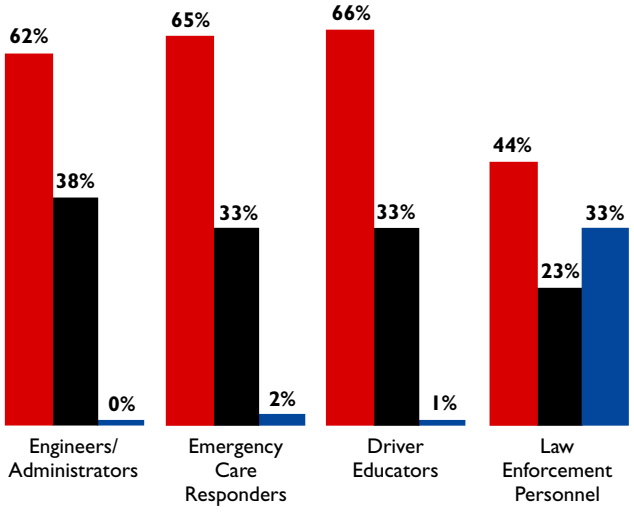


Figure 2 Iowa public response to the question "Is red light running a serious and dangerous practice in your community?"

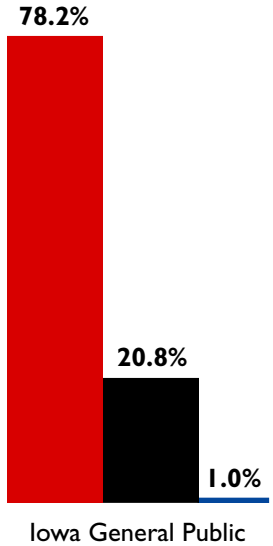


Figure 3 Selected professional response to the question "Would you support legislation permitting the issuance of citations based on automated enforcement?"

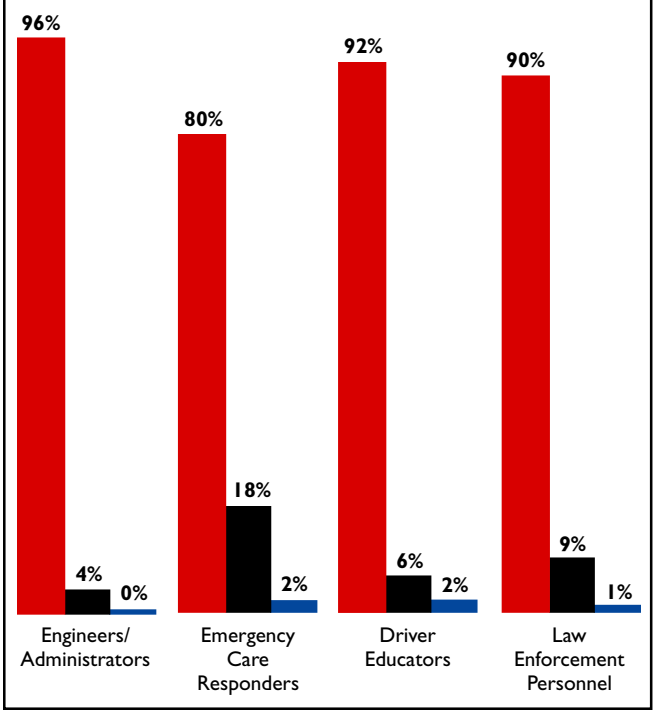
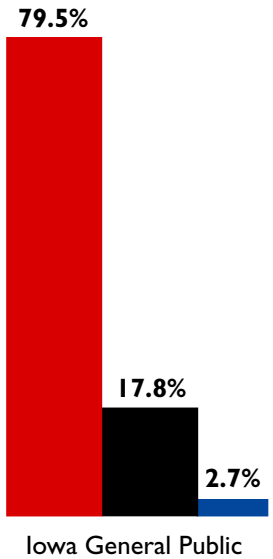


Figure 4 Iowa public response to the question "Would you support the use of cameras to reduce red light running?"



AUTOMATED ENFORCEMENT

Red Light Camera Studies and Programs Nationwide

Since 1992 the Federal Highway Administration (FHWA) has awarded grants to many jurisdictions across the nation for implementation of red light running programs to test and evaluate the use of automated enforcement for reducing red light running occurrences. These programs have proven camera technologies to be very effective in reducing traffic signal violations.

For example, red light violations declined by 57 percent over a five-month period at four intersections in Howard County, Maryland, and overall, 30,000 citations were issued after deployment of cameras in that jurisdiction.[4] The City of Jackson, Michigan, also received federal funding for a red light camera program. Violations there were reduced from 50–60 per week to 8–10 per week.[5] Public support for the program was very positive.

Since the implementation of these initiatives, interest in red light cameras has risen substantially in the United States. Automated enforcement programs, including those used to deter red light running, have been considered and/or implemented in the District of Columbia, Puerto Rico, and 23 states.[6]

Numerous research studies have shown that automated red light enforcement systems can significantly decrease the number of red light running violations and crashes. Moreover, jurisdictional experience has revealed that lower violation rates equate to a decrease in the total number of fatalities and injuries resulting from these crashes. The sophisticated technology of these cameras must be credited in part for the success of these programs.

Red Light Camera Systems

Red light camera systems generally consist of two types of components—fixed and portable. The fixed components—such as detection devices, triggering mechanisms, and camera housings—cannot be easily moved from an intersection after installation. The cameras themselves are portable. To maximize program efficiency, a single camera can be rotated between multiple intersections that have fixed components previously installed (drivers are unable to determine which housings contain cameras).

Typically, cameras are installed to photograph the rear license plate of a violating vehicle. If desired, a two-camera system may be installed with one camera located on each side of the intersection. With this deployment, the front and rear of a violating vehicle can be recorded. A two-camera system is typically used in jurisdictions where legislation requires identification of the driver.

Automated enforcement systems detect approaching vehicles using one of many types of sensor mechanisms. Usually cameras become activated after a preset time period following the initiation of the red phase. The additional time, usually only about a second, allows a grace period for drivers in the "dilemma zone."[7]

Typically, the date, time, speed of the vehicle, and time elapsed since initiation of the red phase are printed onto each photograph in what is known as the data block. Depending on the type of camera system used, photographic evidence is either collected physically at the site or electronically transmitted to a ticket distribution center. After development or processing, the images are reviewed by a police officer. The officer verifies the vehicle

license plate identification and determines whether a violation has taken place. If it is concluded that a violation has occurred, a citation is mailed to the driver or vehicle owner, depending on local legislation.

The medium for identifying violating vehicles is dependent on the type of camera being used.

Historically, 35 mm wet film cameras have been most prevalent,[8] but digital technologies are becoming more popular. See Table 3 for the three types of automated enforcement cameras in use: (1) 35 mm wet film, (2) digital image, and (3) video.

Table 3 Comparison of Camera Types

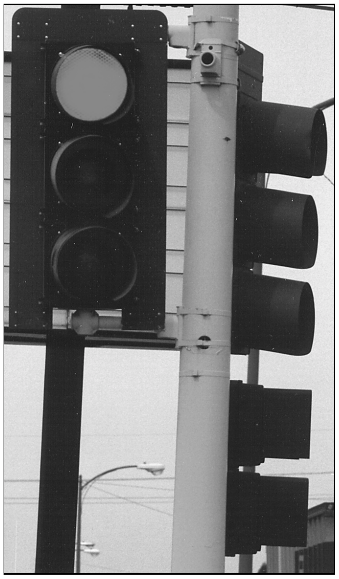
	35 mm Wet Film	Digital Image	Video
Vendors	Aviar, Inc. Electronic Data Systems Lockheed Martin (operating in 38 jurisdictions)	Driver Safety Systems Ltd. Peek Traffic RedFlex Roper Scientific MASD Tecnicon International, Inc. TransCore	ATD Northwest Iteris Nestor, Inc. Monitron, Inc.
Costs*	Cameras less expensive Film and operations can be costly Malfunctions potentially costly	Cameras more expensive No film costs Operations less costly	Cameras expensive No film costs Operations can be relatively expensive
Operations	Personnel must make frequent trips to camera sites to change film Film rolls require special processing Data must be manually collected, processed, and analyzed	Collection, processing, and transmittal of data are computerized, so manual operations are reduced	Collection, processing, and transmittal of data are computerized, so manual operations are reduced
Options	Limited	Camera zoom function Images can be entered into a program that combines photos with citations	Electronic detector system identifies approaching vehicles, requiring less installation time pavement disturbance Continuous monitoring Camera zoom function Additional statistical information from site such as speed and violation profiles
Images	Only two images Not easily subject to possible alterations	Images can be enhanced to reduce glare or brightness	Video sequence provides more data than still images

*Note that costs shown may not represent comparable products and services. Some vendors include maintenance services in their purchase and lease estimates. Others offer options to defray costs, such as a lower purchase price with violators' fines shared with the vendor. Interested jurisdictions should contact vendors directly for more detailed information on current products, services, and rates.

Legislative Concerns

Several legislative concerns associated with automated enforcement have been raised across the country. One argument is that photographs are not always reliable—what is seen on a photo may not always be a clear indication of what actually happened, or there may have been extenuating circumstances not recorded. Generally, however, these issues can be considered and accommodated in the enforcement process. Other arguments, such as possible image alteration, have also been raised. Some say that evidence provided with newer technologies, such as digital cameras, can be too easily manipulated or inadvertently altered by computer or technician error. In many jurisdictions, issues such as these have contributed to obstacles in adopting legislation for automated enforcement of red light violations.

If automated enforcement efforts are undertaken in Iowa, the need for enabling legislation must be considered. Currently the Code of Iowa is silent on the use of photographic evidence for enforcing civil violations. Most established automated enforcement programs in other states consider signal violations as civil infractions. Citations are thus issued to vehicle owners, similar to the method for parking tickets. With this process, only the tag or license plate, usually on the rear of the vehicle, is photographed.



Another option, used in a few jurisdictions, is a criminal citation for signal violations. With this procedure, it is necessary to identify the actual offender; thus, a photo of the driver's face is needed in addition to a photo of the license plate. This option could raise privacy concerns. Generally, fines for criminal violations are higher than civil and "points" are assessed against the driver's license. In addition, two cameras are usually necessary to collect needed evidence for driver identification, whereas only one is needed to photograph the license plate.[9]

For criminal citations, enabling legislation would definitely be necessary. But even for civil penalties, legislation addressing automated enforcement may be beneficial for several reasons, including uniformity of statewide application, consistent penalty assessment, and official support for the process.

OTHER COUNTERMEASURES

Prior to implementing an automated enforcement program, communities may wish to consider other, potentially less costly countermeasures to address perceived excessive signal violations.

Informational and educational efforts can be very beneficial in raising pubic awareness of red light running and support for abatement programs. Successful campaigns may involve media information releases, school programs, police officer presentations, well publicized enforcement efforts, and "official" resolutions and proclamations. The FHWA can provide valuable assistance in this area with programs such as Stop Red Light Running.

Many signal violations may be a result of driver frustration, reaction, or even confusion from inadequately timed and phased traffic signals. Studies have shown that approximately 70 percent of all red light running occurs within 1.5 seconds of the onset of a red signal.[10] Adjustment of the preceding yellow phase to meet Institute of Transportation Engineers recommendations can significantly reduce intersection crashes.[11, 12] Improving signal timing has been indicated as a high priority concern of drivers in a national survey conducted by the FHWA.

Coordination of adjacent signals is another way to potentially reduce driver frustration caused by continually stopping as compared to progressing at an acceptable speed. In addition to reducing the incidence of signal violations, coordination can also improve traffic flow and efficiency by reducing delays and resultant crashes.[13]

Upgrading signal equipment at individual intersections or throughout a system can also provide beneficial results in reducing red light running. For example, since signal head visibility is crucial to proper driver reaction, upgrading to additional, higher intensity, or larger signal heads, backing plates, or modern controllers should be considered.

The installation of traffic signals on some low-volume roads may actually be a factor contributing to red light running behavior. When drivers must stop often at intersections with little or no traffic, the result can be impatience and temptation to run a red light. Removal of such, many times unwarranted, signals can significantly reduce crashes and injuries. The City of Philadelphia experienced a 24 percent decrease in the number of crashes at 199 intersections when signals were removed.[2]

An engineering study should be conducted to determine whether one or more of these countermeasures would be justified at intersections under consideration for improvement.

CONCLUSIONS

Increasing traffic volumes and congestion in many of Iowa's urban areas result in driver impatience and frustration, which are sometimes manifested in aggressive behavior and disregard for traffic laws and signals. These violations, including red light running, jeopardize the safety of drivers and pedestrians. This research effort sought to analyze the incidence and effects of signal violations in Iowa and to identify feasible countermeasures, including automated enforcement, to improve public safety.

This study measured the actual incidence of signal violations at selected intersections in cooperating cities. Violations ranging from less than one every 10 hours to an average of almost 10 per hour were observed. Violations summarized in relation to traffic volumes ranged from less than one to over 38 violations per every 1,000 vehicles.

Actual crash records were also analyzed. Iowa data from 1996 through 1998 show 12 fatalities, approximately 5,900 injuries, and over 7,100 total crashes on reports where "ran traffic signal" was noted as a contributing cause. Crash analysis alone indicates significant effects to public safety from ran-traffic-signal crashes, but these results should be considered in relation to other transportation safety concerns to judge comparative significance.

The final method used to assess the impact of red light running in Iowa involved the use of surveys, both of selected professional groups and the general population. Results from these surveys reveal strong awareness and concern for the potential adverse safety impacts from these violations and also broad support for mitigating efforts, including implementation of automated enforcement to address high-incidence intersections.

Communities with intersections that have a high incidence of red light running may want to consider one or more of the countermeasures presented herein, including that of automated enforcement. Although implementation can be expensive and controversial, the beneficial results from automated enforcement programs have been well documented in numerous research studies and community programs across the country. Positive results include reduction in red light running and associated crashes at target intersections and less need for onsite officer enforcement of signal violations.

Potential benefits from this research may be an improved understanding of the scope of this dangerous practice and a reduction in future incidence through positive mitigation efforts to modify driver behavior. The full report and complete project records are available from the Iowa DOT and CTRE.

References

1. Retting, R. A., and A. F. Williams. Public Opinion Regarding Red Light Cameras and the Perceived Risk of Being Ticketed. In *Transportation Research Board 79th Annual Meeting (Preprint CD-ROM)*. Transportation Research Board, National Research Council, Washington, D.C., Jan. 2000, pp. 1–5.
2. Retting, R. A., A. F. Williams, and M. A. Greene. Red Light Running and Sensible Countermeasures: Summary of Research Findings. *Transportation Research Record*, No. 1640, 1998, pp. 23–26.
3. Polk, A. Electronic Enforcement of Traffic Laws. *ITS Quarterly*, Summer 1998, pp. 12–27.
4. Battle Lines Drawn in California Legislature over Red Light Running Cameras. *Urban Transportation Monitor*, May 22, 1998, p. 3.
5. Ericson, N. Putting a Stop to Red Light Runners. *ITS World*, July/Aug. 1998, pp. 22–26.
6. Red Light Literature. Photocop, Cedar Park, Tex. http://www.photocop.com/red-light.htm. Accessed Aug. 4, 1999.
7. Hans, M. Cameras Catch Red-Light Runners. *Traffic Safety*, Jan./Feb. 1997, pp. 8–13.
8. Stop Red Light Running Literature. Federal Highway Administration, U.S. Department of Transportation, Washington, D.C. http://www.fhwa.dot.gov/stoprlr/camr/camrtech.htm. Accessed Nov. 1999.
9. Turner, S. and A. E. Polk. Overview of Automated Enforcement in Transportation. *ITE Journal*, June 1998, pp. 20–28.
10. Promotional Literature. Nestor, Inc., Providence, R.I., undated.
11. Tarawneh, T. M., V. A. Singh, and P. T. McCoy. Evaluation of Media Advertising and Police Enforcement in Reducing Red Light Violations. *Transportation Research Board 78th Annual Meeting (Preprint CD-ROM)*. Transportation Research Board, National Research Council, Washington, D.C., 1999, pp. 1–22.
12. Retting, R. A., M. A. Greene. Influence of Traffic Signal Timing on Red Light Running and Potential Vehicle Conflicts at Urban Intersections. *Transportation Research Record,* No. 1595, 1997, pp. 1–7.
13. Datta, T. K., K. Schattler, and S. Datta. Red Light Violations and Crashes at Urban Intersections. In *Transportation Research Board 79th Annual Meeting*. Transportation Research Board, National Research Council, Washington, D.C., Jan. 2000, pp. 1–25.